July 9, 2026

Stasia Ferby
Project Assessment Director
BC Environmental Assessment Office
By Email: Stasia.Ferbey@gov.bc.ca

SUBJECT: Overall Final EAO Water Information Request Response Summary

Dear Ms. Ferbey:

Telkwa Mining Limited (Telkwa Mining) is pleased to provide an overall summary of our final EAO Water Information Request response summary and organization which proivdes the complete respoonse to the EAO water IR as follows:

ATTACHMENT A provides the January 29, 2026 that represents the Water Information that was approved for submission after discussions with the EAO and the line agencies of Ministry of Environment and Parks (MENV) and Minsitry of Mining and Critical Minerals (MMCM) on the September 15, 2026 EAO Water IR submission for review.

ATTACHMENT B provides the response to the follow up information requests from MENV on April 15, 2026.

ATTACHMENT C provides the response to the follow up information requests from MMCM on May 15, 2026.

ATTACHMENT D provides the response to the follow up information request 8 and 9 from MENVe on May 22, 2026.

ATTACHMENT E provides the response to the follow up Information request 8 from MENV and MMCM on June 25, 2026.

If you have any questions please do not hesitate to contact Dan Farmer at 604-220-5703 or dan.farmer@telkwa-mining.ca.

Sincerely,



Daniel J. Farmer
Project and Development Manager
Telkwa Mining Limited

Cc: Elise Matzanke, Project Assessment Officer, EAO, email: Elise.Matzanke@gov.bc.ca
Matt Scarr, Project Assessment Director, EAO, email: Matthew.Scarr@gov.bc.ca
Jessy Chaplin, Ecosystems Biologist, Telkwa Mining, email: Jessy.chaplin@telkwa-mining.ca
File

Attachments:

Attachment A: Telkwa Mining Response submitted January 29, 2206 to the Overall EAO Water IR issued by EAO to Telkwa Mining on November 23rd, 2022

Attachment B: Telkwa Mining Response to the follow up information requests from MENV on April 15, 2026

Attachment C: Telkwa Mining Response to the follow up information requests from MCMM on May 15, 2026

Attachment D: Telkwa Mining Response to the follow up information requests 8 and 9 from MENV on May 22, 2026

Attachment E: Telkwa Mining Response to the follow up information request 8 from MENV and MCMM on June 25, 2026

Attachment A: Telkwa Mining Response submitted January 29, 2206 to the Overall EAO Water IR issued by EAO to Telkwa Mining on November 23rd, 2022

MEMORANDUM

TO: Stasia Ferbey, Project Assessment Director, BC Environmental Assessment Office

Elise Matzanke, Project Assessment Officer, BC Environmental Assessment Office

FROM: Dan Farmer, Project, and Development Manager, Telkwa Mining Limited

DATE: January 29, 2026

SUBJECT: **Tenas Project Water Quality EAO Information Request Response**

0. INTRODUCTION

In response to the Information Request (IR) related to water dated November 23, 2022, for Telkwa Mining Limited's (Telkwa Mining) Tenas Project's (Project) Environmental Assessment Certificate (EAC) Application submitted in early 2022 please find Telkwa Mining's response to the questions raised by the British Columbia Environmental Assessment Office (BC EAO) working group.

As part of Telkwa Mining's commitment to undertake additional water flow monitoring for Four, Goathorn, and Tenas Creeks as recommended by SRK Consulting (Canada) Inc. (SRK), the water and load balance model (WLBM) has been updated to reflect the water monitoring completed in 2021 and 2022 for these creeks, see **Appendix 1: Tenas Project, Water and Load Balance Modeling Report (Updated 2025), SRK**. In summary the following was found:

- Goathorn Creek high flows were underestimated by the WLBM provided by the EAC Project Case (August 2022). Low flows were slightly overestimated by the WLBM provided by the EAC Project Case (August 2022), so low flows were reduced for Goathorn Creek in the Final EAC Project Cases (2024).
- Tenas Creek flows measured were comparable to the EAC Project Case (August 2022) for low and high flows and if anything were underestimated by the EAC Project Case (August 2022) model, so the parameter concentrations provided were conservative. High flows were updated for Tenas Creek but no change to low flows were made as part of the Final EAC Project Cases (2024).
- Four Creek flows measured were again comparable to the EAC Project Case (2022) for low and high flows and if anything were underestimated by the EAC Project Case

(August 2022) model. High flows were updated for Four Creek but no change to low flows were made as part of the Final EAC Project Cases (2024).

Additional years of precipitation data have been gathered since the EAC Application was submitted, and it was found that precipitation values in the EAC Project Case (August 2022) model were under reporting annual precipitation values, so these were increased in the Updated and Final EAC Project Cases (2024) versus the EAC Project Case (August 2022)'s WLBM. Please see **Appendix 2: Tenas Project, Hydrometeorological Baseline and Model Development Report (Update 2025), SRK**. Telkwa Mining continued monitoring for Four, Tenas, and Goathorn Creeks in October 2023, and will review stream flow levels again if the Project moves into the permitting process.

Telkwa Mining commenced an acid rock drainage (ARD) barrel program in late 2019 to better understand the potential ARD and metal leaching (ML) characteristics of the material rock zones and overburden recovered within the EA Open Pit. Telkwa Mining has continued testing material seepage from these barrels since 2019. Key observations based on this testing is as follows:

- Only one of the potentially acid generating (PAG) barrels (Barrel 6) has gone **acidic after approximately 4 years** of monitoring. The onset of acidic drainage under field conditions may be accelerated because the barrel samples have been crushed to minus 1/4 inch (8 millimetres [mm]) as the material was the same as used in the humidity cells. There will be a mixture of grain sizes in the commercial operation with several grains much larger than the barrel material size. In addition, the barrel contains a mixture of rock from Zones 6, and 7 and had a weighted Neutralizing Potential Ratio (NPR) of Neutralizing Potential (NP) to Acid Potential (AP) of 0.55. The average weighted NPRs of Zones 6, and 7 in the drillhole database were 1.8 and 1.7, respectively (SRK 2025). The material in Barrel 6 therefore provides a conservative estimate of the lag time to the formation of acidic conditions.
- The source terms for some parameters were overstated (higher concentrations) while others were understated (lower concentrations) in the water and load balance provided in the EAC Project Case (August 2022) based on the laboratory measurements of the effluent collected from these barrels due to assumed scaling factors that were not site-specific. SRK developed updated source terms for *non-PAG* rock, PAG rock Flush term, EA Open Pit Walls, and overburden using the barrel results provided in: **Appendix 3: Geochemical Field Barrel Results Interpretation, Tenas Project, SRK;** and **Appendix 4: Updated Water Quality Source Terms, SRK.**

These source terms were further reviewed and modified for the *non-PAG* rock backfilled into the EA Open Pit by Okane Consultants using a more detailed model that accounted for dimensionality in the *non-PAG* rock backfill (backfill) and oxygen convection and diffusion for several different cover scenarios. Okane Consultants developed a distributed 3-dimensional model focused on

water infiltration and storage, and oxygen levels based on the material properties and the rock backfill pile construction methodology employed by the Project with their report included in **Appendix 5: Tenas Project - Suboxic Evaluation of Non-Acid Generating Mine Rock, Okane**. This modelling exercise modified the source terms for parameters being potentially leached from the backfill and was used for the Final EAC Project Case (2024).

Several updates were made in the water and load balance model since the EAC Project Case (August 2022). The new Project Case was titled "Final EAC Project Case (2024) (as found in **Appendix 1, Tenas Project, Water and Load Balance Modeling Report (Updated 2025), SRK)**, and the integrated changes are described as follows:

- Incorporate the effects of progressive reclamation and backfill/dam/buttress development (for progressively covered areas of *non-PAG*).
- Use of seasonal background parameter concentrations (50th percentile) to reflect the seasonality of the background/baseline parameter quality concentrations related to winter (November to March) and summer (April to October) seasons to develop predicted concentrations from the Project more accurately in the receiving environment.
- Incorporation of blasthole liners for the source control of nitrogen species. This Best Management Practice (BMP) was identified through the additional mitigations assessment.
- Revision of how downstream parameter concentrations in relation to groundwater seepage was calculated based on updated values from the hydrogeological model and to account for dilution from non-contact groundwater to the streams.
- Updates to reflect the recently published climate change models from 2023 versus the 2018 versions that were used in the EAC Project Case (August 2022).

Through the Best Achievable Technology (BAT) assessment, it was determined that the introduction of water treatment through In-situ Active Gravel Bed Reactors (GBR) and/or active water treatment using Reverse Osmosis with an Anaerobic Bioreactor and High-Density Sludge Lime Treatment were not recommended but should only be incorporated using a Trigger Action Response Plan based on site monitoring during all phases of the Project. Further information on the Final EAC Project Case (2024) can be found under **Theme 1**.

Error! Not a valid bookmark self-reference. below provides a summary of the EAC Project Case (August 2022) and the Final EAC Project Case (2024) for parameters that were exceeding water quality guidelines for the EAC Project Case (August 2022). As demonstrated the Final EAC Project Case (2024) does not have exceedances in the receiving environment except for parameters that are already in exceedance for background conditions and a short duration (4 year) exceedance of cobalt in Four Creek which is likely not to occur if attenuation mechanisms in groundwater were accounted for in the water model.

Table 0-1: Water Quality (Maximum Monthly Mean) Results for the EAC Project Case (August 2022) and the Final EAC Project Case (2024) in Post-Closure at Relevant Prediction Nodes Using Expected Source Terms and Average Hydrology Conditions

Location Creek	Parameter	BC WQG (2025) (mg/L)	EAC Project Case (August 2022) (mg/L)	Final EAC Project Case (2024) (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0013	Not Available	0.0016
WQS06 Goathorn Creek	Copper (d)	0.0013	0.0019	0.0016
WQS03_DS Four Creek	Cadmium (d)	0.00023	0.00026	0.000012
	Cobalt (d)	0.00050	0.00066	0.00063
	Nitrite (t)	0.020	0.038	0.0090
	Sulfate (t)	309	360	33
	Selenium (t)	0.0020	0.0058	0.00081
WQS04 Tenas Creek	Cobalt (d)	0.00045	0.00082	0.00029
	Copper (d)	0.0026	0.0031	0.0013
	Nickel (d)	0.0025	0.0031	0.00063
	Nitrite (t)	0.020	0.045	0.0056
	Sulfate (t)	218	260	24
	Selenium (t)	0.0020	0.0041	0.00079

Notes: BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligrams per litre; WQG=water quality guideline.
Red text indicates exceedances of WQGs.
Please note that dissolved copper exceeds the WQGs under background conditions.

1. INFORMATION REQUEST (IR) THEMES 1-8

The IRs provided by the EAO have been grouped into a series of themes for subsequent discussion.

- **Theme 1**: Design alternative treatment options and/or provide additional mitigation measures which are capable of meeting BC Chronic Water Quality Guidelines for the Protection of Aquatic Life (BC WQGs) near appropriately sited discharge locations;
- **Theme 2**: Substantially review the Water Balance Model. The Water Balance Model is key to assessing mitigations against effects to many Valued Components not only water quality;
- **Theme 3**: Have a Qualified Professional (QP) identify lentic areas in the receiving environment which may receive selenium from mine operations, and ensure that background concentrations of selenium in water, sediment, invertebrate, and fish tissues are collected and compiled in those lentic areas;
- **Theme 4**: Conduct additional water quality predictions using recent sensitivity analysis of the semi-permeable pond liner;
- **Theme 5**: Ensure all planned discharges are incorporated into the Water Balance Model and water quality predictions;
- **Theme 6**: Other comments not specified in BC EAO's IR request letter, but provided in the ITT table;
- **Theme 7**: EMLI Geoscience clarifications and information requests; and,
- **Theme 8**: EMLI Geotechnical clarifications and information requests.

Please note:

The order in which the themes are addressed is not the same as the list specified above since Themes 5, and 2 need to be completed prior to commencing Theme 1 which entails a BAT assessment to review alternative treatment technologies/additional mitigations as it is dependent on the WLBM being accepted and understood by the Working Group as it forms the basis of the BAT assessment.

2. RESPONSES TO INFORMATION REQUEST THEMES 1 THROUGH 8

THEME 5: ENSURE ALL PLANNED DISCHARGES ARE INCORPORATED INTO THE WATER BALANCE MODEL AND WATER QUALITY PREDICTIONS

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

The WLBM is missing data from all planned discharges.

507 ITT TABLE AND 516 ITT TABLE

Table 6.2-1 of the Discharge MP lists many surface discharges that are not incorporated into the Water and Load Balance Model. The WLBM application considers the discharges from the Tenas Control Pond, the Management Ponds, and the Rail Infrastructure Pond. For all other discharges, please indicate where each is characterized in the application including source term assessment, water quality predictions, frequency and duration of discharge, mitigation strategies (include liner permeability where applicable), identification of parameters of concern, and residual effects assessment. For all unlined ponds and other discharges to ground, evaluate the discharge following the guidance in ENV "Authorizing Point and Non-point source discharges to ground" (https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/7276_env_rob_dtg_factsheet.pdf) [EA Information Requirement].

IR LETTER NEW AND 516 ITT TABLE

Table 6.2-1 of the Discharge Management Plan lists many surface discharges that are not incorporated into the WLBM. The WLBM application considers the discharges from the Tenas Control Pond, the Management Ponds, and the Rail Infrastructure Pond.

1. *For all other discharges, indicate where each is characterized in the Application, including: source term assessment; water quality predictions; frequency and duration of discharge; mitigation strategies (include liner permeability where applicable); identification of parameters of concern; and residual effects assessment.*
2. *For all unlined ponds and other discharges to ground, evaluate the discharge following the guidance in ENV's Authorizing Point and Non-point source discharges to ground.*

RESPONSE 507 ITT TABLE AND 516 ITT TABLE

This IR request stems from the fact that some of the sedimentation ponds that discharge to ground were not included as part of the WLBM in the EAC Application prepared by SRK and presented in **Appendix 1.0-E Water and Load Balance Modeling Report of the Environmental Assessment Certificate (EAC) Application**. Specifically, the following sedimentation ponds were not included in the overall WLBM:

- Explosive Facility;
- Explosive Magazine;
- Rock Quarry;
- Gravel Quarry 1 and 2; and,
- East and West TAC.

The Explosive Facility, and Rock Quarry sedimentation ponds are lined with impermeable geomembrane liners or equivalent while the remaining sedimentation ponds are unlined.

The reasons why these sedimentation ponds were not considered in the site WLBM when it was developed were:

- They are geographically separate from the EA Open Pit, management and control ponds, and material storage pile water management systems.
- These sedimentation ponds are small and were developed to manage very defined catchments which are not connected to overall water management system for the open pit and material storage structures and have very low flow rates compared to the discharge from mine components through the Tenas Control Pond.
- These sedimentation ponds are expected to only discharge during freshet and storm events as their watersheds are small and defined.
- These sedimentation ponds collect water from inert material such as gravels and soils currently exposed within their catchment area.
- Total Suspended Solids (TSS) is the main parameter of concern for majority of these sedimentation ponds excluding the Explosive Facility and Rock Quarry Sedimentation Ponds where nitrogen species are also potential parameters of concern.
- To control TSS, the sedimentation ponds have been designed according to BC ENV *Technical Guidance 7: Assessing Design Size and Operation of Sediment Ponds* (December 2015). The sedimentation ponds are designed to produce a monthly mean maximum TSS level of 35 mg/L to align with the proposed federal *Coal Mine Effluent Regulations* which is considered protective of the receiving environment.

POND DESCRIPTIONS

The Explosive Magazine Sedimentation Pond captures run off from a 50 by 50-metre (m) pad where the three (3) explosive magazine steel buildings are located. The pad is comprised of crushed gravel at a 1% grade leading to the sedimentation pond. TSS is the only parameter of concern for this pond as no blasting agents are being offloaded or loaded at this location. Furthermore, traffic volumes (4 to 6 trips on dayshift only) at this location will be low as only authorized personnel are permitted to access this location. Only packaged explosive products and blasting accessories are stored at this location inside weatherproof steel buildings and no bulk explosive products are delivered to this location so there is little chance of a spill releasing nitrogen species to the environment. The water discharged from this sedimentation pond will be to the ground via a controlled pumping system and from seepage from the floor of the pond itself.

The Explosive Facility Sedimentation Pond captures run off from a 100 by 100-m pad comprised of crushed gravel at 1 percent (%) grade leading to the sedimentation pond where the one (1)

silo of emulsion (35 tonnes) and one (1) silo of Ammonium Nitrate Prill (50 tonnes) are stored. A closed loop wash bay / maintenance building for washing and maintaining the explosive transport trucks provided by the authorized explosive vendor is also located at this pad. The two parameters of concern identified for this pond are TSS and nitrogen species from potential spills of ammonium nitrate (AN) prill and/or emulsion blasting agents on the pad. This sedimentation pond is lined with a bituminous liner or equivalent and will discharge to ground via a controlled pumping system. Monitoring of the water in the sedimentation pond will be completed in compliance with regulatory approvals and if nitrate/nitrite/ammonia concentrations are above permit approved limits the water will be pumped to the onsite evaporator which is part of the wash bay/maintenance building for the Explosive Facility for treatment. The precipitate will either be shipped offsite for disposal at an approved and licensed facility or combined with blasting agents for detonation as part of the blasting process. In the permitting phase the Explosive Facility Pad and Magazine Pad will be combined into one site with a size of 100 by 100-m thereby reducing the two sedimentation ponds in the EAC application to one for permitting.

The two (2) sedimentation ponds for the Gravel Quarry only collect contact water from activities involving disturbing overburden materials, sands, gravels, and water in contact with gravel from the existing approved Quarry. The two Gravel Quarry Sedimentation Ponds service distinct phases of the Gravel Quarry already approved by Ministry of Mines and Critical Minerals (MCMM) and operated by Telkwa Mining. The two Gravel Quarry Sedimentation Ponds service small catchment areas associated with two gravel pits that will produce approximately 35,000 cubic metres (m^3) of material over the life of the Quarries which is approximately 10 years. These two sedimentation ponds will not operate concurrently, rather the Gravel Quarry Sedimentation Pond 1 will operate for roughly four (4) years until the Gravel Quarry 1 area is exhausted and will be reclaimed and then the Gravel Quarry Sedimentation Pond 2 will operate for the remaining six (6) years until the Gravel Quarry 2 area is exhausted. Furthermore, these ponds will also not be used year around but will only be required during when the quarries are active between Jun and September of the first 10 years. Based on the static geochemical test work conducted for the Rock Quarry, Gravel Quarries, and Tenas Access Corridor (TAC), the overburden and rock materials draining to these sedimentation ponds are *non-PAG* material using an NPR cut off of 2 to 1; however, these materials will be subject to verification testing as detailed in the **Metal Leaching/Acid Rock Drainage (ML/ARD) Management Plan (S13.0-C12)** of the **EAC Application**. These ponds only operate during the first 10 years of the Operation Phase at which time both phases of the gravel quarry are exhausted and reclaimed including the sedimentation ponds.

The two (2) sedimentation ponds adjacent to Goathorn Creek are constructed in support of the **Construction Environmental Management Plan (CEMP) (S13.0-S4)** of the **EAC Application** to provide contingency sedimentation capacity for construction activities being undertaken in this valley on both sides of Goathorn Creek. Again, these two sedimentation ponds only service small

catchment areas on either side of Goathorn Creek (approximately 1 hectare [ha] on each side) and will treat contact water from cut and fill activities taking place if already implemented sediment and erosion control measures are insufficient. Again, TSS is the only parameter of concern as only surficial materials are being disturbed by improvements to the Forest Service Roads (FSRs) and no blasting is envisioned for road construction activities in the Goathorn Creek Valley. As these ponds are constructed primarily in highly permeably material, water discharge from these facilities will be to ground either from the base of the ponds. Once the Construction Phase is complete and the reclamation of the cut and fill slopes for the TAC is complete, these ponds will be decommissioned and reclaimed. The materials excavated and disturbed within the Goathorn Creek Valley have been evaluated and been determined to be *non-PAG* using an NPR cut off of 2.0 to 1; however, these materials excavated will be subject to verification testing as detailed in the **Metal Leaching/Acid Rock Drainage (ML/ARD) Management Plan (S13.0-C12)** of the **EAC Application**.

The Rock Quarry Sedimentation Pond services the catchment of Rock Quarry activities roughly 2.5 ha in size and located 7 kilometres (kms) west of the mine site. The materials have been evaluated and been determined to be *non-PAG* using an NPR cut off of 2.0 to 1. This material will be subject to verification testing of blastholes and/or free dig material as specified in the **Metal Leaching/Acid Rock Drainage (ML/ARD) Management Plan (S13.0-C12)** of the **EAC Application**. The Rock Quarry will only be developed once the gravel quarries are completed which is estimated to occur in Year 10 so the Rock Quarry and two Gravel Sedimentation Ponds will not be in operation concurrently. The two parameters of concern identified for this Rock Quarry were TSS and nitrogen species and it will also discharge to ground and is not lined. Roughly 45,000 m^3 of material will be excavated for road surfacing materials over its 12-year life. Monitoring of the water in the Rock Quarry Sedimentation Pond will be completed in compliance with regulatory approvals.

Table 2-1 below summarizes the operating periods of the various sedimentation ponds not included in the overall WLBM.

Figure 2-1 through **Figure 2-6** illustrate the location of the various sedimentation ponds during four time periods associated with the Project: Construction Phase, Operation Phase Years 1 to 4, Operation Phase Years 5 to 10, Operation Phase Years 11 to 21, Decommissioning and Reclamation Phase, and the Post-closure phase.

Table 2-1: Summary of Operating Timeframes for Sedimentation Ponds not Included in the WLBM

Period	Explosive Facility Sedimentation Pond	Explosive Magazine Sedimentation Pond	Goathorn East and West Sedimentation Ponds	Gravel Quary 1 Sedimentation Pond	Gravel Quarry 2 Sedimentation Pond	Rock Quarry Sedimentation Pond
Construction Phase	No	No	Yes	No	No	No
Years 0 to 4	Yes	Yes	No	Yes	No	No
Years 5 to 10	Yes	Yes	No	No	Yes	Yes
Years 11 to 21	Yes	Yes	No	No	No	Yes
Decommissioning and Reclamation Phase	No	No	No	No	No	No
Post-closure Phase	No	No	No	No	No	No

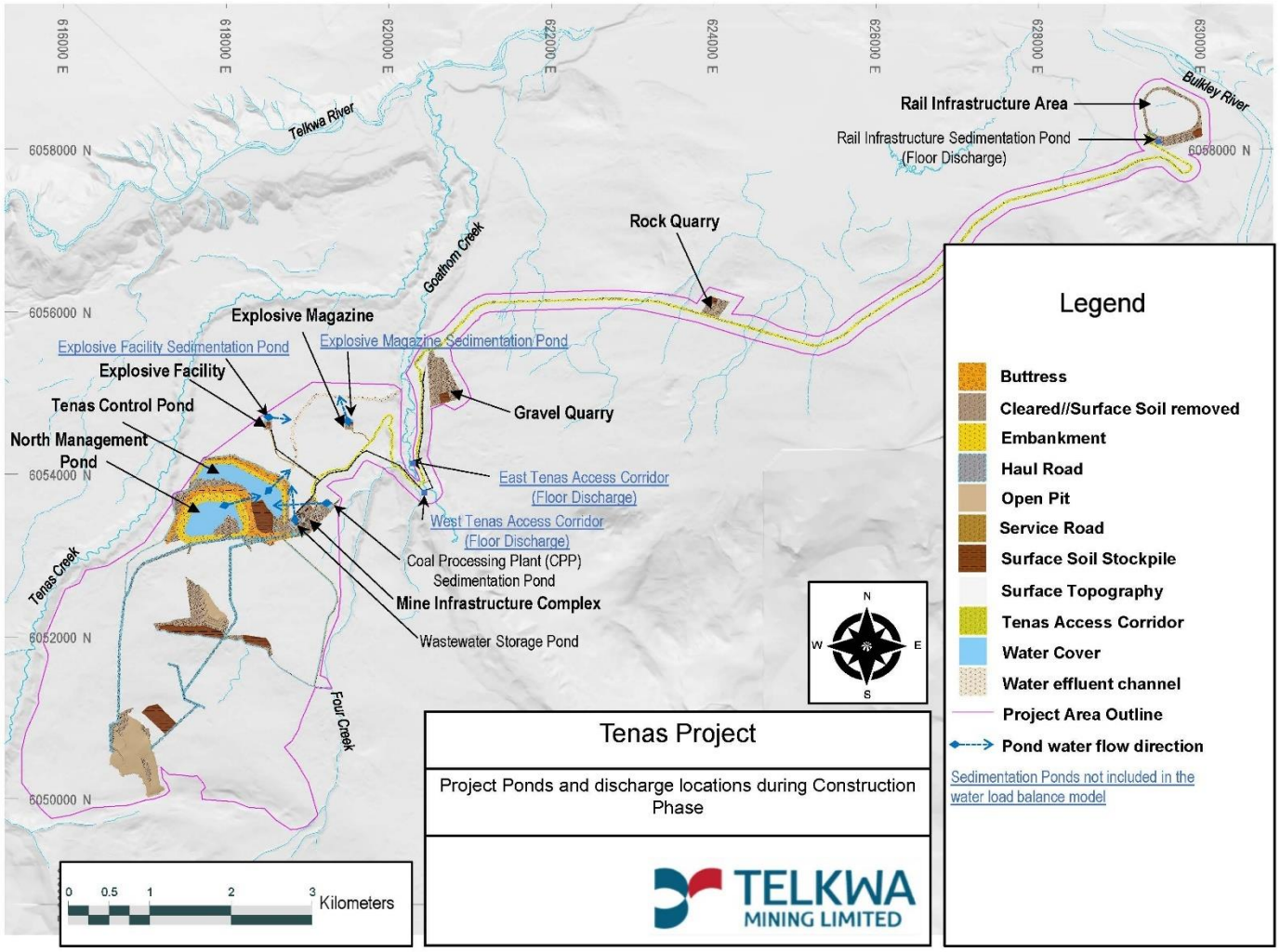


Figure 2-1: Sedimentation Ponds Location and Operation During Construction Phase not Included in WLBM

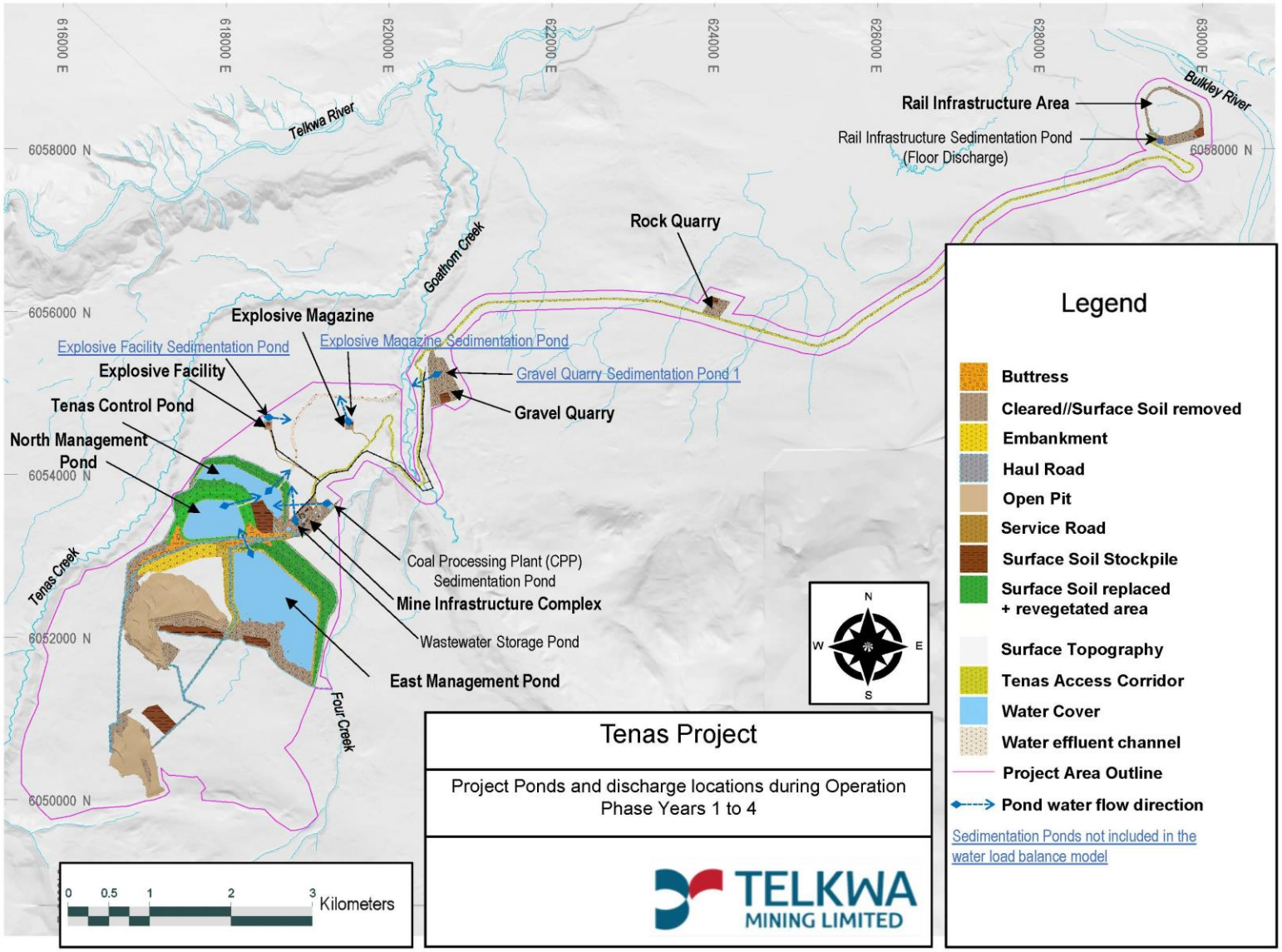


Figure 2-2: Sedimentation Ponds Location and Operation During Operation Phase Years 1 to 4 not Included in WLBM

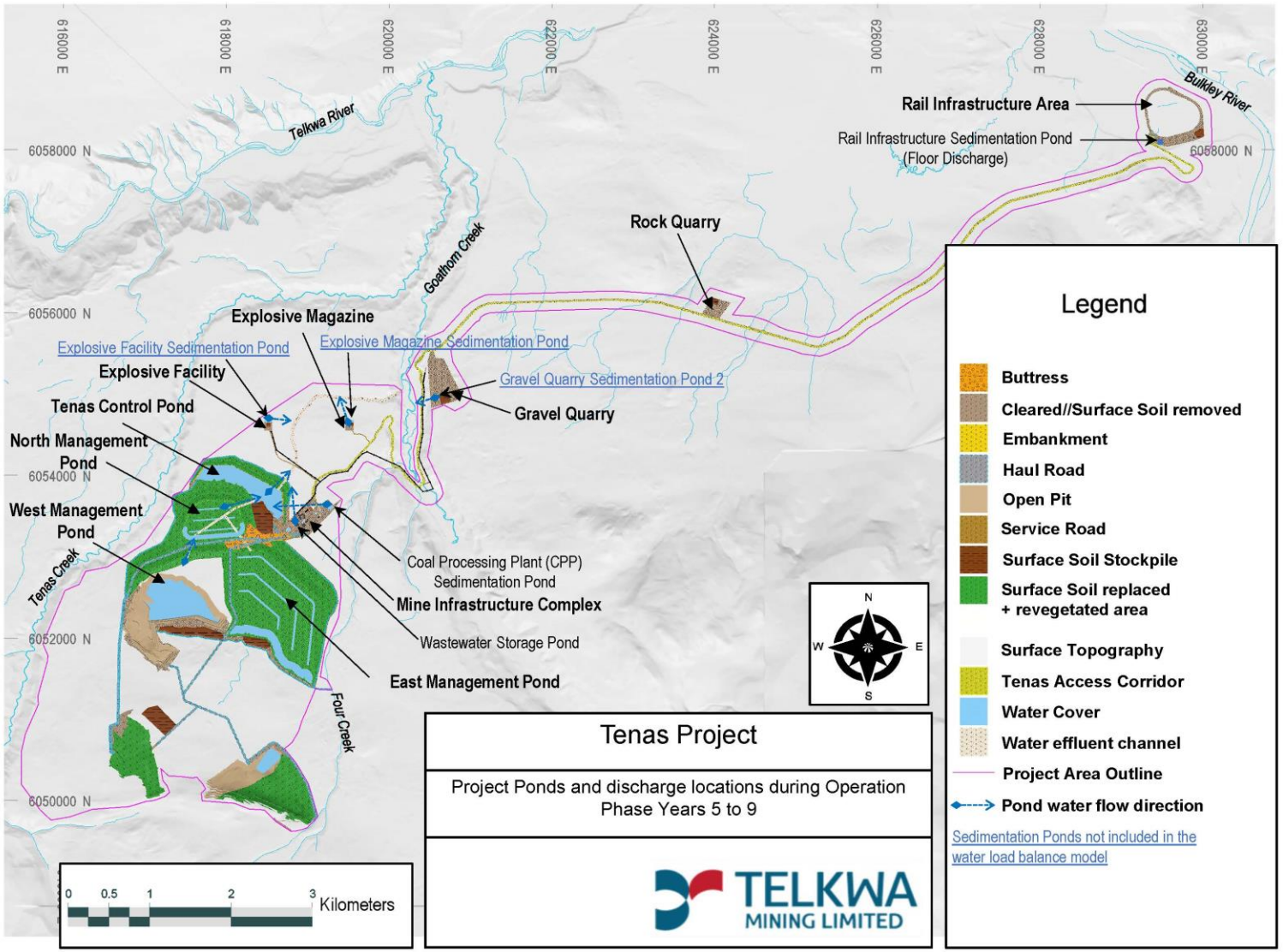


Figure 2-3: Sedimentation Ponds Location and Operation During Operation Phase Years 5 to 9 not Included in WLBM

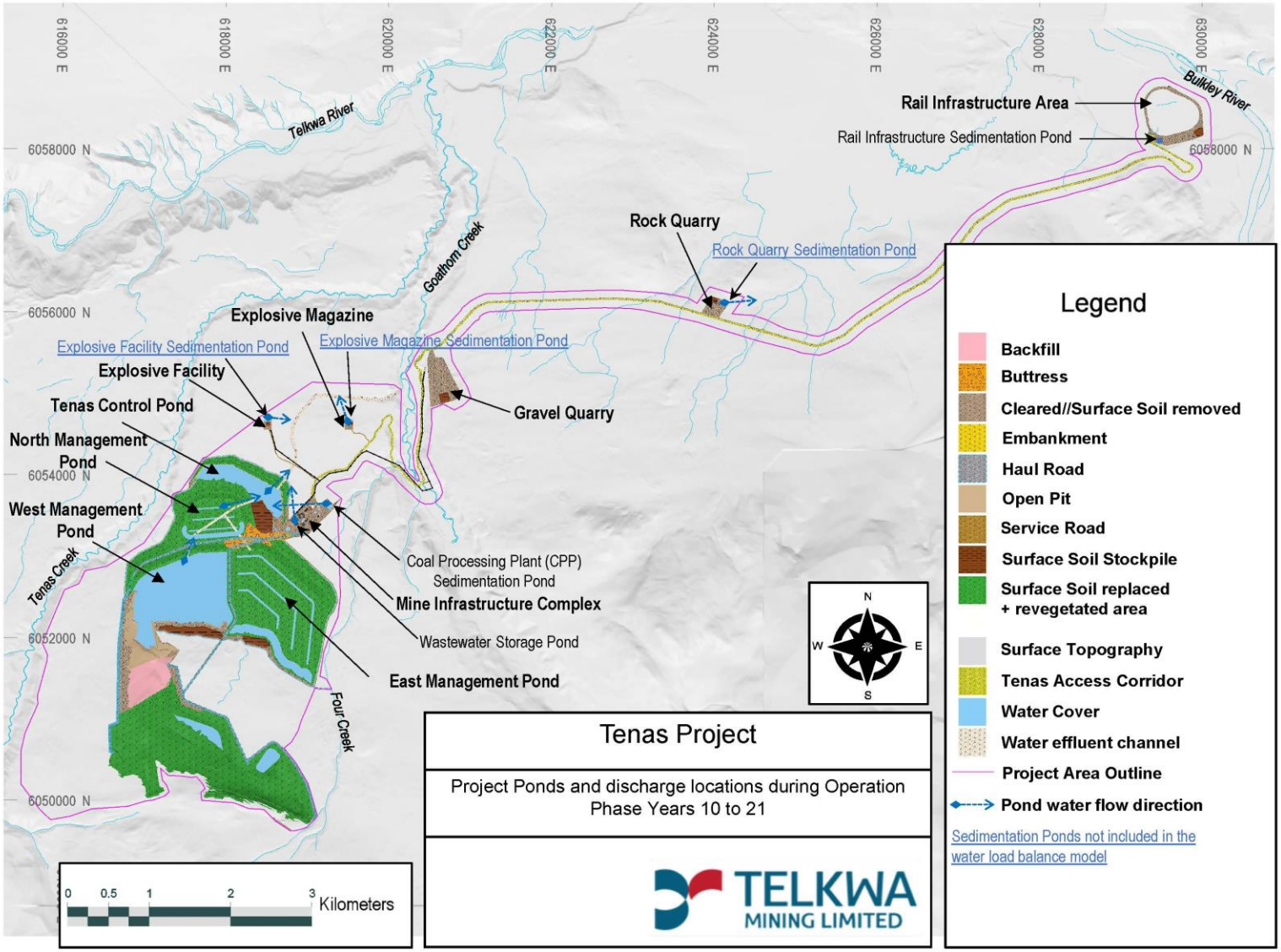


Figure 2-4: Sedimentation Ponds Location and Operation During Operation Phase Years 10 to 21 not Included in WLBM

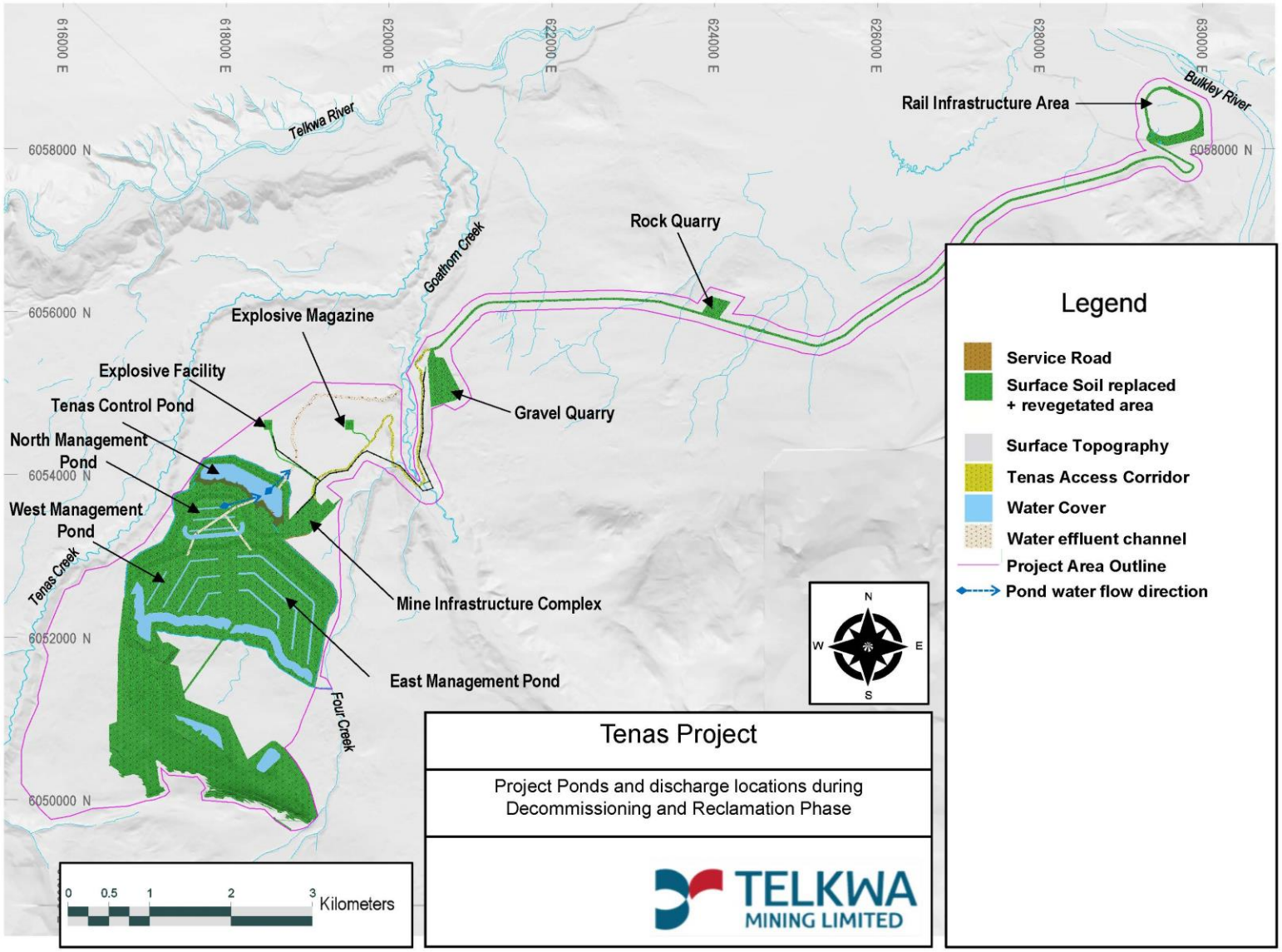


Figure 2-5: Sedimentation Ponds Location and Operation During Decommissioning & Reclamation Phase not Included in WLBM

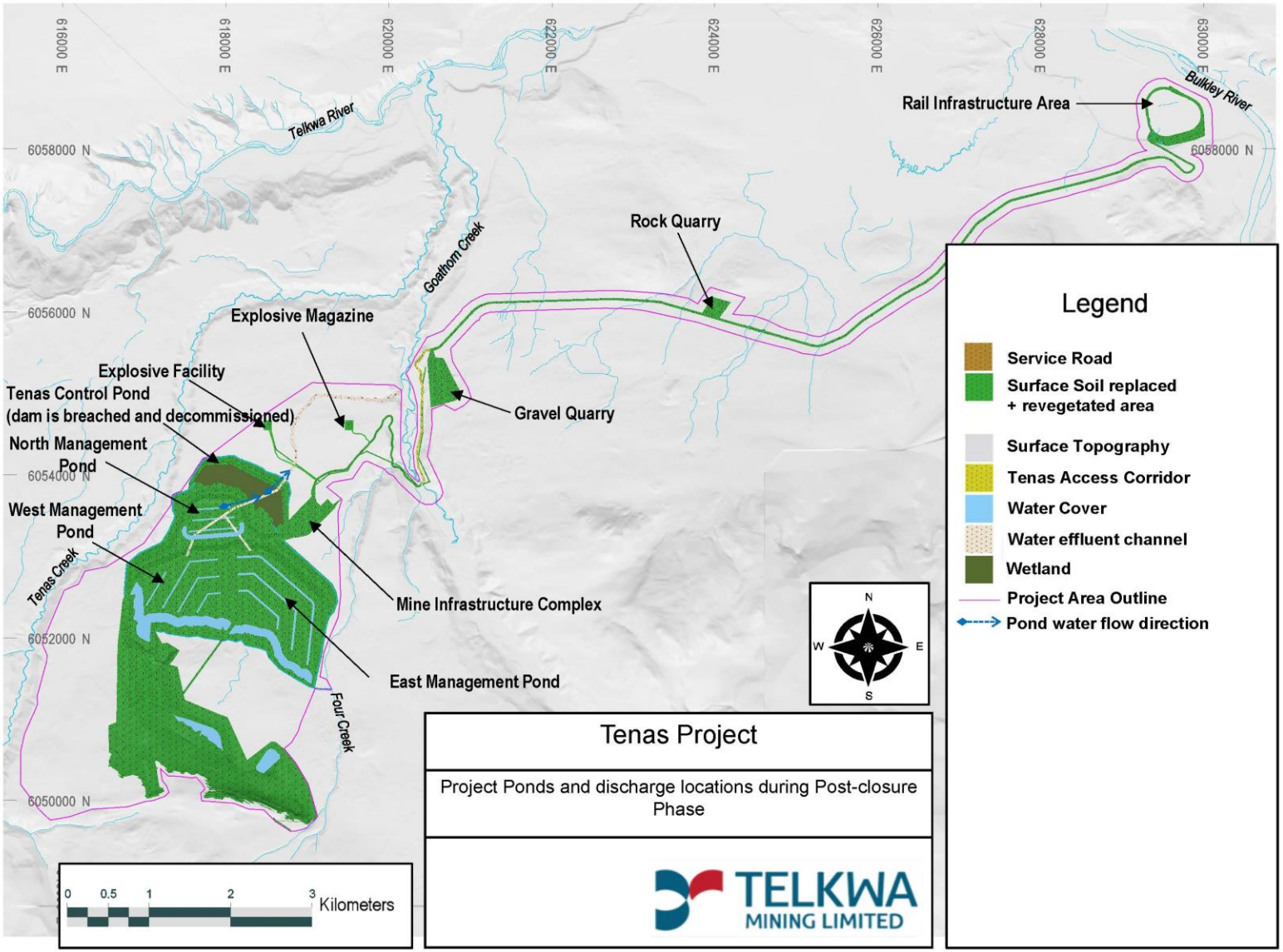


Figure 2-6: Sedimentation Ponds Location and Operation During Post closure Phase not Included in WLBM

Based on the above information the sedimentation ponds identified that the:

- Explosive Facility;
- Explosive Magazine;
- Rock Quarry;
- Gravel Quarry 1 and 2; and,
- East and West TAC

were not included in the overall WLBM completed by SRK for the EAC Application for the Project as including them would have no effect on the water quality and quantity modelled values presented for the prediction nodes nor on the subsequent effects assessments conducted for Surface Water Valued Component.

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by the BC Ministry of Environment (ENV) about the WLBM.

The following discharges have been accounted for in the WLBM:

- Tenas Control Pond;
- CPP Sedimentation Pond;
- Rail Infrastructure Sedimentation Pond;
- Potable Water Storage Pond; and,
- Wastewater Storage Pond.

The Tenas Control Pond is described in **subsections 1.9 Existing Infrastructure and Project Phases**, **1.10 Project Component Summary**, **1.16 Mine Infrastructure Complex (MIC)**, and **1.17 Water Management** in **1.0 Overview of Project Proponent Description** of the **EAC Application**. This pond is the main sedimentation pond for the Project and where mine impacted water is released during the open water season via a surface water discharge into an improved upon natural ephemeral water channel to prevent erosion and sediment release that leads into Goathorn Creek.

The CPP Sedimentation Pond is described in **subsections 1.9 Existing Infrastructure and Project Phases**, **1.10 Project Component Summary**, **1.16 Mine Infrastructure Complex (MIC)**, and **1.17 Water Management** in **1.0 Overview of Project Proponent Description** of the **EAC Application**. The EAC Application has water from the CPP Sedimentation Pond being pumped to the Tenas Control Pond and therefore this pond is not uniquely characterized but is combined with the discharge/seepage quality planned for the Tenas Control Pond. The CPP Sedimentation Pond is lined with a bituminous or alternate lining system. The CPP Sedimentation Pond will have a primary pumping system for pumping flows and a complete duplicate system to provide the

necessary redundancy for any potential pump failures. Furthermore, there will be a spare pump for each one of these systems in case of a pump failure and a backup diesel generator to run these pumps in case of grid power outages.

The discharge from the Wastewater Storage Pond is assessed as part of the overall surface flow discharge from the Tenas Control Pond. The Wastewater Storage Pond is lined with a bituminous or alternate lining system. The discharge from this pond will be via a pumped system to ensure a blending target ratio of 10 to 1 is maintained between flow from the Wastewater Storage Pond and the Tenas Control Pond. This pond has been sized to store a full year of treated wastewater from the sewage treatment plant.

The discharge from the Potable Water Storage Pond is non-contact water from water that is collected by the C02 Channel above the East Management Pond and EA Open Pit and directs this water to Four Creek or to the Potable Water Treatment Plant.

FOLLOWUP COMMENTS

FOLLOW UP 302 ITT TABLE

The discharge of effluent from sedimentation ponds for overland flow to downstream watercourses does not follow best management practices. Erosion resulting from the discharge has the potential to increase the primary POPC (TSS) to receiving waters. The cumulative effects of these additional discharges to the receiving environment have not been accounted for the IDZ study and need to be quantified. Will any mine contact water be directed to the sedimentation ponds [Clarification]?"

RESPONSE FOLLOW UP 302 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

FOLLOWUP COMMENTS

508 ITT TABLE

This conceptual design brief and budgetary estimate does not state the effluent quality or discharge rate to the receiving environment. Please provide this information in a QP certified memo. If the sediment pond to which the effluent will be collected is not lined, please provide the infiltration rate. [Permitting Information Requirement]

RESPONSE 508 ITT TABLE

The Sewage Treatment Plant proposed is a secondary stage treatment plant and is targeting the following average monthly maximum discharge parameters in milligrams per litre (mg/L) at a maximum rate of 5,400 m^3 per year:

- 43 mg/L Nitrate, as nitrogen;
- 0.10 mg/L Nitrite, as nitrogen;
- 2.0 mg/L Ammonia, as nitrogen;
- 20 mg/L Biochemical Oxygen Demand (BOD); and,

- 20 mg/L TSS.

The Sewage Treatment Plant has been designed to allow it to be upgraded to a tertiary style plant in the future if discharge requirements change. The wastewater storage pond where the effluent will be collected from the Sewage Treatment Plant is lined with a bituminous liner or equivalent as is the channel transporting this wastewater to the overall mine discharge channel from the Tenas Control Pond at which point this wastewater is mixed with discharge from the Tenas Control Pond. The wastewater pond has been designed to store a complete year of effluent to provide adequate time for controlled releases from the Wastewater Storage Pond to get an adequate mixing target of approximately 10 to 1 in Goathorn Creek. Please see the attached report from Radloff Engineering and Bionest on the wastewater system in **Appendix 7: Water and Wastewater Treatment Design Report and BioNest Assurance Letter, Radloff**.

Telkwa Mining believes the details above address the requirements set forth in IR **Theme 5**.

THEME 2: SUBSTANTIALLY REVIEW THE WATER BALANCE MODEL. THE WATER BALANCE MODEL IS KEY TO ASSESSING MITIGATION AGAINST EFFECTS TO MANY VALUED COMPONENTS NOT ONLY WATER QUALITY

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Model input values and resulting predictions for the same management structures are inconsistent between the WLBM and the Groundwater model.

509 ITT TABLE

Table 3-16 and Table 3-17 present groundwater connections to mining facilities throughout the life of mine for the expected case and high case. There are some notable differences between these tables and the corresponding tables in Appendix 4.4-A (Tables 6-6, 6-7 and 6-11). For example, the WBM does not appear to consider any groundwater connection to the NMP, while the Groundwater Model predicts seepage from the NMP throughout the life of mine. In other instances, the results appear to be different between the version of the groundwater model used in the WBM and the model presented in the application. For instance, the expected seepage rate from the WMP in Post Closure is 720 m3/d in Appendix 4.4-A while the prediction is 610 m3/d in Appendix 4.3-A. This could increase the predicted post-closure exceedances of selenium at WQS04 as both the NMP and WMP contribute to loadings at this location (based on Table 3-20 in Appendix 4.3-A). Conversely, predicted seepage from EMP in post-closure under the expected case are lower in the Appendix 4.4-A than in Appendix 4.3-A (277 m3/d vs 395 m3/d, respectively) which would reduced to the loading to the receiving environment through groundwater pathways, but may impact the expected surface discharge from the EMP, routed through the NMP and into Goathorn Creek. Please provide water balance and water quality results using inputs from the Groundwater Model provided as part of the application. [EA Information Requirement, QP Response Required].

IR LETTER NEW AND 517 ITT TABLE

There are several inconsistencies in values between Table 3-16 and Table 3-17 and the corresponding groundwater tables in Appendix 4.4-A (Tables 6-6, 6-7 and 6-11) which have provided contradictory information and predictions related to seepage throughout the life of mine, specifically related to selenium loading.

- *Have a QP provide water balance and water quality results using inputs from the Groundwater Model provided as part of the Application.*

RESPONSE 517 AND 509 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM and **Appendix 8: Tenas Project, Hydrogeology Technical Report, SRK**.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Significant uncertainty remains in WLBM calibration, preventing a scientifically defensible effects assessment.

510 ITT TABLE

Section 3.1.2 describes the stochastic model used in Alternative Case 6, but this section does not demonstrate that the stochastic model adequately reproduces the temperature and precipitation variation defined in the baseline characterization (Appendix 1-R).

a) *Please provide plots and tables showing the selected stochastic model parameters produce temperature and precipitation distributions that are representative of the baseline characterization.*

b) *Please provide a rationale to demonstrate 100 model realizations are sufficient to describe climate variability and indicate the range of return periods modeled by this set of realizations. [EA Information Requirement, QP Response Required]*

IR LETTER NEW AND 518 ITT TABLE

Section 3.1.2 describes the stochastic model used in Alternative Case 6, but this section does not demonstrate that the stochastic model adequately reproduces the temperature and precipitation variation defined in the baseline characterization (Appendix 1-R).

1. *Have a QP provide plots and tables showing the selected stochastic model parameters produce temperature and precipitation distributions that are representative of the baseline characterization.*
2. *Have a QP provide a rationale to demonstrate 100 model realizations are sufficient to describe climate variability and indicate the range of return periods modeled by this set of realizations.*

RESPONSE 518 and 510 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Significant uncertainty remains in WLBM calibration, preventing a scientifically defensible effects assessment.

511 ITT TABLE

Please provide or indicate where in the application I can find, annual water balance tables for major mine facilities (Open Pit, EMP, NMP, WMP, Tenas Control Pond) quantifying all modeled inflows, outflows and storage for Operations and Post Closure under a range of climate conditions (average, wet and dry). [EA Information Requirement, QP Response Required]

IR LETTER NEW AND 519 ITT TABLE

Have a QP provide annual water balance tables for major mine facilities (Open Pit, East, West and North Management Ponds, Tenas Control Pond) quantifying all modeled inflows, outflows and storage for Operations and Post Closure under a range of climate conditions (e.g., average, wet and dry).

RESPONSE 511 and 519 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Model nodes need to be appropriately located near planned discharge locations rather than many kilometers downstream.

IR LETTER NEW AND 515 ITT TABLE

a) Have a QP add additional model nodes to represent conditions at:

- *Tributary receiving discharge above confluence with Goathorn Creek.*
- *Goathorn Creek below confluence with tributary receiving discharge.*

Have a QP provide water quantity and quality results for these nodes over the life of mine for the following assessment cases:

- *Project Case*
- *Alternative Case 1, 2, 3, 4 and 5*

Have a QP provide water quality results in figures and table with comparison to relevant water quality guidelines, as provided in Appendix 6 & G of Appendix 4.3-A of the application.

IR LETTER OVERVIEW

Seasonal and monthly variability of background water quality concentrations may affect predicted water quality parameter concentrations.

IR LETTER NEW AND 515 ITT TABLE

b) Have a QP clarify if the background water quality inputs used in the model were annual median values or if monthly (or seasonal) median values were used (section 3.10.1 of Appendix 04.3-A, the Water & Load Balance Modeling Report). If monthly or seasonal background concentrations were used, please provide a table describing their values and ranges. If monthly or seasonal median values were not used, have a QP re-run the Project Assessment Case and Alternative Assessment Case 5 (see Table 2-3 in Appendix 04.3-A) to generate water quality predictions using either monthly (or seasonal) median background values or the annual 95th percentile of background; present results in a format similar to Appendix 6 of Appendix 04.3-A.

RESPONSE 515 ITT TABLE

The following prediction node have been added to the WLBM:

- WQEA1 which represents Goathorn Creek below confluence with tributary receiving discharge; and,
- A prediction node was not added for the tributary receiving discharge above confluence with Goathorn Creek as its quality has been assumed to be same as the end of pipe discharge due to the lack of water in this tributary.

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM. In summary the background water quality inputs used in the EAC Project Case (August 2022) WLBM were monthly mean values while seasonal values are used in both the Updated and Final EAC Project Cases (2024).

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Significant uncertainty remains in WLBM calibration, preventing a scientifically defensible effects assessment.

FOLLOW UP 293 ITT TABLE

"Thank you for the response. I note that the derived synthetic and measured site precipitation appear correlated, as demonstrated in the slides; however, the monthly linear relationships (pg 14) do not demonstrate a relationship approaching 1:1, which would indicate the synthetic approximates the measured data.

- *a) To clarify, were these monthly relationships used to further adjust the derived synthetic record to improve the fit to the measured data? [Clarification, QP response required]*
- *b) Please provide a figure showing concurrent cumulative precipitation records (i.e., double mass curve) and a table with monthly and annual precipitation from both the measured record and final derived/synthetic record(s) that was:*
  - *i. used as input to the water balance model, and*
  - *ii. used to characterize site precipitation and estimate extreme precipitation. If separate records were used, please present both. [EA information requirement, QP response required]"*

IR LETTER NEW AND NEW 293 ITT TABLE

Monthly linear relationships do not demonstrate a relationship approaching 1:1 which would indicate the synthetic approximates the measured data.

1. *Have a QP clarify if monthly relationships were used to further adjust the derived synthetic record to improve the fit to the measured data;*
2. *Have a QP provide a figure showing concurrent cumulative precipitation records (i.e., double mass curve) and a table with monthly and annual precipitation from both the measured record and final derived/synthetic record(s) that was:*

a. *used as input to the WLBM; and used to characterize site precipitation and estimate extreme precipitation (if separate records were used, present both).*

RESPONSE FOLLOW UP 293 ITT TABLE AND NEW 293 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Significant uncertainty remains in WLBM calibration, preventing a scientifically defensible effects assessment.

FOLLOW UP 294 ITT TABLE

Thank you for the response. I'm struggling to understand why this linear regression (Figure 4-16) was selected by the QP as appropriate for this analysis, given the issues described in the response. Without being able to attribute the difference unit runoff/discharge from these similarly located stations to a physical attribute or rationalize an incremental unit runoff of roughly 80 l/s/km2 for the area between these stations, using a 0.8 or 0.85 ratio to scale the historic Goathorn WSC record to the site station represents flawed logic, in my opinion. In particular, the high flow regression is driven, in large part, by the extrapolated high flow section of the site rating curve, where the curve is not supported by stage-discharge measurements.

As Goathorn Creek is the receiving environment for surface discharge from the proposed project and seepage from the management ponds in Post-Closure, the selected regression could have a notable impact on water quality predictions in the receiving environment, thus introducing considerable uncertainty into the assessment of impacts from the proposed project. I understand that this synthetic record was used, in part, to calibrate the rainfall-runoff model used in the water balance model. Using an updated regression (scale by drainage area or refined with

published data), please describe, and quantify the bias that was introduced into the baseline characterization, model calibration and results and impact assessment by the selected regression. Please consider comments ID 295 and 296 in your response. [EA information requirement, QP response required]

294 IR LETTER

Given the minor difference in drainage area between Goathorn-Hydro and Goathorn (08EE008) (1% difference), the selected linear regression (Fig 4-16) describes a surprisingly large difference in unit discharge.
Have a QP use an updated regression (scale by drainage area or refined with published data) to describe and quantify the bias that was introduced into the baseline characterization, model calibration, and results and impact assessment by the selected regression.

RESPONSE 294 IR LETTER AND FOLLOW UP 294 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

INITIAL COMMENTS

295 ITT TABLE

Please provide figures showing mean monthly measured and rainfall-runoff modelled streamflow for Tenas-Hydro, Goathorn-Hydro, and Telkwa-Hydro. It is hard to see the match of hydrograph shape and amplitude at moderate and low flows from the figures provided. As results from the GoldSim model are presented monthly, I am also interested in the visual match at a monthly timestep, over the daily timestep provided. [Information Request]

RESPONSE 295 ITT TABLE

See Attachment #295-1 for mean monthly streamflow from measured and modelled datasets. For measured streamflow, monthly average values were only calculated for months missing less than 5 days of data.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Significant uncertainty remains in WLBM calibration, preventing a scientifically defensible effects assessment.

FOLLOW UP 295 ITT TABLE

Thank you for the plots. It appears the rainfall-runoff model underpredicts the freshet, particular in 2018, and typically predicts that the freshet peaks in June, rather than in April or May as shown in the measured record. In addition, the model appears to be underpredicting summer low flows, with the exception of 2018 at Tenas-Hydro only. As this model was used in the water balance model to predict runoff for unimpacted watersheds as well as reclaimed mine impacted areas, this calibration introduces considerable uncertainty into the water management and water quality predictions. In your response to the following questions, please consider comments ID 294 and 296.

a) *What sensitivity analysis was completed on this model calibration? Were other rainfall-runoff model frameworks attempted and shown to be worse? In particular, I'm interested to know if a model with a more dynamic infiltration/runoff component was considered given the model application.*

b) *If the model were better calibrated to freshet conditions, please describe, and quantify the impact this would have on predicted surface discharge quantity and quality over the life of mine and over a range of climatic conditions?*

c) *If the model were better calibrated to summer low flow conditions, please describe, and quantify the impact this model improvement would have on predicted water quality in the receiving environment during low flow periods over the life of mine over a range of climatic conditions.*

d) *What data collection efforts are underway to support refining/recalibrating/redeveloping this model?*

e) *Why was this calibration considered sufficient for impact assessment? I note the QP has "strongly suggested that this study be revisited and that the model be recalibrated when longer ... records are available... and when all WSC flow data are published".*

RESPONSE FOLLOW UP 295 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Significant uncertainty remains in WLBM calibration, preventing a scientifically defensible effects assessment.

FOLLOW UP IR LETTER 295/296 AND 295 ITT TABLE

The rainfall – runoff model, used in the WLBM to predict runoff from unimpacted and reclaimed watersheds, appears to underpredict the median and range of flow conditions by a sizeable margin in Goathorn Creek, Tenas Creek and Telkwa River when compared to the synthetic records. The rainfall-runoff model also appears to poorly match the hydrograph shape, specifically the magnitude and timing of the freshet and the summer low flows when compared to the measured record. This poor calibration introduces considerable uncertainty into the water management and water quality predictions based on the WLBM results.

- *Have a QP provide a robust demonstration that the model is sufficiently calibrated to available measured and synthetic datasets with a focus on common flow conditions (the annual range of average flow conditions). Where modeled results deviate considerably from baseline characterization, describe and quantity the impact to predicted surface discharge quantity and quality, and predicted water quality in the receiving environment over the life of mine and for the applicable assessment cases caused by model bias.*

  OR

- *Have a QP recalibrate the rainfall-runoff model to provide the evidence outlined above. Describe the impact on surface water discharge quantity and quality, water management (waste management pond water levels), and receiving environment water quality over the life of mine. Provide revised results in a format consistent with Appendix 6 and G Appendix 4.3-A of the application for all assessment cases.*

RESPONSE FOLLOW UP 295 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Significant uncertainty remains in WLBM calibration, preventing a scientifically defensible effects assessment.

FOLLOW UP IR LETTER 295/296 AND 296 ITT TABLE

Thank you for the plots. It appears the rainfall-runoff model underpredicts the median and range of flow conditions by a sizeable margin in Goathorn Creek, Tenas Creek and Telkwa River when compared to the synthetic records. The flows at the 50% probability of exceedance in Telkwa River appear to be underestimated by over 10 m3/s and the estimated mean annual discharge (MAD) at this location is 27.3 m3/s (Table 4-24). Based on the provided flow duration curve (FDC) figure in the response, MAD has a 70% probability of exceedance using the synthetic record while the modelled record gives MAD a 45% probability of exceedance. Similarly, for Tenas Creek, at the 50% probability of exceedance, the modelled record is roughly 0.1 m3/s lower than the synthetic record, and the estimated MAD at this location is 0.5 m3/s. Based on the FDC for Tenas, MAD has a 26% probability of exceedance using the synthetic record, and the difference between the synthetic and modeled is roughly 0.15 m3/s, indicating the MAD is modeled roughly a third lower than the synthetic record suggests. At Goathorn Creek, the modeled record underpredicts the synthetic, which is likely also underestimated (see ID 294).

a) Why was this calibration considered sufficient for impact assessment?

b) Please calibrate the model to the bulk of flow conditions and describe and quantify the impact on surface water discharge quantity and quality, water management (waste management pond water levels), and receiving environment water quality over a range a flow conditions over the life of mine.

[EA information requirement, QP response required]

RESPONSE FOLLOW UP 296 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM.

Telkwa Mining believes **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** with the answers provided above addresses the requirements set forth in IR **Theme 2**.

THEME 1: DESIGN ALTERNATIVE TREATMENT OPTIONS WHICH ARE CAPABLE OF MEETING WATER QUALITY GUIDELINES (WQGS) NEAR APPROPRIATELY SITED DISCHARGE LOCATIONS

FOLLOWUP COMMENTS

175 ITT TABLE

EMLI is consulting with ENV on water quality monitoring and water management measures for this project. Telkwa Coal will need to propose conceptual design of management structures as part of the current application to demonstrate that the Project as proposed is capable of managing water not suitable for discharge and meeting WQGs.

176a ITT TABLE

EMLI understands that ENV's review of the surface water quality effects assessment and proposed water quality benchmarks is ongoing. EMLI notes that based on that review additional water quality mitigation for the Project may be required. Should water treatment or other mitigation measures be proposed for the Project, EMLI will review the information at that time. Telkwa Coal is encouraged to engage as soon as possible with EMLI on any proposed water treatment, especially if any passive or semi-passive technologies are proposed.

RESPONSE 176a ITT TABLE

Telkwa Mining understands if water treatment becomes a requirement that EMLI will need to be engaged with these technologies, whether they are passive, semi-passive or active. Telkwa Mining has started engagement with EMLI as of Q3, 2024.

LETTER IR 176 AND 176b ITT TABLE

1. *Provide conceptual design of alternative treatment options, mitigation measures, and management structures that can manage water not suitable for discharge and that meet BC WQGs.*

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

The Water and Load Balance Model (WLBM) is key to assessing the effectiveness of mitigation against effects to many VCs, including water quality.

- *Source control and mitigation or treatment options included in the WLBM do not demonstrate that Water Quality Guidelines (WQG) will be met near discharge locations and will lead to exceedance of WQGs over many kilometres of multiple watercourses.*

FOLLOW UP IR LETTER NEW AND 514 ITT TABLE

Provide design alternative treatment options which are capable of meeting WQGs near appropriately sited discharge locations. Describe the reliability, control-effectiveness, and treatment efficiency of each mitigation option including the currently proposed option – refer to BC ENV Best Achievable Technology (BAT) guidance. BAT assessments are required prior to the development of Initial Dilution Zones (IDZs) – also refer to BC IDZ development guidance.
When considering discharge standards, follow these best practices and minimum standards:

a) *The discharge must not be acutely toxic.*

Telkwa Mining completed a two-step process to determine if the discharges are potentially acutely toxic as follows:

1. A review was conducted of the end of pipe discharge concentrations versus the relevant BC Water Quality Acute Guidelines with any parameter having a concentration less than these guidelines not being acutely toxic; and,
2. For the few parameters that had end of pipe concentrations higher than the BC Water Quality Acute Guidelines, Borealis Environmental Consulting Inc was retained to review these concentrations versus the relevant acute toxicity limits for rainbow trout and Daphne Magna and determined that the modelled concentrations at end of pipe are not acutely toxic. Please see **Appendix 9: Evaluation of Acute Daphnia Magna and Rainbow Trout LC50 Toxicity Supporting Tenas Project Best Available Technology Assessment Study – Parameters of Concern: Nitrite, Iron (Total) and Iron (Dissolved)**.

Telkwa Mining commits to toxicity testing of final effluent discharges utilizing the methodology provided by BC government via Section F Toxicity Test Methods (https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/manuals/environmental-lab-manual/2023-09-18-bc-elm-2022-section-f.pdf).

b) If the untreated effluent contains constituents that exceed 80% of an applicable WQG, BMPs and BAT must be applied. Chronic WQG for the protection of freshwater aquatic life are most typically used as the guideline. However, if more sensitive uses or values are downstream (e.g., drinking water, irrigation, livestock, wildlife) the most protective WQG will be applied.

c) If the effluent still does not meet WQGs, repeat step (b). Document this iterative process.

d) If the effluent still does not meet WQGs after all reasonable BMPs and BAT are applied, an IDZ may be considered during the permitting process. Some chronic toxicity may be tolerated in the IDZ, but water quality should meet WQGs at the end of the IDZ. An IDZ will not be considered during permitting without an adequate BAT assessment.

e) If the water quality at the end of the IDZ still exceeds chronic WQGs, an SPO may be considered during the permitting process. SPOs must be protective of the site-specific environment. An SPO will not be considered during permitting without an adequate BAT assessment.

514 ITT TABLE

Within the bounds of the above best practices and minimum standards, the proponent, and their qualified professionals (QPs) are normally best suited to consider which site-specific factors should be evaluated regarding feasibility, reliability, control effectiveness, and cost effectiveness. To improve efficiency, it may be useful to have a conversation with the ENV on the file once an outline for the BAT assessment has been developed. In practice, the depth and detail of the BAT assessment submittal will be proportionate to the projected effluent quality. If the selected BAT will achieve BC WQGs at the point of discharge, the submittal can be brief and will likely be readily advanced. If the selected BAT is not capable of meeting BC WQGs in the receiving environment, the submittal must be more substantial and will be subjected to a more intensive review, as it must justify the greater risk to the environment.

Some of the technologies TCL has proposed to consider during the BAT assessment are likely to be effective mitigation measures for the Tenas project. TCL may need to consider a set (a series or train) of technologies to address all contaminants of concern. During an EA process, technologies must be at a readiness level of 7 to be considered as primary mitigation. At permitting, technologies must be at a readiness level of 8 or 9 to be considered as primary mitigation. ENV and EMLI consider some of the proposed technologies to be below the appropriate technology

readiness level (TRL) for the Tenas project. The proponent may conduct a Technology Readiness Assessment (TRA) (refer to technical guidance 21 on the Mining and Smelting Guidance webpage) for consideration by ENV and EMLI to demonstrate the technological readiness of any proposed technology. TCL is encouraged to engage with ENV and EMLI prior to undertaking a TRA.

FOLLOW UP 353 ITT AND 355 ITT TABLE

As a result of the BAT conducted for waste rock and tailings management, the selected strategy (subaqueous storage) will provide a good degree of source control in terms of ML/ARD rate, thereby improving effluent quality. However, a BAT assessment is also required to consider appropriate strategies for the management of mine effluent that will be discharged to the environment.

Discharges to ground and non-point source discharges to the environment must be assessed in addition to discharges to surface water. Standard thresholds for discharges to ground are outlined in the ENV guidance document, which is located here: https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/7276_env_rob_dtg_factsheet.pdf

The water quality model predicts that, due to a slowly advancing groundwater plume, the project will result in WQG exceedances in Four and Tenas Creeks. Although these impacts may not occur until after the target coal has been extracted, they are predicted to persist for generations.

The response to the initial comment includes an explanation that assumes an Initial Dilution Zone (IDZ). Similar to the SPOs, an IDZ will not be assessed or authorized unless a BAT assessment is first conducted (following the ENV guidance document). Following BAT, these considerations (SPOs and IDZ) can be assessed through the permitting process under the Environmental Management Act but are not appropriate for inclusion in this review under the Environmental Assessment Act. [Permitting Information Requirement]

IR LETTER OVERVIEW

Reviewers have identified that the current Application shows potential for significant adverse effects to water quality and aquatic biota as there is insufficient water quality mitigation measures to protect the receiving environment.

- *The predicted water quality and the approach to use a few small watercourses as effluent conveyance will result in residual effects to aquatic valued components (VCs) that cannot be reliably managed in BC Environmental Management Act permitting.*

Alternative treatment options capable of meeting WQGs at appropriately sited discharge locations are missing from the Application.

Additional conceptual design of alternative treatment options, mitigation measures, and management structures are needed to prevent the discharge of water that is not suitable for release to the environment.

IR LETTER OVERVIEW

The Water and Load Balance Model (WLBM) is key to assessing the effectiveness of mitigation against effects to many VCs, including water quality.

- *Source control and mitigation or treatment options included in the WLBM do not demonstrate that Water Quality Guidelines (WQG) will be met near discharge locations and will lead to exceedance of WQGs over many kilometres of multiple watercourses.*

LETTER IR 350 AND 350 ITT TABLE

Provide additional mitigation measures to address the significant exceedance of WQGs in frequency and duration for selenium, nitrite, sulphate and dissolved cadmium in Four Creek and Tenas Creek.

RESPONSE IR 175, 176b, 514, 350, 353, and 355

Final EAC Project Case (2024) Development

Telkwa Mining considered incorporating multiple additional mitigation controls in developing the Final EAC Project Case (2024) consisting of the following additional mitigation controls/best management practices (BMP) and/or technologies:

- Management and Control Pond liner design modifications (technology);
- Additional use of water by the CPP (BMP);
- Blasthole Liners (BMP);
- Passive/Active Flocculation(technology);
- Storage and Use of Freshet Water (BMP);
- Water treatment for surface water flows (technology); and
- Water treatment of seepage flows (technology).

The Final EAC Project Case (2024) does not have exceedances in the receiving environment except for parameters that are already in exceedance for background/baseline conditions and a short duration (4 year) exceedance of cobalt in Four Creek which is likely not to occur if attenuation mechanisms in groundwater were accounted for in the water model.

The following sections provide a description of each additional mitigation control/technology and modelled parameter concentrations compared to the Updated EAC Project Case (2024). Please see **Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK.**

Management and Control Pond Liner Modifications (technology)

Table 2-2 provides a summary of the liner systems presented in the EAC Application. These liners were incorporated into the various management and control ponds for the control of seepage from these structures primarily towards the downstream watercourses of Tenas, Four, and Goathorn Creeks.

Table 2-2: Environmental Assessment Certificate (EAC) Liner Designs

Location	Liner Type	Details
Tenas Control Pond	Bituminous	A bituminous liner installed on compacted existing overburden

Location	Liner Type	Details
North Management Pond (floor, embankment face)	Soil-Bentonite	30-centimetre (cm)-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a 16-ounce filter fabric protection layer all installed on top of compacted existing overburden
East Management Pond (floor, embankment face)	Soil-Bentonite	30-cm-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a 16-ounce filter fabric protection layer all installed on top of compacted existing overburden
West Management Pond (overburden floor, overburden in the pit and embankment face)	Soil-Bentonite	30-cm-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a 16-ounce filter fabric protection layer all installed on top of compacted existing overburden
West Management Pond (bedrock floor)	None	No liner prescribed
West Management Pond (bedrock south end EA Open Pit wall)	None	No liner prescribed

SRK completed an option analysis for Telkwa Mining on various liner modifications with the aim of reducing the potential impact of groundwater seepage to the receiving environment. **Table 2-3** provides two modified liner designs that were considered as a potential technology for BAT assessment provided in **Appendix 11: Tenas Project Best Achievable Technology Assessment Updated, SRK**.

Table 2-3: Revised Liner Designs Investigated

Location	Liner Type	Revised Liner Design Details
Tenas Control Pond	Soil-Bentonite with Bituminous Line Above	15-centimetre (cm)-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a bituminous geomembrane liner on top of this installed on compacted existing overburden.
North Management Pond (floor, embankment face)	Soil-Bentonite	56-cm-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a 30-cm thick layer of compacted overburden protection layer installed above the liner.
East Management Pond (floor, embankment face)	Soil-Bentonite with Bituminous	Option 1: 56-cm-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a 30-cm layer of compacted overburden protection layer installed above the liner. Option 2: 56-cm-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a bituminous geomembrane liner followed by

Location	Liner Type	Revised Liner Design Details
		a 30-cm layer of compacted overburden protection layer installed above the liner.
West Management Pond (overburden floor, overburden in the pit and embankment face)	Soil-Bentonite	56-cm-thick soil bentonite liner that is blended into existing overburden and compacted and then followed by a 30-cm layer of compacted overburden protection layer installed above the liner.
West Management Pond (bedrock floor)**	None**	No liner prescribed**
West Management Pond (bedrock south end wall)	None	No liner prescribed

Notes:

**There is still the possibility to introduce a soil-bentonite liner in the West Management Pond bedrock floor portions during the Operation Phase if parameters of concern are found to be higher in the North, and East Management Ponds than predicted in the EA.

The revised liners specified in **Table 2-3** above were incorporated into the groundwater model to determine seepage levels from these facilities with the revised technical report provided in **Appendix 8: Tenas Project, Hydrogeology Technical Report, SRK**. **Table 2-4** provides a summary of the changes in net seepage values achieved for the above structures.

Table 2-4: Seepage Values in m^3 per day with Revised Liner Designs at End of Mining for Options 1 and 2

CASE	WMP	NMP	EMP	TCP
Updated EAC Project Case (2024)	836	198	458	140
Option 1	373	87	277	8
Option 2	373	87	63	8

These revised seepage values were then used as inputs for the water and load balance model to look at potential mitigations compared to a base case without the use of liners. This was completed by SRK in Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK with **Table 2-5** providing a summary of these results for relevant prediction nodes. Based on the information in **Table 2-5** it was decided to carry this mitigation control forward into the BAT assessment process to determine if this mitigation control is recommended to be incorporated into the Final EAC Project Case (2024).

Table 2-5: Water Quality (Maximum Monthly Mean) Results for Revised Liner Designs in Post-closure using Typical Source Terms and Average Hydrology at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2024) (mg/L)	Updated EAC Project Case (2024) (mg/L)	Liner Option 1 (mg/L)	Liner Option 2 (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021	0.0021
WQSO6 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021	0.0021
WQS03-DS Four Creek	Cobalt (t)	0.004	0.00068	0.00092	0.00050
	Nitrite (t)	0.020	0.015	0.0084	0.00027
	Sulphate (t)	309	33	18	6
	Selenium (t)	0.0020	0.00081	0.00045	0.00013
WQS04 Tenas Creek	Copper (d)	0.0026	0.0015	0.0015	0.0015
	Nitrite (t)	0.020	0.0090	0.0084	0.0080
	Sulfate (t)	218	24	22	20
	Selenium (t)	0.0020	0.00078	0.00072	0.00063

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligrams per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.
Please note that dissolved copper exceeds the WQGs under background conditions.

Additional Water Use by the CPP

The current EAC application has the CPP producing a dry (25% moisture) processed rock stream that is then hauled and placed into the management ponds. The primary reason for this was to limit water use by the Project. However, as the Project discharges water every year when in operation even during drought conditions there is an opportunity to go to a conventional wet slurry system for the processed rock stream by the CPP. This will increase the amount of water required by the CPP with the benefit of permanently tying up this water into the coarse and fine processed rock products. Water from the open pit would be used for this additional use and would improve water quality discharged by the Project. The change in water use by the CPP was incorporated into the WLBM report completed by SRK which is provided in **Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK** with **Table 2-6** below providing a summary of these results for the relevant prediction nodes. Based on these

results and the increased water usage this mitigation control was not carried forward into the Final EAC Project Case (2024).

Table 2-6: Water Quality (Maximum Monthly Mean) Results for Additional Water Use by the CPP during Operation in Post-closure using Typical Source Terms and Average Hydrology at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2024) (mg/L)	Updated EAC Project Case (2024) (mg/L)	Additional CPP Water Use (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021
WQSO6 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021
WQS03-DS Four Creek	Cobalt (t)	0.004	0.00068	0.00069
	Nitrite (t)	0.020	0.015	0.015
	Sulphate (t)	309	33	34
	Selenium (t)	0.0020	0.00081	0.00085
WQS04 Tenas Creek	Copper (d)	0.0026	0.0015	0.0015
	Nitrite (t)	0.020	0.0090	0.0091
	Sulfate (t)	218	24	24
	Selenium (t)	0.0020	0.00078	0.00082

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligrams per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.
Please note that dissolved copper exceeds the WQGs under background conditions.

Blasthole Liners

Telkwa Mining has incorporated the use of blasthole liners for holes in rock requiring the addition of blasting agents into the Final EAC Project Case (2024) using a 75% effectiveness on the portion of nitrogen species being produced from blasting which is conservative compared to the actual 95% effectiveness observed at current operations in BC.

The change in nitrogen species was incorporated into the WLBM report completed by SRK which is provided in **Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK**, with **Table 2-7** below providing a summary of these results for the relevant prediction nodes. Based on these results this mitigation control was incorporated into the Final EAC Project Case (2024).

Table 2-7: Water Quality (Maximum Monthly Mean) Results for Use of Blasthole Liners during Operation in Post Closure using Typical Source Terms and Average Hydrology at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2024) (mg/L)	Updated EAC Project Case (2024) (mg/L)	Use of Blasthole Liners (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021
WQSO6 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021
WQS03-DS Four Creek	Cobalt (t)	0.004	0.00068	0.00068
	Nitrite (t)	0.020	0.015	0.010
	Sulphate (t)	309	33	33
	Selenium (t)	0.0020	0.00081	0.00081
WQS04 Tenas Creek	Copper (d)	0.0026	0.0015	0.0015
	Nitrite (t)	0.020	0.0090	0.0060
	Sulfate (t)	218	24	24
	Selenium (t)	0.0020	0.00078	0.00078

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligrams per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.
Please note that dissolved copper exceeds the WQGs under background conditions.

Passive/Active Flocculation

The EAC Application had a target of producing a maximum TSS concentration for 35 mg/L discharging from sedimentation ponds. To reduce total concentrations of parameters such as Iron and Aluminium, passive and active flocculation can be added to the TCP to reduce the designed maximum TSS concentrations from 35 mg/L to 5 mg/L.

The change in TSS was incorporated into the WLBM report completed by SRK which is provided in **Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK**, with **Table 2-8** below providing a summary of these results for the relevant prediction nodes. Based on the information in **Table 2-8** it was decided to carry this mitigation control forward into the BAT assessment process to determine if this mitigation control is recommended to be incorporated into the Final EAC Project Case (2024).

Table 2-8: Water Quality (Maximum Monthly Mean) Results for the Use of Passive/Active Flocculation During Operation in Post-closure using Typical Source Terms and Average Hydrology at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2024) (mg/L)	Final EAC Project Case (2024) (mg/L)	Decrease TSS levels to 5 mg/L (mg/L)
Tenas Control Pond	Aluminum (t)	0.27	0.39	0.07
	Iron (t)	1.0	1.5	0.2

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; WQG=water quality guidelines. Red text indicates exceedances of WQGs.

Storage and Use of Freshet Water

Telkwa Mining has investigated the storage and use of Freshet water from Channel C02 that diverts water around the Project into Four Creek. The use of water from the C02 channel is to improve the robustness of the water cover for PAG material in the management ponds especially the East Management Pond.

The change in the storage and use of freshet water was incorporated into the WLBM report completed by SRK which is provided in **Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK**, with **Table 2-9** below providing a summary of these results for the relevant prediction nodes. Given the minor reductions in parameter concentrations in the receiving environment and that this option is inconsistent with the best management practice of keeping noncontact water out of the Project, this mitigation control was not carried forward into the Final EAC Project Case (2024).

Table 2-9: Water Quality (Maximum Monthly Mean) Results for the Storage and Use of Freshet Water at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2024) (mg/L)	Updated EAC Project Case (2024) (mg/L)	Additional C02 Water to MPs (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0012	0.0021	0.0021
WQSO6 Goathorn Creek	Copper (d)	0.0012	0.0021	0.0021
WQS03-DS Four Creek	Cobalt (t)	0.004	0.00068	0.00056
	Nitrite (t)	0.020	0.015	0.011
	Sulphate (t)	309	33	26
	Selenium (t)	0.0020	0.00081	0.00063

Location Creek	Parameter	BC WQG (2024) (mg/L)	Updated EAC Project Case (2024) (mg/L)	Additional C02 Water to MPs (mg/L)
WQS04 Tenas Creek	Copper (d)	0.0026	0.0015	0.0015
	Nitrite (t)	0.020	0.0090	0.0079
	Sulfate (t)	218	24	22
	Selenium (t)	0.0020	0.00078	0.00065

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligrams per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.
Please note that dissolved copper exceeds the WQGs under background conditions.

Active Water Treatment

This mitigation control allows for the treatment of surface flows via various methods prior to water being discharged. This mitigation control was reviewed further using the subsequent BAT assessment process to select the appropriate technology for this Project and then determine if this technology was recommended.

Summary of BMP Assessment Process

Based on analysis above, **Table 2-10** below was generated which summarizes the results of the BMP Assessment process indicating which BMPs were selected for incorporation into the Final EAC Project Case (2024) and which technologies should be reviewed further in the BAT Assessment Process.

Table 2-10: Summary of the BMP Assessment Process

BMP / Technology	Incorporation into the Final EAC Project Case (2024)	Carried forward into the BAT Assessment Process	Comment
Additional use of water by the CPP	No	N/A	Not effective for the reduction of POCs in either seepage or surface discharge
Blasthole Liners	Yes	N/A	Incorporate into Final EAC Project Case (2024) as a source control technology
Storage and Use of Freshet Water	No	N/A	Not effective for the reduction of Parameters of Concern (POCs) in either seepage or surface discharges
Management and Control Pond Liner Modifications	N/A	Yes	Effective for reduction of seepage reaching downstream creeks
Passive/Active Flocculation	N/A	Yes	Effective for reduction some total parameter concentraions such as Iron
Active Water Treatment	N/A	Yes	Effective for reduction of POCs in surface water discharge to Goathorn Creek

BAT Assessment

As a reminder the Final EAC Project Case (2024) does not have exceedances in the receiving environment except for parameters that are already in exceedance for background/baseline conditions and a short duration (4 year) exceedance of cobalt in Four Creek which is likely not to occur if attenuation mechanisms in groundwater were accounted for in the water model.

As provided above the following mitigations were carried forward into the BAT process:

- Modified liners in the management and control ponds;
- Passive/Active Flocculation; and,
- Active water Treatment.

SRK identified several Parameters of Concern (POCs) based on the guidance definition provide by the Ministry of Environment for the Updated EAC Project Case (2024) WLBM using typical source terms. Potential water treatments could be applied to try and meet BC WQGs at the end of pipe and the receiving environment. To that effect, Telkwa Mining contracted SRK to complete a BAT assessment on available treatment technologies for these POCs using the guidance provided by the BC provincial government and SRK's full report is provided in **Appendix 11: Tenas Project Best Achievable Technology Assessment Updated, SRK**. A multi-step process that mirrored the 2024 guidance provided by BC ENV was followed as summarized by **Figure 2-7** below.

Table 2-11 below summarizes the results obtained by the MAA for the various water treatment technologies that were carried forward from screening analysis.

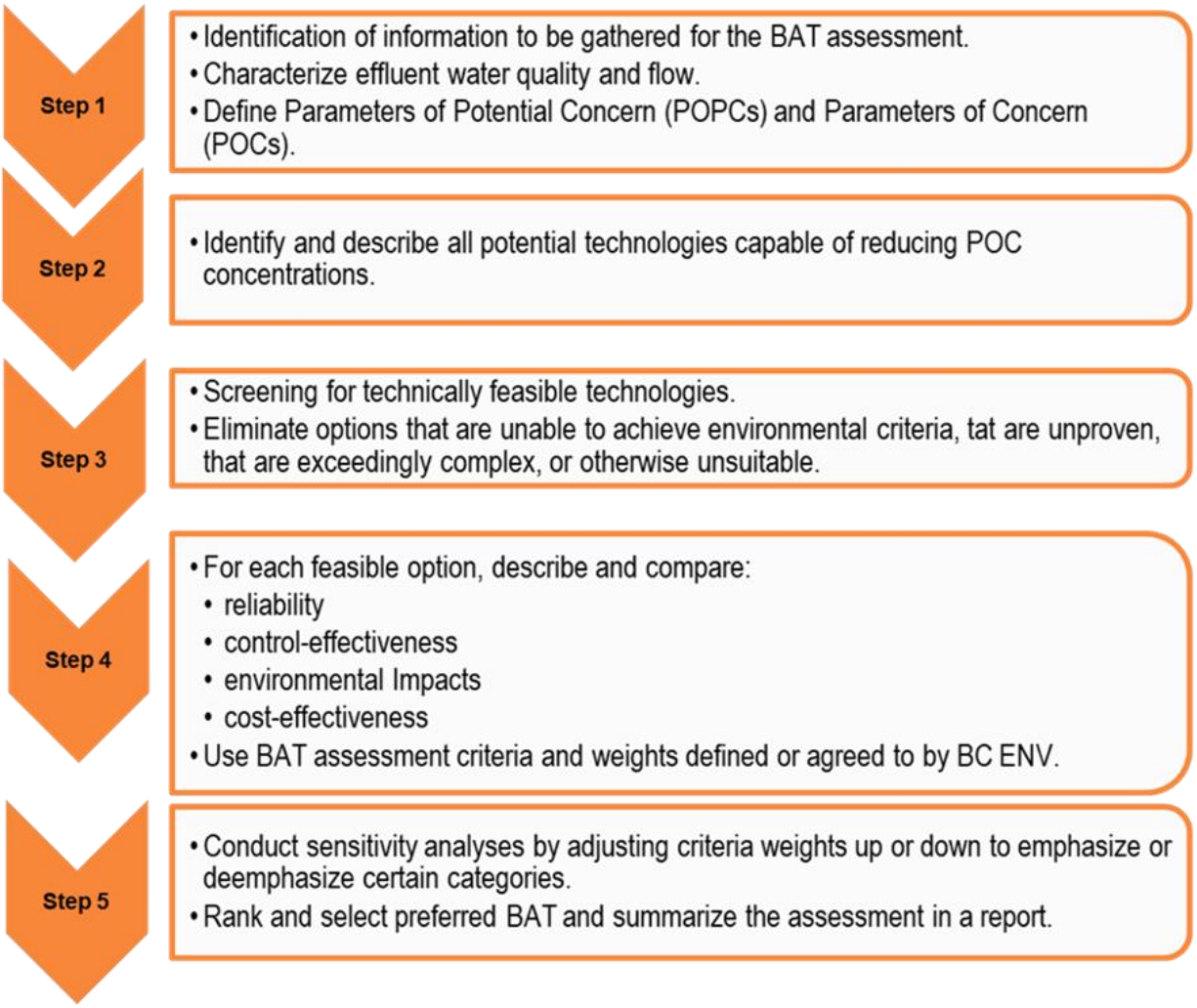


Figure 2-7: Bat Methodology Based on BC ENV's 2024 Guidance Document

Table 2-11: Summary of MAA Rankings for Active Water Treatment Technologies that Met Screening Requirements

		Base Case with BMPs	Passive/Active Flocculation	In-situ Active (GBR)	RO + MBBR	RO + MBBR + HDS Lime	RO + MBBR + Sulphide	RO + MBBR + Ferric	RO + MBBR + Ion Exchange	Zero Liquid Discharge	Modified Liners in Water Management Ponds
Assessment Criterion	**Weight**	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 7**	**Option 8**	**Option 9**	**Option 10**
Reliability	**20**	**17**	**16**	**14**	**15**	**14**	**14**	**15**	**14**	**12**	**16**
Risk Assessment	5	3	3	3	4	4	3	4	4	4	3
Robustness	5	5	3	3	4	3	4	4	3	4	5
Scalability	5	4	5	4	3	3	3	3	3	2	3
Long-term Viability	5	5	5	4	4	4	4	4	4	2	5
Control-Effectiveness	**30**	**13**	**13**	**20**	**20**	**22**	**22**	**20**	**26**	**28**	**13**
Pollutant Reduction	20	1	1	2.5	2.5	3	3	2.5	4	4.5	1
Toxicity Reduction	10	4.5	4.5	5	5	5	5	5	5	5	4.5
Environmental & Socio-Cultural Impacts	**25**	**23**	**23**	**22**	**20**	**17**	**17**	**17**	**17**	**10**	**22**
Energy Efficiency	5	5	5	4.5	3.5	3.5	3.5	3.5	3.5	1	5
Greenhouse Gas Emission	6	5	5	4.5	4	3.5	3.5	3.5	3.5	1	3.5
Footprint	4	5	5	4.5	4	3	3	3	3	3	5
Secondary Waste Production	5	5	5	4.5	4	3	3	3	2.5	1	5
Adherence to Yintah Management Directives	5	3	3	4	4	4	4	4	4	4	4
Cost-Effectiveness	**25**	**25**	**25**	**22**	**14**	**12**	**12**	**12**	**12**	**5**	**19**
Efficient Use of Existing Resources	3	5	5	4	2	2	2	2	2	1.5	3
Life Cycle Cost Analysis	22	5	5	4.5	3	2.5	2.5	2.5	2.5	1	4
Total	**100**	**78**	**77**	**78**	**69**	**65**	**65**	**64**	**69**	**55**	**71**

Source: https://srk.sharepoint.com/sites/NACAPR002055/Internal/BAT Assessment/Telkwa BAT Tech Screening REV01.xlsx

Based on the above table, the top ranking of the water treatment technologies is:

1. In-situ Active GBR and Base Case with BMPS/BATS with no additional mitigations;
2. Passive/Active Flocculation;
3. Modified Liners in Management and Control Ponds;
4. RO + MBBR and RO + MBBR + Ion Exchange; and,
5. RO + MBBR + HDS Lime and RO + MBBR + Sulphide.

The modelled water quality output for two selected water treatment systems (Options 1 In-situ Active GBR and 5 RO + MBBR + HDS Lime) is provided in **Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK**, with **Table 2-12** providing a summary of these results for the selected nodes. Given the results of the BAT assessment, and the impact on water quality in the receiving environment these two additional mitigations were not selected to be incorporated into the Final EAC Project Case (2024) as no exceedance was found in the receiving environment but rather these mitigations will only be incorporated via an approved Trigger Action Response Plan in permitting.

Table 2-12: Water Quality (Maximum Monthly Mean) Results for Active Water Treatment of Surface Flows in Post-closure using Typical Source Terms and Average Hydrology at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2024) (mg/L)	Updated EAC Project Case (2024) (mg/L)	In-situ Active GBR Treatment (mg/L)	Active Treatment RO+MBBR+HDS Lime (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021	0.0020
WQSO6 Goathorn Creek	Copper (d)	0.0013	0.0021	0.0021	0.0020
WQS03-DS Four Creek	Cobalt (t)	0.004	0.00068	0.00075	0.00069
	Nitrite (t)	0.020	0.015	0.010	0.015
	Sulphate (t)	309	33	44	34
	Selenium (t)	0.0020	0.00081	0.00066	0.00085
WQS04 Tenas Creek	Copper (d)	0.0026	0.0015	0.0016	0.0015
	Nitrite (t)	0.020	0.0090	0.0033	0.0091
	Sulfate (t)	218	24	36	24
	Selenium (t)	0.0020	0.00078	0.00033	0.00079

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligram per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.

Please note that dissolved copper exceeds the WQGs under background conditions.
Please note the current proposed configuration active water treatment does not affect groundwater seepage which is the causes of elevated POCs in Four and Tenas Creeks

Incorporation of Further Mitigations for the Final EAC Project Case (2024) based on the BAT and BMP Assessments

A review of the mitigation options was completed based on the BMP and BAT assessments completed above with the results summarized in the **Table 2-13** below to help guide how and when mitigations will be incorporated into the Final EAC Project Case (2024).

Table 2-13: Summary of Further Mitigations/Technologies Incorporated or Discarded for the Final EAC Project Case (2024) Based on the BAT and BMP Assessments

Mitigation	BAT or BMP	Recommendations
Management and Control Pond Liners	BAT	• Do not adopt in the Final EAC Project Case (2024). • Adopt as a contingency to be implemented via a Trigger Action Response Plan in permitting for West Management Pond. • Submit during Permitting phase for regulatory approvals.
Use of Blasthole Lines	BMP	• Adopt this option for the Final EAC Project Case (2024).
Use of passive/active flocculation in TCP and Rail Infrastructure Sedimentation Pond	BAT	• Do not adopt in the Final EAC Project Case (2024). • Adopt as a contingency to be implemented via a Trigger Action Response Plan in permitting. • Submit during Permitting phase for regulatory approvals.
Active Treatment of surface flows using RO+MBBR+HDS Lime	BAT	• Do not adopt in the Final EAC Project Case (2024). • Adopt as a contingency to be implemented via a Trigger Action Response Plan in permitting. • Develop Permit level Design. • Submit during Permitting phase for regulatory approvals.
Passive Treatment of surface and seepage flows via Gravel Bed Reactors	BAT	• Do not adopt in the Final EAC Project Case (2024). • Adopt as contingency to be implemented via a Trigger Action Response Plan in permitting. • Develop Permit Level Design. • Submit during Permitting phase for regulatory approvals.

Based on the above information the Final EAC Project Case (2024) will incorporate blasthole liners as a further BMP beyond those already provided in the Updated EAC Project Case (2024) and EAC Project Case (August 2022).

Contingency Mitigations, in accordance with a Trigger Action Response Plan

Following a meeting with EAO, BC Ministry of Environment, and BC Ministry of Mining & Critical Minerals on December 8, 2025, Telkwa Mining understands that the Province of BC is concerned

with potential uncertainty associated with the predictive modelling of water quality from greenfield mining projects and the use of In-situ Active GBRs as a primary mitigation means for addressing POCS. Telkwa Mining had SRK review and modify the BAT report to:

- Clearly recommend that RO+MBBR+HDS Lime is the primary mitigation to address future water quality concerns.

To deal with potential technology readiness concerns with the In-situ Active GBR water treatment technology, Telkwa Mining will commit to designing, permitting, and constructing a pilot In-situ Active GBR water treatment system in the CPP Sedimentation Pond or alternative pond as part of the Construction Phase so that this system is in place for monitoring its effectiveness for treating contact water and seepage from the Project to increase the technology level of this method to 8 or 9 for identified POCs (such as nitrogen species, selenium, metals).

Furthermore, to deal with potential uncertainty risks in the WLBM Telkwa Mining commits to designing both a permit level In-situ Active GBR and RO+MBBR+HDS Lime water treatment systems and applying for permit approvals for both contingency mitigations. By having permit approvals and permit level designs in place for constructing the In-situ Active GBR and/or the RO+MBBR+HDS Lime active water treatment systems will allow them to be constructed within approximately one year of making a final execution decision based on measured POC concentrations at the end of pipe, in the seepage, in the management and control ponds, and in the receiving environment during the Construction and Operation Phases prior to the POCs exceeding the BC WQGs in the receiving environment.

During annual monitoring specified during the permitting process, if it becomes evident that POCs will trend to be above the BC WQGs in the future, some or all the following additional contingency mitigations can be implemented for the Project based on a Trigger Action Response Plan that will be provided and approved during permitting:

- Implement water treatment for surface and seepage water flows using the In-situ Active GBR water treatment method in the management ponds as these ponds will be constructed with the necessary infrastructure already incorporated to allow for the construction of this water treatment process.
- Implement passive/active flocculation for the reduction of total parameter concentrations in sedimentation and control ponds.
- Implement RO+MBBR+HDS lime active water treatment into the Water Management Plan.
- As the liner for the WMP will not be constructed till after year 5 which allows the implementation of liner Modifications for the WMP prior to PAG being placed into the management pond if TARP indicates this is a requirement.

Construction and implementation of any of these contingency mitigations will be contingent upon, and in accordance with, an agreed upon consensus-based Trigger Action Response Plan (TARP) to be developed during the BC provincial permitting process. As an example, exceedances of defined parameter of concern concentrations measured by the water quality monitoring program at agreed upon locations, all as defined in the TARP, would trigger the construction of the RO+MBBR+HDS Lime (TRL 8 or 9) water treatment system. Construction of the water treatment system will not necessarily be during the Construction Phase or even during the Operation Phase of the Project, but rather will be based on monitoring of Parameters of Concern and modelling demonstrating that there will be exceedances of the identified permit limits in the future that will likely cause measured adverse impacts to aquatic receptors, and that the RO+MBBR+HDS Lime system would be able to treat. The TARP would have similar provisions for the other contingency mitigations noted above. This commitment is also contingent on the responsible permitting agencies agreeing to not incorporate the permitted water treatment facility (or other contingency mitigations) into bonding requirements until such time as the treatment facility (or other contingency mitigation) achieves commercial operation.

The Final EAC Project Case (2024) does not reflect the impact of adding these contingency mitigations to the predictions provided in the WLBM. However, TML had SRK investigate adding active water treatment technology **in Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK** and is also included in **Appendix 12: Environmental Effects Assessment - Surface Water Valued Component** and provided in **Table 2-12** above. The Final EAC Project Case (2024) was included in the WLBM completed by SRK without active water treatment and is provided in **Appendix 1: Tenas Project, Water and Load Balance Modeling Report (Updated 2025), SRK**.

Summary of Final EAC Project Case (2024) Submitted

With the completion of the BAT assessment process and implementation of recommended additional mitigation controls the modelled effluent still does not meet all WQGs at discharge(end of pipe).

Telkwa Mining's and SRK's view is that all reasonable BMPs and BATs have been implemented for the Project and while the Project is not in the permitting phase, the implementation of an IDZ can be considered during the EAC application process for point source surface water discharges to provide modelled parameters in the receiving environment. After applying an IDZ which is provided in **Appendix 13, Tenas Project - Initial Dilution Zone Assessment (Final), SRK**, identified that POCs due to the Project meet the BC WQGs for the protection of aquatic life at the edge of the IDZ except for parameters that already exceed the guidelines under background/baseline conditions.

Table 2-14 below summarizes the results of the EAC Project Case (August 2022), and the Final EAC Project Case (2024) against the BC WQGs at selected prediction nodes after the application of an IDZ for surface water discharge into Goathorn Creek. The Final EAC Project Case (2024) is provided in **Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK**.

Table 2-14: Water Quality (Maximum Monthly Mean) Results for EAC Project Case (August 2022), Updated EAC Project Case (2024), and Final EAC Project Case (2024) in Post-closure at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2025) (mg/L)	EAC Project Case (August 2022) (mg/L)	Final EAC Project Case (2024) (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0013	Not Available	0.0016
WQS06 Goathorn Creek	Copper (d)	0.0013	0.0019	0.0016
WQS03_DS Four Creek	Cadmium (d)	0.00023	0.00026	0.000012
	Cobalt (d)	0.00050	0.00066	0.00063
	Nitrite (t)	0.020	0.038	0.0090
	Sulfate (t)	309	360	33
	Selenium (t)	0.0020	0.0058	0.00081
WQS04 Tenas Creek	Cobalt (d)	0.00045	0.00082	0.00029
	Copper (d)	0.0026	0.0031	0.0013
	Nickel (d)	0.0025	0.0031	0.00063
	Nitrite (t)	0.020	0.045	0.0056
	Sulfate (t)	218	260	24
	Selenium (t)	0.0020	0.0041	0.00079

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligram per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.
Please note that dissolved copper exceeds the WQGs under background conditions.

In the EAC Application, Telkwa Coal submitted water quality and quantity predictions based on a Project development scenario. Telkwa Mining, with support from SRK, then completed an assessment of implementing new mitigations requested by the ENV and EMLI to determine if POC concentrations can get closer and ideally below BC WQGs in the receiving environment. The additional mitigation of incorporating blasthole liners was incorporated into what is now considered the Final EAC Project Case (2024) for water quality and quantity predictions. This case does not have exceedances of any parameters in the receiving environment except for dissolved cobalt for a short duration (four years) at one of the downstream Prediction Node in Four Creek.

Dissolved copper was also in exceedances in Goathorn Creek, but this parameter was above the WQG in the background/baseline. The effects assessment on the Surface Water Valued Component was updated to reflect the results of the Final EAC Project Case (2024) and using a local study area which is provided **Appendix 12: Environmental Effects Assessment - Surface Water Valued Component**. In summary, there is no change to the conclusion that was presented in the EAC Application submitted in 2022 which stated "**no significant adverse residual effects**" from the Project on the Surface Water Valued Component are expected.

Telkwa Mining believes the information in the attached appendices and the above information addresses the requirements set forth in IR **Theme 1**.

THEME 4: CONDUCT ADDITIONAL WATER QUALITY PREDICTIONS USING RECENT SENSITIVITY ANALYSIS OF THE SEMI-PERMEABLE POND LINER

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Recent sensitivity analysis of the semi-permeable pond liner to conduct additional water quality predictions is missing from the Application.

FOLLOW UP 1 - 356a ITT TABLE

Thank you for conducting the additional analysis and presenting the results at WQS03_DS and WQS04 at (post?) closure in the memo. Neither of these locations would be affected by the resultant increase in the surface discharge to Goathorn Creek, which was the concern underlying the original comment.

For discussion purposes, please consider Figure 4-8 of Appendix 4.3A: Water and Load Balance Modelling Report. Between 2045 and 2050, the cover water in the NMP has a higher selenium concentration than the pore water. Assuming a lower permeability liner, more cover water would be discharged to Goathorn Creek via the proposed surface discharge, commensurate with the reduction in pore water seepage under the ponds. This could result in an increase in selenium concentration in Goathorn Creek downstream from the discharge point.

Cover water concentrations also exceed pore water concentrations while the ponds are being actively loaded with the PAG material.

Using the 15% seepage reduction model (and commensurate increase in surface discharge), please provide a QP certified memo, including graphs predicting water quality (POCs only) at WQS06 from operations through post closure. Estimate water quality in Goathorn Creek at the effluent discharge point and WQS06. [EA Information Requirement]

IR LETTER 356 AND FOLLOW UP 2 – 356b ITT TABLE

Have a QP run three new WLBM scenarios:

- *Reduce the seepages through the management pond liners by 90% relative to the project case (with a commensurate increase in surface discharge). This scenario simulates blinding of the pond liners.*
- *Reduce the seepages through the management pond liners by 90% and assume low flow conditions (modified alternate case 5: 7Q10 low flow).*
- *Reduce the seepages through the management pond liners by 90% and assume high source term conditions (modified alternate case 2: high source terms).*

RESPONSE 356 ITT TABLE AND 356 ITT TABLE

This request is in relation to the request by ENV about the range in permeability that the soil-bentonite liner may experience due to construction variability which was provided during the round 1 IR as +/- 15%. Telkwa Mining has been requested to provide revised water quality predictions at EA1 assuming a 15% decrease in seepage under typical hydrology conditions, an 90% decrease in seepage under typical hydrology conditions, 90% decrease in seepage using 7Q10 low flows, and for a 90% decrease in seepage and high source terms under typical hydrology conditions.

While Telkwa Mining understands the need to review various scenarios, the 7Q10 scenario is not likely as during low flows the various management and control ponds will not be discharging to the environment as the Project will be keeping all water on site during this event to ensure the water covers are maintained for the various management ponds.

Table 2-15 below provides the summary of the results at relevant prediction nodes for the various parameters.

Table 2-15: Water Quality Results (Maximum Monthly Mean) for Seepage Scenarios at in Post-closure using Typical Source Terms and Average Hydrology at Relevant Prediction Nodes

Location Creek	Parameter	BC WQG (2025) (mg/L)	Final EAC Project Case (2024) (mg/L)	15% reduction in seepage and expected source terms (mg/L)	90% reduction in seepage and expected source terms (mg/L)	90% reduction in seepage, 7Q10 flows, and expected source terms (mg/L)	90% reduction in seepage and High source terms (mg/L)
WQSEA1 Goathorn Creek	Copper (d)	0.0013	0.0016	0.0016	0.0016	0.0016	0.0016
	Selenium (t)	0.0020	0.0013	0.0011	0.0020	0.0025	0.0032
WQSO6 Goathorn Creek	Copper (d)	0.0012	0.0017	0.0017	0.0017	0.0017	0.0017
	Selenium (t)	0.0020	0.0015	0.0011	0.0020	0.0025	0.0032
WQS03-DS Four Creek	Cadmium (d)	0.00023	0.000012	NA	0.0000079	0.000011	0.0000089
	Cobalt (d)	0.00056	0.00063	NA	0.00015	0.00060	0.00039
	Nitrite (t)	0.020	0.0090	NA	0.0016	0.0079	0.0049
	Sulphate (t)	309	33	NA	6.4	31	19
	Selenium (t)	0.0020	0.00081	NA	0.00013	0.00073	0.00048
WQS04 Tenas Creek	Cobalt (d)	0.00045	0.00029	NA	0.00025	0.00021	0.00072
	Copper (d)	0.0026	0.0013	NA	0.0013	0.0012	0.0013
	Nitrite (t)	0.020	0.0056	NA	0.0049	0.0039	0.016
	Sulfate (t)	218	24	NA	20	17	67
	Selenium (t)	0.0020	0.00079	NA	0.00063	0.00050	0.0024

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligram per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.
Please note that dissolved copper exceeds the WQGs under background conditions.

FOLLOWUP COMMENTS

IR LETTER 356 AND 356 ITT TABLE

Add a new node to the WLBM in Goathorn Creek, 100m downstream of the confluence with the tributary into which the effluent is discharged. For the 3 scenarios listed above, for each node where a parameter is predicted to exceed a chronic BC WQG PAL, graphically illustrate water quality (for the exceeding parameters only) at those nodes from baseline through to post closure. On each graph, show the chronic BC WQG for the most sensitive use or value.

RESPONSE 356 ITT TABLE

This prediction node has been added to the WLBM and is identified as WQSEA1. Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** which is a technical memo addressing the IR questions posed by ENV about the WLBM for a complete list of parameter concentrations and supporting graphs.

IR LETTER 356 AND 356 ITT TABLE

[Figures 2.2-2.4 of Appx 4.3 (WLBM report) show Four Creek joining Goathorn Creek at WQS05, instead of WQS06. Is this an error in the diagram? If so, has this error been incorporated into the model?]

Four Creek joins Goathorn Creek above WQSO6 (even above EA1) while Tenas Creek joins Goathorn Creek above WQS05 which has been verified as correct in the model. The figures have been corrected and included in **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK**.

Telkwa Mining believes the responses above in addition to those provided in the attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK** address the requirements set forth in IR **Theme 4**.

THEME 3: HAVE A QUALIFIED PROFESSIONAL IDENTIFY LENTIC AREAS IN THE RECEIVING ENVIRONMENT WHICH MAY RECEIVE SELENIUM FROM MINE OPERATIONS, AND ENSURE THAT BACKGROUND CONCENTRATIONS OF SELENIUM IN WATER, SEDIMENT, INVERTEBRATE, AND FISH TISSUES ARE COLLECTED AND COMPILED IN THOSE LENTIC AREAS

FOLLOWUP COMMENTS

IR LETTER NEW AND 520 ITT TABLE

Have a qualified professional identify lentic areas in the receiving environment which may receive selenium from mine operations, and ensure that background concentrations of selenium in water, sediment, invertebrate, and fish tissues are collected and compiled in those lentic areas.

RESPONSE 520 ITT TABLE

There are no lentic areas in the current receiving environment based on a review by Palmer Environmental as provided in **Appendix 14: Tenas Coal Mine Information Request # 498, 500-504, and 520 - Expert Advice Regarding Fish and Fish Habitat Within the Project Area, Palmer Environmental, Palmer Environmental** attached.

As part of permitting an Aquatic Effects Monitoring Program (AEMP) will be submitted describing the monitoring that will be completed in relation to all aspects of the Project including selenium concentrations and their species.

Telkwa Mining believes the responses provided above and in **Appendix 14: Tenas Coal Mine Information Request # 498, 500-504, and 520 - Expert Advice Regarding Fish and Fish Habitat Within the Project Area, Palmer Environmental, Palmer Environmental**, address the requirements set forth in IR **Theme 3**.

THEME 6: OTHER ITT TABLE COMMENTS

FOLLOWUP COMMENTS

FOLLOW UP 306 ITT TABLE

Due to the high consequence and likelihood of selenium speciation occurring as a result of reducing conditions commonly observed in lentic waters these processes should be included in the modelling. In addition, in order to have informative data to base impacts to the receiving environment on a water sampling node should be created a maximum of 100 meters downstream of the proposed discharge location. Currently, it appears that WQS06 is the nearest downstream node at approximately 4.3 km from the proposed discharge (refer to comment 319) [EA Information Requirement].

RESPONSE FOLLOW UP 306 ITT TABLE

Telkwa Mining acknowledges the comment and after discussion with EMLI in 2023 and QPs, the model cannot include the required modelling included in the model as it is difficult to predict with any degree of confidence what species of selenium produced and what concentrations might be present. It was agreed at the last meeting with the water sub-working group that this modelling would no longer be required.

Telkwa Mining has added a new prediction node labelled EA1 at point approximately 100 m from the discharge point into Goathorn Creek for the Project. As the selenium concentration in the Final EAC Project Case (2024) is below the BC WQGs no adverse effect is expected as the value in this guideline is protective for all selenium species as there is no distinction provided in the guidelines in terms of selenium species. The requirement of additional selenium and selenium species monitoring in the existing environment and during the Construction and Operation Phases can be made a condition of the EAC Certificate.

FOLLOWUP COMMENTS

FOLLOW UP 307 ITT TABLE

Due to the potential for impacts to aquatic biota and resident fish populations, these impacts should be considered in a local context [EA Information Requirement].

LETTER IR 307 AND FOLLOW UP 307 ITT TABLE

Consider the impacts of exceeded BC water quality guidelines (WQGs), particularly to aquatic biota and resident fish populations, at a local scale rather than regional scale.

RESPONSE FOLLOW UP 307 ITT TABLE

Please find the response for this ITT in the attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK**.

Telkwa Mining has implemented an additional mitigation use a pipeline to transport discharge from the Tenas Control Pond to Goathorn Creek in the Construction, Operation and Decommissioning and Reclamation Phases and will only use the existing channel once end of pipe parameter concentrations will not cause effects to fish and fish habitat in this channel.

In summary Telkwa Mining had SRK revise the effects assessment for the Surface Water Valued Component based on the Local Study Area versus the Regional Study Area and still found there were no significant adverse effects due to the Project on the Surface Water Valued Component.

FOLLOWUP COMMENTS

FOLLOW UP 310 ITT TABLE

It sounds like this stream will no longer provide any significant ecological function. This is an issue under the federal Fisheries Act and may need attention from MLWRS and/or DFO.

RESPONSE FOLLOW UP 310 ITT TABLE

The stream currently does not have flow for most of the year and only in major storm events and for a brief period in freshet is there any water flows present in this ephemeral channel, as its catchment is extremely limited under background/baseline conditions. Based on the background/baseline site assessment completed for fish and fish habitat as part of the EAC Application this tributary does not provide viable fish habitat according to QPs. The photo **(Figure 2-8 below)** below illustrates this stream during the October 2023 rainy season with no signs of water by the leaf debris left in the channel.



Figure 2-8: Tributary to Goathorn Creek During the October 2023 Rainy Season

FOLLOWUP COMMENTS

FOLLOW UP 319 ITT TABLE

Thank you for your response. It appears as though the closest downstream prediction node from the discharge location is WQS06, located approximately 4.3 km from the point of discharge. It would be useful to have a prediction node closer to the point of discharge, perhaps 100 meters downstream of confluence of unnamed tributary to Goathorn Creek and Goathorn Creek [EA Information Requirement].

RESPONSE FOLLOW UP 319 ITT TABLE

Telkwa Mining has added a new prediction node labeled EA1 at the point approximately 100 m from the discharge point into Goathorn Creek for the from the ephemeral tributary.

FOLLOWUP COMMENTS

FOLLOW UP 350 ITT TABLE

It appears that Water Quality Guidelines for selenium, nitrite, and sulphate (and dissolved cadmium in Four Creek) will be exceeded in approximately 4 or more kilometres of Four Creek, and 5 or more kilometres of Tenas Creek for up to half of the year (Nov-Apr) for more than ten years of the mine life. This is significant in magnitude, geographic extent, frequency, and duration. [Comment]

FOLLOW UP 350 ITT TABLE

Response for Comment 351 applies to this Round 1 Comment, however, Comment 351 remains unresolved, and that Round 1 Response does not address frequency and duration effects characteristics.

FOLLOW UP 351 ITT TABLE

I remain in disagreement with the scale at which effects to Valued Components are being assessed and, because of that, the residual effects characterization. TCL has changed this specific assessment metric to stream length, however, they still assess affects at the RSA scale. The fish, invertebrates and other VCs in Tenas and Four Creeks are predicted to be subject to potential impacts from multiple water quality constituents in more than 4 kilometres of creek (over 20 and 25% of the entire stream length per Attachment 351-1) during half of each year for 10 years of mine life. This is not low residual effects at the scale of the individual stream (most appropriate), or even at the scale of the entire Tenas Creek watershed (the LSA, more appropriate than the RSA).

RESPONSE FOLOW UP 351/350 ITT TABLE

Please find attached **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK**, for a signed and stamped response.

Telkwa Mining has implemented an additional mitigation use a pipeline to transport discharge from the Tenas Control Pond to Goathorn Creek in the Construction, Operation and Decommissioning and Reclamation Phases and will only use the existing channel once end of pipe parameter concentrations will not cause effects to fish and fish habitat in this channel.

In summary Telkwa Mining had SRK revise the effects assessment for the Surface Water Valued Component based on the Local Study Area versus the Regional Study Area and still found there were no significant adverse effects due to the Project on the Surface Water Valued Component.

FOLLOWUP COMMENTS

352 ITT TABLE

This section of App4.3-A indicated that total selenium exceedances are expected in both winter and summer months. The characterization of residual effects in 4.3 Surface Water Quality chapter contradicts this. Clearly indicate when total selenium will be exceeded. [EA Information Requirement]

FOLLOW UP RESPONSE 352 ITT TABLE

The Final EAC Project Case (2024) Model results in the downstream node in Four Creek (WQS03DS) show no exceedances of the WQG for selenium during any period. The maximum Final EAC Project Case (2024) maximum mean monthly modelled concentration through this period is 0.00081 mg/L.

Similarly, the Final EAC Project Case (2024) Model results for the downstream node of Tenas Creek (WQS04), show no exceedances of the WQG for selenium during any period. The maximum mean monthly modelled concentration through this period is 0.00015 mg/L for the Final EAC Project Case (2024).

FOLLOWUP COMMENTS

385/387 ITT TABLE

Table 5.2-1 provides the screening of water quality parameters to determine COPCs for wildlife, and ECCC notes that maximum modelled mean monthly values were used. ECCC recommends using a more conservative water quality statistic (e.g., maximum concentrations) to determine COPC values that would not be protective of acute effects during sensitive life stages for wildlife (e.g., amphibian egg and tadpole development).

385/387 ITT TABLE

Comment provided by Provincial ENV Reviewer: TCL's previous response is that a mean value is a maximum value ("the maximum modelled mean monthly value means the maximum concentration that is predicted."). I would ask them to have a QP confirm whether any single discrete sample is predicted to exceed an acute BC Water Quality Guideline for the protection of the most sensitive use/value (wildlife or avian in this case).

RESPONSE 385/387 ITT TABLE

Please see **Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK**.

FOLLOWUP COMMENTS

FOLLOW UP 388 ITT TABLE

Provincial Reviewer Response: Adequately addressed. Aquatic receptors are expected to be more sensitive to aluminum than avian spp or wildlife (ENV 2021. Reformat of 1988 Aluminum Water Quality Guidelines). Despite this, I would recommend they include aluminum in their residual effects characterizations.

RESPONSE FOLLOW UP 388 ITT TABLE

Aluminum was not carried forward into a residual effects characterization as Aluminum concentrations with the Project are within the natural variability of background/baseline conditions. This is demonstrated by the Telkwa River having exceedances of Aluminum under background/baseline conditions while upstream prediction nodes do not have exceedances from the Project for Aluminum. If monitoring indicates that Aluminum is trending above WQGs in

Goathorn, Four, and/or Tenas Creeks, Telkwa Mining will implement a water treatment strategy for this parameter. **Table 2-16** below summarizes the Aluminum results for selected prediction node.

Table 2-16: Water Quality Results (Maximum Monthly Mean) for Aluminum at Relevant Prediction Nodes for Updated EAC Project Case (2024)

Location Creek	Parameter (total)	BC WQG (2024) (mg/L)	EAC Project Case (August 2022) (mg/L)	Updated / Final EAC Project Case (2024) (mg/L)	Comments
WQSOEA1 Goathorn Creek	Aluminium	0.27	N/A	0.099	Upstream of WQS06 and WQS05 P50 background/baseline 0.034 P95 background/baseline is 0.66
WQSO5 Goathorn Creek	Aluminium	0.27	0.17	0.0089	Upstream of WQS09
WQS03_DS Four Creek	Aluminium	0.69	0.25	0.15	Upstream of WQSEA1 P50 background/baseline is 0.081 P95 background/baseline is 1.1
WQS04 Tenas Creek	Aluminium	0.35	0.10	0.068	Upstream of WQS05 P50 background/baseline is 0.047 P95 background/baseline is 1.7
WQSO9 Telkwa River	Aluminium	0.19	0.26	0.267 due to background/baseline conditions	P50 background/baseline is 0.12 * P95 background/baseline is 1.5
WQS011 Bulkley River Upstream	Aluminium	0.18	0.14	0.11	Downstream of Rail Loadout P50 background/baseline is 0.088 P95 background/baseline is 1.2
WQS012 Bulkley River Downstream	Aluminium	0.18	0.16	0.15	Downstream of confluence with the Telkwa River P50 background/baseline is 0.088 P95 background/baseline is 1.2

Notes: %=percent; BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligram per litre; WQG=water quality guidelines.
Red text indicates exceedances of WQGs.

FOLLOWUP COMMENTS

FOLLOW UP 389 ITT TABLE

Not adequately addressed. TCL's response is to argue why SPOs are appropriate thresholds for screening COPCs. ENV (and apparently ECCC) disagrees and believes unapproved SPOs are inappropriate to use in an EA process. Using WQGs to screen COPCs, we would screen, at the least, Aluminum, Cobalt, and Sulphate as parameters for further effects assessment and characterization, including for wildlife, avian and aquatic receptors.

RESPONSE FOLLOW UP 389 ITT TABLE

Table 2-17 (Table 5.2-1 from EAC Application) was revised based on the most stringent WQG available for fresh water/wildlife/avian and the Final EAC Project Case (2024) using the format of Table 5.2-1 from the EAC application. Please note Table 5.2-2 did not appear in the EAC Application.

Based on **Table 2-17** below no parameters were identified as Parameter of Interest in the receiving environment beyond Cobalt which as short-term exceedance (four years) of the WQGs. This parameter was also identified as POC in the BAT analysis provided in **Appendix 11: Tenas Project Best Achievable Technology Assessment Updated, SRK**. Based on this analysis no further mitigations are recommended beyond the best management practices and technologies already employed by the Project.

Table 2-17: (Table 5.2-1 in EAC application) Water Quality (Maximum Monthly Mean) Results for the Final EAC Project Case (2024) in Post Closure versus Relevant Guidelines

Parameter	Units	Final EAC Project Case (2024) (mg/L)	Location of Greatest Parameter Concentration	BC AWQG or BC WWQG (Aquatic, Livestock, or Wildlife)*, if none exist use CCME (mg/L)	Guideline Source	Exceedance Factor WQG (Final EAC Project Case (2024)) Maximum Modelled Result/Guideline
Aluminum (t)	mg/L	0.15	Four Creek, WQS03_DS	0.69	BC AWQG	0.22
Arsenic (t)	mg/L	0.0011	Four Creek, WQS03_DS	0.005	BC AWQG	0.22
Beryllium (t)	mg/L	0.00011	Four Creek, WQS03_DS	0.00013	BC WWQG	0.85
Boron (t)	mg/L	0.023	Four Creek, WQS03_DS	1.2	BC AWQG	0.020
Cadmium (d)	mg/L	0.000012	Four Creek, WQS03_DS	0.00023	BC AWQG	0.050
Chloride (t)	mg/L	0.47	Four Creek, WQS03_DS	150	BC AWQG	0.0030
Chromium (VI) (t)	mg/L	0.00074	Four Creek, WQS03_DS	0.001	BC WWQG	0.74
Cobalt (d)	mg/L	0.00063	Four Creek, WQS03_DS	0.00056	BC AWQG	1.1
Copper (d)	mg/L	0.0019	Four Creek, WQS03_DS	0.0047	BC AWQG	0.40
Fluoride (t)	mg/L	0.11	Four Creek, WQS03_DS	1.4	BC AWQG	0.080
Iron (d)	mg/L	0.12	Telkwa River, WQS09	0.35	BC AWQG (acute)	0.34
Lead (t)	mg/L	0.000060	Four Creek, WQS03_DS	0.0061	BC AWQG	0.0001
Manganese (t)	mg/L	0.012	Four Creek, WQS03_DS	1.1	BC AWQG	0.010
Mercury (t)	mg/L	0.0000038	Four Creek, WQS03_DS	0.000020	BC AWQG	0.19
Molybdenum (t)	mg/L	0.0012	Four Creek, WQS03_DS	0.034	BC AWQG (ruminant)	0.035
Nickel (d)	mg/L	0.0012	Four Creek, WQS03_DS	0.0047	BC WWQG	0.26
Nitrate (t)	mg/L	0.43	Four Creek, WQS03_DS	3.0	BC AWQG	0.14
Nitrite (t)	mg/L	0.0090	Four Creek, WQS03_DS	0.02	BC AWQG	0.45

Parameter	Units	Final EAC Project Case (2024) (mg/L)	Location of Greatest Parameter Concentration	BC AWQG or BC WWQG (Aquatic, Livestock, or Wildlife)*, if none exist use CCME (mg/L)	Guideline Source	Exceedance Factor WQG (Final EAC Project Case (2024)) Maximum Modelled Result/Guideline
Selenium (t)	mg/L	0.00081	Four Creek, WQS03_DS	0.002	BC AWQG	0.41
Silver (t)	mg/L	0.0000050	Four Creek, WQS03_DS	0.0015	BC AWQG	0.00
Strontium (t)	mg/L	0.33	Four Creek, WQS03_DS	2.5	ECCC FEQG for Aquatic Life	0.13
Sulfate (t)	mg/L	33	Four Creek, WQS03_DS	309	BC AWQG	0.11
Thallium (t)	mg/L	0.000013	Four Creek, WQS03_DS	0.0008	BC AWQG	0.016
Uranium (t)	mg/L	0.00025	Four Creek, WQS03_DS	0.0085	BC AWQG	0.030
Zinc (d)	mg/L	0.0025	Four Creek, WQS03_DS	0.014	BC AWQG	0.18

Notes: * = Wildlife and Aquatic guidelines were selected as there no plans on using the water from the Project for Irrigation Purposes.

* = WQG for stream with highest modelled concentration

BC=British Columbia; EAC=Environmental Assessment Certificate; mg/L=milligram per litre; WQG=water quality guidelines

Red text indicates exceedances of WQGs.

Telkwa Mining believes the details above and provided in attached appendices address the requirements set forth in IR **Theme 6**.

THEME 7: EMLI GEOSCIENCE CLARIFICATIONS

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

EMLI does not support the application of the concept that an entire zone can be designated potentially acid generating (PAG) or non-PAG based on an average weighed NPR. Application of an average weighed NPR implies that a portion of the material from that unit will become acid generating at some point in the future. Although the overall drainage from that storage area may be pH-neutral due to mixing with the non-PAG portion of the unit or non-PAG material from another unit, the current Management Plan does not address blending and the current source terms do not account for a blended non-PAG / PAG rock piles or covers that are exposed to allow advanced stage weathering and acidic hot-spots within the pile. Additional information should therefore be presented by the proponent to support this approach.

RESPONSE IR LETTER OVERVIEW

Telkwa Mining assumes the concern outlined in the statement above from EMLI is with *non-PAG* zones as the statement has no bearing on the PAG zones as the entire zone is submerged underwater as stated in the EAC Application section 1 even if portions of these zones are potentially *non-PAG* unless operational verification sampling provides evidence that portions of these zones could be managed as *non-PAG* based on operational NPR cut-off values and that they are also large enough to efficiently separate with the equipment available.

Telkwa Mining has identified that, even though an entire zone might be classified as *non-PAG* based on a comparison of its bulk composition to an NPR cut off of 2.0, that there might be a component of PAG rock both within the overall aerial extent of the zone and within the vertical thickness of the zone that may have to be managed appropriately to ensure ARD does not occur from separable PAG materials not being placed underwater. The source term for *non-PAG* material placement has assumed that appropriate segregation and mixing/blending has occurred within the vertical thickness during the mining process that a non-PAG landform (NPR > or equal to 2.0) is established for storage piles, embankments, and buttresses. If operational verification testing is conducted on PAG zones the same methodology will be used as what is used for *non-PAG* zones to identify any potential separable *non-PAG* material within PAG zones.

The following zone polygons can be identified as *non-PAG* using an NPR cutoff of 2.0 AP to 1.0 NP and their bulk geochemical properties:

- Overburden (Zone 0);
- Portions of Zone 1;
- Portions of Zone 4; and,
- Portions of Zone 8 (not mined as part of the EA Open Pit).

Table 2-18 summarizes the zone classification for materials at the Tenas Deposit based on their bulk geochemical properties.

Table 2-18: Material Zone Classification Based on NPR of 2.0

Material Zone Name	ARD Assignment in Mine Plan and EAC Application Based on an NPR of 2.0	Stratigraphic Location	Average Zone Weighted NPR
Zone 0 / Overburden	*non-PAG*	Till and overburden – topography to bedrock	17.5
Zone 1	*non-PAG* with potentially separable PAG zones	Bedrock surface to top of Seam e (minus Zone 1a)	3.1
Zone 1a	PAG	Select area above Seam e to bottom of Seam e	0.7
Zone 2 & 3	PAG	Bottom of Seam e to bottom of Seam c	0.8
Zone 4	*non-PAG* with potentially separable PAG zones	Bottom of Seam c to top of Seam b	2.6
Zone 5	PAG	Top of Seam b to top of Seam 1U	1.2
Zone 55	PAG	Top of Seam 1U to bottom of Seam 1L	1.9
Zone 6	PAG	Bottom of Seam 1L to bottom of Seam 1Lc	1.8
Zone 7**	PAG	Below Seam 1Lc to the bottom of Seam 1Ld	1.7
Zone 8**	*non-PAG* with potentially separable PAG zones	Below Seam 1Ld	5.0

** **Notes:** Zones 7 and 8 are not currently recovered within EA open pit design; (1) As understood all zones even bulk non-PAG zones contain some PAG material and in some cases these PAG materials could be large enough to segregate out during the mining process.

ARD=acid rock drainage; NPR=neutralization potential ratio; PAG=potentially acid generating

Figure 2-9 through **Figure 2-15** below illustrate the distribution of the average overall exploration drillhole weighted NPR values for rock zones mined within the EA Open Pit with polygons illustrated using an NPR cut-off of 2.0 with green exploration drillhole polygons being classified as *non-PAG* and red exploration drillhole polygons being classified as PAG.

Please note the **entirety** of Zones 1a, 2/3, 5, 55, and 6 were planned to be placed underwater in the EAC application and will continue to be planned to be placed underwater until verification testing is completed on blastholes demonstrate that *non-PAG* regions of a suitable size and thickness is present using an NPR cut off criteria of 2.0.

Please note this is for illustration purposes only as verification testing will be based on blastholes which will be completed on a much tighter spacing and be completed for every bench mined versus the entire length of an exploration drillhole.

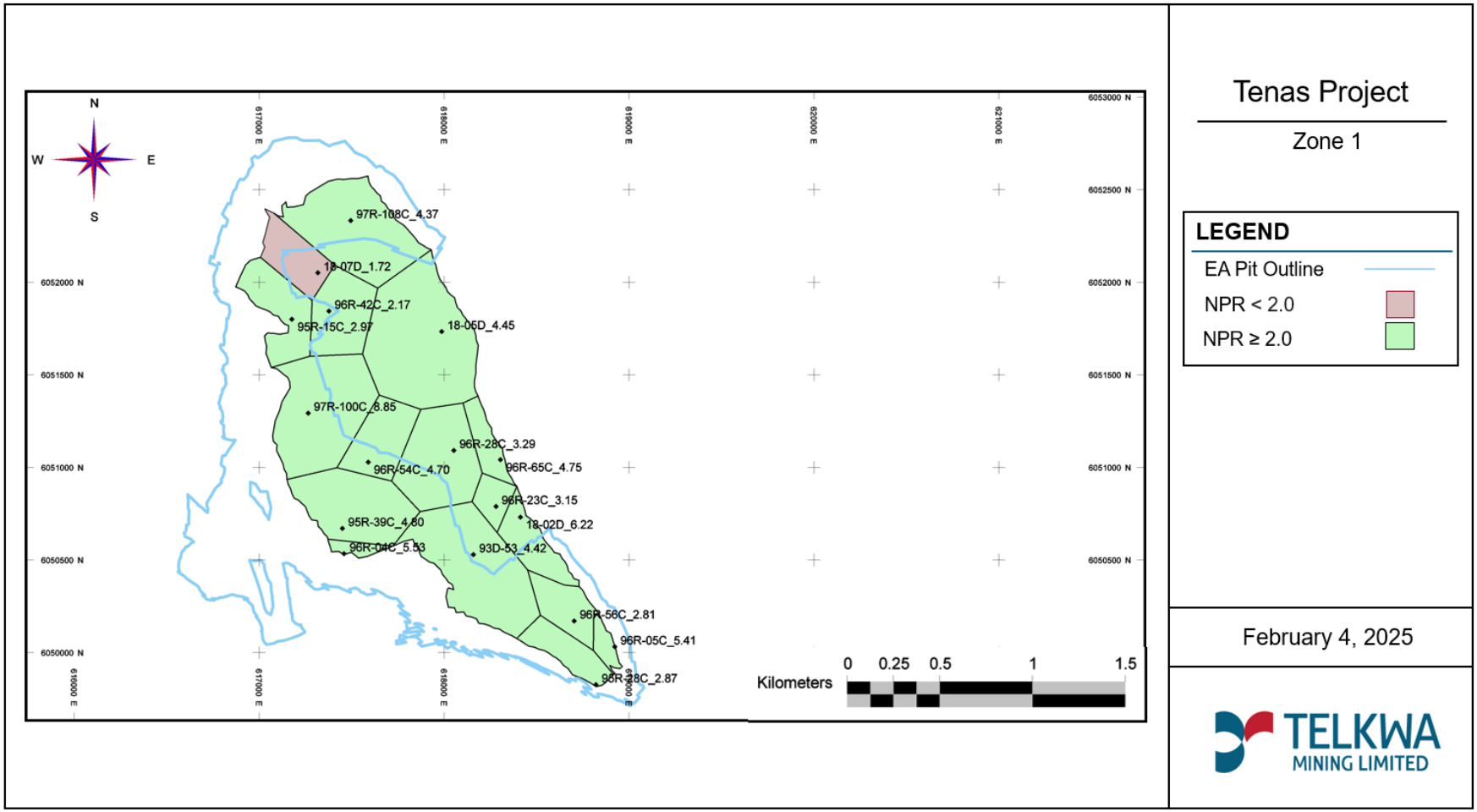


Figure 2-9: Zone 1 PAG and *non-PAG* Polygons Classified Against an NPR Cut-Off of 2.0, with Zones in Red Being Submerged Underwater in the EAC Application

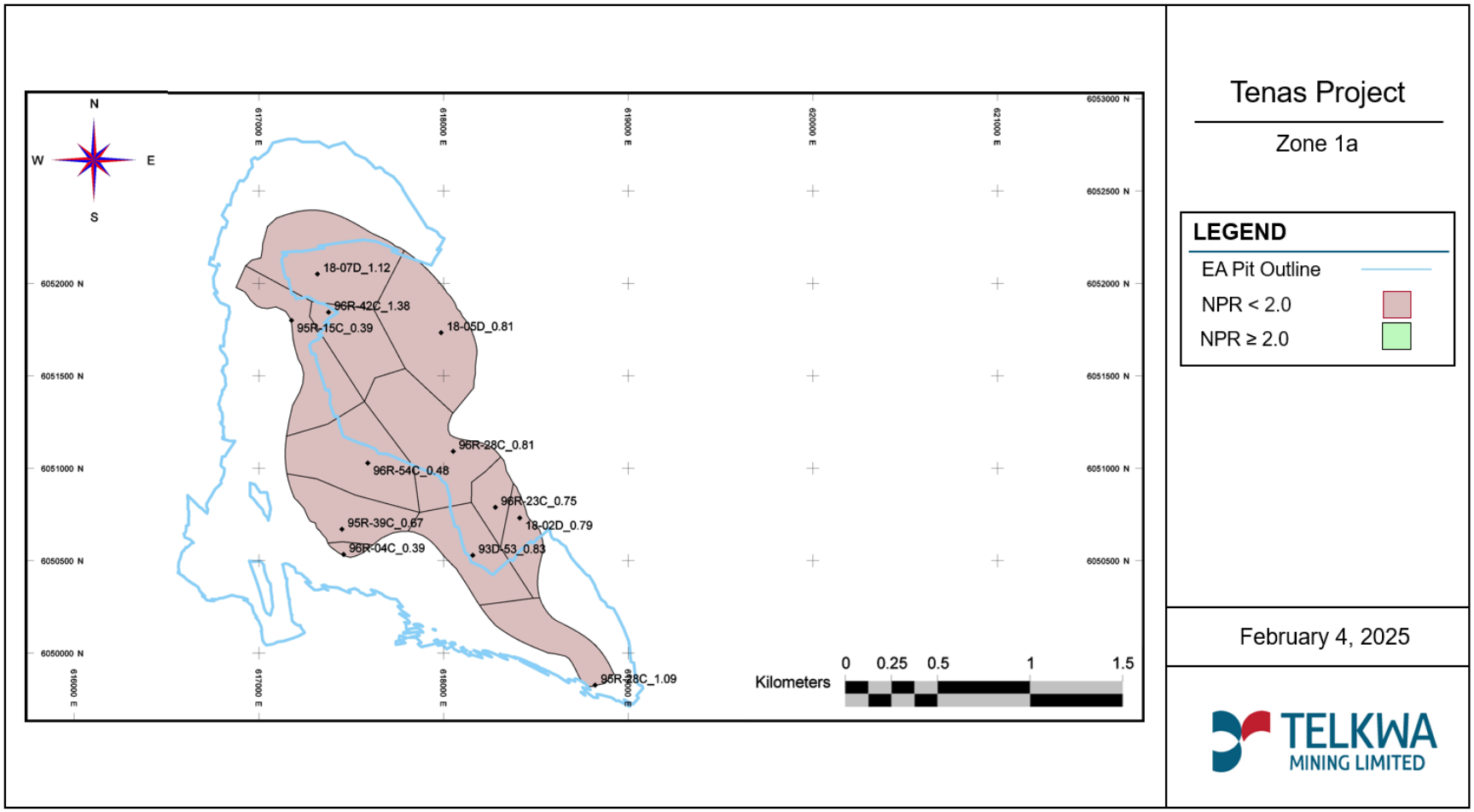


Figure 2-10: Zone 1a PAG and *non-PAG* Polygons Classified Against an NPR Cut-Off of 2.0, Entire Zone Treated as PAG in EAC Application and Submerged Underwater

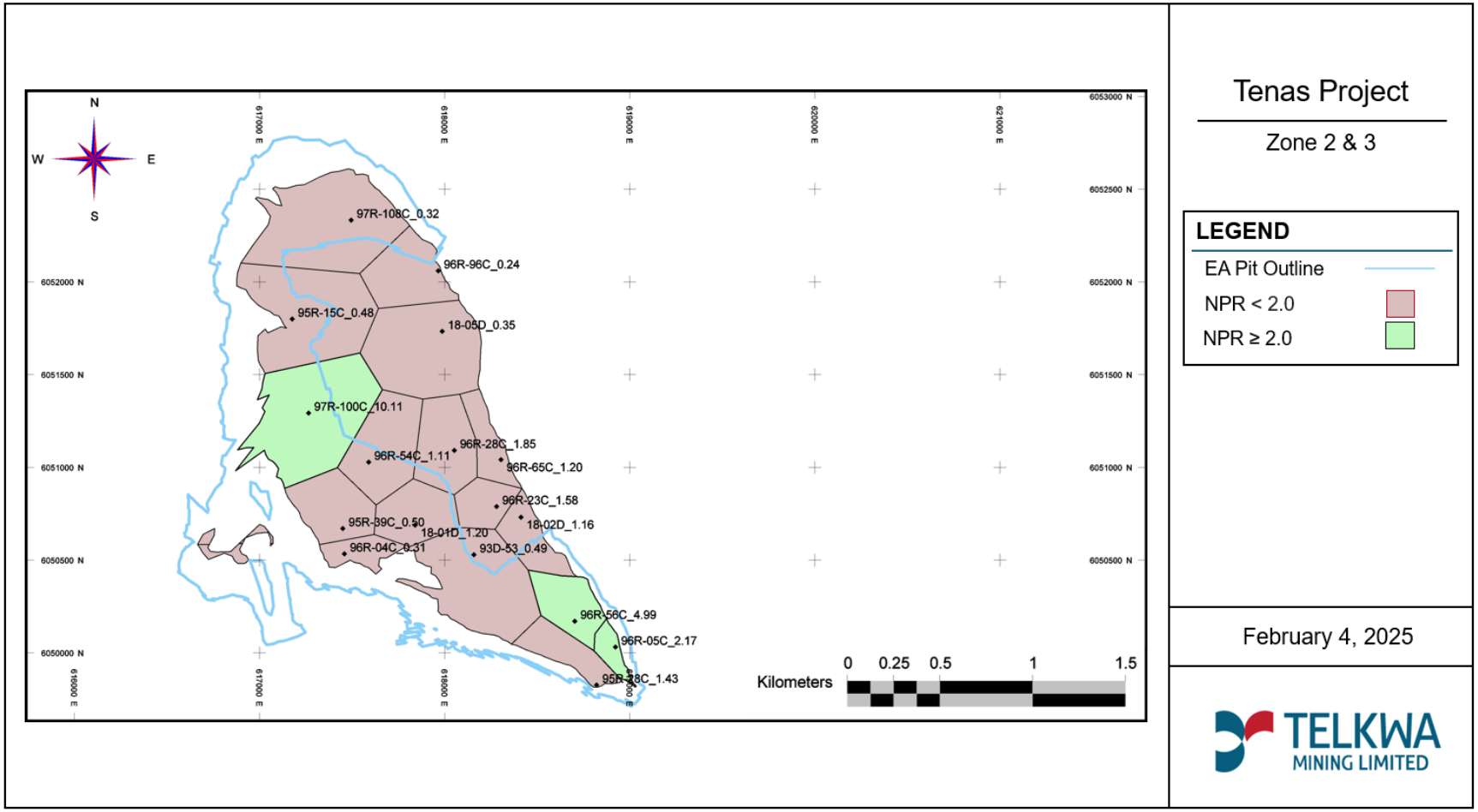


Figure 2-11: Zone 2/3 PAG and *non-PAG* Polygons Classified Against an NPR Cut-Off of 2.0, Entire Zone Treated as PAG in EAC Application and Submerged Underwater

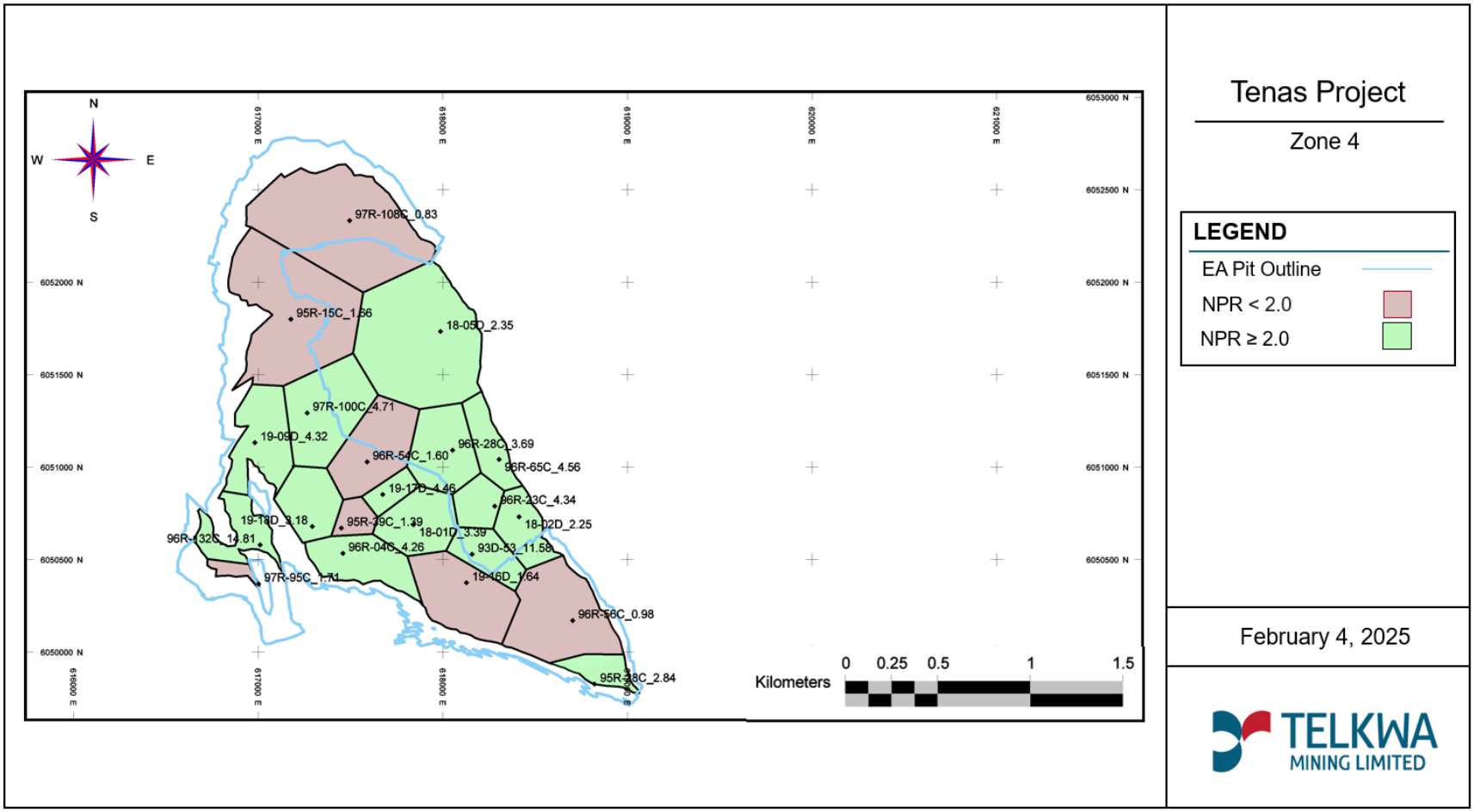


Figure 2-12: Zone 4 PAG and *non-PAG* Polygons Classified Against an NPR Cut-Off of 2.0, Red Polygons Submerged Underwater in the EAC Application

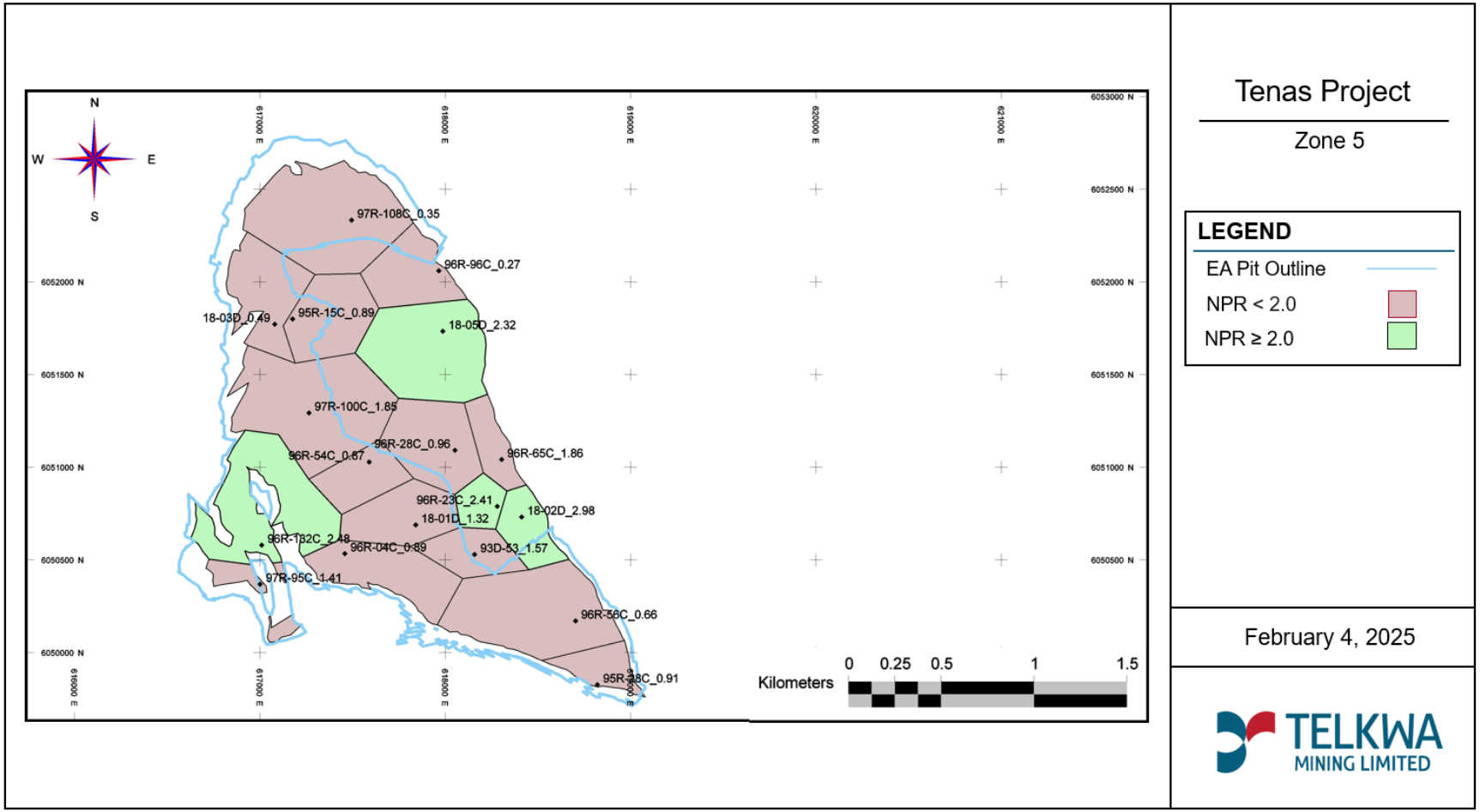


Figure 2-13: Zone 5 PAG and *non-PAG* Polygons Classified Against an NPR Cut-Off of 2.0, Entire Zone Treated as PAG in EAC Application and Submerged Underwater

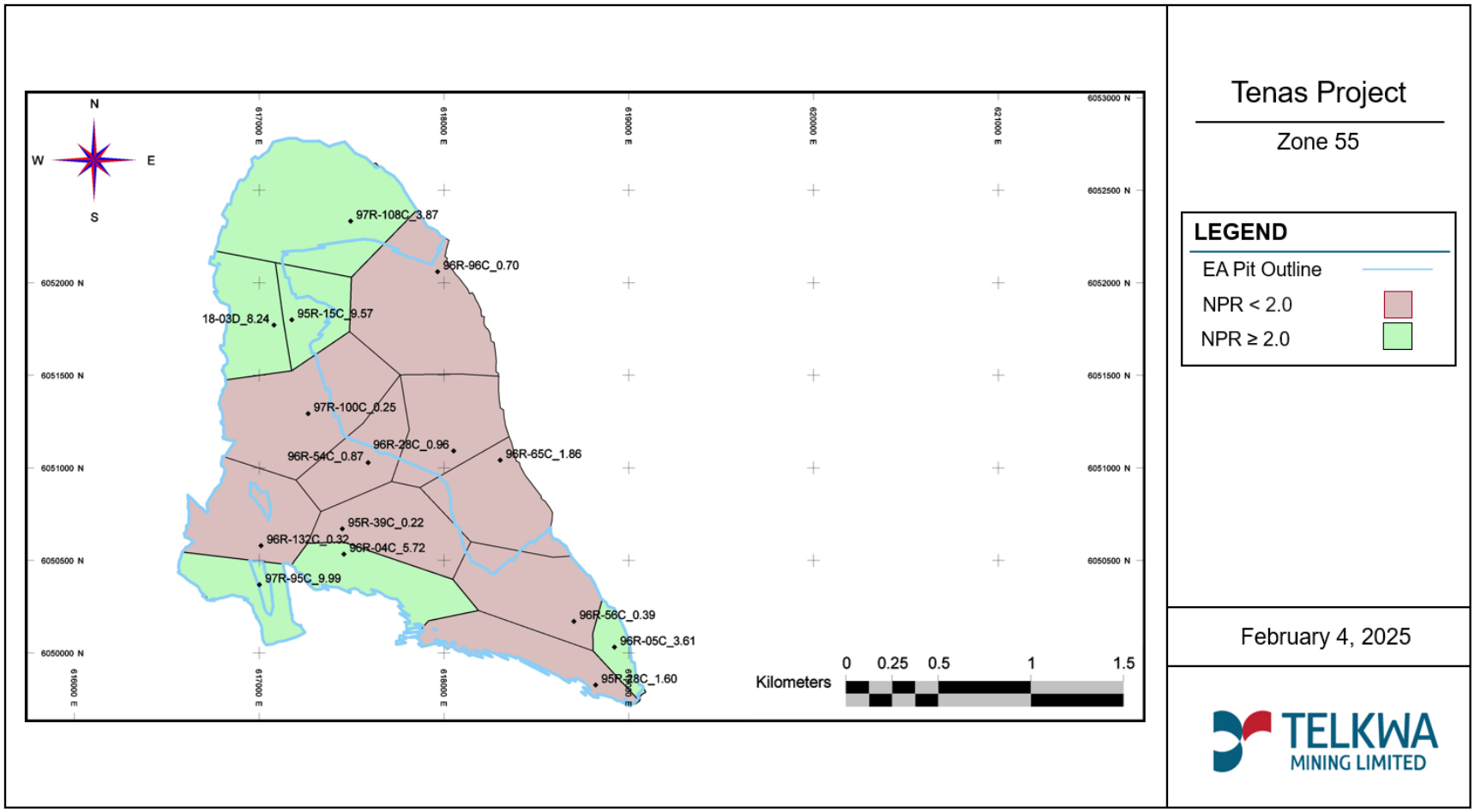


Figure 2-14: Zone 55 PAG and *non-PAG* Polygons Classified Against an NPR Cut-Off of 2.0, Entire Zone Treated as PAG in EAC Application and Submerged Underwater

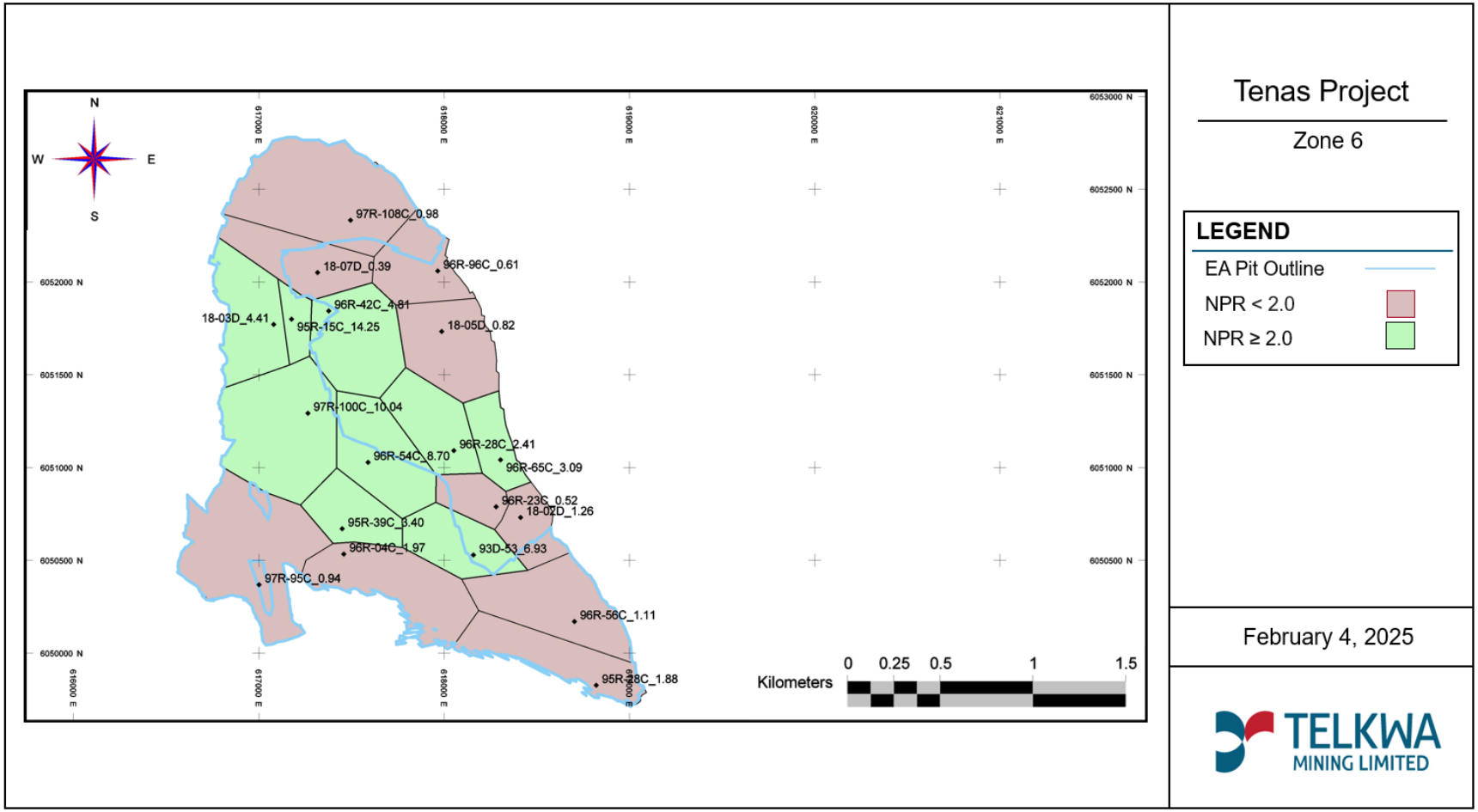


Figure 2-15: Zone 6 PAG and *non-PAG* Polygons Classified Against an NPR Cut-Off of 2.0, Entire Zone Treated as PAG in EAC Application and Submerged Underwater

As illustrated by the figures above, Zone 1 is the only zone that is almost entirely *non-PAG* on an aerial basis with only one exploration drillhole having an NPR less than 2.0 on an aerial extent (1.80) and Zone 1a is all PAG with no exploration drillholes having an NPR greater than or equal 2.0. Zones 7, and 8 have not been provided as there are no plans for mining of either of these zones and neither zone forms part of the EA Open Pit walls. Zones 1, 2/3, 4, 5, 55, and 6 have exploration drillholes that are both *non-PAG* and PAG based on the geochemical data collected using an NPR cutoff of 2.0. However, in the EAC application submission **all of zones 1a, 2/3, 55, 5, and 6 material** were classified as PAG and assumed to be placed underwater into the management ponds to be conservative for planning purposes while Zones 1, and 4 were demarcated into *non-PAG* and PAG polygons for the EAC Application based on the individual exploration drillhole NPR values on an aerial basis, distribution of material within the vertical column of exploration drillholes, and their locations respective to economic coal seams.

Note that these NPR values are only used for planning purposes and regulatory applications such as the EAC Application as the actual segregation of PAG from *non-PAG* will be based on field sampling and testing of blastholes with material being designated as PAG using a cutoff of an NPR 2.0 during the Construction and Operation Phases. The spacing of the blastholes will be on a much tighter spacing than exploration drilling can ever practically achieve.

Appendix 15: Tenas Project, Mine Material Management based on an NPR Cut-Off of 2.0, 1.80, 1.60, and 1.20, Telkwa Mining provides how Telkwa Mining would manage the various material zones would be managed if blasthole verification testing confirmed the exploration drillhole data and an NPR cut-off of 2.0 was used, or the EAC Application Methodology was used to classify PAG from *non-PAG* material. As demonstrated by **Table 2-19,** even when using an NPR value 2.0, a drillhole (exploration and/or blasthole) with a bulk property that would classify the entire drillhole polygon as *non-PAG* (NPR greater than 2.0) may have portions within the vertical length of a drillhole that may get placed underwater due to PAG intervals being present that can effectively be segregated (**Table 2-19**). **Table 2-19** indicates segregation is possible based on the drillhole interval NPR values.

Furthermore, some minor PAG units within an overall *non-PAG* drillhole polygon will become blended vertically within a polygon through the mining and blasting process into the surrounding *non-PAG* material so that the entire drillhole polygon can be considered *non-PAG* if these PAG zones are too small to be separated as illustrated by **Table 2-20**.

Finally, some geochemical zones in the EAC application that were classified as PAG might have polygons that could be managed as *non-PAG* during the Construction and Operation Phases. **Table 2-21** shows a Zone 6 exploration drillhole with a bulk NPR greater than 4.0 for this drillhole which could clearly be managed as *non-PAG* if confirmed by blasthole confirmation testing.

Table 2-19: Mining Plan for Zone 1 with a Bulk NPR of 3.29 for Drillhole T96R-28C

Hole-ID	Sample Depth and Thickness (m)			ABA Zones	Mine Plan Inputs				BULK ZONE NPR	EAC Application Plan	Mining Plan at NPR of 2.00
	From	To	Thickness		Sulfide	AP	NP	NPR			
T96R-28C	12.50	14.32	1.82	1	0.53	16.59	22.3	1.34		Place underwater	Place underwater
T96R-28C	14.32	14.68	0.36	1	0.71	22.12	9.73	0.44			
T96R-28C	14.68	15.08	0.4	1	3.79	118.57	47.42	0.40			
T96R-28C	15.08	17.07	1.99	1	0.79	24.7	23.2	0.94			
T96R-28C	17.07	17.86	0.79	1	1.48	46.31	19.6	0.42			
T96R-28C	17.86	18.40	0.54	1	1.02	32.03	7.04	0.22			
T96R-28C	18.40	19.66	1.26	1	1.10	34.36	21.4	0.62			
T96R-28C	19.66	20.11	0.45	1	0.26	8.1	29.5	3.62	3.29	non-PAG	non-PAG
T96R-28C	20.11	20.99	0.88	1	0.10	3	49	15.45		non-PAG	non-PAG
T96R-28C	20.99	26.93	5.93	1	0.23	7.3	36.7	5.05		non-PAG	non-PAG
T96R-28C	26.92	35.09	8.17	1	0.61	19.2	42.9	2.24		non-PAG	non-PAG
T96R-28C	35.09	35.93	0.84	1	0.31	10	416	43.38		non-PAG	non-PAG
T96R-28C	35.93	45.03	9.10	1	0.42	13.1	43.8	3.35		non-PAG	non-PAG
T96R-28C	45.03	47.83	2.80	1	0.24	7.6	43.8	5.80		non-PAG	non-PAG
T96R-28C	47.83	55.72	7.89	1	0.12	4	114	30.21		non-PAG	non-PAG
T96R-28C	55.72	63.86	8.14	1	0.27	8.4	44.7	5.31		non-PAG	non-PAG

Table 2-20: Mining Plan for Zone 6 with a Bulk NPR of 2.97 for Drillhole T96R-15C

Hole-ID	Sample Depth and Thickness (m)			ABA Zones	Mine Plan Inputs				BULK ZONE NPR	EAC Application Plan	Mining Plan at NPR of 2.00
	From	To	Thickness		Sulfide	AP	NP	NPR			
T95R-15C	6.50	7.62	1.12	1	0.129884	4.1	26.8	6.60		non-PAG	non-PAG
T95R-15C	7.62	7.92	0.30	1	-0.0183676	-1	473.6892	-825.26		non-PAG	non-PAG
T95R-15C	7.92	9.90	1.98	1	0.1802336	5.6	25.0	4.44		non-PAG	non-PAG
T95R-15C	9.90	11.34	1.44	1	0.2007464	6.3	48.3	7.70		non-PAG	non-PAG
T95R-15C	11.34	13.04	1.70	1	0.2016788	6.3	25.9	4.11		non-PAG	non-PAG
T95R-15C	13.04	14.18	1.14	1	0.2473664	7.7	22.3	2.88		non-PAG	non-PAG
T95R-15C	14.18	15.43	1.25	1	0.3452684	10.8	28.6	2.65		non-PAG	non-PAG
T95R-15C	15.43	17.05	1.62	1	0.2688116	8.4	25.0	2.97		non-PAG	non-PAG
T95R-15C	17.05	19.57	2.52	1	0.4711424	14.7	28.6	1.94	**2.97**	Blend into surrounding units	Blend into surrounding units
T95R-15C	19.57	21.51	1.94	1	0.7881584	24.6	51.9	2.11		non-PAG	non-PAG
T95R-15C	21.51	24.15	2.64	1	0.922424	28.8	30.4	1.05		Blend into surrounding units	Blend into surrounding units
T95R-15C	24.15	25.96	1.81	1	0.6016784	18.8	72.6	3.86		non-PAG	non-PAG
T95R-15C	25.96	27.30	1.34	1	0.5858276	18.3	32.2	1.76		Blend into surrounding units	Blend into surrounding units

Table 2-21: Mining Plan for Zone 6 with a Bulk NPR of 4.41 for Drillhole T18-03D

Hole-ID	Sample Depth and Thickness (m)			ABA Zones	Mine Plan Inputs				BULK ZONE NPR	EAC Application Plan	Mining Plan at NPR of 2.00
	From	To	Thickness		Sulfide	AP	NP	NPR			
T18-03D	17.500	17.650	0.15	6 Coal Cleaning					4.41	Place underwater	Place underwater
T18-03D	17.650	18.6	0.95	6	1.1	35.31	33.8	0.96			Blend into surrounding units
T18-03D	18.6	19.4	0.8	6	0.1	4.2	12.5	2.96			non-PAG
T18-03D	19.4	19.6	0.2	6	0.4	12.8	26.0	2.03			non-PAG
T18-03D	19.6	20.5	0.9	6	0.1	2.2	15.5	7.09			non-PAG
T18-03D	20.5	22.25	1.75	6	0	2	37	23.87			non-PAG
T18-03D	22.25	23.16	0.91	6	0	1	55	87.20			non-PAG
T18-03D	23.16	23.56	0.4	6	0	2	51	32.51			non-PAG
T18-03D	23.56	25	1.44	6	0	1	94	74.80			non-PAG
T18-03D	25	26.12	1.12	6	0	2	77	49.15			non-PAG
T18-03D	26.12	28	1.88	6	0.4	13.8	27.8	2.02			non-PAG
T18-03D	28	29.06	1.06	6	0.5	14.4	70.3	4.89			non-PAG
T18-03D	29.06	30	0.94	6	0.3	8.8	34.3	3.92			non-PAG
T18-03D	30	32.25	2.25	6	0.3	10.6	18.8	1.77			Blend into surrounding units
T18-03D	32.25	32.65	0.4	6	1.48	46.25	6.0	0.13			

As the material zones mined with excavators/shovels will occur in approximately 12-m benches and a ML/ARD verification process will be conducted in advance of mining, any potential PAG or *non-PAG* material will be identified at a bench scale (12 m) as the sample interval recovered will be based on the planned mining horizon for the rock units within a blasthole. If sampling identifies separable PAG units within a mining horizon that require active management that can be mined efficiently with an excavator/shovel they will be managed as per the procedure provided as follows:

- For any separable PAG rock within blasthole polygons (defined as 2 times the burden and spacing distances) identified with an NPR less than 2.0 will need to be placed underwater within an average of 6 months and no longer than 12 months to mitigate the generation of ARD;
- Rock resulting from coal cleaning will be treated as PAG even if surrounding materials is *non-PAG* due to the inclusion of coaly materials into the rock;
- Rock materials will be treated as *non-PAG* if verification testing shows an NPR greater than or equal to 2.0 within blasthole polygons (defined as 2 times the burden and spacing distances);
- For overburden, surface soils, processed rock, rock construction materials, and non-rock construction materials will be treated as PAG if their NPR is less than 2.0, and verification testing will need to be done for these materials if they are to be treated as *non-PAG* as per the **ML/ARD Management Plan (ML/ARDMP; S13.0-C12)**; and,
- If verification testing is not completed, rock and processed rock will be treated as PAG.

Operational sampling committed to under the **ML/ARD Management Plan (ML/ARDMP; S13.0-C12)** provides sufficient data for final decision making on material segregation and placement as it has the necessary density and sample frequency needed to provide the certainty required for the protection of water quality and downstream environmental integrity.

Furthermore, at least one confirmation sample will be taken for each blast pattern which will be sourced from the reserve samples kept from the blasthole samples from the blast pattern. This sample confirmation requirement applies if only one type of geochemical material is consistently present for the entire blast being mined (i.e., all PAG or *non-PAG*). If more than one material type is identified based on the NPR cut off of 2.0 within an individual blast pattern a confirmation sample will be taken from each identified geochemical material which will be identified by material type, geochemical classification, zone, bench, lift number, blasthole, and blast pattern identifiers.

Lastly, random quarterly *non-PAG* rock pile samples will be taken from active *non-PAG* rock lifts in areas where rock has been placed during the last quarter. The number of samples will be based on an approximate 200 by 200-m grid pattern and taking a sample on every node of this grid. The

same criteria will be used as for operational blasthole verification testing with material having an NPR less than 2.0 being designated as PAG, while materials with an NPR greater than 2.0 being designated as *non-PAG*. If PAG material is identified by these grid points additional sampling will be conducted on approximately 25-m offset concentric circles from this location until a *non-PAG* sample is measured as illustrated by **Figure 2-16** below.

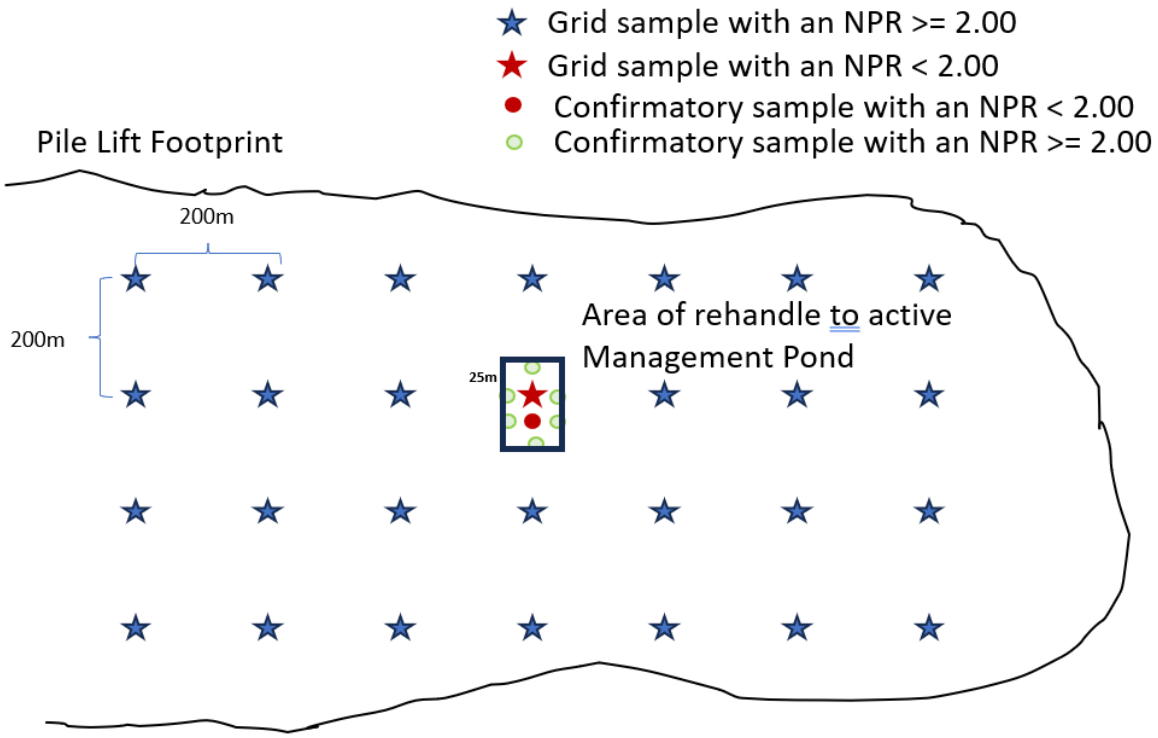


Figure 2-16: *Non-PAG* Pile Lift Material Confirmation Testing

Once the *non-PAG* rock pile lift area is defined by confirmatory testing and a bulk NPR and sulfur % has been calculated based on the sample testing completed; the following actions will be taken:

- If the bulk NPR for the sample is less than 2.0 an investigation will be completed, including a survey of the material's location and review of material that was placed there via the site electronic tracking system.
- Then a risk assessment will be conducted to determine if this this material will be rehandled and placed underwater in one of the active management ponds.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

The current sampling frequency does not provide adequate information to define or refine PAG volume estimates beyond what they have specified in the ML/ARD Management Plan. Monitoring the geochemical characterization of ore, waste, and overburden must be based on proper sampling frequency representative of the proportional volume of sampled materials.

LETTER IR 136 AND 136 ITT TABLE

Indicate what additional sampling and characterization studies are planned to meet BC ML/ARD Guidelines. For instance, Zone 4 is underrepresented in the static test database.

2 Available from: https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/permitting/ml-ard

RESPONSE LETTER IR 136 AND 136 ITT TABLE

SRK has provided responses to this geoscience IR in **Appendix 16: Telkwa Coal Tenas Project Environmental Assessment Application – Responses to 2022 Supplemental Geochemistry Information Requests from the Ministry of Energy, Mines and Low Carbon Innovation, SRK**.

FOLLOWUP COMMENTS

OVERVIEW IR LETTER

The metal leaching/acid rock drainage (ML/ARD) Management Plan in Section 6.4 specifies that all materials excavated from zones 1a and 2/3 will be managed as potentially acid generating (PAG). Material from zones 5, 55, and 6 were characterized as non-PAG but will be initially classified and managed as PAG unless testing can demonstrate otherwise. To facilitate the shorter turnaround times that are required to make operational decisions for placement of blasted rock, rejects, and other materials, the results of the geochemical characterization are used to develop operational proxies for determining NP and AP in an onsite laboratory that will be equipped with a Leco furnace. Section 6.1.3 of the ML/ARD Management Plan specifies an NPR of 1.2 is proposed to classify PAG mine rock at the Project. Clarifications and justifications on the ML ARD management plan and use of NPR 1.2 and 2 criteria as cutoff for verification and planning purposes should be provided.

IR LETTER 140, 142, 143, 146 and 148 AND 140a ITT TABLE

The ML/ARD Management Plan Section 6.4 specifies that all materials excavated from zones 1a and 2/3 will be managed as PAG. Material from zones 5, 55, and 6 were characterized as non-PAG but will be initially classified and managed as PAG unless testing can demonstrate otherwise. To facilitate the shorter turnaround times that are required to make operational decisions for placement of blasted rock, rejects, and other materials, the results of the geochemical characterization are used to develop operational proxies for determining NP and AP in an onsite laboratory that will be equipped with a Leco furnace. Section 6.1.3 of the ML/ARD Management Plan specifies an average weighted NPR of 1.2 is proposed to classify PAG mine rock at the Project.

1. *Provide clarifications and justifications for the proposed ML ARD management plan and use of weighed average NPR 1.2 and 2 criteria as cutoff for verification and planning purposes.*

RESPONSE 140a ITT TABLE

SRK has provided a response to this geoscience IR in **Appendix 16: Telkwa Coal Tenas Project Environmental Assessment Application – Responses to 2022 Supplemental Geochemistry Information Requests from the Ministry of Energy, Mines and Low Carbon Innovation, SRK.**

Telkwa Mining contracted SRK to provide a scientifically defensible NPR criterion for segregating *non-PAG* material from PAG material for the planning/regulatory and operational verification phases based on site-specific data for the Tenas Deposit and best practices provided in the MEND (2009) prediction manual for drainage chemistry from sulphidic geologic materials.

SRK determined that a site-specific NPR cut off criteria of 1.20 for this deposit was appropriate to characterize blasthole rock as PAG (NPR less than 1.2) or *non-PAG* (NPR greater than or equal to 1.2). However, Telkwa Mining has elected to use a more conservative NPR criterion of 2.0 as a cut off versus the site-specific value of 1.20 to identify exploration drillhole and blasthole rock as PAG and non-PAG. This criterion was selected to ensure that Telkwa Mining will not classify PAG rock as *non-PAG rock*. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, Telkwa Mining will apply to revise the proposed NPR criterion.

The following provides a clear definition for the NPR cut off criterion used for the Tenas Project.

Planning, Regulatory, and Operational Stages

For mine planning processes, regulatory submissions such as the EAC application and operational verification testing, an NPR cut off criteria of 2.0 will be used to segregate *non-PAG* from PAG in exploration drillhole and/or blasthole. All rock with an NPR value less than 2.0 will be designated as PAG while rock having an NPR >= 2.0 will be classified as *non-PAG* based on verification testing specified in the ML/ARD management plan attached in **Appendix 17: Metal Leaching/Acid Rock Drainage Management Plan, SRK**.

Non-rock materials such as surface soils, overburden, processed coal, processed rock, and run-of-mine coal were characterized as PAG or *non-PAG* also using a cut-off of 2.0.

The justification to use an NPR cutoff of 2.0 for the planning, regulatory submission and operational stages for rock and non-rock materials is based on other deposits in BC, and an understanding of the site-specific geochemical information for this Project. The NPR criterion of 2.0 is also supported by the static geochemical testing results which showed that positive correlation of calcium and magnesium to the modified-NP indicating carbonate minerals are available to neutralize acid production (SRK 2024b).In addition, as noted above, kinetic testing results (SRK 2024b) indicate that an NPR of 1.2 is sufficient to identify rock as PAG or *non-PAG*. Selection of an operational NPR greater than the site-specific value is therefore suitable for identifying rock as PAG or *non-PAG*.

FOLLOWUP COMMENTS

IR LETTER 140, 142, 146 and 140a ITT TABLE

2. *Clarify what NPR criterion of 1.2 or 2 will be applied to manage waste material from zones 5, 55, and 6 and define them as non-PAG or PAG.*

RESPONSE 140a ITT TABLE

An NPR criterion of 2 will be applied to manage rock material from all zones including zones 5, 55 and 6.

SRK has provided a response to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

148 ITT TABLE

Please provide an updated management plan that addresses comments discussed in comments EMLI 140, 142, 143, and 146

IR LETTER 140, 142, 146 and 148 AND 140a ITT TABLE

3. *Based on responses to comments EMLI 140, 142, 143, and 146 indicate if updates to the proposed Metal Leaching (ML) Acid Rock Drainage (ARD) management plan are needed to address blending of material.*

RESPONSE 140a ITT TABLE

No blending beyond what is provided through the normal mining process is planned for this Project.

The ML/ARDMP has been updated to reflect the proposed change in NPR criterion and is attached in **Appendix 17: Metal Leaching/Acid Rock Drainage Management Plan, SRK**.

SRK has provided a response to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

The ability to maintain a consistent water cover and to coordinate staged flooding and PAG placement was not demonstrated within the WLBM inputs or through contingencies in the waste management plan or mine plan.

168 ITT TABLE

The model assumes that all rock will be submerged underwater within 6 to 12 months. Please provide the contingencies in the waste management plan or mine plan to ensure maintenance of a consistent water cover and to coordinate staged flooding and PAG placement.

IR LETTER 140, 142, 146 and 148 AND 140a ITT TABLE

4. *Provide contingencies in the waste management plan or mine plan to maintain a consistent water cover and to coordinate staged flooding and PAG placement.*

RESPONSE 140a ITT TABLE

SRK has provided a response to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

LETTER IR 140, 142, 143, 146, and 145, AND 140b ITT TABLE

To address overestimation of available NP, please specify the best-fit linear regression of the data in Figure 8 and do not fix the line through the origin. A review of Figure 8 of Appendix 1.0-M that illustrates the relationship between TIC-Fe Corrected and Modified NP also indicates that the Modified NP may on occasion overestimate available NP and as a result, revising the NPR criterion to the minimum NPR cut-off value of 1.2 may result in PAG rock being managed as Non-PAG mine rock.

a) *Provide a greater range of percentile values in Table 2-4 and provide discussion of how spatially extensive a full PAG interval would be encountered for each zone in the pit.*

Regulatory Clarification provided via email from Morgan Dyas on February 9th, 2024

The request to "provide a discussion of how spatially extensive a full PAG interval would be encountered for each zone in the pit" is based on the implications stemming from the statement in Appendix 1.0 M (SRK, 2022) that a unit is NPAG based on an average NPR > 1.2. The characterization results indicate that the Tenas Project geologic units contain both PAG and NPAG strata. For example, more than 10 of the 20 boreholes that intersected Unit 5 have NPR < 1.2, thus over ½ of the strata in this unit is PAG. By stating that overall a unit is NPAG implies that the mixing and blending associated with the standard mining procedures of a unit will prevent localized ARD from forming within a waste rock pile. To prevent localized ARD, published blending studies (Andrina, 2009; Mehling, 1998) indicate that blended quantities greater than 1:1 are required. This could not be achieved for Unit 5 without active management and may be difficult for units such as Unit 6 or Unit 7 that have median NPR of 1.7 and 1.6, respectively.

An understanding of the spatial distribution of PAG and NPAG within a stratigraphic unit would be required to allow effective blending to occur. The request to provide the spatial distribution of PAG strata was to determine if there is currently enough data to support that units designated as NPAG could actually be handled and placed as NPAG. Handling the entire zone for units 1a, 2/3, 5,55 and 6 as PAG and placing them in permanent flooded storage the average thickness and aerial map extent of each unit within the pit limits is adequate. However, if another type of PAG management is considered, more detailed characterization and identification of NPAG zones would be requested.

Information required for units 1 and 4 where NPAG is proposed to be segregated from PAG provide a map with average thickness and extent of the PAG and NPAG zones within the pit limits and show data points that were used to define the zones. This information would be helpful to inform additional characterization that may be required to allow segregation decisions to be made during permitting and/or operations.

Reference:

Andrina, J., 2009. Physical and Geochemical Behaviour of Mine Rock Stockpiles in High Rainfall Environments. A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Graduate Studies (Mining Engineering), the University of British Columbia.

Mehling, P. 1998. BLENDING AND LAYERING WASTE ROCK TO DELAY, MITIGATE OR PREVENT ACID ROCK DRAINAGE AND METAL LEACHING: A CASE STUDY REVIEW MEND Project 2.37.1 April 1998.

RESPONSE 140b ITT TABLE

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

To clarify, SRK (2022) does not state that zones whose bulk properties are *non-PAG* will be mined as *non-PAG*. SRK (2022) states that all zones contain both PAG and *non-PAG* zones. The classification on the bulk properties was completed to provide an estimate of the *non-PAG* and

PAG quantities for the purpose of mine planning. As described in the ML/ARD Management Plan, verification will be conducted for *non-PAG* zones and separable PAG intervals in *non-PAG* zones will be segregated and submerged in the management ponds, in the same manner as rock from zones that were characterized as PAG based on their bulk quantities.

Telkwa Mining has stated that no blending is occurring for *non-PAG* units on a horizontal aerial basis to achieve a higher NPR, rather *non-PAG* areas will not be placed underwater while PAG areas will be placed underwater. The only blending that will occur is within the vertical horizon of a mining bench of 12 meters which is expected to occur from drilling/blasting and mining activities within the dig face.

Figure 2-17 shows how Zone 5 would be segregated if verification testing agreed with the exploration drillhole polygons and an NPR cut-off of 2.0 was used with blocks in green being treated as *non-PAG* while blocks in red and yellow are treated as PAG. The above methodology follows a very similar and proven process used in metal mines to designate ore from mine rock, with this Project is using it to designate PAG from *non-PAG* rock. However, in the EAC Application the entire Zone 5 was classified as PAG and placed underwater. The same exercise could be completed using a different NPR criterion value if Telkwa Mining were successful in amending the NPR value of 2.0 being used in the EAC application.

Zones 5 and 6 are both entirely placed underwater in the EAC application so there is currently no segregation of polygons above an NPR of 2 versus below 2 so the statement above is not applicable to the EAC application. As stated earlier, Zones 7 and 8 are not mined within the EA open pit so the reference to Zone 7 above is not relevant to this application, however it would be subject to the same verification testing as other zones if it were to be encountered and to be treated as non-PAG.

Figure 2-18 and **Figure 2-19** illustrate how zones 1, and 4 were split into PAG and *non-PAG* zones for the EAC application using a cut off of 2.0. Polygons coloured in red and yellow were treated as PAG while polygons colored green were treated as *non-PAG*.

The methodology proposed is like that used to define ore and non-ore at a metal mine based on the blastholes and blending is currently not planned to occur.

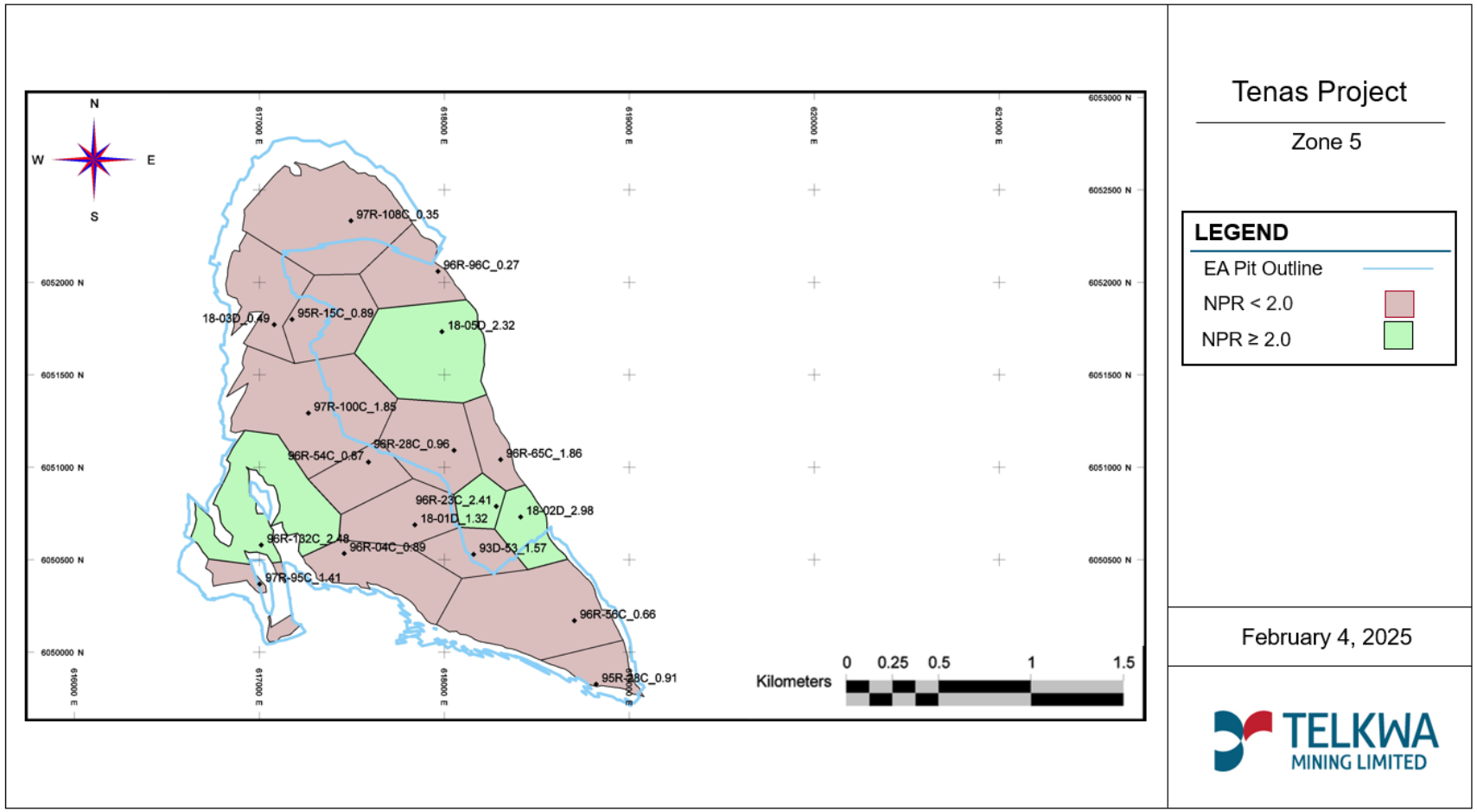


Figure 2-17: Zone 5 Classification Based on Using an NPR Cutoff of 2.0 with Red Polygons Being Classified as PAG and Green Polygons Being Treated as *non-PAG*

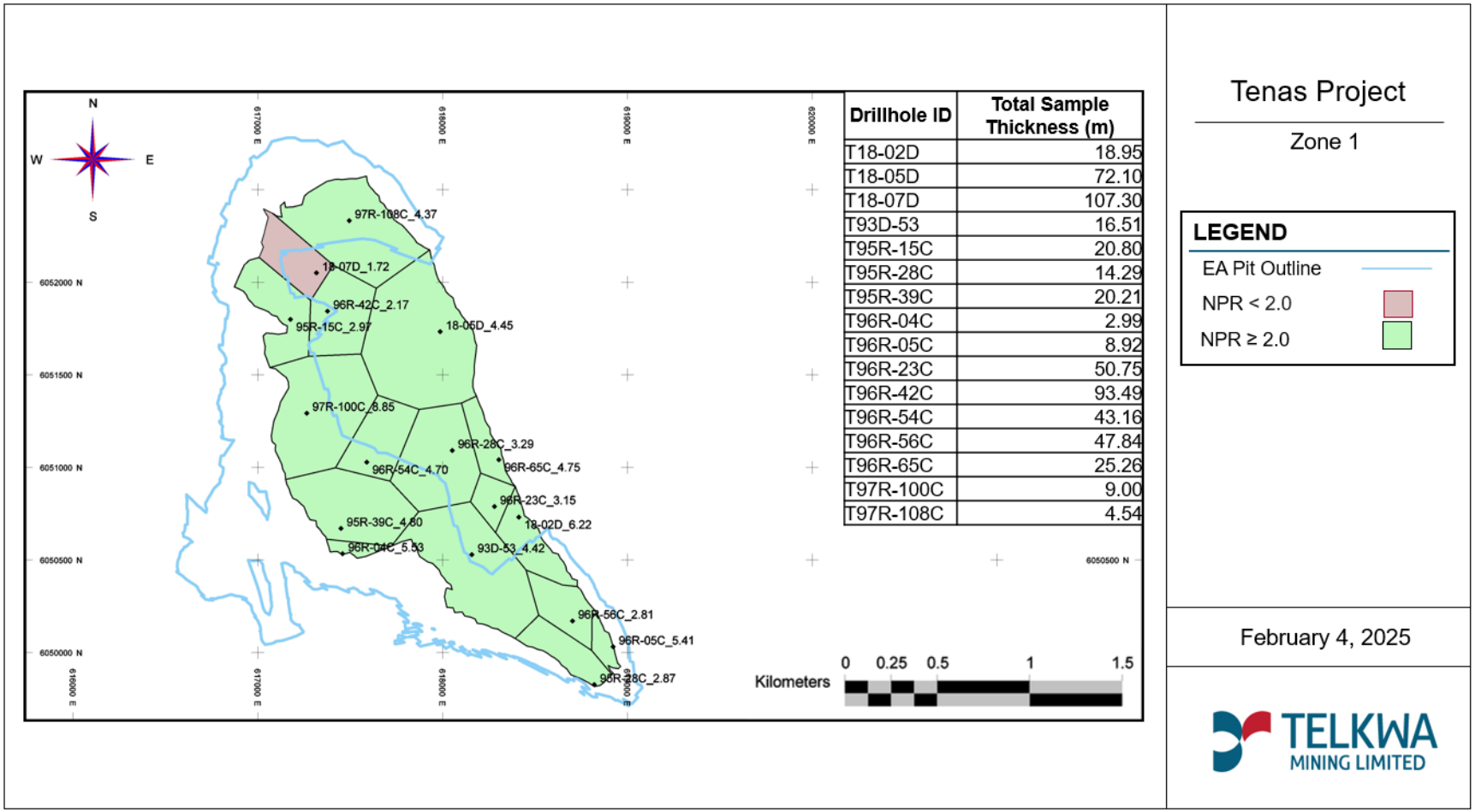


Figure 2-18: Zone 1 PAG and non-PAG Polygons Classified Against an NPR Cut-Off of 2.0, with Zones in Red Being Submerged Underwater in the EAC Application

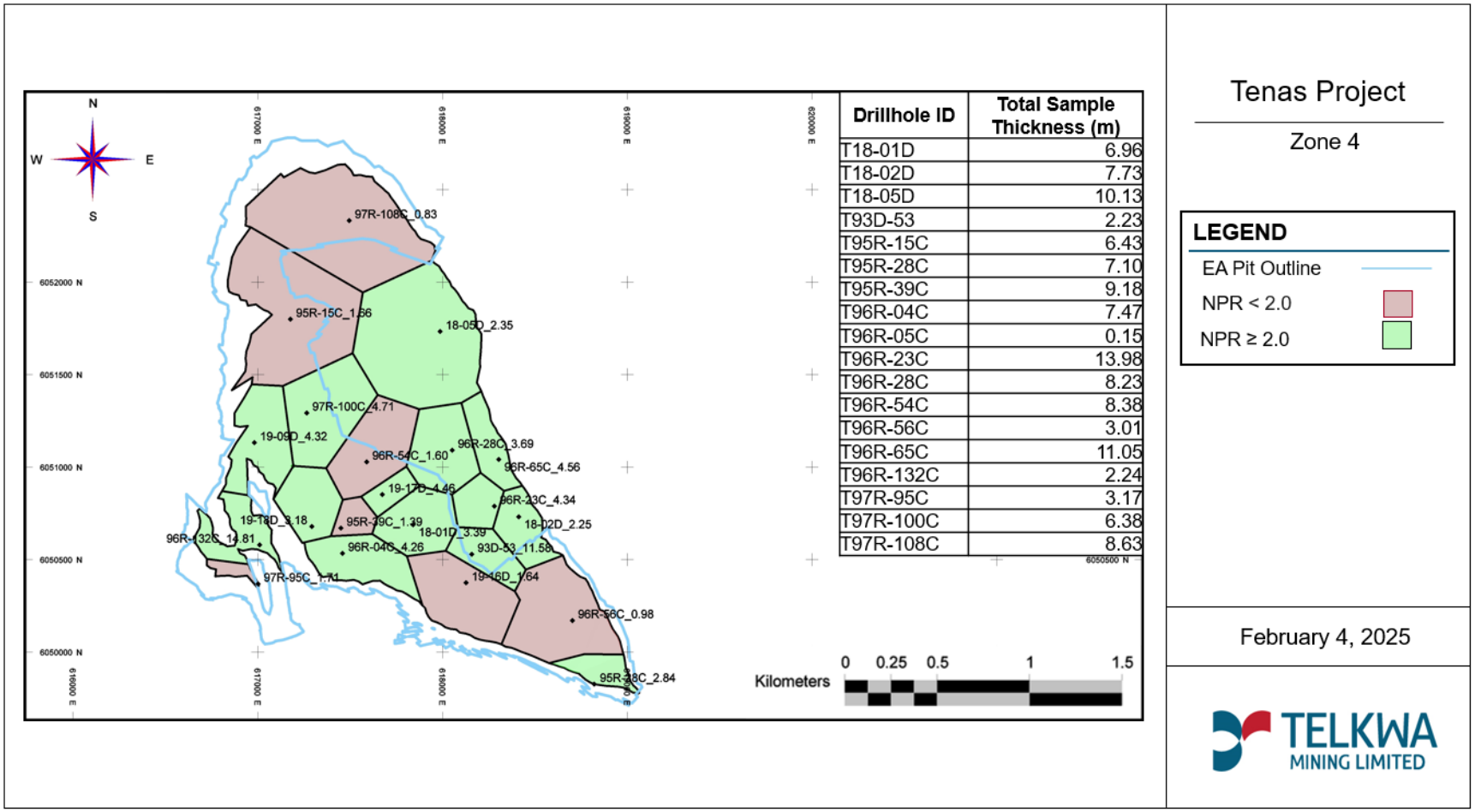


Figure 2-19: Zone 4 PAG and non-PAG Polygons Classified Against an NPR Cut-Off of 2.0, Red Polygons Submerged Underwater in the EAC Application

Table 2-22 below summarizes the zone distribution and volumes within the EA Open Pit.

Table 2-22: Summary of Zone Thicknesses, Extents, and Volumes with the EA Open Pit

Zone	Average Thickness (m)	Aerial Extent (m^2)	Volume (kbcm)
0 *non-PAG*	8.1	2,650	21.409
1 PAG	12.1	115	0.538
1 *non-PAG*	18.1	1,200	21.501
1a PAG	1.8	1,250	2.197
2/3 PAG	9.2	1,350	12.427
4 PAG	7.4	600	4.948
4 *non-PAG*	7.0	1,000	7.205
5 PAG	3.8	1,940	7.380
55 PAG	1.2	1,725	2.110
6 PAG	5.2	1,815	2.228
PAG Rock	**Variable**	**Variable**	**31,828**
Non-PAG Rock	**Variable**	**Variable**	**28.706**
Non-PAG Overburden	8.1	2,650	21.409

FOLLOWUP COMMENTS

142 ITT Table

Carbonate molar ratio (CMR) is a critical assessment because it has implications on estimates for the time to onset of ARD, the volume of PAG rock that requires management and the design of the ARD management facilities at site. As noted in the TCL response, the flattening of the CMR vs. sulphate trend shown on Figure 14 represents the minimum NPR cut-off as the CMR evaluation does not account for other factors that need to be accounted for when assigning NPR criteria such as NP availability and other factors as outlined in MEND 2009 ARD Prediction Manual. It is the opinion of the reviewer that assigning a NPR cutoff criteria solely based on the CMR and not taking into account other factors that may affect the on-set of ARD, such as available NP, is not supported by the presented data and contributing factors at a mine scale. This comment is related to Comment #140 #143, and #146.

RESPONSE 142 ITT TABLE

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

FOLLOW UP 143 ITT TABLE

EMLI understands that the average weighted NPR of 1.2 did not account for other factors that may affect the onset of ARD, such as blended PAG and non-PAG strata in an unsaturated embankment or pile. EMLI understands that the NPR cutoff of NPR = 1.2 did not account for other factors that may affect the onset of ARD, such as available NP. The proponent should therefore provide an extended evaluation of these other factors if they wish to apply for an average

weighted NPR less than 2.0. Until this demonstration is done the Proponent should use a uniform approach based on NPR criterion of 2 to designate zoning of material as PAG or non-PAG and ensure their ML ARD management plan is updated accordingly.

OVERVIEW IR LETTER

The geochemical characterization report defines non-PAG material based on weighed NPR of 1.2. If the application of a weighted average NPR of 1.2 to define non-PAG and PAG zones is not conservative, it may impact the quantity of PAG waste rock to manage and configuration of the project during the life of mine. Additional information should therefore be presented by the proponent to demonstrate the conservativeness of this approach.

- *EMLI understands that the neutralization potential ratio (NPR) cutoff of NPR = 1.2 did not account for other factors that may affect the on-set of acid rock drainage (ARD), such as available NP blended PAG and non-PAG strata in an unsaturated embankment or pile. An evaluation of these other factors with an average weighted NPR less than 2.0 was not provided.*

LETTER IR 143 AND 143 ITT TABLE

EMLI understands that the weighted NPR cutoff of NPR = 1.2 to define non-PAG zones 5, 55, and 6. This did not account for other factors that may affect the on-set of ARD, such as available NP blended PAG and non-PAG strata in an unsaturated embankment or pile.

1. *Provide an extended evaluation of these other factors if an average weighted NPR less than 2.0 is applied.*
2. *Provide a demonstration of the conservativeness of application of an average weighted NPR of 1.2*

RESPONSE 143 ITT TABLE

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

The metal leaching potential of overburden may not be driven by the same processes as sulphidic mine rock ARD and as a result, basic static testing [e.g., acid base accounting (ABA) and metal content] alone may not quantify the risk associated with overburden. The proposed geochemical characterization and monitoring program must also include testing methods to assess the metal leaching potential.

LETTER IR 145 AND 145 ITT TABLE

Conduct a geochemical characterization and monitoring program using methods to assess the ML potential.

a) Specify what additional methods will be employed as part of the geochemical characterization and monitoring program to characterize the metal/contaminant leaching potential at the expected pH of the material on the mine site.

b) b) Evaluate the metal/contaminant leaching potential and duration at the expected pH from the samples already collected to characterize the overburden.

RESPOSNE 145 ITT TABLE

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

Follow up to 146 ITT Table

Please propose a more conservative development of the Tenas mine rock NP designation and the ARD criterion of NP/AP = 1.2 based on responses to comments EMLI 140, 142 and 143.

LETTER IR 140, 142, 143, 146, and 145, AND 140b ITT TABLE

a) *Propose a more conservative development of the Tenas mine rock NP designation and the ARD criterion of NP/AP = 1.2.*

EMLI Clarification provided on April 18, 2024

The EMLI request is requesting the proponent to determine a more conservative approach to define PAG strata for the Tenas Project. The request is based on the individual IRs provided in the Round 2 EMLI Geoscience IRs 140, 142, 143 and 146. The request may be fulfilled by revising the approach to calculate available NP and/or revising the NP/AP criterion for PAG strata. It may be best summarized by point 3 of IR 143 outlined below.

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

Telkwa Mining contracted SRK to provide a scientifically defensible NPR criterion for segregating *non-PAG* material from PAG material for the planning/regulatory and operational verification phases based on site-specific data for the Tenas Deposit and best practices provided in the MEND (2009) prediction manual for drainage chemistry from sulphidic geologic materials.

SRK determined that a site-specific NPR cut off criteria of 1.20 for this deposit was appropriate to characterize blasthole rock as PAG (NPR less than 1.2) or *non-PAG* (NPR greater than or equal to 1.2). However, Telkwa Mining has elected to use a more conservative NPR criterion of 2.0 as a cut off versus the site-specific value of 1.20 to identify exploration drillhole and blasthole rock as PAG and *non-PAG*. This criterion was selected to ensure that Telkwa Mining will not classify PAG rock as *non-PAG* rock. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, Telkwa Mining will apply to revise the proposed NPR criterion.

The following provides a clear definition for the NPR cut off criterion used for the Tenas Project.

Planning, Regulatory, and Operational Stages

For mine planning processes, regulatory submissions such as the EAC application and operational verification testing, an NPR cut off criteria of 2.0 will be used to segregate *non-PAG* from PAG in exploration drillhole and/or blasthole. All rock with an NPR value less than 2.0 will be designated as PAG while rock having an NPR >= 2.0 will be classified as *non-PAG* based on verification testing specified in the ML/ARD management plan attached in **Appendix 17: Metal Leaching/Acid Rock Drainage Management Plan, SRK**.

Non-rock materials such as surface soils, overburden, processed coal, processed rock, and run-of-mine coal were characterized as PAG or *non-PAG* also using a cut-off of 2.0.

FOLLOWUP COMMENTS

FOLLOWUP COMMENTS LETTER IR 153 AND 153 ITT TABLE

EMLI understands that precipitation of these mineral phases, and the predicted concentrations, will be validated through operational water quality monitoring.

1. *Specify how the minerals or other attenuation processes identified through speciation modelling will be confirmed by mineralogical or geochemical characterization of the material.*

RESPONSE 153 ITT TABLE THEME #1

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

LETTER IR 153 AND 153 ITT TABLE

2. *Describe the field or laboratory studies that will be conducted to validate these assumptions (e.g., field barrel program).*

RESPONSE 153 ITT TABLE THEME #2

Telkwa Mining initiated a field barrel program in October of 2019 and includes a discussion of the available results up to October 2023 which is four years of data. The report is provided in **Appendix 3: Geochemical Field Barrel Results Interpretation, SRK**. Key findings of this program are:

- After four plus years of testing only one barrel has gone acid using material from the drill program.
- Source terms for some parameters were updated in the Final EAC Project Case (2024) to reflect what the monitoring has shown to date.

Telkwa Mining will continue monitoring the barrel samples for the foreseeable future with SRK providing a follow up analysis every 2 to 3 years.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

Additional sensitivities are needed to refine the water quality modelling predictions:

- *Exposed PAG rock in the management pond during a period of early closure;*
- *PAG rock exposures on pit wall;*
- *Upper-case prediction that is representative of challenging blasting conditions that could lead to higher nitrogen loading to blasted rock.*

LETTER IR 154, 157, AND 161 AND 154a ITT TABLE

1. *Prepare a sensitivity within the WLBM to evaluate how a 4-meter thickness of PAG rock left exposed in a management pond during a period of early closure would affect water quality.*
2. *Provide a sensitivity in the water quality model to allow PAG exposures on pit wall to understand how exposure of PAG may affect downstream water quality.*
3. *Develop an upper-case prediction that is representative of challenging blasting conditions that could lead to higher nitrogen loading to blasted rock.*

RESPONSE LETTER IR 154, 157, AND 161 AND 154a ITT TABLE

SRK has provided responses to this geoscience IR in **Tenas Project – Water and Load Balance Modeling Report (Updated 2025), SRK**.

FOLLOWUP COMMENTS

LETTER IR 154, 164 AND 154, 164 ITT TABLE

1. *Clarify what loading rates were used for developing mine rock source terms, including differences in Table 2-6 and Attachment 2 and Table A-4.*
2. *Provide annual non-PAG material quantities required to construct the embankments and the location of where this material will be sourced.*

RESPONSE LETTER IR 154, 164, AND 154, 164 ITT TABLE

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

EMLI understands that the App 13.5 reports that calcite precipitation is likely to occur in seepage from mine site facilities and in site water management ponds in varying degrees during operations, closure, and post-closure. However, predictions indicate that calcite precipitation is not expected to occur downstream of the proposed project footprint based on current observations and baseline concentrations. Additional information should be provided on:

- *The demonstration that calcite precipitation is not expected to occur downstream of the proposed project including all seepage and surface pathways.*
- *The mechanisms that might lead to calcite precipitation.*
- *Proposed calcite monitoring, management plan, and contingency measures to prevent or treat the onset of calcite precipitation downstream of the project discharge.*

174 LETTER IR AND ITT TABLE

EMLI understands that, based on the conclusions made in Appendix 13.5-K, calcite precipitation is likely to occur in seepage from mine site facilities and in site water management ponds in varying degrees during operations, closure, and post-closure. However, predictions indicate that calcite precipitation is not expected to occur downstream of the proposed project footprint based on current observations and baseline concentrations.

1. *What are the uncertainty and gaps around the current assessment that calcite precipitation is not expected to occur downstream of the proposed project footprint based on current observations and baseline concentrations? Please describe how the baseline observations and related conclusions relate to the projected load from the mine and propose recommendations to address these uncertainties and gaps.*
2. *Please update the calcite conceptual model provided in App 13.5K to include seepage pathways through groundwater or provide a rationale for its omission.*
3. *Provide clarifications on the mechanisms and likelihood of calcite precipitation in the immediate downstream environment including all pathways (i.e., surface and groundwater) below the end-of-pipe discharge location in Goathorn Creek.*
4. *Provide details of the calcite monitoring and management plan to prevent onset of calcite precipitation downstream of the project discharge and contingency measures to be implemented if specific triggers on the mine site are reached.*

RESPONSE 174 ITT TABLE

SRK has provided responses to this geoscience IR in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

175 ITT TABLE

EMLI is consulting with ENV on water quality monitoring and water management measures for this project. Telkwa Coal will need to propose conceptual design of management structures as part of the current application to demonstrate that the Project as proposed is capable of managing water not suitable for discharge and meeting WQGs.

176a ITT TABLE

EMLI understands that ENV's review of the surface water quality effects assessment and proposed water quality benchmarks is ongoing. EMLI notes that based on that review additional water quality mitigation for the Project may be required. Should water treatment or other mitigation measures be proposed for the Project, EMLI will review the information at that time. Telkwa Coal is encouraged to engage as soon as possible with EMLI on any proposed water treatment, especially if any passive or semi-passive technologies are proposed.

IR LETTER OVERVIEW

Additional conceptual design of alternative treatment options, mitigation measures, and management structures are needed to prevent the discharge of water that is not suitable for release to the environment.

LETTER IR 176 AND 176b ITT TABLE

1. *Provide conceptual design of alternative treatment options, mitigation measures, and management structures that can manage water not suitable for discharge and that meet BC WQGs.*

RESPONSE 176 ITT TABLE

This was previously addressed by IR **Theme 1 RESPONSE IR 175, 176b, 514, 350, 353, and 355** above.

Telkwa Mining believes the details above and the attached appendices address the requirements set forth in IR **Theme 7**.

THEME 8: EMLI GEOTECHNICAL CLARIFICATIONS

FOLLOWUP COMMENTS

IR LETTER OVERVIEW

The proponent does not identify the processed rock waste as tailings and does not identify the North, East, and West Management Ponds as tailings storage facilities (TSFs). As per the Health, Safety and Reclamation Code for Mines in British Columbia (the Code), the definition of "tailings" is: "the residue remaining from the preparation of a concentrate of minerals or coal;" and a "tailings storage facility" (TSF) is: "a facility that stores tailings." As per these definitions, the "processed rock" described in the Application is considered tailings and the North, East and West Management Ponds are TSFs.

- *TSFs have different minimum requirements than water dams in BC, including, but not limited to, minimum factors of safety, minimum design requirements for larger flood (return event and duration) and seismic events, downstream slopes, and many other requirements related to water management, performance, monitoring and surveillance, governance, etc.*

RESPONSE IR LETTER OVERVIEW

Telkwa Mining and SRK classified the management ponds as water holding ponds versus tailings storage ponds due to the following reasons:

- Embankment construction does not use tailing materials as a construction material but rather used engineered specified materials from mining activities;
- The ratio of PAG rock to processed rock (tailings) is approximately 11.25 to 1 on a volume basis so PAG rock will be the predominant material dictating performance of the materials contained within the embankment;
- Processed rock did not match definition of tailings provided by Vick; and,
- Processed rock is dewatered to less than 25% moisture prior to placement within the management ponds.

However, even though Telkwa Mining and SRK did not classify the management and control ponds as tailings storage facilities, due to the size of the management and control ponds, closeness to population centers such as the Village of Telkwa, and fish habitat Telkwa Mining/SRK utilized the guidelines for design requirements that matched the tailings pond design guidelines as these were the most conservative parameters to reference as summarized by **Table 2-23** below.

Table 2-23: Canadian Dam Association Guidelines for Design of Tailings Dams[1]

Dam Class	Annual Exceedance Probability - Floods[2]	Annual Exceedance Probability - Earthquakes	Minimum Static Factor of Safety			Downstream Slope No Steeper Than
			End of Construction	Long Term	Full or Partial Drawdown	
Low	1/3 between 1/975 and PMF	1/2,475	1.5	1.5	1.5	2H:1V
Significant	1/3 between 1/975 and PMF	1/2,475				
High	1/3 between 1/1,000 and PMF	1/2,475				
Very High	2/3 between 1/1,000 and PMF	½ between 1/2475 and 1/10,000 or MCE				
Extreme	PMF	1/10,000 or MCE				

Notes:

1. Adapted from CDA Dam Safety Guidelines, 2013. Further context and guidance provided there.
2. The Code required that a facility that stores the inflow design flood use a minimum event duration of 72 hours.

Source: BC MEMLI 2022

MCE=Maximum Credible Earthquake; PMF=probable maximum flood.

Telkwa Mining has adopted a more conservative approach to the design of the management ponds than is required for even some of the parameters for a Tailings Storage Facility (TSF).

For example, the Factor of Safety (FOS) that Telkwa Mining has put in place is 1.60 for all periods versus 1.50 provided in **Table 2-23** above and a downstream slope no steeper than 3H to 1V and an upstream slope no steeper than 2.5H to 1V versus 2H to 1V downstream requirement specified by **Table 2-23** above.

Given their proximity to the Village of Telkwa, the more stringent requirements of TSF embankments will be applied to management and control pond embankments regarding but not limited to the following parameters:

- minimum FOS;
- minimum design requirements for larger flood (return event and duration);
- seismic events;
- downstream and upstream slopes;
- water management;

- performance;
- monitoring and surveillance;
- governance;
- emergency response plan; and,
- etc.

Please find additional information on this IR provided in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOW UP COMMENTS

LETTER IR 171 AND 171 ITT TABLE

The report FINAL Tenas Project Dam Breach Assessment Report dated April 2021, by SRK (Canada) Ltd., included as Appendix 1.0-AA of the Application, has not been appropriately sealed in accordance with Engineers and Geoscientists BC requirements. Provide appropriately sealed documents, as required, including the Dam Breach Analysis included as Appendix 1.0-AA of the Application.

RESPONSE 171 ITT TABLE

Please find attached **Appendix 19: Tenas Project Dam Breach Assessment Report, SRK**.

FOLLOW UP COMMENTS

IR LETTER OVERVIEW

Completion of an alternative means of undertaking the proposed project with respect to options for tailings management that considers technology, siting, and water balance has not been demonstrated.

LETTER IR 178 AND 178 ITT TABLE

Applications must include an alternatives assessment for the Management Ponds/Tailings Storage Facilities and the alternatives assessment completed should be consistent with the Guidelines for the Assessment of Alternative for Mine Waste Disposal.

1. Provide a detailed review of tailings storage alternatives assessed to support the proposed mine plan
3. Available from: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/environmental-assessments/guidance-documents/eao-guidance-tailingsmanagement.pdf
4 Available from: https://www.canada.ca/en/environment-climate change/services/managing-pollution/publications/guidelines-alternatives-mine-waste-disposal/chapter- 1.html

RESPONSE 178 ITT TABLE THEME #1

Based on the geochemical work conducted, processed rock has been classified as PAG material and as such placement of this material underwater is the recommended management strategy for this material to prevent potential ARD in the future. This was the conclusion of **Tenas Project PAG Management Alternative Means Assessment for managing this material, SRK**, provided by SRK with the EAC Application and included again as **Appendix 20: PAG Management Alternatives Assessment, SRK** with this response.

This requirement influences all future decisions with respect to this material, which is why this assessment was completed first. In response to this IR, SRK completed an **PAG Alternative Materials Storage Assessment** using the guidelines provided by Environment and Climate Change Canada *Guidelines for the Assessment of Alternatives for Mine Waste Disposal, July 2014* which is provided in **Appendix 21: Tenas Project Potential Acid Generating Material Storage Alternatives Assessment, SRK**. Based on the guidelines a multiple-stage process was completed as follows:

1. Step 1 involved completing a screening exercise to determine potential viable location for the storage of materials.
2. Step 2 involved completing a Multiple Accounts Analysis (MAA) for the identified preferred locations and configurations to identify the preferred option going forward.
3. Step 3 involved completing a sensitivity analysis to determine if the preferred option was robust enough to remain the preferred option under several conditions.

Figure 2-20 and **Figure 2-21** below illustrate the results of the MAA and sensitivity analysis which demonstrated that the option submitted in the EAC Application was the preferred option to carry forward into detailed design during the permitting phase of the Project.

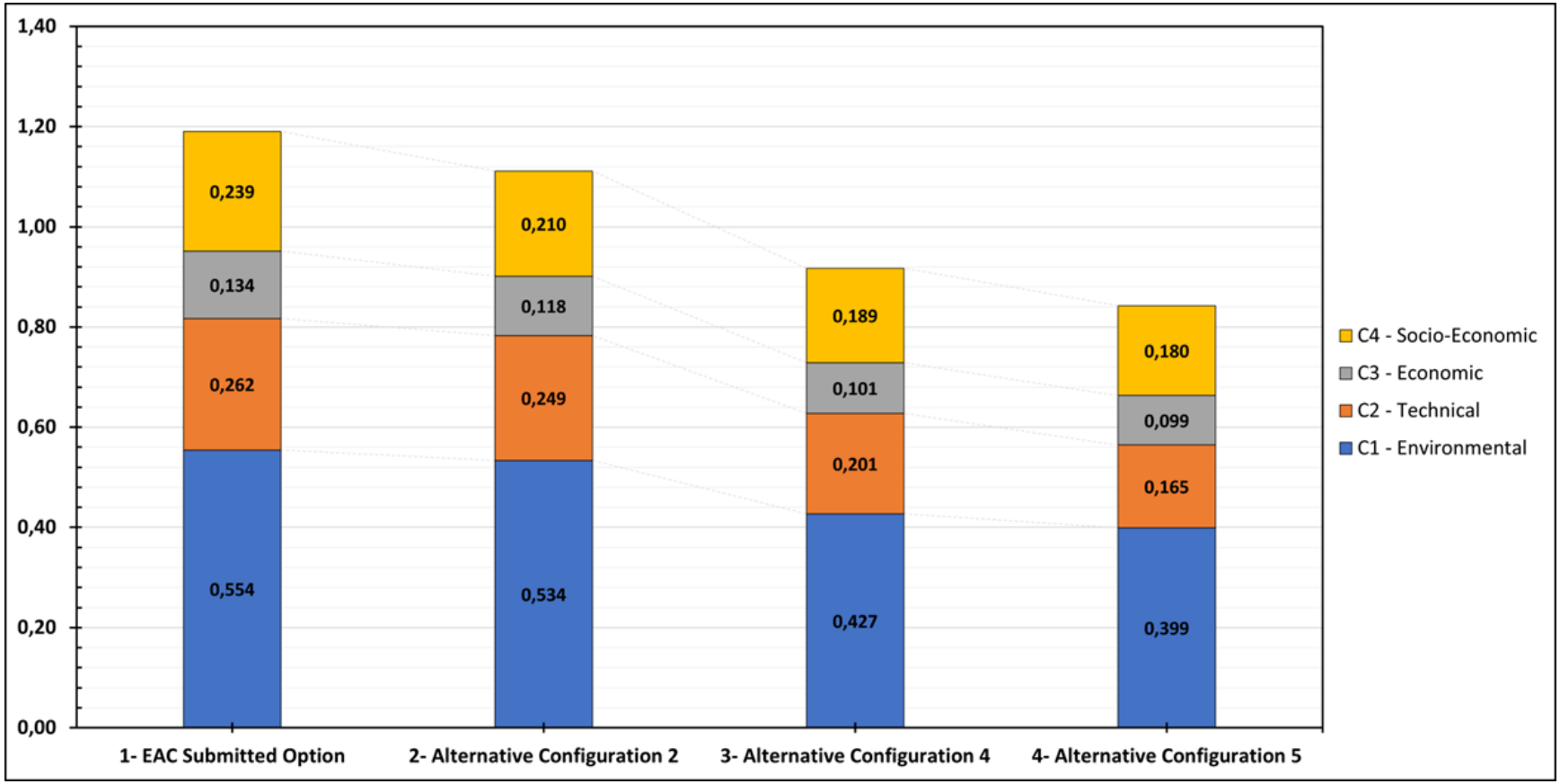


Figure 2-20: Multiple Accounts Analysis Results of the Final EAC Project Case (2024) Location versus Alternatives

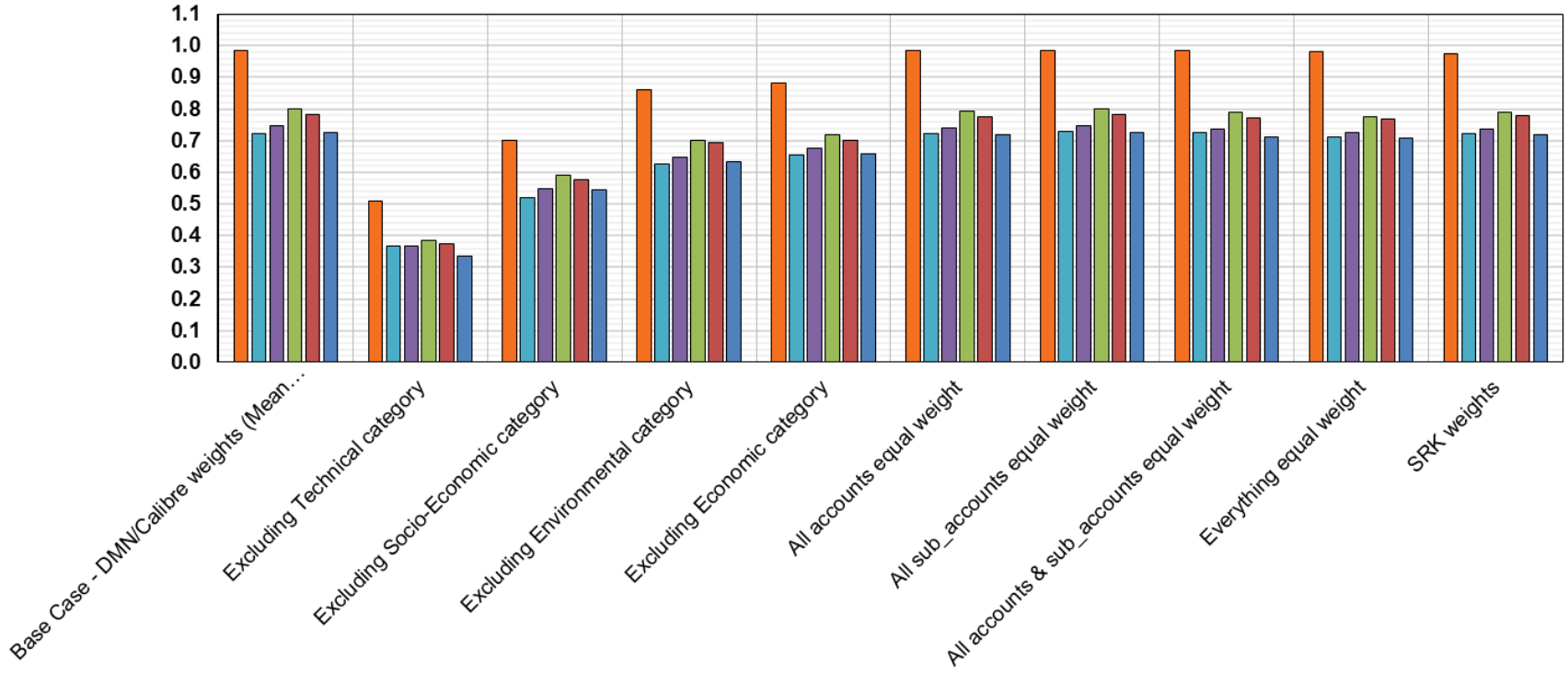


Figure 2-21: Multiple Accounts Analysis Sensitivity Results of the Final EAC Project Case (2024) Location versus Alternatives

Please find additional information on this IR provided in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

FOLLOWUP COMMENTS

OVERVIEW LETTER IR

Results of the Dam Breach Analysis (DBA) does not clearly support the selected Consequence Classification Ratings for Dams or the seismic design criteria required by the Code given that the DBA reports that over 100 people could be impacted or at risk in the event of a breach of one of more of the management pond embankments. The Consequence Classification and seismic design criteria are lower than what is anticipated from the results of the Dam Breach Analysis, which could result in use of design criteria that are not consistent with regulatory requirements or accepted industry practice.

LETTER IR 181 AND FOLLOW UP 181 ITT TABLE

1. *Provide justification for the selection of the failure scenarios considered, including descriptions of the findings of all cascading failure modes/scenarios assessed.*
2. *Provide justification for selection of a "Very High" Consequence Classification given the findings of the Dam Breach Analysis that over 100 people could be impacted or at risk in the event of potential failure or breach of one or more of the management pond embankments.*
    a. *Include the relevant TSF regulations and guidelines that support this determination.*
    b. *Indicate what evaluation of possible environmental impacts due to the release of the contents of the North, West or East Management Ponds was used as a basis for selection of Consequence Classification. The environmental impacts should be consistent with the current understanding of the project (PAG tailings, etc.) and include appropriate references to the sources of information considered.*
3. *Provide justification for selection of the TSF design flood events (Inflow Design Flood and Environmental Design Flood). Include the relevant TSF regulations and guidelines that support this design event selection.*
4. *Provide justification for selection of an earthquake with a return period of 1 in 2,475 years for the Management Ponds/TSFs stability assessment. Include the relevant TSF regulations and guidelines that support this design event selection.*

RESPONSE FOLLOW UP 181 ITT TABLE

Please find additional information on this IR provided in **Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK**.

Telkwa Mining believes the details above and provided in attached appendices address the requirements set forth in IR **Theme 8**.

3. FIRST NATION FEEDBACK

The Office of the Wet'suwet'en (OW) provided comment on these submissions on February 28, and March 12, 2025, which are summarized in

Table 3-1 below. Responses have been provided in **Appendix 22 Tenas Project Information Request Responses from Office of the Wet'suwet'en – Final, SRK**.

Telkwa Mining is expecting further input could be provided from Wet'suwet'en during their Assessment Process. Where modifications or clarifications of responses are appropriate Telkwa Mining will provide supplemental information to both the EAO and OW.

Table 3-1: February 28, March 12, and May 15, 2025, Comments from OW

Comment ID	Master ITT Comment ID (BC EAO)	OW Comment from Feb 28 or Mar 12 Letters/Report	OW Recommendations from Feb 28 or Mar 12 Letters/Report
OW-011	175, 176, 307, 350, 353, 355, 356, 514	As mentioned, a presentation from TML is welcome. However, OW has its own priorities and objectives related to protecting aquatic resources in the territory. OW is working to identify Project-related issues related to water quality, water and load balance modeling, water treatment, and hydrology.	To address this IR, the Proponent should: • Provide all the information requested in OW's forthcoming responses to TML's IR responses. • Consider forthcoming information from OW regarding how all concerns related to Project impacts on aquatic resources have been identified and characterized. • Consider forthcoming information from OW regarding whether monitoring and mitigation plans are adequate to address adverse impacts to aquatic resources. Impacts to water may also be considered in the RIA being conducted by OW. This IR will remain open until OW is satisfied with how information from the RIA and the outcomes of OW's review of TML documents and engagement with TML on this issue are incorporated into Project monitoring, mitigation, and adaptive management plans.
OW-038	350 and 351	The Proponent provides 11 mitigation options (6 single treatment options and 5 that are combinations of 3 or more of the single treatment options) and models the results. The results show options for reduction of max monthly concentrations and reduction of WQG for Four Creek and Tenas Creek. All of the viable options for reduction include a combination of multiple treatments and would result in some periods of time of reduced downstream natural streamflow.	The Proponent provides viable options for reducing concentrations of selenium, sulfate, cadmium, and nitrate/nitrite including a combination of multiple treatments. In some cases (Table 9), exceedances still occur (e.g., selenium, nitrate) at the end of pipe, even when multiple treatments are applied, particularly from the Tenas Control Pond. While the right combination of mitigation treatments will definitely improve downstream water quality, there are impacts to local streamflow and in some cases other constituents (e.g., increases in selenium). The most concerning reductions in streamflow for both Tenas and Four Creek are during late summer months (August) and winter baseflows. It doesn't appear that these reductions in streamflow have been modelled within the Water Load Balance Model to predict how the lower flows will impact downstream WQ at prediction nodes, although reduced concentrations in surface and groundwater should help, reduced water flow could end up balancing that reduction and total constituent loading may ultimately not change much. This warrants further investigation. To resolve these issues, TML must: • Provide more information on how the reduction of water flow in the Tenas and Four Creek is involved in mitigations for reducing concentrations of selenium, sulfate, cadmium, and nitrate/nitrite; • Provide data for how this reduction is incorporated into the Water Load Balance Model to predict how the lower flows will impact water quality downstream, especially during late summer months (August) and winter baseflows; • Provide more information on the proposed water mitigations, including the reliability and risks of each option associated with failure of effective treatment, in addition to the expected beneficial change and the expected consequences of each treatment option;
OW-039	350 and 351	As above, the Proponent provides 11 mitigation options and describes aspects of treatment efficiency and effectiveness for each option, including modelled water quality outcomes. The Proponent provides information on the expected beneficial change and the expected consequences of each treatment option but does not provide risks associated with failure of effective treatment.	The reliability and risks of each option are not discussed, and very little information is provided on situations where the mitigation option may be less effective/ ineffective (i.e., high, or low run off conditions, liner failure, etc.). The water treatment plan option (Control 5) appears to be one of the most effective options, particularly when combined with other options. However, the design details of the water treatment plant have not been developed (which the proponent acknowledged in the document), and the reductions in constituent concentrations are only assumed. This would require additional storage and appropriate treatment rates, along with additional energy and waste disposal costs. As water treatment, in combination with other approaches, is the most effective way of reducing exceedances from the ponds, this option should be pursued but TML must provide more information on the details of that process (including detailed operations of the treatment facility over time, energy and water use, and efficiency of treatments, etc.). TML must provide further information on alternative treatment plans and outcomes that describe how the water treatment facility would be designed, what standards would be used, the operation, and the duration.
OW-040	356	The Proponent developed a new node (WQSEA1) of water quality measures for the Water and Load Balance Model (WLBM), 100 m downstream of the confluence with the unnamed tributary for Project discharge on Goathorn Creek. The Proponent developed and ran new WLBM scenarios to review the impacts of changes in seepage rates on expected water quality and says, "Water quality results will be presented at the new node (WQSEA1), WQS06, WQS05, WQS04, and WQS03_DS with the Final EA Water and Load Balance results". We have been unable to find the aforementioned document containing the results. There were some errors in the figure from the WLBM report (Fig 2.2-2.4 of App 4.3) that showed incorrect connections of the three creeks (Four	We are unable to find the documents containing the results of this IR response, "Final EA Water and Load Balance results", or Attachment IR 356-1 as the IR response does not provide further information regarding where these documents are located. We are unable to find any documents with that name in the review materials provided to us and therefore could not review the IR. Please provide these documents, including figures for each of the requested scenarios in the IR (Tributary receiving discharge above confluence with Goathorn Creek, and Goathorn Creek below confluence with tributary receiving discharge); projected water quality from baseline through to post-closure; and updated figures from the WLBM report (Fig 2.2-2.4 of App 4.3) that showed incorrect connections of the three creeks (Four Creek, Tenas Creek, Goathorn Creek).

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		Creek, Tenas Creek, Goathorn Creek), but the proponent claims the errors in the figure were NOT incorporated into the model and that the model correctly accounts for the mixing of streams. There are final figures presented in Attachment IR 356-1; however, we also cannot find this document as the attachment with that name at the end of App F contains no information. We are also unclear whether this is the location of the other results the authors describe (e.g., figures for each of the requested scenarios and projected WQ from baseline through to post-closure). Because we were unable to locate this document, we could not completely review the response to the IR.	
OW-041	NEW	Same comment as previous. The Proponent developed a new node (WQSEA1) of water quality measures for the Water and Load Balance Model (WLBM), 100 m downstream of the confluence with the unnamed tributary for Project discharge on Goathorn Creek. The Proponent developed and ran new WLBM scenarios to review the impacts of changes in seepage rates on expected water quality and says, “Water quality results will be presented at the new node (WQSEA1), WQS06, WQS05, WQS04, and WQS03_DS with the Final EA Water and Load Balance results”. We have been unable to find the aforementioned document containing the results. There were some errors in the figure from the WLBM report (Fig 2.2-2.4 of App 4.3) that showed incorrect connections of the three creeks (Four Creek, Tenas Creek, Goathorn Creek), but the proponent claims the errors in the figure were NOT incorporated into the model and that the model correctly accounts for the mixing of streams. There are final figures presented in Attachment IR 356-1; however, we also cannot find this document as the attachment with that name at the end of App F contains no information. We are also unclear whether this is the location of the other results the authors describe (e.g., figures for each of the requested scenarios and projected WQ from baseline through to post-closure). Because we were unable to locate this document, we could not completely review the response to the IR.	We are unable to find the documents containing the results of this IR response, “Final EA Water and Load Balance results”, or Attachment IR 356-1 as the IR response does not provide further information regarding where these documents are located. We are unable to find any documents with that name in the review materials provided to us and therefore could not review the IR. Please provide these documents, including figures for each of the requested scenarios in the IR (Tributary receiving discharge above confluence with Goathorn Creek, and Goathorn Creek below confluence with tributary receiving discharge); projected water quality from baseline through to post-closure; and updated figures from the WLBM report (Fig 2.2-2.4 of App 4.3) that showed incorrect connections of the three creeks (Four Creek, Tenas Creek, Goathorn Creek).
OW-042	NEW	The IR document says, "In summary, the background water quality inputs used in the EAC Project Case (August 2022) were monthly mean values while seasonal values are used in both the Updated and Final EAC Project Cases (2024)". However, in Appendix F, Section 4.18.2, SRK says "The EA WLBM used statistics from the full water quality baseline monitoring record, including the 50th percentile and 95th percentile for each stream. Monthly or seasonal background source terms were not used". This is relatively confusing as responses in the IR in different locations are providing different answers to the initial question. In Appendix F, they follow up by saying they generated new baseline statistics for the Final EAC Project Case (2024) based on updated data, including a new 50th percentile for the winter months and a 50th percentile for the "rest of the year" (May to October). They say the Final EA Water and Load Balance Report will include the seasonal source terms for background concentrations on the in-stream water quality conditions, so we assume this is the 50th percentile or the median. However, it is unclear if this will be presented as the main WQ prediction scenario or alternative assessment scenario(s). We were unable to locate the document referred to as Final EA Water and Load Balance Report to further review.	Reporting the use of different time scales is troublesome, especially in a region with high seasonal variability. The caching of all "open water" months into one "summer season" is not appropriate as there are very different climate and ecosystem processes influencing or influenced by spring vs summer vs fall water quality dynamics. The use of one seasonal value may be skewed by over-represented high or low values that occur during more months, and therefore not representative of periods exhibiting seasonally low or high values. Monthly values would be more appropriate to capture full seasonal variability. Please provide this information. In addition, we were unable to fully review this IR because we could not locate the referenced document "Final EA Water and Load Balance Report". Please provide this information.
OW-043	NEW	Some of the sedimentation ponds that discharge to the natural ground were not included as part of the WLBM in the EAC application (the proponent lists 6). Four of the ponds are lined with impermeable geomembrane liners or equivalent and the remaining 2 are unlined. They were not considered in the site water and load balance model when it was developed because: 1) they are geographically separate from the EA Open Pit, management and control ponds, and material storage pile water management systems, 2) they are small and manage very defined catchments with low flow rates compared to discharge from mine components through Tenas Control Pond, 3) TSS is the main POC for most of these ponds but some also include nitrogen species, 4) they are designed to produce TSS well below the BC (35 vs 50 ppm) requirement so deemed protective of aquatic environment, 5) the remaining pond doesn't discharge to the environment it gets pumped	The organization of various ponds and their connectivity, as well as the lack of data associated with each pond is an obvious source of confusion in the application. This theme arises in many comments throughout the proponent’s IR response. Discharges from sedimentation ponds (excluding Tenas Control Pond/North Management Pond and Rail Infrastructure Pond) are directed towards natural ground. The Proponent plans to convey this water along natural flow pathways to eventually reach downstream watercourses. Despite use of pumps and other structures for controlled release, there is risk of overflow and higher amounts of release during high rain events, which may increase downstream erosion potential. The Proponent must provide a clear map of the location and connectivity of each pond along with an associated table that includes all the requested information from the IR.

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		to the Tenas Control Pond, and 6) they describe how they deal with material from the Explosive Magazine Pond.	
OW-044	NEW	The only discharge that will be directed into a stream is the Tenas Control Pond (and North Management Pond after closure). An IDZ study was prepared to evaluate discharge from Tenas Control Pond, which found that discharge would not be acutely toxic. This discharge was simulated in the Water and Load Balance Model to quantify the expected effect in streams. They do not reference the IDZ study used to evaluate discharge, so we were unable to review in the context of this IR. The Proponent ensures that when the ponds are discharging, they will be monitored on a “regular basis” (frequency not mentioned) and monthly when not discharging. Monthly monitoring proposed with various (3) "action steps" proposed to address WQ exceedances if they should occur. Some of these involve reactions to chemical parameter exceedances of BC WQG over a "period of months".	Note that an IDZ will not be considered during permitting without an adequate BAT assessment. Given that a new BAT assessment has been performed with alternative treatment options, the IDZ study would need to be redone to account for water quality differences derived from various different treatment options. The comment does not address the need to also evaluate cumulative effects around the IDZ. In addition, the proposed frequency of monitoring for exceedances is inadequate given the risk to downstream fish. These ponds will be monitored monthly to evaluate toxicity results against authorized limits for lethality of Rainbow Trout. If exceedances exist, a number of actions are proposed to reduce exceedance, but given the frequency of monitoring (monthly) and the amount of time required for implementation of the proposed actions, it is possible exceedances (and downstream negative effects) could persist for a substantial amount of time (months) before any resolution. This presents a considerable prolonged threat to fish and ecosystem health. TML must correct these discrepancies.
OW-045	520	There are no lentic (i.e., lakes or ponds) water bodies located in the near-field or far-field receiving environments of the Project.	The concern here is sedimentation and conversion of selenium species, so there may be opportunities for this in micro-lentic environments such as back channels and pool environments along the stream course, but according to the proponent in this local study and regional study region there are no lentic environments.
OW-046	176	Mitigation control scenarios are discussed and compared, including the pros and cons of expected changes in water quality. The most effective treatments for reduction of selenium and nitrate-nitrite in both control ponds are combinations of multiple mitigation strategies, many of which include the strategy of water quality treatment (listed as "mitigation control 5").There are no plans or outcomes developed that describe how the water treatment facility would be designed or operate, some of the benefits are based on assumed targets met through treatment.	However, there are no actual plans or outcomes developed that describe how the water treatment facility would be designed or operate, some of the benefits are based on assumed targets met through treatment. This is acceptable but should be fleshed out further, and it should be confirmed that these targets can actually be met if this is considered a feasible option. The Proponent is also assuming the water quality treatment would persist past the end of closure as the model shows results out to 2100. Additional information on water treatment facility is needed (design, standards, operation, and duration) and should not be assumed if this is considered as an option, in conjunction with other mitigation strategies (it is included on the list of combined best options). There are also effects on streamflow in Four and Tenas Creek, which should be explored more with the water load balance model. Goat Creek was not included in the model outputs, although this is acknowledged by the authors. Impacts on Goat Creek should be included in additional assessment of further mitigation strategies.
OW-047	154, 157, 161	The Proponent claims that the evaluation of how a 4-meter thickness of PAG left exposed in a management pond would affect water quality is not possible because of the way the pumping system is set up and that the management ponds are always built ahead of PAG placement to ensure that the PAG is below water level. We are concerned that the Proponent dismissed this request saying that under properly managed scenarios this would not be a concern. "	We are concerned that the Proponent dismissed this request saying that under properly managed scenarios this would not be a concern. However, it doesn't provide information on the effects of exposed PAG to water quality under scenarios where the management pond techniques fail, such as failure of a pond dam or failure of the pumping system to work as designed. The Proponent must provide this information and include scenarios in the water quality model for estimating impacts where management actions fail, to provide a clear picture of the downstream impacts of PAG under less-than-ideal conditions, but conditions that could possibly occur if there are situations where proper management cannot occur (failure of pumping system or pond dam, or some other instance where a 2m cover of water cannot be maintained).
OW-048	154, 157, 161	It is unclear where the information is associated with this IR. Within App D they cite a ""SRK 2024a"" (page 16) with the results of the model output using the various source terms but the reference is not included at the end of the document under ""References"". Appendix A- Water Balance Report. contains source terms but has not been updated to include a sensitivity like requested in the IR.	We were unable to review this IR responses as we were unable to find the supporting information. Please provide this information.
OW-049	174	The predictions provided in SRK (2022d) indicate that calcite is not expected to form in downstream tributaries since predicted alkalinity, calcium and magnesium concentrations are like existing conditions and there is currently no visual evidence of calcite precipitation even though surface water in these drainages is supersaturated with respect to calcite under baseline conditions. Because of this, they suggest that site-specific Saturation Indices (SI) may need to be developed once sufficient monitoring data are available. They describe how if calcite formation is identified as part of the operational monitoring program, TML will develop a mitigation plan that will be submitted to EMLI for approval. The most common calcite prevention mitigation strategy is	1. The response to the IR states that the estimated SI do not suggest calcite precipitation, but detailed discussion is not in the reference. They do not specify what additional monitoring data is required for site-specific calculation of site-specific SIs for calcite. Is TML referring to monitoring data from this post-project operations, or baseline data? It is unclear where in the referenced SRK (2022d) document they specifically address calcite, as the term “calcite” only appears once in the document. TML must update the Discharge Management Plan and provide further information on how operation and a post-closure increase in conductivity in ponds and the receiving environment will affect the SI for calcite and predictions for precipitation. 2. Higher pCO2 in groundwater will be more likely to precipitate calcite at possible groundwater seepage locations (contact with atmosphere). Some accounting for this should be included in the conceptual model.

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		addition of antiscalant to site effluent. This would be the most likely mitigation strategy should it be required. They also say there is no need to include groundwater seepage in the conceptual model as there is no reason for CO2 off-gassing to occur along groundwater pathways at the Project, and calcite is therefore not expected to precipitate in groundwater pathways.	3. Within the referenced SRK 2022d (Tenas Project Water and Load Balance Modeling Report REV1), we cannot find discussion of calcite precipitation, including mechanisms, contributing factors, predictions, etc. The response to the IR states that the estimated SI do not suggest calcite precipitation, but detailed discussion on this topic is not in the reference. According to the IR response, "predictions provided in SRK (2022d) indicate that calcite is not expected to form in downstream tributaries since predicted alkalinity, calcium and magnesium concentrations are like existing conditions". However, there are multiple examples of increases in alkalinity and magnesium (in particular) in the load model. Therefore, TML must explore conditions in terms of potential for calcite precipitation. 4. There is no plan, other than including calcite in the surface water quality monitoring program. If calcite formation is observed, then they will develop a mitigation plan. This plan will likely include mitigation using antiscalants. The proponent does not discuss this option further but should include considerations and possible impacts and interactions of the use of antiscalant for reducing calcite precipitation considering the high background conditions of aluminum in these watersheds.
OW-050	181	The statement "The effect of the rainy-day breach on aquatic habitat is low given the PMF/Q200 conditions already present" is not supported given the discharge at the mouth of Tenas Creek is estimated to be 1100 m^3/s in comparison to a PMF of 168 m^3/s, and that maximum water velocity and rate of discharge increase from a flood wave are not accounted for. However, we do agree that the risk to aquatic life for a breach of the East Dam or West Dam should be 'Very High' due to the likelihood of major long-term deterioration of critical steelhead spawning habitat. We believe that the 'Very High' classification would be more appropriate for a breach of the North or Tenas Dams as well given the likelihood of major long-term deterioration of critical steelhead spawning habitat in Tenas and Goathorn Creeks.	Given the likelihood of major long-term deterioration of critical steelhead spawning habitat in Tenas and Goathorn Creeks, a 'Very High' risk classification should be used for a breach of the North Dam or Tenas Dam.
OW-118	NEW	To help OW better assess how TML is protecting the Environmental Flow Needs, provide details on how and/or TML will manage flows to avoid high risk levels and maintain environmental flow needs (reduction of <10% of mean average by season) during operation. To help OW better assess how TML is protecting the Environmental Flow Needs, provide details on how and/or TML will manage flows to avoid high risk levels and maintain environmental flow needs (reduction of <10% of mean average by season) during operation.	Commit to appropriate planning for contaminant areas, which requires a proactive approach to mitigating contaminant leakage (rather than attempting to mitigate once problems have been identified);
OW-120	NEW	To help OW better assess how TML is protecting the Environmental Flow Needs, provide details on how and/or TML will manage flows to avoid high risk levels and maintain environmental flow needs (reduction of <10% of mean average by season) during operation. To help OW better assess how TML is protecting the Environmental Flow Needs, provide details on how and/or TML will manage flows to avoid high risk levels and maintain environmental flow needs (reduction of <10% of mean average by season) during operation.	Consider the appropriateness of water and load balance models and correct seepage migration rates and timing of peak contaminant concentrations;
OW-122	NEW	For Surface Water, Ground Water, and Aquatic Resources VCs, TML must:	Provide the cited document in Appendix D: "SRK 2024a" (page 16), which is missing from the end of the document under "References". Appendix A- Water and Load Balance Model Report.
OW-123	NEW	For Surface Water, Ground Water, and Aquatic Resources VCs, TML must:	Update the Discharge Management Plan - Calcite Precipitation document to include: • How operation and a post-closure increase in conductivity in ponds and the receiving environment affect the Saturation Indices (SI) for calcite, and predictions for precipitation; • Accounting for higher pCO2 in groundwater, which is more likely to precipitate calcite; • Further accounting for increased calcite precipitation in instances where alkalinity and magnesium in the water increase; and • A separate calcite monitoring and management plan, which considers possible impacts and interactions of the use of antiscalants for reducing calcite precipitation, considering the high background conditions of aluminum in these watersheds.
OW-124	NEW	For Surface Water, Ground Water, and Aquatic Resources VCs, TML must:	Provide additional information and figures for the Water and Load Balance Model Report that we have not been able to locate, including: • Final figures presented in "Attachment IR 356-1 as the attachment with that name at the end of App F contains no information;

Comment ID	Master ITT Comment ID (BC EAO)	OW Comment from Feb 28 or Mar 12 Letters/Report	OW Recommendations from Feb 28 or Mar 12 Letters/Report
			• Figures for each of the requested scenarios in the IR (Tributary receiving discharge above confluence with Goathorn Creek, and Goathorn Creek below confluence with tributary receiving discharge) and projected water quality from baseline through to post-closure; • Updated figures from the WLBM report (Fig 2.2-2.4 of App 4.3) that originally showed incorrect connections of the three creeks (Four Creek, Tenas Creek, Goathorn Creek); and • TML's response to the IR, labelled "Final EA Water and Load Balance results", or Attachment IR 356-1.
OW-125	NEW	For Surface Water, Ground Water, and Aquatic Resources VCs, TML must:	Use climate change predictions in the understanding of potential impacts throughout the operation and post-closure periods (e.g., changes in flow and changes in stream temperature due to changes in flow and air temperature).
OW-126	NEW	For Surface Water, Ground Water, and Aquatic Resources VCs, TML must:	Resolve outstanding technical questions regarding PAG Rock management and seepage including: • If PAG rock is to be submerged prior to the onset of ARD/ML, why would seepage tailings facilities contain the products of ARD/ML? • How much seepage is expected out of tailings facilities, both in groundwater and in surface water?

4. CLOSING

Thank you again for providing Telkwa Mining with the opportunity to respond to the Water Quality IRs from ENV and MEMLI. Telkwa Mining believes the responses provided close out the information requests that fall under Items 1 through 8. If there are any further questions or concerns, please do not hesitate to contact me.

Sincerely Yours,



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5. ATTACHMENTS

BC EAO AND OFFICE OF THE WET'SWUET'EN INFORMATION REQUESTS

Appendix 1: Tenas Project, Water and Load Balance Modeling Report (Updated 2025), SRK
Appendix 2: Tenas Project, Hydrometeorological Baseline and Model Development Report (Update 2025), SRK
Appendix 3: Geochemical Field Barrel Results Interpretation – Tenas Project, SRK
Appendix 4: Updated Water Quality Model Source Terms, SRK
Appendix 5: Tenas Project - Suboxic Evaluation of Non-Acid Generating Mine Rock, Okane
Appendix 6: Tenas Project Information Request Responses Related to Surface Water Valued Component, SRK
Appendix 7: Water and Wastewater Treatment Design Report and Bionest Assurance Letter, Radloff
Appendix 8: Tenas Project, Hydrogeology Technical Report, SRK
Appendix 9: Evaluation of Acute Daphnia Magna and Rainbow Trout LC50 Toxicity Supporting Tenas Project Best Available Technology Assessment Study – Parameters of Concern: Nitrite, Iron (Total) and Iron (Dissolved)
Appendix 10: Effect of Mitigation Controls on Water Quality and Quantity of the Tenas Project, SRK
Appendix 11: Tenas Project Best Achievable Technology Assessment Updated, SRK
Appendix 12: Environmental Effects Assessment - Surface Water Valued Component

Appendix 13: Tenas Project, Initial Dilution Zone Assessment, SRK
Appendix 14: Tenas Coal Mine Information Request # 498, 500-504, and 520 - Expert Advice Regarding Fish and Fish Habitat Within the Project Area, Palmer Environmental
Appendix 15: Tenas Project, Mine Material Management Based on an NPR Cut-Off of 2.0, 1.80, 1.60, and 1.20, Telkwa Mining
Appendix 16: Telkwa Coal Tenas Project Environmental Assessment Application – Responses to 2022 Supplemental Geochemistry Information Requests from the Ministry of Energy, Mines and Low Carbon Innovation, SRK
Appendix 17: Metal Leaching/Acid Rock Drainage Management Plan, SRK
Appendix 18: Tenas Project Information Request Responses Related to Geotechnical Aspects, SRK
Appendix 19: Tenas Project Dam Breach Assessment Report, SRK
Appendix 20: PAG Management Alternatives Assessment, SRK
Appendix 21: Tenas Project Potential Acid Generating Material Storage Alternatives Assessment, SRK
Appendix 22: Tenas Project Information Request Responses from Office of the Wet'suwet'en – Final, SRK

APPENDIX 1: TENAS PROJECT, WATER AND LOAD BALANCE MODELING REPORT (UPDATED 2025), SRK

APPENDIX 2: TENAS PROJECT, HYDROMETEOROLOGICAL BASELINE AND MODEL DEVELOPMENT REPORT (UPDATE 2025), SRK

APPENDIX 3: GEOCHEMICAL FIELD BARREL RESULTS INTERPRETATION – TENAS PROJECT, SRK

APPENDIX 4: UPDATED WATER QUALITY MODEL SOURCE TERMS, SRK

APPENDIX 5: TENAS PROJECT - SUBOXIC EVALUATION OF NON-ACID GENERATING MINE ROCK, OKANE

APPENDIX 6: TENAS PROJECT INFORMATION REQUEST RESPONSES RELATED TO SURFACE WATER VALUED COMPONENT, SRK

APPENDIX 7: WATER AND WASTEWATER TREATMENT DESIGN REPORT AND BIONEST ASSURANCE LETTER, RADLOFF

APPENDIX 8: TENAS PROJECT, HYDROGEOLOGY TECHNICAL REPORT, SRK

APPENDIX 9: EVALUATION OF ACUTE DAPHNIA MAGNA AND RAINBOW TROUT LC50 TOXICITY SUPPORTING TENAS PROJECT BEST AVAILABLE TECHNOLOGY ASSESSMENT STUDY – PARAMETERS OF CONCERN: NITRITE, IRON (TOTAL) AND IRON (DISSOLVED)

APPENDIX 10: EFFECT OF MITIGATION CONTROLS ON WATER QUALITY AND QUANTITY OF THE TENAS PROJECT, SRK

APPENDIX 11: TENAS PROJECT BEST ACHIEVABLE TECHNOLOGY ASSESSMENT UPDATED, SRK

APPENDIX 12: ENVIRONMENTAL EFFECTS ASSESSMENT - SURFACE WATER VALUED COMPONENT

APPENDIX 13: TENAS PROJECT, INITIAL DILUTION ZONE ASSESSMENT, SRK

FINAL

Tenas Project – Initial Dilution Zone Assessment

Tenas Project, Canada

Telkwa Mining Limited Gold Inc.



SRK Consulting (Canada) Inc. ■ CAPR002055 ■ September 2025

srk consulting

FINAL

Tenas Project – Initial Dilution Zone Assessment

Tenas Project, Canada

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File Name:
Telkwa_IDZstudy_CAPR002055_FINAL_20250912.docx

Suggested Citation:
SRK Consulting (Canada) Inc. 2025. Tenas Project – Initial Dilution Zone Assessment. FINAL. Prepared for Telkwa Mining Limited Gold Inc.: 1415 Hankin Ave Telkwa, BC V0J 2X0, . Project number: CAPR002055. Issued September 2025.

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The opinions expressed in this document have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. While SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

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Executive Summary

SRK Consulting (Canada) Inc. (SRK) completed an initial dilution zone (IDZ) study for the proposed Tenas Project (the Project) in northwest British Columbia to support the Environmental Assessment Certificate Application (EA) submission for the Project in May 2022 and to address the 2024 Joint Application Information Requirements (JAIR) in anticipation that the work will be used to support future permitting of the Project. This study updates the IDZ assessment provided in the EA based on the findings of Best Achievable Technology (BAT) assessment (SRK 2025a), and updated effluent discharge information from the Water and Load Balance (WLB) model for the Project. The assessment was carried out following the Technical Guidance 11 (TG11) produced by the BC Ministry of Environment and Parks.

The IDZ is in Goathorn Creek below the confluence with a tributary that receives Project discharge from the Tenas Control Pond (TCP) and North Management Pond (NMP) during operation and post closure, respectively. This also includes discharge from the sewage treatment plant during the Operation Phase. To characterize and delineate the IDZ, three (3) credible and conservative cases were considered:

- a worst case (very worst condition),
- a reasonable worst case (worst case that potentially could occur), and
- an expected case (case corresponding to typical expected conditions).

The cases were defined based on conservative assumptions considering the in-stream flow and water quality of Goathorn Creek, and discharge rate and quality of Project effluent.

Parameters of Concern (POCs) were selected based on the findings of BAT assessment using the required regulatory guidance and updated water quality guidelines, which identified POCs through screening end of pipe Project discharge water quality results from WLB model against 80% of applicable Water Quality Guidelines (WQGs). WQGs were chosen according to the following order of preference:

- The lowest of BC Approved Water Quality Guidelines (BC AWQG) or BC Working Water Quality Guidelines (BC WWQG) for protection of freshwater aquatic life, except for molybdenum for which more stringent BC's ruminant (wildlife) was selected,
- Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME WQG), or
- Environment and Climate Change Canada Water Quality Guidelines (ECCC WQG).

Parameters identified as POCs and considered in this study are listed below:

- Nitrogen Nutrients: Nitrate, Nitrite,
- Sulphate,
- Metals: Aluminum (total), Cobalt (dissolved), Copper (dissolved), Iron (total), Nickel (dissolved), Thallium (total), Zinc (dissolved), and
- Oxyanions: Molybdenum (total), Selenium (total).

To characterize the Goathorn Creek IDZ, cross-sectional channel morphology was surveyed at regularly spaced transects near the discharge location. Based on these surveys, a hydrodynamic model was developed using HEC-RAS (version 6.6, USACE 2024). The estimated stream hydraulic properties were utilized in the mixing-dilution modeling. The water quality in Goathorn Creek and its mixing and dilution

characteristics were modeled using CORMIX (version 12.0, Doneker and Jirka 2007). Estimates of the IDZ extent and corresponding plume features such as the flow occupied within the IDZ, and its length and width were obtained considering the dilution required for each POC to meet WQGs.

The modeled water quality of each POC in the Goathorn Creek was compared with the IDZ evaluation criteria for flow occupied within the IDZ and its length and width, based on TG11 guidance. For the worst case, nitrite, cobalt and selenium do not meet WQG after complete mixing and aluminum exceeds the IDZ criterion for 100 m length during operation, while aluminum and selenium do not meet WQG after complete mixing in post-closure. This case is very conservative and likely to only occur during very dry periods when the Project is likely not discharging. Emphasis was placed upon the reasonable worst case, and the expected case, both of which are still conservative but provide more realistic evaluation scenarios. The results are summarized below.

During Operation Phase:

- IDZ criteria to meet applicable WQGs are satisfied for nitrate, nitrite, sulphate, aluminum, cobalt, iron, nickel, thallium, zinc, and molybdenum for the reasonable worst and expected cases.
- The IDZ extent of selenium exceeds the TG11 guidance (100 m length) for the reasonable worst case (153 m length), but meets the guidance for the expected case. WQG is exceeded for dissolved copper due to background concentration higher than the WQG, but the effluent concentration reaches background concentrations after complete mixing.

During-Post Closure Phase:

- POCs including nitrate, nitrite, molybdenum, nickel, thallium, and zinc do not require an IDZ, as the effluent concentrations at end of pipe are below the corresponding WQGs for the IDZ cases.
- IDZ criteria based on TG11 guidance is met for sulfate, aluminum, cobalt, iron, and selenium for the reasonable worst and expected cases. The guidance is exceeded for dissolved copper with background concentration higher than the WQG, but the effluent concentration reaches background concentrations after complete mixing.

The analyses of this study provided a range for spatial extent of IDZ for conditions anticipated for worst to expected cases as outlined in TG11. Based on the reasonable worst case and the expected case, a minimum IDZ length of 153 m, and 44 m would be needed during Operation and Post-closure phase, respectively, to meet the instream WQGs for the POCs identified.

1 Introduction

The Tenas Project (the Project) is a proposed open pit steelmaking coal mine, located approximately 25 km southwest of Smithers near the Town of Telkwa, British Columbia. Surface water in the Project Footprint area will be collected through a series of management and sedimentation control ponds. Excess water will be discharged via a tributary to Goathorn Creek.

An initial dilution zone (IDZ) assessment was prepared for the Project discharge to support the Discharge Management Plan for the Project as part of the Environmental Assessment Certificate Application (EA) submission for the Project in May 2022. IDZ characterization is required to address the 2024 Joint Application Information Requirements (JAIR) for the EA. This assessment is intended to delineate the extent of IDZ for the effluent discharge from the Project under a range of discharge and mixing conditions in the receiving stream.

This technical report describes the approach, methodology, analyses, and results completed to evaluate the IDZ development from the Project's effluent discharge and its spatial extent in the receiving Goathorn Creek. The assessment was conducted following the Technical Guidance 11 (TG11) provided by the BC Ministry of Environment and Parks (ENV 2019).

1.1 Background and Scope

SRK previously completed an IDZ study for the Project in 2022 (SRK 2022) based on the information available at the time of study as part of the Environmental Assessment Certificate Application (EA) submission for the Project in May 2022. The recently completed Best Achievable Technology (BAT) assessment (SRK 2025a) identified Parameters of Potential Concern (POCs) in the discharge of treated effluent from the Project, using the water quality model results from the Water and Load Balance (WLB) model developed for the Project (SRK 2025b). This study updates the IDZ assessment based on latest findings of BAT assessment and updated effluent discharge information from the WLB model for the Project.

The objective of the IDZ Assessment is to characterize the physical mixing of the Project's discharge (effluent) into the Goathorn Creek (receiver) under different conditions and evaluate the IDZ extent for the treated effluent. The scope of work includes the following:

- Characterization of effluent and receiver water quality and quantity to develop conservative cases for IDZ evaluation,
- Hydrodynamic mixing modeling to characterize effluent dispersion and dilution in the receiver, and
- IDZ delineation to estimate the spatial extent of mixing zone downstream of the discharge point based on TG11 guidance.

1.2 Regulatory Context

The IDZ is a regulatory zone in the receiving aquatic environment where an effluent discharge is mixed and is delineated by the point at which the concentrations of parameters of concern in mixed waters are

reduced above appropriate water quality guidelines to below those limits. The release of POCs should not cause acute toxicity in the receiving environment and the discharge at the end of the pipe cannot be acutely toxic prior to mixing. The BC Ministry of Environment and Parks (ENV) considers an IDZ for authorized project discharges based on the assessment of requested effluent releases according to Provincial guidance TG11 (ENV 2019).

The allowable extent of an IDZ depends on the sensitivity and value of the receiving environment downstream of the discharge. TG11 provides some guidance on spatial dimensions for proposed IDZs. For rivers and streams (flowing water), the guidance recommends that an IDZ be limited to 25% of stream width, can occupy 25% of stream flow volume during low-flow conditions (e.g. 7Q10), and may extend up to 100 meters from the discharge point (ENV 2019). As outlined in TG11, these dimensions will vary on a case-by-case basis, depending on site-specific factors.

The potential for potential chronic toxicity is limited to within the IDZ extent, without significantly affecting aquatic life and integrity of the water body as a whole (ENV 2019). Appropriate selection of water quality guidelines (WQGs) is therefore critical in determining the extent of an IDZ. Selection of receiving WQGs is described in SRK (2025b), where the long-term average BC Approved Water Quality Guidelines (BC AWQG) and the BC Working Water Quality Guidelines (BC WWQG) for freshwater aquatic life were considered. Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Aquatic Life (CCME WQG) or Environment and Climate Change Canada Water Quality Guidelines (ECCC WQG) were used for parameters for which no BC AWQG or BC WWQG have yet been established.

1.3 Study Approach

TG11 provides guidance on the management of surface water quality, quantity, and discharge requirements for industrial effluent releases. Based on TG11 guidance, the following components were characterized for IDZ assessment:

- Receiver flow and water quality – estimation of flow statistics (i.e., monthly, annual) and 7Q10 low-flow, and an evaluation of representative background baseline concentrations with consideration of receiving water. A combination of conservative background water quality and low-flow conditions were used as a basis for IDZ assessment.
- Effluent discharge quantity and quality – assessment of maximum and expected discharge rates and concentrations, with consideration of site water management and long-term water quality.
- Mixing zone features – modeling and delineation of the size and extent of the mixing zone beyond which effluent dispersion restores the receiver's water quality to in-stream WQGs or background concentrations.

TG11 specifies the presentation of worst, expected and best cases for an IDZ assessment. The cases presented in this report deviates from this methodology by replacing the best case with a reasonable worst case that is commonly seen and represents a more conservative yet realistic scenario for IDZ evaluation. The 3 cases presented include: a worst case (i.e., a very worst condition), a reasonable

worst case (i.e., worst case that potentially could occur), and an expected case (i.e., case that corresponds to typical average conditions).

Table 1-1 lists the 3 cases and their corresponding flow and water quality conditions for Goathorn Creek and the discharge from the management ponds (i.e., Project Effluent). The flow and water quality conditions have been described in the hydrometeorological baseline report (SRK 2024) and the water and load balance model results (SRK 2025b). Details of these cases are described in Sections 2.2 and 2.3.

Table 1-1. Definition of IDZ assessment cases

Cases	Goathorn Creek		Project Effluent	
	Flow condition	Water quality	Effluent discharge	Effluent quality
Worst case	7Q10 low-flow [1] of the lowest dilution month	75th percentile background concentration	Maximum discharge for lowest dilution month	Maximum concentration with typical source terms
Reasonable worst case	Lowest 7Q10 flow during open water months	50th percentile background concentration	Maximum discharge for the same lowest 7Q10 month (open water)	Maximum concentration with typical source terms
Expected case	Mean flow during effluent release period [2]	50th percentile background concentration	Average discharge during effluent release period	Expected concentration with typical source terms

Source: Prepared in the text

Notes:

[1] 7Q10 low-flow: 7-day minimum flow that is expected to occur once every 10 years.

[2] Open water season (May-Oct) is the effluent release period for the Operation phase, while year-round discharge occurs in the Post-closure phase.

Mixing and dilution modeling was conducted to evaluate the IDZ extent for POCs for the worst, reasonable worst and expected cases and compared against TG11 guidance. The hydraulic and mixing modeling approach are presented in Section 3 and the IDZ delineation results are provided in Section 4.

2 Site Overview and Input Characterization

2.1 Site Description and Effluent Discharge

The management ponds (i.e., East, West and North Management Ponds) for the Project will collect surface water from the active mine area. The Tenas Control Pond (TCP) will be constructed downstream of mining infrastructure and will collect water from the management ponds and upstream mining activities prior to discharging excess water to the aquatic environment. Discharge will be directed towards an ephemeral tributary of Goathorn Creek (Figure 2-1). Assessment of alternative discharge locations at a scoping level indicated that this location is beneficial in terms of water management, disturbance, and dilution capacity. A sewage treatment plant will operate onsite that will also discharge treated sewage effluent to the same tributary of Goathorn Creek during open-water season and will mix with the overall Project's discharge.

Goathorn Creek is a tributary of Telkwa River and flows along the eastern and northern extents of the Project. It is a braided creek with moderate width. Project discharge from the pond is conveyed to the Goathorn Creek through a tributary channel. This channel is typically steep, and the natural slope carries water downstream, ultimately discharging water along the left bank of Goathorn Creek. The tributary is not fish bearing above the barrier, and erosion protection will be installed along the tributary to the confluence with Goathorn Creek (SRK 2021a). During the Operation phase (Year 0 to Year 22), the TCP discharges only during the open water season months and mixes with treated sewage effluent in the tributary channel. The TCP will be decommissioned upon closure (after year 25) and excess water will be released from the North Management Pond (NMP) through the same tributary channel towards Goathorn Creek.

Water quality in Goathorn Creek has the potential to be affected by mining operation. The primary pathways for potentially affecting water quality, sources and receptors to the creek have been described in the Tenas Project Conceptual Site Model (SRK 2021b). For ease of reference, the Conceptual Site Model for the Tenas Project is found in Chapter 1, Project Overview, Appendix 1-T (App01.0-T_CSM-WaterModel_May2022-.pdf). The identified receptors including mammals, fish, amphibians, and human health were considered in the selection of the most appropriate water quality threshold criteria for the IDZ assessment described in Section 2.3.1.

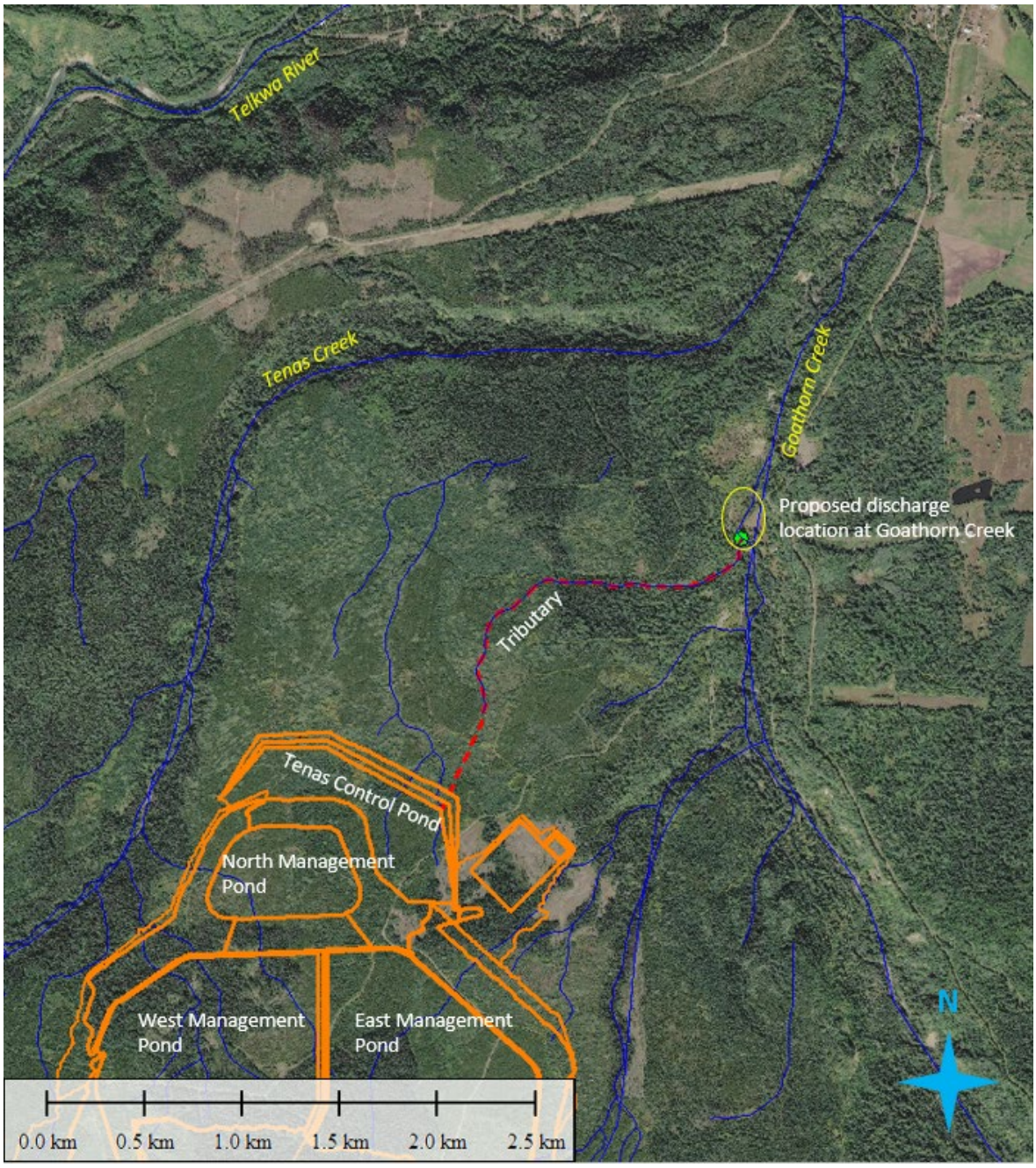


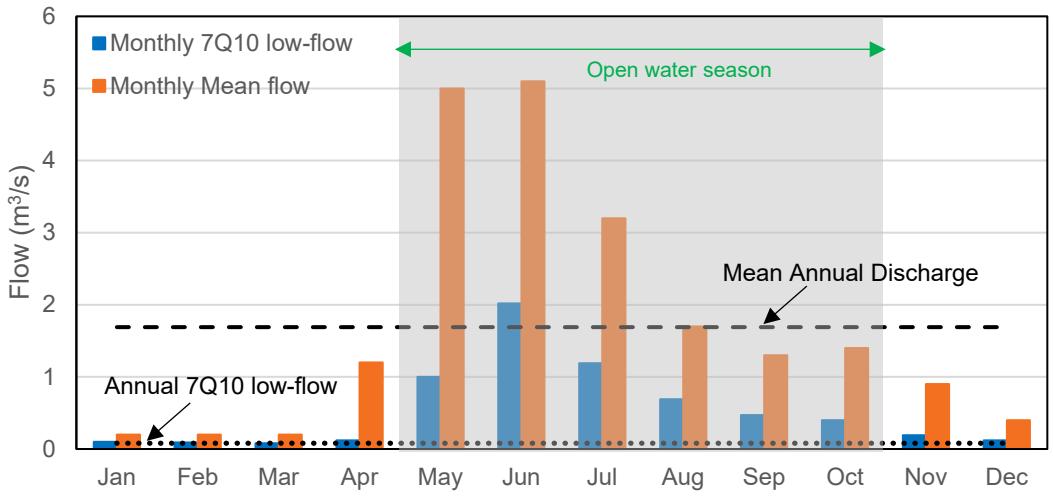
Figure 2-1. Location of proposed effluent discharge from the Project to Goathorn Creek

2.2 Flow Characterization

Goathorn Creek is the receiving environment for the Project discharge from the TCP during the Operation phase and NMP upon closure. Hydrologic estimates for the creek were calculated based on the synthetic record of the Goathorn hydrologic station, which was developed based on scaling from the Goathorn Creek Water Survey of Canada (WSC) station long-term data. The hydrology and detailed flow estimates for the creek are described in the Hydrometeorological Baseline Report (SRK 2024).

The hydrograph of Goathorn Creek is dominated by meltwater in freshet (Figure 2-2), with a mean annual discharge of 1.7 m^3/s at the Goathorn hydrologic station (SRK 2024). Low flows typically occur in late fall and winter. The annual 7-day consecutive low flow during a 10-year return period (7Q10) is expected to be 0.08 m^3/s at the Goathorn hydrologic station.

Table 2-1 outlines the monthly and annual flow statistics based on Goathorn-Hydro station data. Monthly 7Q10 low-flow estimates range from 0.08 – 2.0 m^3/s. During the open water season (i.e., May – October), the monthly mean flow in the creek at Goathorn-Hydro station ranges between 1.1 and 5.1 m^3/s, with an average of 2.9 m^3/s.



Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\InputDataAnalysis\TelkwaIDZ_InputSummary_rev09_EAModel41.xlsm

Figure 2-2. Monthly Flow at Goathorn Hydrologic Station in Goathorn Creek

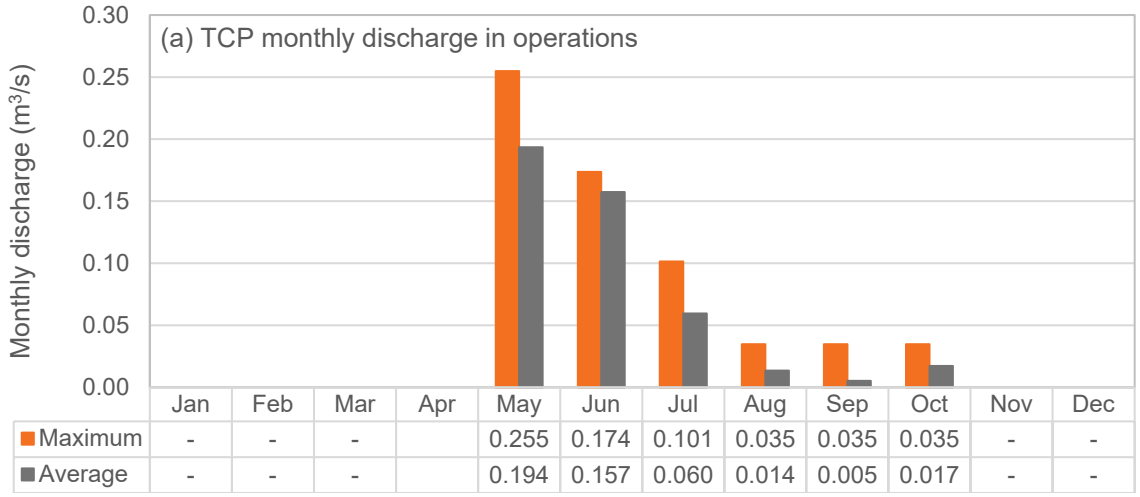
Table 2-1. Goathorn Creek Monthly and Annual Flow Statistics

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
7Q10	0.10	0.09	0.08	0.12	1.0	2.0	1.2	0.69	0.47	0.40	0.19	0.12	0.08
Average	0.22	0.18	0.19	1.4	5.1	5.1	3.1	1.5	1.2	1.1	0.79	0.34	1.7

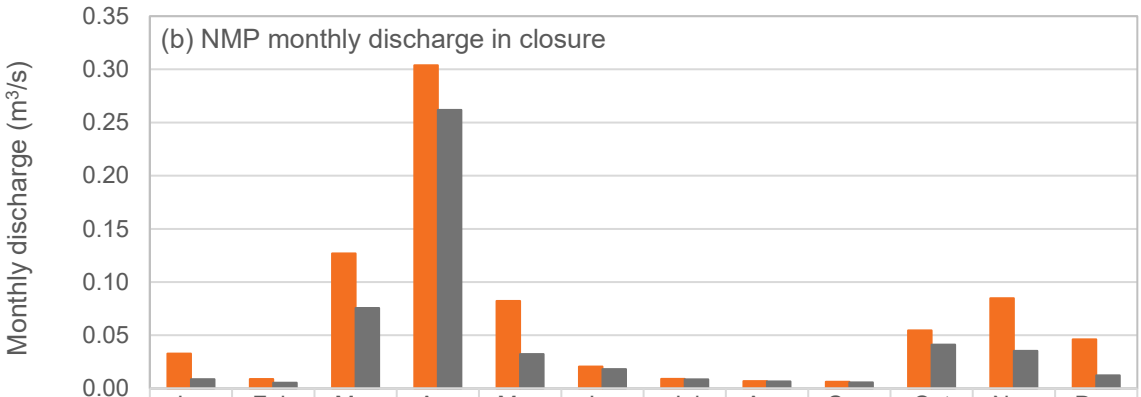
Source: SRK (2024)

Project discharge from the TCP (during Operation phase) and the NMP (after closure) into the Goathorn Creek tributary was obtained from the water and load balance (WLB) model for the Project Footprint. Long-term discharges to the receiving environment were estimated considering the Project Case condition with expected groundwater seepage, typical source terms and average hydrology (SRK 2025b).

Monthly maximum and average discharges from the TCP (during operations until 2048, Year 22) and the NMP (during Post-Closure after 2048, Year 22) were obtained from the long-term WLB model results (Figure 2-3). TCP discharge in operation occur in the open water season. Based on average hydrologic condition predictions, discharge from TCP is highest in May, with maximum and average rate of 0.26 and 0.19 m^3/s, respectively. The closure discharge from NMP will be highest in April.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	-	-	-		0.255	0.174	0.101	0.035	0.035	0.035	-	-
Average	-	-	-		0.194	0.157	0.060	0.014	0.005	0.017	-	-



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	0.033	0.009	0.127	0.304	0.082	0.021	0.009	0.007	0.006	0.055	0.085	0.046
Average	0.008	0.005	0.076	0.262	0.032	0.018	0.009	0.007	0.006	0.041	0.035	0.012

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\InputDataAnalysis\TelkwaIDZ_InputSummary_rev09_EAModel41.xlsm

Figure 2-3. Monthly Project discharge from (a) Tenas Control Pond (TCP) during the Operation phase, and (b) North Management Pond (NMP) upon closure

The lowest dilution capacity occurs at low-flow in Goathorn Creek with high Project discharge. The IDZ evaluation cases for worst, reasonable worst and expected conditions were developed conservatively considering the low-dilution periods during the Operation phase and after closure.

Among the summer open-water season months (May – October) of effluent release during the Operation phase, the 7Q10 flow is lowest is October (Table 2-1). However, the dilution capacity is lowest in May, which corresponds to relatively low monthly 7Q10 condition (Figure 2-2) with maximum Project discharge (Figure 2-3a). Conservative IDZ cases based on combinations of Project discharge rates and in-stream flow conditions were developed for operation as follows:

- Worst case: Maximum monthly Project discharge (May) with the May 7Q10 low-flow conditions, representing lowest dilution condition.
- Reasonable worst case: Lowest monthly 7Q10 flow during open water season (October) and the corresponding monthly maximum discharge during this time (October).
- Expected case: Mean streamflow during effluent release period (May – October) with average Project discharge over the same period.

Discharge from the NMP after closure is assumed to occur year-round with no operational controls in-place to store water. The dilution capacity is lowest in April, when the Project discharge is maximum and Goathorn Creek may still be flowing below freshet flows. Conservative IDZ cases based on combinations of Project discharge rates and in-stream flow conditions were developed for the Post-closure phase as follows:

- Worst case: Maximum monthly Project discharge (April) with the April 7Q10 low-flow conditions, representing lowest dilution condition.
- Reasonable worst case: Lowest monthly 7Q10 flow during open water season (October) and the corresponding monthly maximum discharge during this time (October).
- Expected case: Mean annual flow in the stream (year-round effluent release) with average Project discharge over the same period (January – December).

Table 2-2 outlines the Goathorn Creek flow and Project discharge conditions selected for the IDZ evaluation cases. It should be noted that the worst case for Post-closure phase corresponds to the maximum discharge (0.30 m^3/s) from NMP during 7Q10 flow conditions, with the discharge rate being 2.5 times higher than the in-stream flow (flow ratio 0.4:1). This case is not realistic as the WLB model predictions represent average hydrology conditions, and the 7Q10 flow is expected to occur only during a very dry period with corresponding decrease in discharge from the Project.

A WLB model simulation of 1-in-100-year dry period for two consecutive years indicated that the maximum discharge from the NMP would be 0.071 m^3/s which corresponds to a flow ratio of 1.7:1. Therefore, a conservative but realistic 1:1 flow ratio condition was also evaluated for the worst case in post-closure and modeled for IDZ delineation.

Table 2-2. Flow Summary for IDZ Evaluation Cases

Cases	Goathorn Creek		Effluent Release		Flow ratio [1]
	Flow condition	***Flow (m^3/s)***	***Discharge condition***	***Discharge (m^3/s)***	
Operation (discharge from Tenas Control Pond)					
Worst case	7Q10 low-flow of the lowest dilution month (May)	1.0	Maximum discharge for the lowest dilution month (May)	0.26	3.9:1
Reasonable worst case	Lowest 7Q10 flow during open water months (Oct)	0.4	Maximum discharge for the same open water month (Oct)	0.035	11.4:1
Expected case	Mean flow during effluent release period (May – Oct)	2.9	Average discharge during effluent release period (May – Oct)	0.074	38.6:1
Post Closure (discharge from North Management Pond)					
Worst case	7Q10 low-flow of the lowest dilution month (April)	0.12	Maximum discharge for the lowest dilution month (April)	0.30 (0.12)[2]	0.4:1 (1:1)[2]
Reasonable worst case	Lowest 7Q10 flow during open water months (Oct)	0.4	Maximum discharge for the same open water month (Oct)	0.055	7.3:1
Expected case	Mean flow during effluent release period (Jan – Dec)	1.7	Average discharge during effluent release period (Jan – Dec)	0.043	39.3:1

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\InputDataAnalysis\TelkwaIDZ_InputSummary_rev09_EAModel41.xlsm

Notes:

[1] Corresponds to ratio of Goathorn Creek flow to effluent discharge rate.

[2] Represents a realistic case with 1:1 flow ratio.

2.3 Water Quality Characterization

Water quality characterization for each of the IDZ cases, including background baseline water quality in Goathorn Creek, water quality guidelines, water chemistry of the effluent releases and corresponding POCs, is discussed in the following sections.

2.3.1 Water Quality Guidelines

Water quality guidelines (WQG) for the Goathorn Creek receiving environment were established based on applicable provincial or federal guidelines. WQGs were chosen according to the following order of preference (SRK 2025a):

- The lowest of BC Approved Water Quality Guidelines (BC AWQG) or BC Working Water Quality Guidelines (BC WWQG) for protection of freshwater aquatic life,
- Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME WQG) when BC Guidelines are unavailable, or
- Environment and Climate Change Canada Water Quality Guidelines (ECCC WQG) when the above are unavailable.

The only exception to the use of BC WQG aquatic life guidelines was for molybdenum (total), for which BC's ruminant (wildlife) was chosen as the WQG as it was lower than aquatic receptors and was reasonably applicable for this Project (SRK 2025b). In the absence of chronic WQG, short-term BC acute WQG was used for total iron. For guidelines that depend on toxicity-modifying factors, medium background values from background baseline datasets within each creek were used.

The WQGs were applied to screen for POCs and delineate IDZ in the receiving Goathorn Creek.

2.3.2 Parameters of Concern

POCs in the effluent releases were identified by screening Project end of pipe discharge water quality results from the Tenas Project WLB model (SRK 2025b) against the WQGs. The BAT assessment used the modeled surface and groundwater discharge concentrations as a basis for identifying POCs (SRK 2025a). Parameters with modelled discharge concentrations greater than 80% of applicable WQGs at end of pope were identified as POCs. The same approach was used in this study. Exception from BAT assessment applies for cobalt for which the BC AWQG was updated from total to dissolved component. Also, thallium (total) was identified as a POC based on the recent WQG.

Parameters identified as POCs and considered in this study are listed below:

- Nitrogen Nutrients: Nitrate, Nitrite,
- Sulphate: Sulphate,
- Metals: Aluminum (total), Cobalt (dissolved), Copper (dissolved), Iron (total), Nickel (dissolved), Thallium (total), Zinc (dissolved), and
- Oxyanions: Molybdenum (total), Selenium (total).

2.3.3 Background Water Quality

The background baseline water quality information for Goathorn Creek has been described in SRK (2025b). Baseline water quality monitoring indicated that exceedances of WQGs have occurred historically in Goathorn Creek for total and dissolved aluminum, dissolved copper, and total iron. In analyzing the receiving water quality data, values less than the method detection limit (MDL) were assumed to be equal to the MDL to remain conservative.

The IDZ assessment utilized the 50th (median) and 75th percentile concentrations of the water quality parameters, with the upper percentile used to represent the worst case as a conservative approach. The 50th percentile background concentration was used for the reasonable worst case and the expected case.

WQGs of Goathorn Creek and the 50th and 75th percentile background concentration of each POCs are presented in Table 2-3. These are utilized in evaluating exceedances and estimating IDZ extent for each case evaluated in the study. Among the POCs considered, background concentration of dissolved copper (50th and 75th percentile) was higher than the in-stream WQG.

Table 2-3. Background concentration and long-term water quality guidelines for Goathorn Creek

Parameter	Goathorn Creek Background Concentration (mg/L)		Water Quality Guideline (WQG)	
	50th Percentile	75th Percentile	Value (mg/L)	Source
Nitrate-nitrogen	0.041	0.054	3	BC AWQG
Nitrite-nitrogen	0.0005	0.0009	0.02	BC AWQG
Sulphate	24	31	218	BC AWQG
Aluminum, total[1]	0.092	0.23	0.27	BC AWQG
Cobalt, dissolved	0.00005	0.00005	0.00045	BC AWQG
Copper, dissolved[1, 2]	0.0014	0.0021	0.0013	BC AWQG
Iron, total	0.085	0.27	1	BC Acute WQG
Molybdenum, total	0.00047	0.00054	0.034	BC ruminant wildlife guideline
Nickel, dissolved[1]	0.00025	0.00025	0.0022	BC WWQG
Selenium, total	0.000086	0.00012	0.002	BC AWQG
Thallium, total	0.000005	0.000005	0.00003	BC AWQG
Zinc, dissolved[1]	0.0010	0.0015	0.0074	BC AWQG

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\ CormixInput_WLBM\ Results_IDZ_Inputs_EAModel41_20250717.xlsm

Notes:

[1] Guideline dependent on toxicity-modifying factors, calculated based on medium background values from baseline dataset.

[2] Background baseline concentration higher than in-stream WQG.

2.3.4 Effluent Water Quality

Long-term estimates of effluent water quality were developed from the WLB modeling results from pre-Project conditions, through Operation and Post-closure phases (SRK 2025b). These modelled predictions incorporate variability in hydrologic conditions, groundwater conditions and geochemical source terms. Results were presented in terms maximum and average concentrations for expected source terms, considering two 6-month periods – the open water period, denoted as summer (i.e., May through October) and the winter period, where streamflow is dominated by groundwater recharge (i.e., November through April).

To represent the IDZ cases, statistics on the water quality time series were selected. Since the Project release from the TCP is discharged in open water season, summer statistics were used to define the IDZ cases for the Operation phase. Concentrations of the POCs for the worst case and the reasonable worst case were represented by maximum concentration, while expected case corresponded to average summer concentration with expected source term (Table 2-4).

After the Operation phase, the TCP is decommissioned, and discharge controls are no longer available. Project discharge from the NMP is high in March and April, which have the least dilution capacity after closure. Therefore, winter statistics were selected for IDZ Post-closure cases, since these provide conservative estimates compared to summer concentrations. The winter maximum concentration was selected for the worst and reasonable worst cases, and the average concentration was used for the expected case.

WLB model results indicated that when TSS in treated effluent is assumed maximum (35 mg/L), the total iron concentration exceeds the acute guideline of 1.0 mg/L. If the TSS is reduced by half, the iron concentrations are below the acute limit. This is an artifact of assuming high TSS in the effluent. Furthermore, Borealis Environmental Consulting Incorporated reviewed the POC acute toxicity concentrations and determined that total iron concentrations do not exceed LC50 values for rainbow trout and Daphne and therefore the modelled effluent is not expected to be acutely toxic (SRK 2025a).

Table 2-4. Effluent water quality characterization for the identified POCs

Parameter	Effluent Concentration (mg/L)					
Project Phase	**Operation**			**Post Closure**		
IDZ Case	**Worst case**	**Reasonable worst case**	**Expected case**	**Worst case**	**Reasonable worst case**	**Expected case**
Water Balance Result Statistics	**Maximum**	**Maximum**	**Average**	**Maximum**	**Maximum**	**Average**
Period	**Summer**	**Summer**	**Summer**	**Winter**	**Winter**	**Winter**
Nitrate-nitrogen	4.3	4.3	0.96	0.87	0.87	0.33
Nitrite-nitrogen	0.099	0.099	0.023	0.02	0.02	0.0077
Sulphate	410	410	220	220	220	190
Aluminum, total	0.39	0.39	0.38	0.39	0.39	0.38
Cobalt, dissolved	0.0029	0.0029	0.0019	0.00069	0.00069	0.00052
Copper, dissolved	0.0015	0.0015	0.0011	0.0022	0.0022	0.0017
Iron, total	1.5	1.5	1.5	1.5	1.5	1.5
Molybdenum, total	0.036	0.036	0.018	0.0076	0.0076	0.0063
Nickel, dissolved	0.006	0.006	0.0037	0.0022	0.0022	0.0017
Selenium, total	0.022	0.022	0.011	0.008	0.008	0.0059
Thallium, total	0.000050	0.000050	0.000034	0.000016	0.000016	0.000014
Zinc, dissolved	0.0088	0.0088	0.0055	0.0018	0.0018	0.0015

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\ CormixInput_WLBM\ Results_IDZ_Inputs_EAModel41_20250717.xlsm

2.4 Sewage Effluent

The sewage treatment plant (STP) will discharge treated effluent into the tributary of Goathorn Creek. The treated effluent is held in a pond over winter and discharged during the open-water season from May through September. The average discharge rate from the STP is 41.5 m^3/day (0.0005 m^3/s). The effluent water quality was obtained from WLB modeling (SRK 2025b) and is presented in Table 2-5. Considering TCP discharge rate (Table 2-2) and corresponding water quality (Table 2-4) for the three IDZ cases, concentrations in the tributary of Goathorn Creek were obtained based on mass balance approach assuming a fully mixed condition.

After mixing of sewage effluent and TCP discharge, total ammonia concentration in the tributary was below the WQG (1.5 mg/L) and therefore Ammonia was not considered a POC. Nitrate-nitrogen and nitrite-nitrogen was identified as POCs (refer to Section 2.3.2), and the mixed concentrations in the tributary were used for IDZ modeling at the Goathorn Creek.

According to BC Municipal Wastewater Regulation, a dilution ratio of 10:1 is required for sewage effluent (Radloff 2021), which will be supplied by the discharge from the Tenas Control Pond during the Operation phase. The dilution for the IDZ cases is high (> 70), and the required water to mix with sewage effluent will be met throughout operations based on available water in the TCP.

Table 2-5. Water quality of treated sewage effluent

Parameter	Cases	Effluent concentration (mg/L)		Concentration in tributary [1] (mg/L)	Dilution [2]
		STP	TCP		
Nitrate	Worst	36.9	4.3	4.4	532
	Reasonable worst	36.9	4.3	4.7	74
	Expected	36.9	1.2	1.2	155
Nitrite	Worst	0.1	0.099	0.099	532
	Reasonable worst	0.1	0.099	0.099	74
	Expected	0.1	0.023	0.023	155
Total ammonia	Worst	1.9	0.56	0.56	532
	Reasonable worst	1.9	0.56	0.58	74
	Expected	1.9	0.13	0.14	155

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\InputDataAnalysis\TelkwaIDZ_InputSummary_rev09_EAModel41.xlsm

Notes:

[1] Obtained from mass-balance considering discharge rate from sewage treatment plant (STP) and Tenas Control Pond (TCP)

[2] Considering TCP discharge rate and sewage effluent discharge rate

2.5 Stream Survey

A field survey was carried out on October 30, 2020, in Goathorn Creek by DWB Consulting Services Limited (2020). During the survey, the average streamflow in the creek was 1.2 m^3/s, based on the real-time hydrometric monitoring at Water Survey of Canada station 08EE008 (WSC 2020). This is comparable to the flow rate used in the reasonable worst case (i.e., 0.99 m^3/s) which corresponds to the 7Q10 flow during freshet (May).

To obtain a detailed description of the Goathorn Creek IDZ, cross-sectional measurements were carried out at five (5) locations upstream and downstream of the proposed discharge point (Figure 2-4). The tributary discharges from the left bank at the creek, and a section (denoted by section C) was measured at this discharge location. Two more sections upstream (sections A and B) and two sections downstream (sections D and E) were surveyed, covering about a 220 m reach near the discharge location. In each section, measurements were taken at close intervals to capture the local variation of channel depth. Locations of the overbank points and water levels were also noted. The presence of boulders and cobbles in the creek makes the cross-sectional shapes highly irregular (Figure 2-4). The bed profile and the channel slope were obtained from these cross-sectional measurements. The estimated bed slope for the surveyed reach is about 2.3% (DWB 2020).



Figure 2-4. Surveyed cross sections near the Goathorn Creek discharge point

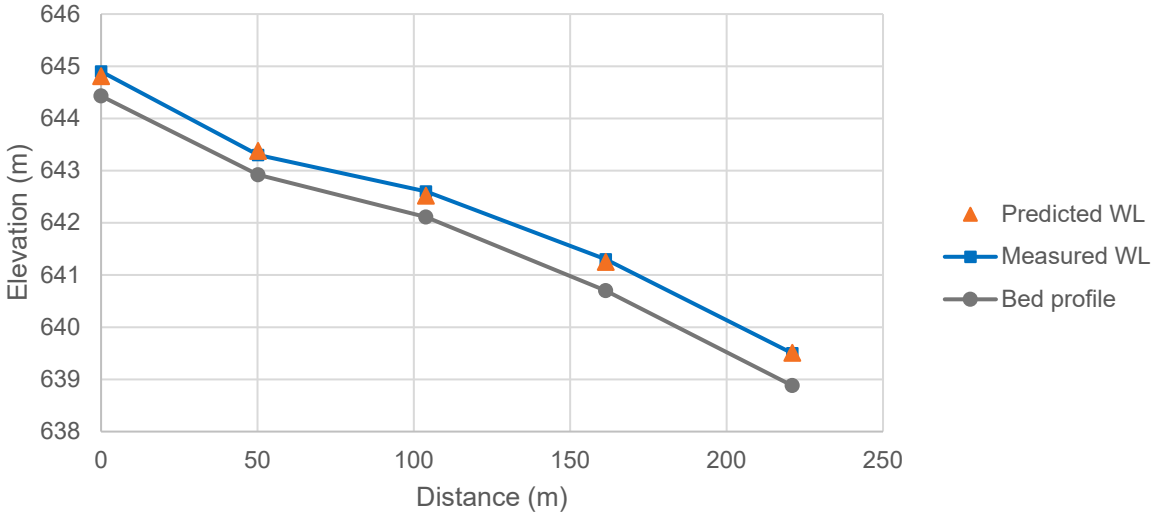
3 Hydraulic and Mixing Modeling

Stream hydraulic properties were utilized to develop mixing-dilution model, as these govern dispersion characteristics in the receiving environment. HEC-RAS (version 6.6, USACE 2024) was utilized to build a hydrodynamic model of the Goathorn Creek and develop inputs for mixing modeling. The water quality in the Goathorn Creek and its mixing and dilution characteristics were modeled using CORMIX (version 12.0, Doneker and Jirka 2007), which is a computer-aided system for the analysis, prediction, and design of regulatory mixing zones, and is supported by the US Environmental Protection Agency.

3.1 Hydraulic Model Development

The HEC-RAS model domain was constructed using the surveyed cross sections measured upstream and downstream of the discharge point, covering about 220 m long reach of the Goathorn Creek. Because of the highly irregular geometry, cross sections were interpolated at a 2 m spacing for better representation of hydraulic features. During the cross-section survey, average flow at the Goathorn Creek was 1.2 m^3/s, which was applied as the upstream boundary condition. The model was set to a normal depth boundary condition at the downstream model extent.

Since the IDZ assessment typically uses low-flow conditions, the variation in roughness between the channel and overbank locations is not very important, and a single channel roughness value was assigned for the entire reach. The model was calibrated by adjusting Manning's roughness coefficient 'n' to maintain observed water depths in the upstream sections. The estimated roughness coefficient was 0.14, typical of the large cobbles and boulders observed at the site. This also falls within the range of acceptable roughness values found in literature (USACE 2024). The measured and simulated water surface elevation agreed very well, with a correlation coefficient, R^2 = 0.999 (Figure 3-1), indicating an appropriate selection of the model parameters.



Source: Z: \1CT027.003 Telkwa/2020 EA Water Management Support\900_Discharge_Mgmt\IDZ_study\Hydraulic Analysis\HEC-RAS Modeling\GHC_IDZ_hecras_calibration_rk.xlsx

Figure 3-1. Comparison between the measured and simulated water surface elevation

3.2 Hydraulic Characterization Results

The calibrated model was utilized to simulate the Goathorn Creek flow conditions for the three cases – worst, reasonable worst and expected conditions, during the Operation and Post-closure phases. For each case, the creek flow, and the corresponding effluent discharge rate (Table 2-2) were considered for the creek's total flow. Various hydraulic parameters, such as depth, velocity, and width, were averaged over the IDZ reach downstream of the discharge location. Table 3-1 highlights the hydraulic characteristics for each case, which were utilized in the mixing-dilution modeling described in Section 3.3.

Table 3-1. Hydraulic features of Goathorn Creek for different cases

Parameter	Calibration	Operation			Post Closure		
		Worst case	Reasonable worst case	Expected case	Worst case	Reasonable worst case	Expected case
Total flow (m^3/s)	1.2	1.26	0.44	2.93	0.24[2]	0.46	1.73
Slope (m/m) [(1)]	0.023	0.023	0.025	0.023	0.025	0.025	0.023
Average Depth (m)	0.31	0.32	0.20	0.43	0.15	0.20	0.36
Average Velocity (m/s)	0.49	0.49	0.37	0.61	0.32	0.38	0.53
Average Width (m)	9.1	9.2	6.8	11.8	5.5	6.8	9.9

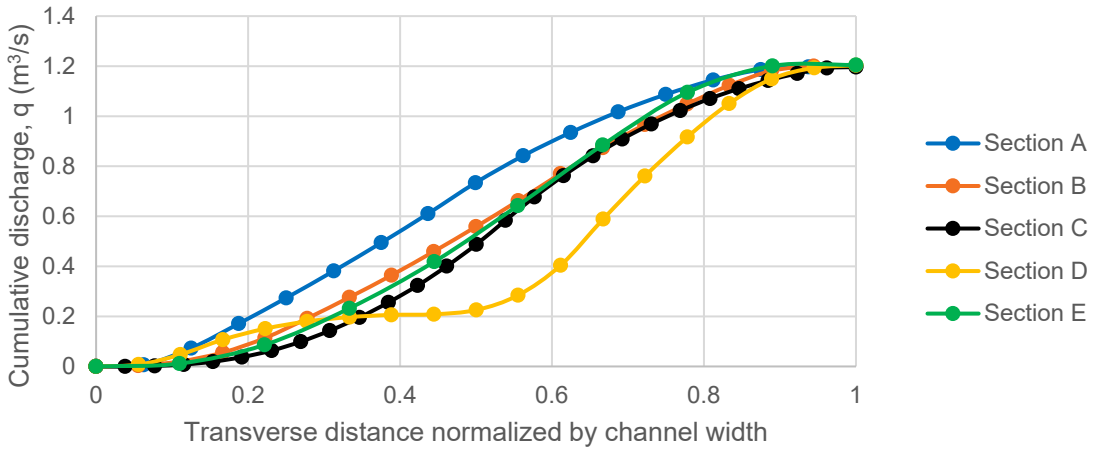
Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\HydraulicModeling\TelkwaIDZ_GHC_hecras_modeling_rev05_2025update.xlsx

Notes:

[1] Slope of the energy grade line.

[2] Corresponds to the case with 1:1 flow ratio.

Using the calibrated hydrodynamic model, velocity distribution and the corresponding cumulative discharge were analyzed for the Goathorn Creek. The cumulative discharge, *q*, represents the volumetric flow rate which occurs between the bank and a given position within the channel, and is equal to zero at one bank and equal to the total discharge (Q) at the other bank. The cumulative discharge distribution at the surveyed sections of the Goathorn Creek is illustrated in Figure 3-2 where q = 0 at the left bank and q = 1.2 m^3/s at the right bank of the creek. The distribution is similar for most cases, except for section A (which is narrow) and section D (with divided flow).



Source: Z: \1CT027.003 Telkwa/2020 EA Water Management Support\900_Discharge_Mgmt\IDZ_study\ CORMIX_Modeling\ TelkwaIDZ_CORMIX_ModelResults_rev04_nst.xlsm

Figure 3-2. Cumulative discharge distribution at Goathorn Creek sections

The distribution of cumulative discharge lines in a channel provides an indication of the overall flow pattern that is important for constituent transport. The closely spaced discharge lines, as shown in Figure 3-3, represent areas of large depth and higher velocities in the Goathorn Creek. Also, the sections are typically shallow towards the left bank, so wider plume widths are expected for effluent discharge, which exceeds that provided in the TG11 guidance. For example, Section C (discharge location) and downstream sections occupy 37-56% channel width for 25% flow. As a result of this site-specific shallow-flow configuration, wider plume width criterion (40% of channel width) was used for IDZ delineation (see Table 4-1).

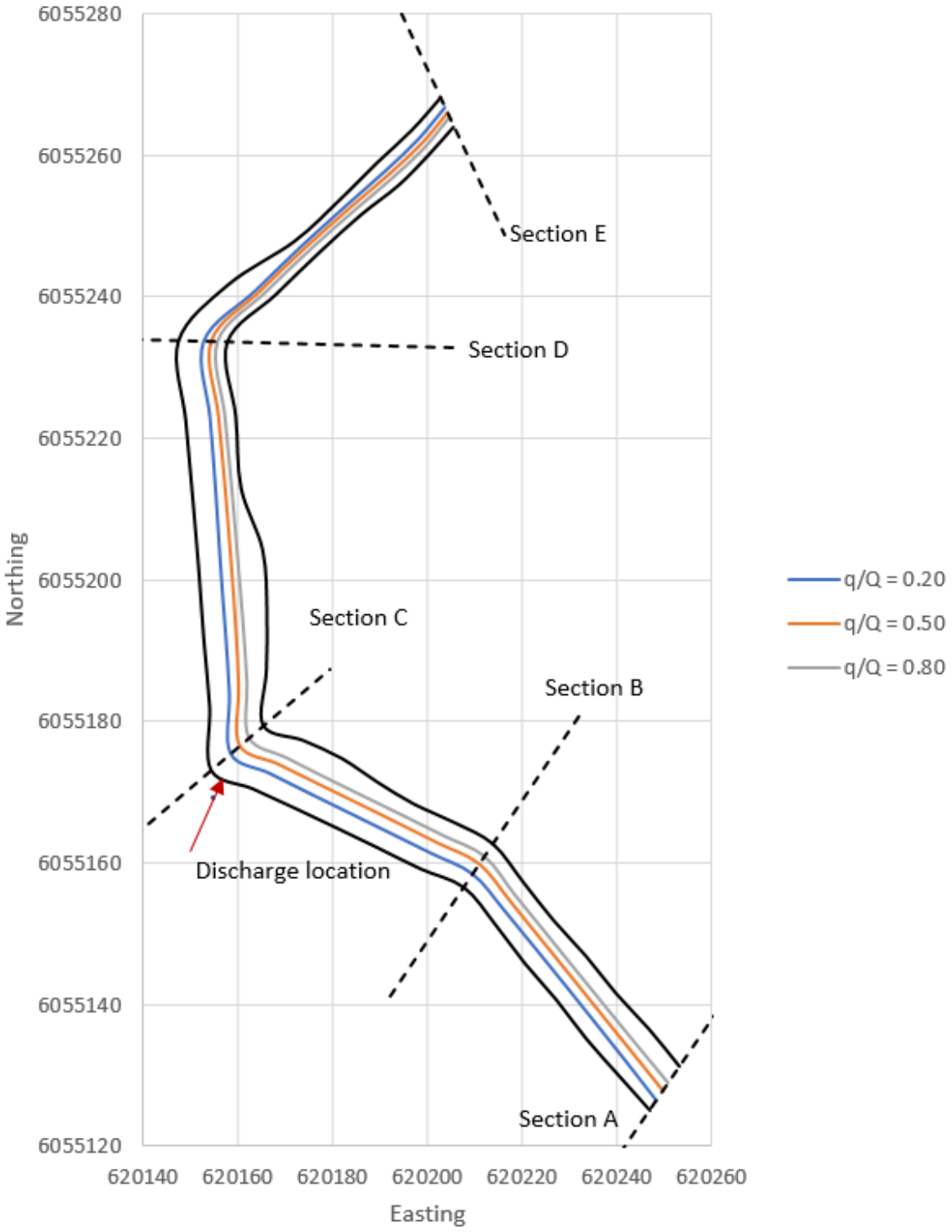


Figure 3-3. Illustration of cumulative discharge near the Goathorn Creek IDZ

3.3 Mixing Model Description

CORMIX employs jet integral model for near-field (Yotsukura and Sayre, 1976) and cumulative discharge method for far-field mixing processes (Doneker and Jirka, 2007). The program requires input on flow and discharge rate, hydraulic condition, simplified geometry of ambient and discharge channel, and water quality descriptions, among others.

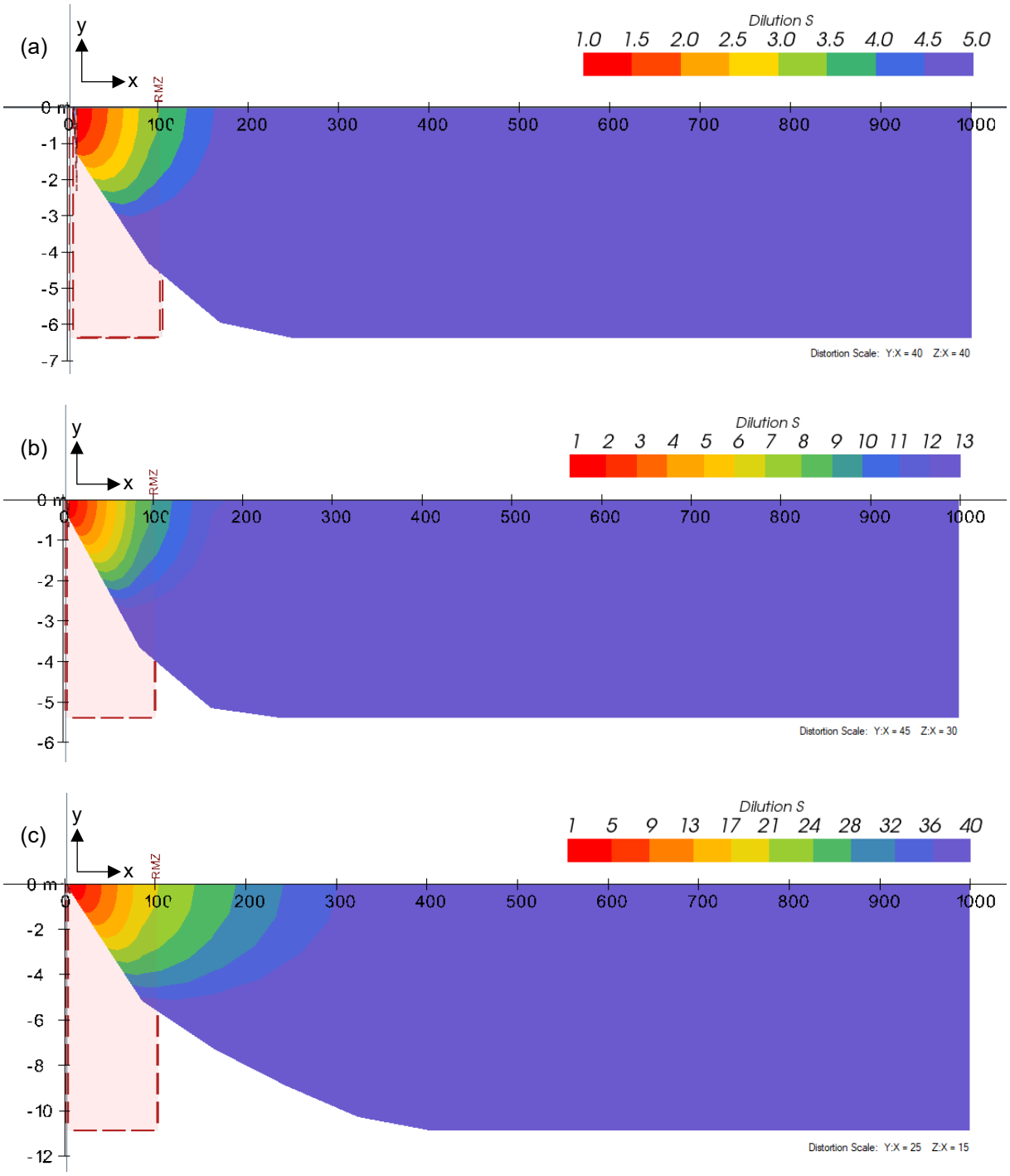
For the IDZ cases evaluated in this study, the model was configured as a slightly meandering channel (conservative assumption) to represent the Goathorn Creek, with Manning's roughness coefficient obtained from the hydraulic modeling (Section 3.1). The model geometry for each IDZ case was schematized as a rectangular cross-section keeping the depth-velocity conditions consistent with hydraulics of the creek (refer to Table 3-1). For the tributary (discharging channel), it was assumed that the velocity is the same as the creek, and the depth at the discharge location is like the mean depth of creek flow. The model domain was extended up to 1.5 km downstream of the discharge location.

For water quality prediction, parameter concentrations were specified for the effluent discharge with consideration of background water quality in the creek. With the mixing models set for the worst, reasonable worst and expected cases, in-stream water quality was evaluated for each POC. Estimates of the effluent plume were obtained at various distances downstream of the discharge location, and across the transverse direction of the creek.

3.4 Dilution Characterization

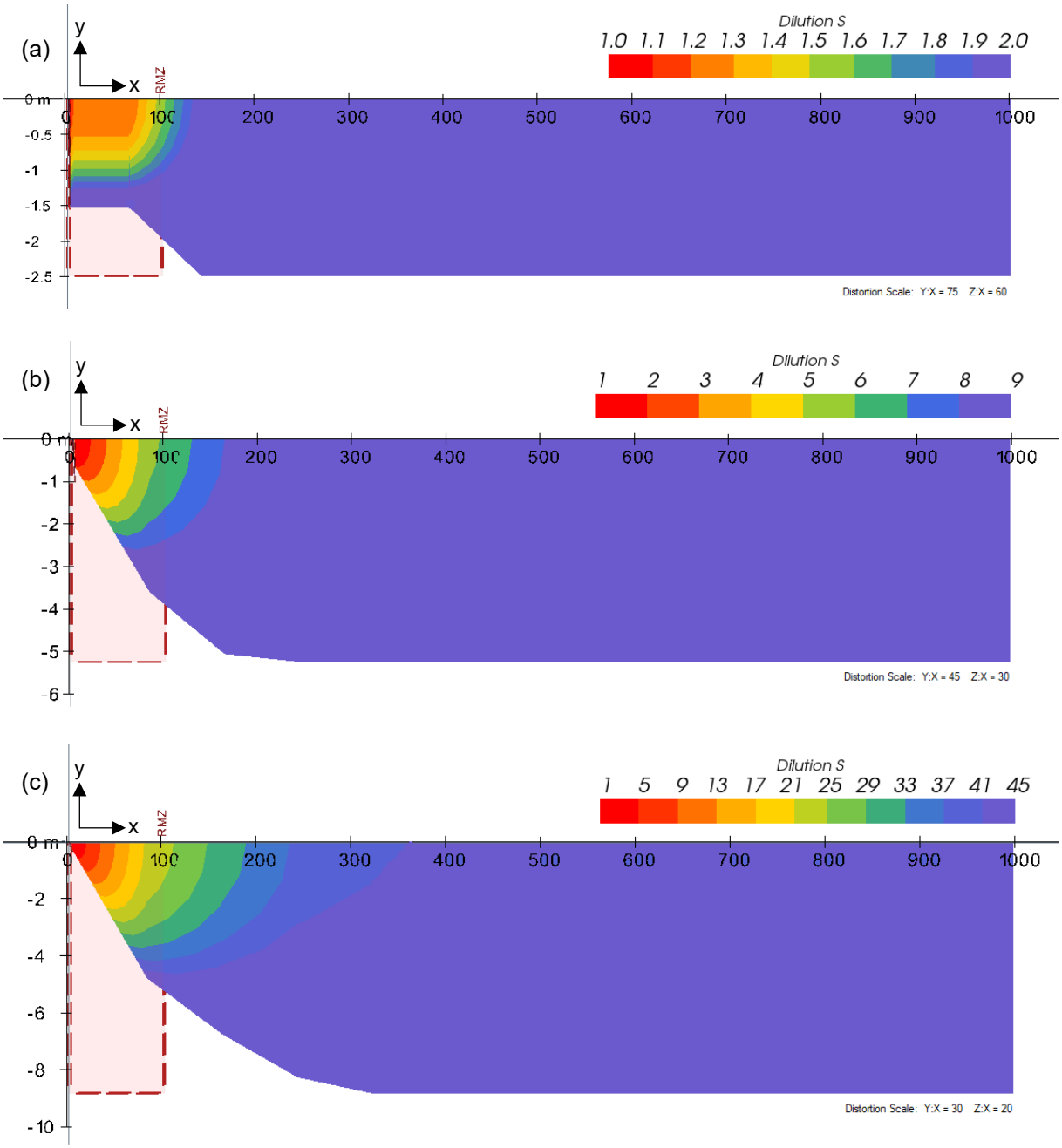
The developed CORMIX model was used to predict water quality in the Goathorn Creek due to effluent discharge from the TCP (during the Operation phase) and the NMP (during the Post-closure phase). The model provided estimates of concentration change and corresponding dilution of the effluent plumes at downstream locations.

Figure 3-4 and Figure 3-5 illustrate dilution contours for the IDZ cases during the Operation and post-closure, respectively. The dilution (denoted as S) is defined as the effluent concentration (or initial concentration) over the concentration at a point resulting from mixing. Since CORMIX utilizes the 'cumulative discharge method', the transverse dimension illustrated in the figures represents relative width in terms of cumulative discharge across the creek. The actual width was obtained using the cumulative discharge distribution of the surveyed cross sections described in Section 3.2.



Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling

Figure 3-4. Model results showing dilution for the IDZ cases during the Operation phase – (a) worst case (S_{max} = 4.9), (b) reasonable worst case (S_{max} = 12.4), and (c) expected case (S_{max} = 39.6)



Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling

Figure 3-5. Model results showing dilution for the IDZ cases during the Post-closure phases – (a) worst case (1:1 flow ratio) (S_{max} = 2), (b) reasonable worst case (S_{max} = 8.3), and (c) expected case (S_{max} = 40.3)

As a result of turbulent mixing, the effluent plume is diluted downstream beyond the discharge location. The maximum dilution depends on the creek flow and the effluent discharge rate. Due to shallow depths, plumes become vertically well-mixed within shorter distances, and the dilution is governed by transverse mixing across channel width. The mixing coefficient for different cases varied from 0.014 to 0.05 m^2/s (Table 3-2), where the dimensionless mixing coefficient was about 0.5. This is a conservative estimate and falls within literature values. The dimensionless transverse mixing coefficients can vary from 0.3 to 0.6 for regular channels and 0.6 to 0.9 for gently meandering channels (Fischer et al. 1979; Rutherford 1994).

Table 3-2. Mixing model results for various cases

Parameter	Operation			Post Closure		
	Worst case	Reasonable worst case	Expected case	Worst case[1]	Reasonable worst case	Expected case
Goathorn Creek Flow (m^3/s)	1	0.4	2.86	0.12	0.4	1.69
Effluent Discharge Rate (m^3/s)	0.26	0.035	0.074	0.12	0.055	0.043
Total Flow (m^3/s)	1.26	0.44	2.93	0.24	0.46	1.73
Transverse Mixing Coefficient (m^2/s)	0.042	0.021	0.066	0.014	0.022	0.050
Limiting Dilution, S_{max} [2]	4.9	12.4	39.6	2.0	8.3	40.3
Complete Mixing Length, L_{mix} (m)	192	179	362	122	177	277

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling\TelkwaIDZ_CORMIX_ModelResults_rev05_2025update.xlsm

Notes:

[1] Corresponds to the case with 1:1 flow ratio.

[2] Maximum possible dilution for a given flow condition.

Table 3-2 shows the model predicts that complete mixing during operation will be achieved at 192 m, 179 m, and 362 m downstream from the effluent source for the worst case, reasonable worst case and expected case, respectively. It remains in similar range for the reasonable worst case and expected case in post closure but reduces to 122 m for the worst case with 1:1 flow ratio. These results suggested that complete mixing is not achieved within the 100 m length from the discharge. However, background and discharge water quality must be included in the assessment to determine if concentrations are likely to be below the WQG at the edge of the mixing zone at 100 m, as discussed in Section 4.

4 Initial Dilution Zone Assessment

The mixing and dilution of Project discharge and corresponding effluent plume were delineated based on the CORMIX model developed for the Goathorn Creek and compared with TG11 guidance. POCs identified for the effluent discharge were considered for this assessment, as discussed in the following sections.

4.1 IDZ Delineation

Spatial extent of the IDZ and plume features such as the flow occupied within the IDZ, and its length and width were estimated for the three IDZ cases. As outlined in TG11, these dimensions can vary depending on site-specific factors. Because of the shallow configuration near the left banks of Goathorn Creek (Section 3.2), plume widths are typically higher for a given flow condition, and 40% of channel width was considered for IDZ delineation. This width corresponds to 25% of total flow at the discharge location (section C, Figure 3-2). Emphasis was placed upon the IDZ length and flow criteria for evaluation. Table 4-1 outlines the evaluation criteria for the Goathorn Creek IDZ.

Table 4-1. Evaluation criteria for IDZ delineation

IDZ Feature	Criterion	Reference / Remark
Length	100 m	TG11 (ENV 2019)
Flow	25% of total flow	TG11 (ENV 2019)
Width	40% of channel width	Based on site-specific condition guided by TG11 (Section 3.5.2)

Source: Compiled in text

4.2 IDZ Results for Operation

4.2.1 Fully Mixed Conditions

Water quality in the Goathorn was analyzed using the mixing model and considering instream flow and background water quality as well as effluent concentration and discharge rate from the TCP during operation. The model estimated change in concentration as the effluent is diluted downstream because of turbulent mixing. The identified POCs were modeled for each IDZ cases to estimate concentrations after complete mixing and compared with in-stream WQGs (Table 4-2). The results are summarized below:

- Fully mixed concentration of nitrite, cobalt and selenium exceeds the WQG for the worst case, but meets the guideline for the reasonable worst and expected cases,
- WQG is exceeded for dissolved copper in all cases due to high background concentration. Effluent concentrations for the IDZ cases are approximately equal or lower than the background level, and
- Other parameters meet the respective WQGs for all IDZ cases after fully mixed condition is achieved.

Table 4-2. Fully Mixed Concentrations of POCs in Goathorn Creek (Operation Phase)

Parameter	WQG (mg/L)	Fully Mixed Concentration (mg/L)		
		Worst case (L_{mix} = 192 m)	Reasonable worst case (L_{mix} = 179 m)	Expected case (L_{mix} = 362 m)
Nitrate	3	0.94	0.42	0.07
Nitrite	0.02	**0.021**	0.0084	0.0011
Sulfate	218	108	55	29
Aluminum, total	0.27	0.26	0.12	0.10
Cobalt, dissolved	0.00045	**0.00063**	0.00028	0.00010
Copper, dissolved	0.0013	**0.0020**[1]	**0.0014**[1]	**0.0014**[1]
Iron, total	1	0.52	0.20	0.12
Molybdenum, total	0.034	0.0077	0.0033	0.0009
Nickel, dissolved	0.0022	0.0014	0.0007	0.0003
Selenium, total	0.002	**0.0046**	0.0018	0.0004
Thallium, total	0.00003	0.000014	0.000009	0.000006
Zinc, dissolved	0.0074	0.0030	0.0021	0.0016

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling\TelkwaIDZ_CORMIX_ModelResults_rev05_2025update.xlsm

Notes: **Orange Bolded** value represents exceedance with respect to the WQG.

[1] Exceedance resulted from high background baseline concentration in Goathorn Creek.

4.2.2 Mixing Zone Extent

The effluent concentration from the TCP and the Goathorn Creek background baseline water chemistries were applied to the mixing model to delineate IDZ for each POC, considering the dilution required to meet the corresponding WQG. The IDZ extent was defined as the area downstream of discharge beyond which the instream WQGs will be met. The modeled water quality of each POC and corresponding plume features (length and width of the mixing zone) in the Goathorn Creek was compared with the IDZ evaluation criteria (Table 4-1) based on TG11 guidance.

Figure 4-1 shows the delineated plumes (area with concentration higher than WQG) of the POCs for TCP discharge. The plume lines correspond to the lines where WQGs are met. The IDZ extent cannot be estimated for dissolved copper due to higher background baseline concentration than the WQG. IDZ criteria based on TG11 guidance are exceeded in the Operation phase for the following parameters:

- Worst case: Aluminum
- Reasonable worst case: Selenium

Table 4-3 compares the results of the IDZ delineation for each POC against the TG11 criteria for IDZ length, fraction of flow occupied and its width. For the worst case, nitrite, cobalt and selenium do not meet WQG after complete mixing. The maximum IDZ length is 128 m which corresponds to aluminum plume. Nitrite, cobalt and aluminum meet IDZ criteria for the reasonable worst case, but the maximum IDZ length extends to 153 m to meet instream selenium WQG. All parameters meet the TG11 guidance for the expected case.

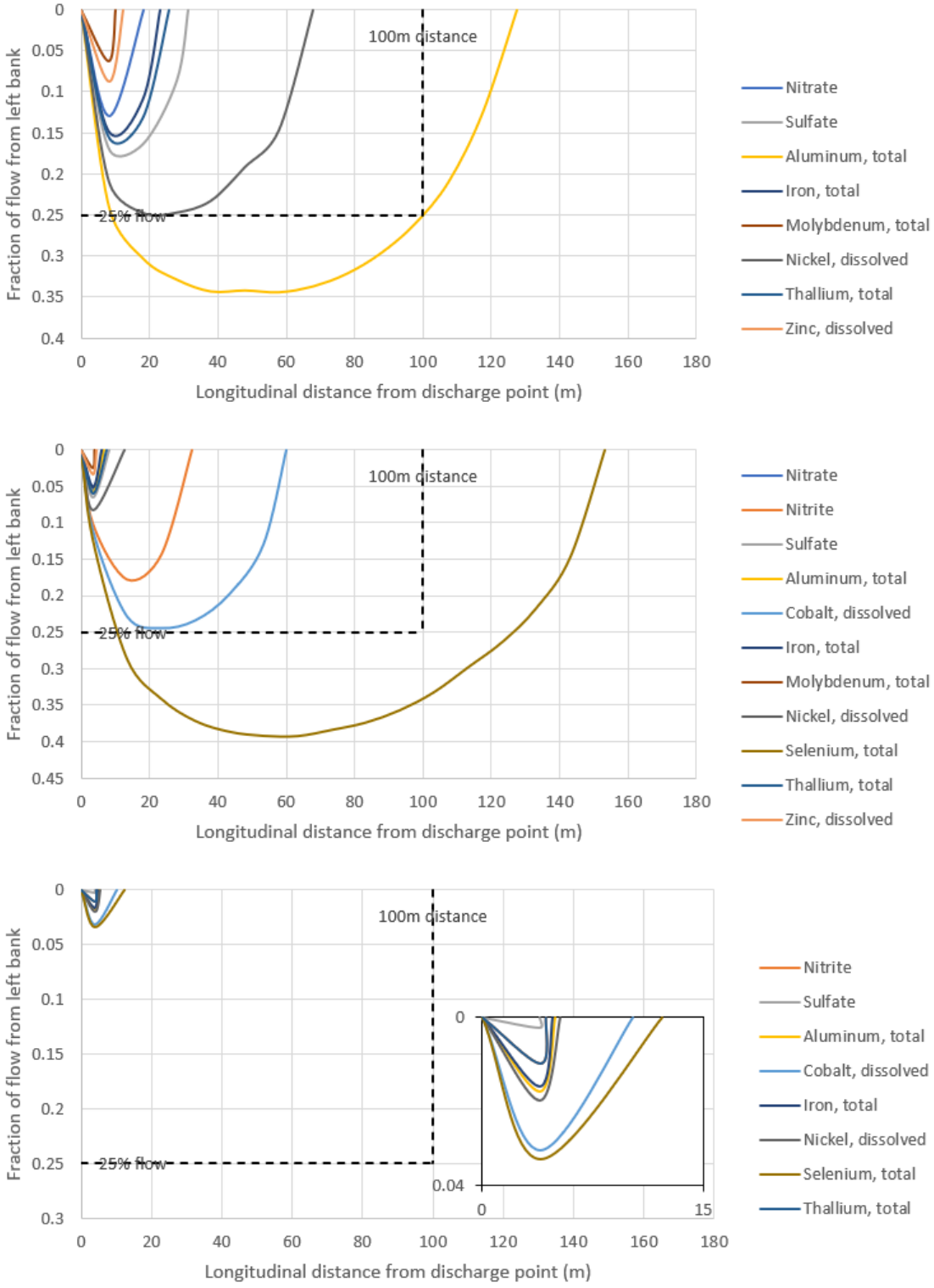


Figure 4-1. Plume delineation of POCs during the Operation phase – (a) worst case, (b) reasonable worst case, and (c) expected case

Table 4-3. IDZ Delineation Results for TCP Discharge in the Operation phase

Parameter	Scenario	WQG (mg/L)	Background concentration (mg/L)	Effluent concentration (mg/L)	IDZ length (m)	IDZ flow (% of stream)	IDZ width (% of stream)
Nitrate *	Worst case	3	0.054	4.4	18	13	32
	Reasonable worst	3	0.041	4.7	6	5	23
	Expected case	3	0.041	1.2	n.a.	n.a.	n.a.
Nitrite *	Worst case	0.02	0.0009	0.099	Fully mixed concentration > WQG		
	Reasonable worst	0.02	0.0005	0.099	32	18	36
	Expected case	0.02	0.0005	0.023	< 5	1	13
Sulphate	Worst case	218	31	410	31	17	35
	Reasonable worst	218	24	410	8	7	25
	Expected case	218	24	220	< 5	< 1	8
Aluminum, total	Worst case	0.27	0.23	0.39	128	34	47
	Reasonable worst	0.27	0.092	0.39	7	6	24
	Expected case	0.27	0.092	0.38	5	2	16
Cobalt, dissolved	Worst case	0.00045	0.00005	0.0029	Fully mixed concentration > WQG		
	Reasonable worst	0.00045	0.00005	0.0029	60	24	41
	Expected case	0.00045	0.00005	0.0019	10	3	19
Copper, dissolved	Worst case	0.0013	0.0021	0.0015	Background concentration > WQG		
	Reasonable worst	0.0013	0.0014	0.0015	Background concentration > WQG		
	Expected case	0.0013	0.0014	0.0011	Background concentration > WQG		
Iron, total	Worst case	1	0.27	1.5	23	15	33
	Reasonable worst	1	0.085	1.5	6	5	23
	Expected case	1	0.085	1.5	5	2	15
Molybdenum, total	Worst case	0.034	0.00054	0.036	10	6	24
	Reasonable worst	0.034	0.00047	0.036	< 5	2	18
	Expected case	0.034	0.00047	0.018	n.a.	n.a.	n.a.
Nickel, dissolved	Worst case	0.0022	0.00025	0.006	68	25	41
	Reasonable worst	0.0022	0.00025	0.006	13	8	27
	Expected case	0.0022	0.00025	0.0037	5	2	16
Selenium, total	Worst case	0.002	0.00012	0.022	Fully mixed concentration > WQG		
	Reasonable worst	0.002	0.000086	0.022	153	39	49
	Expected case	0.002	0.000086	0.011	12	3	20
Thallium, total	Worst case	0.00003	0.000005	0.000050	26	16	34
	Reasonable worst	0.00003	0.000005	0.000050	7	6	24
	Expected case	0.00003	0.000005	0.000034	4	1	13
Zinc, dissolved	Worst case	0.0074	0.0015	0.0088	12	9	27
	Reasonable worst	0.0074	0.0015	0.0088	< 5	3	20
	Expected case	0.0074	0.0015	0.0055	n.a.	n.a.	n.a.

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling\TelkwaIDZ_CORMIX_ModelResults_rev05_2025update.xlsm

Notes: n.a. refers to not applicable when effluent concentration is equal or below the WQG.
* Effluent concentration considers discharge from sewage treatment plant.

4.3 IDZ Results for the Post-closure Phase

4.3.1 Fully Mixed Conditions

Fully mixed conditions in Goathorn Creek during the Post-closure phase was modeled for the IDZ cases, using instream flow and background quality as well as effluent concentration and discharge rate from the NMP. For the worst case, both the unrealistic (0.4:1 ratio of creek flow to effluent discharge rate) and the conservative realistic worst case scenario (1:1 flow ratio) were evaluated for comparison (Table 4-4).

Comparison of the fully mixed concentrations of the POCs against WQGs showed parameters met their respective WQG for the IDZ cases during the Post-closure phase, except for aluminum and selenium for the worst case. WQG is also exceeded for cobalt and iron in the worst case at 0.4:1 flow ratio, but this condition is not realistic and unlikely to occur. Like the Operation phase, the fully mixed concentration of dissolved copper is higher than WQG due to elevated background baseline concentration.

Table 4-4. Fully Mixed Concentration of POCs in Goathorn Creek (Post-closure)

Parameter	WQG (mg/L)	Fully Mixed Concentration (mg/L)			
		Worst case (0.4: 1)[1]	Worst case (1:1)[1] (L_{mix} = 122 m)	Reasonable worst (L_{mix} = 177 m)	Expected case (L_{mix} = 277 m)
Nitrate	3	0.64	0.46	0.14	0.05
Nitrite	0.02	0.015	0.010	0.003	0.001
Sulfate	218	166.5	125.5	47.7	28.1
Aluminum, total	0.27	**0.34**	**0.31**	0.13	0.10
Cobalt, dissolved	0.00045	**0.00051**	0.00037	0.00013	0.00006
Copper, dissolved	0.0013	**0.0022**[2]	**0.0022**[2]	**0.0015**[2]	**0.0014**[2]
Iron, total	1	**1.15**	0.89	0.26	0.12
Molybdenum, total	0.034	0.0056	0.0041	0.0013	0.0006
Nickel, dissolved	0.0022	0.0016	0.0012	0.0005	0.0003
Selenium, total	0.002	**0.0058**	**0.0041**	0.0010	0.0002
Thallium, total	0.00003	0.000013	0.000011	0.000006	0.000005
Zinc, dissolved	0.0074	0.0017	0.0017	0.0015	0.0015

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling\TelkwaIDZ_CORMIX_ModelResults_rev05_2025update.xlsm

Notes: **Orange Bolded** value represents exceedance with respect to the WQG

[1] Corresponds to ratio of Goathorn Creek flow to effluent discharge rate.

[2] Exceedance resulted from high background baseline concentration in Goathorn Creek.

4.3.2 Mixing Zone Extent

For discharge from the North Management Pond during/after closure, POCs including nitrate, nitrite, total molybdenum, dissolved nickel, total thallium and dissolved zinc do not register an IDZ, as the effluent concentrations are below the corresponding WQGs for the IDZ cases. The IDZ extent cannot be

estimated for dissolved copper due to it having a higher background baseline concentration than the WQG.

POCs with IDZ in Post-closure phase, along with plume delineation, are illustrated in Figure 4-2. Among these parameters, iron and cobalt exceeds the flow criteria (IDZ flow > 25%) for the worst case, but the extent remains within the 100 m guidance value based on TG11 criteria. These parameters meet the guidance for the reasonable and expected cases. Sulfate, aluminum and selenium also meet the IDZ criteria for these cases.

Table 4-5 compares the results of the IDZ delineation for each POC against the TG11 criteria after closure. For the worst case, aluminum and selenium do not meet WQG after complete mixing, and maximum IDZ length is 95 m which corresponds to iron plume. The maximum IDZ extent for the reasonable worst case is 44 m based on selenium WQG requirement.

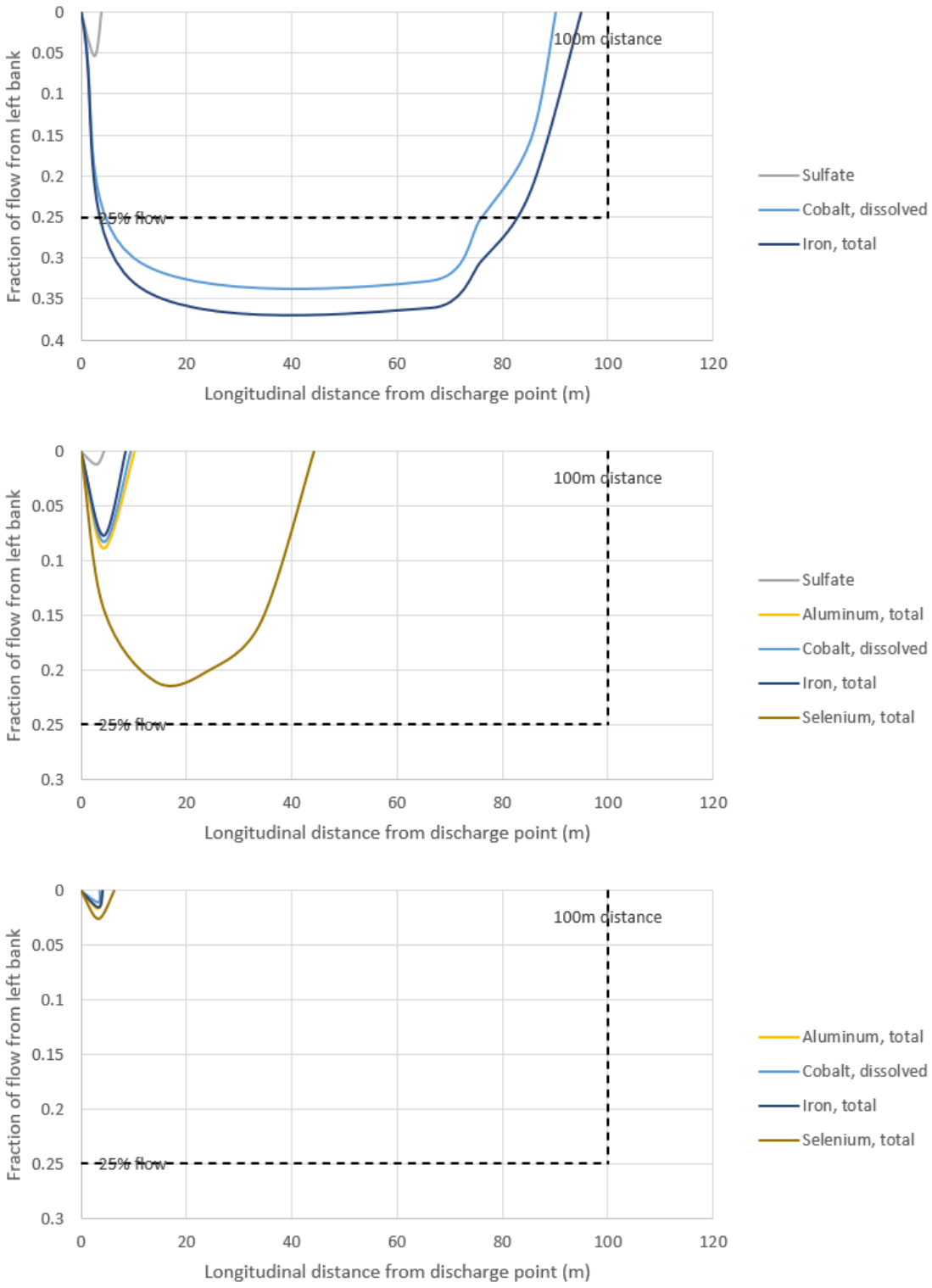


Figure 4-2. Plume delineation of POCs during post closure – (a) worst case (1:1 flow ratio), (b) reasonable worst case, and (c) expected case

Table 4-5. IDZ Delineation Results for NMP discharge after closure

Parameter	Scenario	WQG (mg/L)	Background concentration (mg/L)	Effluent concentration (mg/L)	IDZ length (m)	IDZ flow (% of stream)	IDZ width (% of stream)
Nitrate	Worst case	3	0.054	0.87	n.a.	n.a.	n.a.
	Reasonable worst	3	0.041	0.87	n.a.	n.a.	n.a.
	Expected case	3	0.041	0.33	n.a.	n.a.	n.a.
Nitrite	Worst case	0.02	0.0009	0.02	n.a.	n.a.	n.a.
	Reasonable worst	0.02	0.0005	0.02	n.a.	n.a.	n.a.
	Expected case	0.02	0.0005	0.0077	n.a.	n.a.	n.a.
Sulphate	Worst case	218	31	220	< 5	5	23
	Reasonable worst	218	24	220	< 5	1	14
	Expected case	218	24	190	n.a.	n.a.	n.a.
Aluminum, total	Worst case	0.27	0.23	0.39	Fully mixed concentration > WQG		
	Reasonable worst	0.27	0.092	0.39	10	9	28
	Expected case	0.27	0.092	0.38	< 5	2	16
Cobalt, dissolved	Worst case	0.00045	0.00005	0.00069	90	33	46
	Reasonable worst	0.00045	0.00005	0.00069	9	8	27
	Expected case	0.00045	0.00005	0.00052	4	1	13
Copper, dissolved	Worst case	0.0013	0.0021	0.0022	Background concentration > WQG		
	Reasonable worst	0.0013	0.0014	0.0022	Background concentration > WQG		
	Expected case	0.0013	0.0014	0.0017	Background concentration > WQG		
Iron, total	Worst case	1	0.27	1.5	95	36	48
	Reasonable worst	1	0.085	1.5	8	8	26
	Expected case	1	0.085	1.5	< 5	2	15
Molybdenum, total	Worst case	0.034	0.00054	0.0076	n.a.	n.a.	n.a.
	Reasonable worst	0.034	0.00047	0.0076	n.a.	n.a.	n.a.
	Expected case	0.034	0.00047	0.0063	n.a.	n.a.	n.a.
Nickel, dissolved	Worst case	0.0022	0.00025	0.0022	n.a.	n.a.	n.a.
	Reasonable worst	0.0022	0.00025	0.0022	n.a.	n.a.	n.a.
	Expected case	0.0022	0.00025	0.0017	n.a.	n.a.	n.a.
Selenium, total	Worst case	0.002	0.00012	0.008	Fully mixed concentration > WQG		
	Reasonable worst	0.002	0.000086	0.008	44	21	38
	Expected case	0.002	0.000086	0.0059	6	3	18
Thallium, total	Worst case	0.00003	0.000005	0.000016	n.a.	n.a.	n.a.
	Reasonable worst	0.00003	0.000005	0.000016	n.a.	n.a.	n.a.
	Expected case	0.00003	0.000005	0.000014	n.a.	n.a.	n.a.
Zinc, dissolved	Worst case	0.0074	0.0015	0.0018	n.a.	n.a.	n.a.
	Reasonable worst	0.0074	0.0015	0.0018	n.a.	n.a.	n.a.
	Expected case	0.0074	0.0015	0.0015	n.a.	n.a.	n.a.

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling\TelkwaIDZ_CORMIX_ModelResults_rev05_2025update.xlsm

Notes: n.a. refers to not applicable when effluent concentration is equal or below WQG

4.4 Evaluation of Results

BC provincial regulations recognize that dilution can play a role in mitigating the effects of effluents, and that an accepted area of higher concentrations of parameters can be present in an IDZ prior to full mixing. Evaluation of the IDZ cases based on BC's TG11 guidance indicated that, during the worst-case scenario, Goathorn Creek exceeds WQG: for nitrite, aluminum, cobalt and selenium during the Operation phase, and for aluminum and selenium during the Post-closure phase. It is important to note that the worst case is very conservative, as it considers the 7Q10 low flow combined with maximum discharge from the facility. It is unlikely water would need to be discharged from the Project during such a dry period. A WLB model run for 1-in-100-year dry event also confirmed that the discharge from the Project would be considerably lower than the modelled maximum discharge from the Project based on average hydrology condition.

A more realistic case is the reasonable worst case for which IDZ criteria to meet WQG is only exceeded for selenium during the Operation phase. The IDZ criteria is also exceeded for dissolved copper for all cases due to higher background baseline concentration compared to the WQG. POCs with exceedances for the reasonable worst case are discussed below:

Dissolved copper: Background concentration of dissolved copper is higher than the WQG of 0.0013 mg/L, with 50th percentile and 75th percentile concentrations of 0.021 and 0.014 mg/L, respectively. This results in no dilution capacity available in the Goathorn Creek. Although the effluent concentration during the Operation and Post-closure phases is higher than the WQG (except for the expected case during the Operation phase), the concentration is approximately equal to the creek's background baseline level after mixing (Table 4-6), and therefore the baseline water quality is not further deteriorated.

Table 4-6. Evaluation of Dissolved Copper Concentrations for the IDZ Cases

IDZ Case	WQG (mg/L)	Background Concentration (mg/L)	Operation		Post-Closure	
			Effluent Concentration (mg/L)	Fully Mixed Concentration (mg/L)	Effluent Concentration (mg/L)	Fully Mixed Concentration (mg/L)
Worst case	0.0013	0.0021	0.0015	0.0020	0.0022	0.0022
Reasonable worst	0.0013	0.0014	0.0015	0.0014	0.0022	0.0015
Expected case	0.0013	0.0014	0.0011	0.0014	0.0017	0.0014

Source: NA CAPR002055 Telkwa Project General EA Support - IDZ update\MixingModeling\TelkwaIDZ_CORMIX_ModelResults_rev05_2025update.xlsm

Total selenium: The IDZ criteria based on TG11 guidance is exceeded for total selenium for the reasonable worst case during the Operation phase, with an IDZ length of 153 m and the plume occupying 39% of the creek's flow (Table 4-3). The reasonable worst case scenario combines conservative conditions in both effluent quality (maximum concentration) and Goathorn Creek flows (7Q10 low-flow). The IDZ reduces to only 12 m for the expected case during the Operation phase. TG11 guidance is also met for the reasonable worst case and expected case after closure (Table 4-5).

5 Conclusions

The Goathorn Creek IDZ assessment was carried out following the TG11 guidance, produced by the BC Ministry of Environment and Parks. The assessment considers Tenas Project discharge during operation and after closure, with discharge from TCP and NMP, respectively. To characterize and delineate the extent of IDZ, three credible and conservative cases were considered, based on site-specific information:

- a worst case (very worst condition)
- a reasonable worst case (a worst case that could potentially occur)
- an expected case (case corresponding to typical conditions)

The IDZ assessment was carried out for POCs identified by the BAT assessment for the Project. The following parameters were identified as POCs: nitrate, nitrite, sulphate, aluminum (total), cobalt (dissolved), copper (dissolved), iron (total), nickel (dissolved), thallium (total), zinc (dissolved), molybdenum (total) and selenium (total).

Hydrodynamic mixing modeling was conducted to evaluate the IDZ extent for POCs for the worst, reasonable worst and expected cases and compared against TG11 guidance. For the worst case, Goathorn Creek exceeds WQG for aluminum, cobalt, nitrite, and selenium during the Operation phase, and for aluminum and selenium during the Post-closure phase. The worst case is very conservative and unlikely to occur during very dry periods as the Project will not be discharging. Emphasis was placed upon the reasonable worst case and the expected case, which are conservative but provides realistic evaluation scenario. The results are summarized below.

During the Operation Phase:

- IDZ criteria to meet applicable WQGs are satisfied for nitrate, nitrite, sulphate, aluminum, cobalt, iron, nickel, thallium, zinc, and molybdenum for the reasonable worst and expected cases.
- The IDZ extent of selenium exceeds the TG11 recommended length of 100 m for the reasonable worst case but meets the instream WQG further downstream. The IDZ criteria of 100 m is met for the expected case.
- WQG is exceeded for dissolved copper due to background baseline concentration higher than the WQG, but the effluent concentration reaches background concentration after complete mixing.
- The maximum length of IDZ is 153 m and 12 m for the reasonable worst and expected cases, respectively (based on selenium).

During the Post-closure Phase:

- POCs including nitrate, nitrite, molybdenum, nickel, thallium, and zinc do not register an IDZ, as their effluent concentrations are below the corresponding WQGs for the IDZ cases.
- IDZ criteria based on TG11 guidance is met for sulfate, aluminum, cobalt, iron, and selenium for the reasonable worst and expected cases. The guidance is exceeded for dissolved copper with background baseline concentration higher than the WQG but remains close to the background level after complete mixing.

- The maximum length of IDZ is 44 m and 6 m for the reasonable worst and expected cases, respectively (based on selenium).

5.1 Limitations and Recommendations

- This IDZ assessment has been prepared based on the information available at the time of study. The assessment should be updated if any changes in the baseline conditions or modelled effluent discharge projections are expected.
- The CORMIX modeling work was carried out using geometry based on field measured cross sections. Uncertainty exists in the mixing and IDZ lengths presented herein, as the model does not account local variations (rapids, flow around cobbles and boulders) that impacts mixing. It is suggested to confirm the mixing zone lengths through field monitoring and tracer study program, particularly during low flow period.

Closure

This report, Tenas Project – Initial Dilution Zone Assessment, was prepared by



Rajib Kamal, PhD
Consultant

and reviewed by



Soren Jensen, PEng
Principal Consultant

EGBC Permit to Practice Reg. No.: EGBC 1003655

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with accepted professional engineering and environmental practices.

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APPENDIX 14: TENAS COAL MINE INFORMATION REQUEST # 498, 500-504, AND 520 - EXPERT ADVICE REGARDING FISH AND FISH HABITAT WITHIN THE PROJECT AREA, PALMER ENVIRONMENTAL

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Memorandum

Date: June 4, 2024
Project #: 1905903

To: Dan Farmer
Chief Operating Officer
Telkwa Mining Ltd.

From: Glenn Wagner and Rick Palmer, Palmer

cc: James Henderson, Telkwa Mining Ltd.

Re: Tenas Coal Mine Information Request # 498, 500-504, and 520
Expert advice regarding fish and fish habitat within the Project area

1. Introduction

This memorandum has been prepared in response to an Information Request (IR) provided by the Office of the Wet'suwet'en as part of the adequacy review of the previously filed Tenas Coal Mine Environmental Assessment Application (Telkwa Coal Limited 2022). Specifically, this memorandum addresses IR #493, #500, #501, #502, #503, #504, and #520. These IRs, along with Palmer's response to each, are presented in the following sections.

2. Responses to Information Request

Information Request # 498

The Tenas Coal Project does not consider the environmental flow needs (EFN) of these ecosystems.

Client Response:

Telkwa Coal acknowledges the comment. The EFN methods and results are included in subsection 5.2.1.1.6 of the Fish and Fish Habitat Valued Component (S4.0-C6) chapter including EFN criteria used to assess changes in flows. EFN was conducted. We have also provided this for Four Creek.

Palmer Response:

Environmental flow needs criteria were used to assess changes in base flows in Tenas Creek and Four Creek.

Predicted Tenas Creek flow changes were assessed, resulting in a Risk Management Level 1 during spring, early summer, and fall, and Risk Management Level 2 during winter months and late summer.

Predicted flow diversions in Four Creek were assessed, resulting in a Risk Management Level 3 for each given season and Project phase.

Information Request #500

How can TC monitor and offset for loss of fish production when they haven't measured it?

Client Response

Monitoring will include comparison of fish species composition, relative abundance, and fish condition to baseline conditions and will be calibrated to unaffected reference sites. Statistically significant changes in these parameters will be used to determine if the mine is having population level effects on fish.

Palmer Response

Fish abundance, a measure of fish production, was surveyed on Four Creek in 2017-2018 (Telkwa Coal Limited 2022) and an estimated total population of 1,300 Dolly Varden (*Salvelinus malma*) was calculated. Four Creek is the only stream in the Project area with predicted potential effects due to reduced flows.

Additional fish abundance estimate surveys of Tenas Creek, Goathorn Creek, and a reference creek are planned for 2024. Fish abundance of these three streams will be monitored during all phases of the project to determine whether any changes are attributable to the project. Additional variables to be monitored include fish health and distribution.

Information Request # 501

Offsetting projects have a documented 63% failure rate, how will TC ensure that theirs is not one of those?

Client Response

TCL acknowledges the comment. Compliance (offsetting is implemented as described) and effectiveness (fish use, habitat stability, and persistence) monitoring will be used to determine the efficacy of offset habitats and will direct requirements for expanding, enhancing, or augmenting implemented offset habitats.

Palmer Response

Any fish habitat offset that is created in a Fish Offsetting Plan will be designed based on the target fish species and life history stage for which it is intended. Construction monitoring will occur to assure compliance with designs.

Habitat offsets will be monitored for a set time period determined by DFO, during which threshold values of success (e.g., fish presence, aquatic invertebrate community establishment, slope stability) will be used to determine the effectiveness at each site.

Information Request #502

Who will manage WQ and structural issues after the 25-year post-closure period?

Client Response

TCL will be required to manage water quality and maintenance by the amounts provided in the reclamation security bond. The bond is approved by regulatory agencies, and the bond amount (dollars) is reviewed and re-approved every 5 years based on actual costs expended during the past 5 years.

Palmer Comment

Palmer/SLR is not leading the WQ, therefore, no official response is provided.

Typically, mine closure and post-closure phases will include site reclamation and monitoring. The goal of planned reclamation is to restore the site to as close to pre-construction condition as possible, including water quality constituents (e.g., metals, phosphorus, selenium) that are similar to baseline levels and within natural variation for the site.

Information Request #503

Most of the data on fish community and habitat usage is from the 1980s, and their own data shows that it may have changed. Why didn't they survey more than 9 sites in two years?

Client Response

TCL acknowledges the comment. Results of fish community data from project studies was consistent with historical fish community data. Twelve representative sites were sampled to determine fish species distributions and relative abundance. Where potential project effects were identified (i.e., Four Creek), more intensive sampling was conducted (i.e. several fish distribution and multiple pass depletion sites within potentially affected reaches).

Palmer Response

Baseline fish and fish habitat studies were conducted from 2017 to 2020 (Telkwa Coal Limited 2022) on six potentially affected streams over multiple seasons, as per requirements of the Environmental Assessment Act (2002). The studies performed included fish community surveys, fish abundance surveys, fish health, and fish tissue metals analysis. Additional steelhead spawning surveys are being performed in 2023 and 2024 to answer specific questions raised by regulators.

Information Request #504

Where is critical steelhead spawning areas in the project area, and how will they protect them?

Client Response

TCL acknowledges the comment. Important steelhead habitats were historically identified in lower sections of Tenas and Goathorn Creeks. There are no predicted residual effects in these watercourses as a result of water quality, changes in base flows, and/or habitat loss.

Palmer Response

Historical studies by Bustard (1985) suggested steelhead spawning likely takes place in the lower 5 km of Tenas Creek and in the lower 2 km of Goathorn Creek. Spawning surveys performed in 2018 (Telkwa Coal Limited 2022) and 2023 (Palmer 2024) did not observe any actively spawning steelhead. One steelhead carcass was observed in the lower 1 km of Goathead Creek in 2018, downstream of the Aveling Coalmine Road, corroborating steelhead use of the lower reaches, closest to the Telkwa River.

In 2023, Palmer conducted a summer Steelhead survey to determine whether juvenile Steelhead utilized Tenas Creek, Goathorn Creek, and Four Creek (Palmer 2024). Based on a morphometric and visual assessment, juvenile fish captured in Tenas Creek and Goathorn Creek appeared to be resident Rainbow Trout (*Oncorhynchus mykiss*), rather than migratory Steelhead. No Rainbow Trout or Steelhead were captured in Four Creek.

No significant changes in stream flows, water temperature, sediment concentrations, nutrient concentrations, contaminant concentrations, or habitat loss are predicted for the lower 5 km of Tenas Creek or the lower 2 km of Goathorn Creek (Telkwa Coal Limited 2022).

Information Request #520

Have a qualified professional identify lentic areas in the receiving environment which may receive selenium from mine operations, and ensure that background concentrations of selenium in water, sediment, invertebrate, and fish tissues are collected and compiled in those lentic areas.

Client Response

N/A

Palmer Response

There are no lentic (i.e., lakes or ponds) water bodies located in the near-field or far-field receiving environments of the Project. The Project area tributary streams (i.e., Tenas Creek, Four Creek) flow directly into Goathorn Creek, which flows into the Telkwa River. Approximately 7 km east of its confluence with Goathorn Creek, the Telkwa River flows directly into the Bulkley River. The Bulkley River flows approximately 90 km west to the Skeena River, with no lentic areas along the route.

3. Certification

Prepared By:

Glenn Wagner, Ph.D, R.P.Bio.
Senior Fisheries Biologist

Approved By:

Rick Palmer, M.Sc., R.P.Bio
CEO, Senior Fisheries Biologist

4. References

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APPENDIX 15: TENAS PROJECT, MINE MATERIAL MANAGEMENT BASED ON AN NPR CUT-OFF OF 2.0, 1.80, 1.60, AND 1.20, TELKWA MINING

Tenas Project Mining Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T18-01D	12.38	13.6	1.22	2	2.09	65.31	31.8	0.49	Place underwater	Place underwater	1.20	Place underwater	Place underwater	Place underwater
T18-01D	13.6	14	0.4	2	3.1	96.88	90.3	0.93						
T18-01D	14.00	15.8	1.8	3	1.09	34.06	16.0	0.47						
T18-01D	15.8	17.2	1.4	3	1.2	38.1	50.8	1.33						
T18-01D	17.2	18.70	1.5	3	0.9	26.6	51.0	1.92	non-PAG	non-PAG			non-PAG	
T18-01D	18.70	19.000	0.3	3	0.2	5.6	17	2.93	non-PAG	non-PAG			non-PAG	
T18-01D	19.000	21.160	2.16	3	0.6	17.2	54.0	3.14	non-PAG	non-PAG			non-PAG	
T18-01D	21.160	21.310	0.15	Coal Cleaning					Place underwater	Place underwater			Place underwater	
T18-01D	21.310	23.040	1.73	C Seam							COAL			
T18-01D	23.040	23.19	0.15	Coal Cleaning					Place underwater	Place underwater	3.07	Place underwater	Place underwater	Place underwater
T18-01D	23.19	27.7	4.51	4	0.6	19.4	93.8	4.84	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-01D	27.7	30	2.3	4	1.2	38.8	51.8	1.34	non-PAG	Blend into surrounding units		Blend into surrounding units	Blend into surrounding units	Blend into surrounding units
T18-01D	30	33.7	3.7	5	0.6	18.4	27.8	1.51	non-PAG	Place underwater	1.32	Place underwater	Place underwater	Place underwater
T18-01D	33.7	36.350	2.65	5	0.7	22.81	25.5	1.12	Blend into surrounding units					
T18-01D	36.350	36.500	0.15	Coal Cleaning					Place underwater					
T18-01D	36.500	38.350	1.85	1 Seam							COAL			
T18-01D	38.350	38.500	0.15	Coal Cleaning					Place underwater	Place underwater	1.51	Place underwater	Place underwater	Place underwater
T18-01D	38.500	40.4	1.9	6	4.33	135.31	105.0	0.78	Blend into surrounding units					
T18-01D	40.4	43.93	3.53	6	0.9	29.1	88.8	3.06	non-PAG					
T18-01D	43.93	44.75	0.82	6	0.2	6.9	47	6.84	non-PAG					

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T18-02D	8.35	12.03	3.68	1	0.2	5.6	45	7.91	non-PAG	non-PAG	6.22	non-PAG		non-PAG
T18-02D	12.03	15.3	3.27	1	0.2	5.0	46	9.10	non-PAG	non-PAG		non-PAG		non-PAG
T18-02D	15.3	18.58	3.28	1	0	4	92	21.10	non-PAG	non-PAG		non-PAG		non-PAG
T18-02D	18.58	21.3	2.72	1	0	7	98	14.98	non-PAG	non-PAG		non-PAG		non-PAG
T18-02D	21.3	24.3	3	1	0.4	10.9	46.0	4.21	non-PAG	non-PAG		non-PAG		non-PAG
T18-02D	24.3	27.3	3	1	0.5	14.7	53.8	3.66	non-PAG	non-PAG		non-PAG		non-PAG
T18-02D	27.3	28.8	1.5	1A	1.1	35.6	39.5	1.11	Place underwater	Place underwater	0.79	Place underwater	Place underwater	Place underwater
T18-02D	28.8	30.3	1.5	1A	1.1	34.1	41.8	1.23						
T18-02D	30.3	32.88	2.58	1A	1.3	39.7	49.3	1.24						
T18-02D	32.88	33.94	1.06	1A	1.0	31.9	53.0	1.66						
T18-02D	33.94	37	3.06	1A	2.26	70.63	23.8	0.34						
T18-02D	37	39.3	2.3	2	2.11	65.94	14.0	0.21	Place underwater	Place underwater	1.16	Place underwater	Place underwater	Place underwater
T18-02D	39.3	41.5	2.2	2	1.61	50.31	14.5	0.29						
T18-02D	41.5	45.18	3.68	3	0.4	13.1	67.8	5.17	non-PAG	non-PAG			Non-PAG	non-PAG
T18-02D	45.18	48.200	3.02	3	0.6	18.8	49.5	2.64	non-PAG	non-PAG			Non-PAG	non-PAG
T18-02D	48.2	48.550	0.35	3	3.22	100.63	8.0	0.08	Place underwater	Place underwater			Place underwater	Place underwater
T18-02D	48.550	48.700	0.15	Coal Cleaning										
T18-02D	48.700	50.350	1.65	C Seam							COAL			
T18-02D	50.350	50.500	0.15	Coal Cleaning					Place underwater	Place underwater	2.17	Place underwater	Place underwater	Place underwater
T18-02D	50.5	50.5	0	4	0.3	9.1	18.3	2.02	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-02D	50.5	52.8	2.3	4	0.4	12.5	58.3	4.66	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-02D	52.8	54.3	1.5	4	0.7	20.3	112.0	5.51	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-02D	54.3	58.08	3.78	4	1.6	50.0	62.8	1.26	non-PAG	Blend into surrounding units		Blend into surrounding units	Blend into surrounding units	Blend into surrounding units
T18-02D	58.08	60.3	2.22	5	1.0	30.6	194.0	6.33	non-PAG	non-PAG	2.98	Place underwater	non-PAG	non-PAG
T18-02D	60.3	63.3	3	5	0.6	17.2	29.3	1.70	non-PAG	non-PAG			Non-PAG	Blend into surrounding units

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T18-02D	63.3	66.3	3	5	0.4	11.3	70.5	6.27	non-PAG	non-PAG				non-PAG
T18-02D	66.3	67.8	1.5	5	1.47	45.94	22.8	0.50	Place underwater	Place underwater			Place underwater	Place underwater
T18-02D	67.8	68.350	0.55	5	2.12	66.25	13.5	0.20						
T18-02D	68.350	68.500	0.15	Coal Cleaning										
T18-02D	68.500	75.620	7.12	1 Seam							COAL			
T18-02D	75.620	75.770	0.15	Coal Cleaning					Place underwater	Place underwater	1.26	Place underwater	Place underwater	Place underwater
T18-02D	75.770	78.3	2.53	6	0.8	23.4	44.8	1.91						
T18-02D	78.3	79.2	0.9	6	2.28	71.25	23.8	0.33						
T18-02D	79.2	79.54	0.34	6	0	5	164	34.99						
T18-02D	79.54	80.72	1.18	6	1.79	55.94	43.0	0.77						
T18-03D	10.5	10.650	0.15	5	1.96	61.25	30.3	0.49	Place underwater	Place underwater	0.49	Place underwater	Place underwater	Place underwater
T18-03D	10.650	10.800	0.15	Coal Cleaning										
T18-03D	10.800	12.570	1.77	1U Seam							COAL			
T18-03D	12.570	12.720	0.15	Coal Cleaning					Place underwater	Place underwater	8.24	Place underwater	Place underwater	Place underwater
T18-03D	12.720	12.82	0.1	55	0.2	5.31	9.3	1.75						
T18-03D	12.82	13.44	0.62	55	0	1	30	24.24						
T18-03D	13.44	14.750	1.31	55	0.1	3.4	21.5	6.25						
T18-03D	14.750	14.900	0.15	Coal Cleaning										
T18-03D	14.900	17.500	2.6	1L Seam							COAL			
T18-03D	17.500	17.650	0.15	Coal Cleaning					Place underwater	Place underwater	4.41	Place underwater	Place underwater	Place underwater
T18-03D	17.650	18.6	0.95	6	1.1	35.31	33.8	0.96	Blend into surrounding units	Blend into surrounding units			Blend into surrounding units	Blend into surrounding units
T18-03D	18.6	19.4	0.8	6	0.1	4.2	12.5	2.96	non-PAG	non-PAG				non-PAG
T18-03D	19.4	19.6	0.2	6	0.4	12.8	26.0	2.03	non-PAG	non-PAG				non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T18-03D	19.6	20.5	0.9	6	0.1	2.2	15.5	7.09	non-PAG	non-PAG				non-PAG
T18-03D	20.5	22.25	1.75	6	0	2	37	23.87	non-PAG	non-PAG				non-PAG
T18-03D	22.25	23.16	0.91	6	0	1	55	87.20	non-PAG	non-PAG			non-PAG	non-PAG
T18-03D	23.16	23.56	0.4	6	0	2	51	32.51	non-PAG	non-PAG			non-PAG	non-PAG
T18-03D	23.56	25	1.44	6	0	1	94	74.80	non-PAG	non-PAG			non-PAG	non-PAG
T18-03D	25	26.12	1.12	6	0	2	77	49.15	non-PAG	non-PAG			non-PAG	non-PAG
T18-03D	26.12	28	1.88	6	0.4	13.8	27.8	2.02	non-PAG	non-PAG			non-PAG	non-PAG
T18-03D	28	29.06	1.06	6	0.5	14.4	70.3	4.89	non-PAG	non-PAG			non-PAG	non-PAG
T18-03D	29.06	30	0.94	6	0.3	8.8	34.3	3.92	non-PAG	non-PAG			non-PAG	non-PAG
T18-03D	30	32.25	2.25	6	0.3	10.6	18.8	1.77	non-PAG	Blend into surrounding units			non-PAG	Blend into surrounding units
T18-03D	32.25	32.65	0.4	6	1.48	46.25	6.0	0.13	Blend into surrounding units				Blend into surrounding units	
T18-05D	13.5	22.5	9	1	0.4	11.3	24.0	2.13	non-PAG	non-PAG	4.45	non-PAG	Non-PAG	non-PAG
T18-05D	22.5	23.2	0.7	1	1.36	42.5	34.3	0.81	Blend into surrounding units	Blend into surrounding units		Blend into surrounding units	Blend into surrounding units	Blend into surrounding units
T18-05D	23.2	30.6	7.4	1	0.8	25.6	68.0	2.65	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	30.6	33.5	2.9	1	0	5.0	48	9.66	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	33.5	37.4	3.9	1	0.4	12.8	36.5	2.85	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	37.4	38.9	1.5	1	0.3	10.0	54.5	5.45	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	38.9	42.4	3.5	1	0.5	15.0	59.3	3.95	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	42.4	46	3.6	1	0.6	19.1	55.0	2.89	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	46	49.6	3.6	1	0.9	26.9	82.5	3.07	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	49.6	53.2	3.6	1	0.4	13.4	44.5	3.31	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	53.2	56.8	3.6	1	0	5	144	27.11	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	56.8	59.6	2.8	1	0	5	61	12.20	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	59.6	62.3	2.7	1	0.2	7.2	49	6.82	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	62.3	65.3	3	1	0	3	62	18.12	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	65.3	68.4	3.1	1	0.3	7.8	56.0	7.17	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T18-05D	68.4	71.4	3	1	0.2	7.2	67	9.32	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	71.4	75.1	3.7	1	0	6.9	73	10.59	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	75.1	78.6	3.5	1	0.4	12.5	84.8	6.78	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	78.6	82.1	3.5	1	0.8	24.4	57.3	2.35	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	82.1	85.6	3.5	1	0.8	25.3	117.0	4.62	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	85.6	88.3	2.7	1A	1.3	39.7	68.0	1.71	Place underwater	Place underwater	0.81	Place underwater	Place underwater	Place underwater
T18-05D	88.3	91.4	3.1	1A	2.13	66.56	22.5	0.34						
T18-05D	91.4	93.97	2.57	2	2.04	63.75	21.0	0.33	Place underwater	Place underwater	0.35	Place underwater	Place underwater	Place underwater
T18-05D	93.97	94.61	0.64	2	2.64	82.5	14.5	0.18						
T18-05D	94.61	96.9	2.29	3	1.96	61.25	22.8	0.37						
T18-05D	96.9	97.61	0.71	3	1.98	61.88	34.3	0.55						
T18-05D	97.61	99.820	2.21	3	3.34	104.375	-0.30	0.00						
T18-05D	99.820	99.970	0.15	Coal Cleaning										
T18-05D	99.970	101.970	2	C Seam							COAL			
T18-05D	101.970	102.120	0.15	Coal Cleaning					Place underwater	Place underwater	2.21	Place underwater	Place underwater	Place underwater
T18-05D	102.12	102.17	0.05	4	0.1	2.5	11.0	4.40	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	102.17	106.3	4.13	4	0.3	9.7	56.8	5.86	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	106.3	108.7	2.4	4	0.3	9.1	61.3	6.76	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-05D	108.7	111.1	2.4	4	1.6	49.7	54.0	1.09	Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T18-05D	111.1	111.9	0.8	4	1.7	53.13	23.8	0.45						
T18-05D	111.9	112.1	0.2	4	3.31	103.44	41.0	0.40						
T18-05D	112.1	112.6	0.5	5	1.82	56.88	16.8	0.30			2.32			
T18-05D	112.6	115.5	2.9	5	0.4	12.2	109.0	8.94						
T18-05D	115.5	119.000	3.5	5	1.2	38.4	47.8	1.24						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T18-05D	119	119.350	0.35	Coal Cleaning	1.35	42.19	5.3	0.13						
T18-05D	119.350	119.500	0.15	Coal Cleaning										
T18-05D	119.500	126.600	7.1	1 Seam							**COAL**			
T18-05D	126.600	126.750	0.15	Coal Cleaning					**Place underwater**	**Place underwater**	**0.82**	**Place underwater**	**Place underwater**	**Place underwater**
T18-05D	126.750	126.8	0.05	6	0.2	7.5	11.0	1.47						
T18-05D	126.8	128.8	2	6	0.4	11.6	29.3	2.53						
T18-05D	128.8	131.6	2.8	6	2.44	76.25	33.8	0.44						
T18-05D	131.6	131.9	0.3	6	2.34	73.13	8.0	0.11						
T18-05D	131.9	132.2	0.3	6	2.05	64.06	58.0	0.91						
T18-05D	132.2	132.5	0.3	6	2	71	-2.3	-0.03						
T18-05D	132.5	132.85	0.35	6	1.11	34.69	20.8	0.60						
T18-05D	132.85	133.6	0.75	6	0	5	127	25.40						
T18-05D	133.6	134.4	0.8	6	0.4	10.9	80.0	7.31						
T18-05D	134.4	135	0.6	6	5.58	174.38	87.8	0.50						
T18-05D	135	135.8	0.8	6	2.97	92.81	24.0	0.26						
T18-07D	6.9	10.4	3.5	1	0.7	23.1	44.8	**1.94**	**Place underwater**	**Place underwater**	**1.72**	**Place underwater**	**Place underwater**	**Place underwater**
T18-07D	10.4	14.8	4.4	1	1.7	52.5	54.0	1.03						
T18-07D	14.8	18.3	3.5	1	1.69	52.81	24.5	0.46						
T18-07D	18.3	22.2	3.9	1	1.31	40.94	26.0	0.64						
T18-07D	22.2	26.1	3.9	1	0.73	22.81	20.5	0.90						
T18-07D	26.1	30	3.9	1	1.05	32.81	16.5	0.50						
T18-07D	30	33.9	3.9	1	1.2	37.5	19.5	0.52						
T18-07D	33.9	38.2	4.3	1	1.6	50.0	9.5	0.19						
T18-07D	38.2	42.3	4.1	1	1.14	35.63	21.3	0.60						
T18-07D	42.3	44.2	1.9	1	0.92	28.75	12.3	0.43						
T18-07D	44.2	49.8	5.6	1	0.7	20.9	27.8	1.33						
T18-07D	49.8	52.8	3	1	0.7	20.6	27.0	1.31						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T18-07D	52.8	57.15	4.35	1	0.53	16.56	10.3	0.62						
T18-07D	57.15	61.5	4.35	1	0.85	26.56	15.0	0.56						
T18-07D	61.5	63.4	1.9	1	1.0	30.3	152.0	5.01						
T18-07D	63.4	66.8	3.4	1	0.8	25.0	19.0	0.76						
T18-07D	66.8	69.6	2.8	1	1.6	49.4	101.0	2.05						
T18-07D	69.6	72.4	2.8	1	1.81	56.56	26.0	0.46						
T18-07D	72.4	75.6	3.2	1	1.8	57.2	104.0	1.82	non-PAG	non-PAG				
T18-07D	75.6	78.8	3.2	1	1.1	34.7	175.0	5.05	non-PAG	non-PAG			non-PAG	
T18-07D	78.8	84	5.2	1	0.6	17.2	27.5	1.60	non-PAG	Blend into surrounding units			Blend into surrounding units	
T18-07D	84	86.9	2.9	1	1.1	34.4	187.0	5.44	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-07D	86.9	92.2	5.3	1	1	20	205	10.09	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-07D	92.2	96.3	4.1	1	0.6	17.5	31.5	1.80	non-PAG	Blend into surrounding units		Place underwater	non-PAG	Place underwater
T18-07D	96.3	104.7	8.4	1	0.3	7.8	20.5	2.62	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-07D	104.7	107.8	3.1	1	0.6	19.7	35.3	1.79	non-PAG	Blend into surrounding units		Place underwater	non-PAG	Place underwater
T18-07D	107.8	111.1	3.3	1	0.2	5.6	44	7.88	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T18-07D	111.1	114.2	3.1	1	0.3	10.3	20.8	2.02	non-PAG	non-PAG	1.72	non-PAG	non-PAG	non-PAG
T18-07D	114.2	117.4	3.2	1A	0.4	12.8	40.8	3.18	Place underwater	Place underwater	1.12	Place underwater	Place underwater	Place underwater
T18-07D	117.4	120.6	3.2	1A	1.27	39.69	32.8	0.83						
T18-07D	120.6	123.8	3.2	1A	1.31	40.94	31.3	0.76						
T18-07D	123.8	127.5	3.7	6	2.11	65.94	17.3	0.26	Place underwater	Place underwater	0.39	Place underwater	Place underwater	Place underwater
T18-07D	127.5	129.3	1.8	6	0.2	4.7	26	5.61						
T18-07D	129.3	132.4	3.1	6	1.12	35.0	16.5	0.47						
T18-07D	132.4	133.8	1.4	6	1.23	38.44	7.3	0.19						
T18-07D	133.8	134	0.2	6	0.86	26.88	7.0	0.26						
T18-07D	134	134.6	0.6	6	2.17	67.813	7.3	0.11						
T93D-53	7.62	9.67	2.05	1	0.22	6.9	40.2	5.87	non-PAG	non-PAG	4.42	non-PAG	non-PAG	non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T93D-53	9.67	11.92	2.25	1	0.2538932	7.9	37.6	4.73	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T93D-53	11.92	14.97	3.05	1	0.1606532	5	64	12.66	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T93D-53	14.97	18.02	3.05	1	0.2110028	6.6	28.6	4.33	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T93D-53	18.02	21.03	3.01	1	0.3946856	12.3	33.1	2.68	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T93D-53	21.03	24.13	3.10	1	0.3881588	12.1	25.9	2.13	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T93D-53	24.13	27.18	3.05	1A	1.631048	51.0	74.3	1.46	Place underwater	Place underwater	0.83	Place underwater	Place underwater	Place underwater
T93D-53	27.18	28.93	1.75	1A	1.70564	53.3	57.3	1.07						
T93D-53	28.93	31.50	2.57	1A	1.966712	61.46	31.27	0.51						
T93D-53	31.50	31.83	0.33	1A	0.3760376	12	475	40.46						
T93D-53	31.83	33.43	1.60	1A	1.696316	53.01	31.27	0.59						
T93D-53	33.43	35.83	2.40	1A	1.435244	44.85	36.66	0.82						
T93D-53	35.83	36.47	0.64	1A	2.693984	84.19	9.73	0.12						
T93D-53	36.84	39.97	3.13	1A	2.516828	78.65	27.68	0.35						
T93D-53	39.97	40.12	0.15	1A	12.5681	392.753	12.426	0.03						
T93D-53	40.12	40.96	0.84	2	0.922424	28.83	20.5	0.71	Place underwater	Place underwater	0.49	Place underwater	Place underwater	Place underwater
T93D-53	40.96	41.29	0.33	2	1.770908	55.340875	na	na						
T93D-53	41.29	43.61	2.32	3	1.696316	53.01	36.66	0.69						
T93D-53	43.61	43.82	0.21	3	1.575104	49.22	14.22	0.29						
T93D-53	43.82	46.330	2.51	3	2.330348	72.82	24.99	0.34						
T93D-53	46.330	46.480	0.150	Coal Cleaning										
T93D-53	46.48	48.18	1.70	C Seam	1.677668	52.427125	na	na			COAL			
T93D-53	48.180	48.330	0.15	Coal Cleaning					Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T93D-53	48.33	48.63	0.3	4	0.2408396	7.5	25.0	3.32	non-PAG	non-PAG	10.26	non-PAG	non-PAG	non-PAG
T93D-53	48.63	50.02	1.39	4	0.624056	19.5	66.3	3.40	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T93D-53	50.02	50.41	0.39	4	0.1075064	3	552	164.24	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T93D-53	50.41	54.38	3.97	5	0.95972	30.0	85.1	2.84	non-PAG	non-PAG	1.57	Place underwater	Place underwater	Place underwater
T93D-53	54.38	56.04	1.66	5	2.554124	79.82	34.86	0.44		Place underwater				

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T93D-53	56.04	56.19	0.15	Coal Cleaning					Place underwater					
T93D-53	56.19	62.96	6.77	1 Seam	0.58676	18.33625	na	na			COAL			
T93D-53	62.960	63.110	0.15	Coal Cleaning					Place underwater	Place underwater	6.93	Place underwater	Place underwater	Place underwater
T93D-53	63.110	64.26	1.15	6	0.5923544	18.5	59.1	3.19						
T93D-53	64.26	67.35	3.09	6	2.610068	81.56	29.48	0.36						
T93D-53	67.35	68.23	0.88	6	3.421256	106.91425	na	na						
T93D-53	68.23	68.73	0.5	6	1.407272	43.98	38.5	0.87						
T93D-53	68.73	70.85	2.12	6	0.5429372	17.0	77.9	4.59	non-PAG	non-PAG			non-PAG	non-PAG
T93D-53	70.85	71.23	0.38	6	3.589088	112.16	18.71	0.17	Blend into surrounding units	Blend into surrounding units			Blend into surrounding units	Blend into surrounding units
T93D-53	71.23	71.57	0.34	6	2.703308	84.478375	na	na						
T95R-15C	6.50	7.62	1.12	1	0.129884	4.1	26.8	6.60	non-PAG	non-PAG	2.97	non-PAG	non-PAG	non-PAG
T95R-15C	7.62	7.92	0.30	1	-0.0183676	-1	473.6892	-825.26	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-15C	7.92	9.90	1.98	1	0.1802336	5.6	25.0	4.44	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-15C	9.90	11.34	1.44	1	0.2007464	6.3	48.3	7.70	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-15C	11.34	13.04	1.70	1	0.2016788	6.3	25.9	4.11	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-15C	13.04	14.18	1.14	1	0.2473664	7.7	22.3	2.88	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-15C	14.18	15.43	1.25	1	0.3452684	10.8	28.6	2.65	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-15C	15.43	17.05	1.62	1	0.2688116	8.4	25.0	2.97	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-15C	17.05	19.57	2.52	1	0.4711424	14.7	28.6	1.94	non-PAG	non-PAG	2.97	Blend into surrounding units	non-PAG	Blend into surrounding units
T95R-15C	19.57	21.51	1.94	1	0.7881584	24.6	51.9	2.11	non-PAG	non-PAG		non-PAG	Non-PAG	non-PAG
T95R-15C	21.51	24.15	2.64	1	0.922424	28.8	30.4	1.05	Blend into surrounding units	Blend into surrounding units		Blend into surrounding units	Blend into surrounding unit	Blend into surrounding units
T95R-15C	24.15	25.96	1.81	1	0.6016784	18.8	72.6	3.86	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T95R-15C	25.96	27.30	1.34	1	0.5858276	18.3	32.2	1.76	non-PAG	non-PAG		non-PAG	non-PAG	Blend into surrounding units
T95R-15C	27.30	27.84	0.54	1A	1.584428	49.51	20.5	0.41	Place underwater	Place underwater	0.39	Place underwater	Place underwater	Place underwater
T95R-15C	27.84	29.63	1.79	1A	2.087924	65.25	21.4	0.33						
T95R-15C	29.63	29.91	0.28	1A	2.63804	82.44	38.45	0.47						
T95R-15C	29.91	30.48	0.57	1A	1.416596	44.27	25.89	0.58						
T95R-15C	30.48	30.89	0.41	1A	3.738272	116.82	45.63	0.39						
T95R-15C	30.89	31.18	0.29	1A	3.122888	97.59	24.99	0.26						
T95R-15C	31.18	31.68	0.50	1A	0.8543588	26.7	16.02	0.60						
T95R-15C	31.68	32.97	1.29	2	1.202144	37.57	22.3	0.59	Place underwater	Place underwater	0.48	Place underwater	Place underwater	Place underwater
T95R-15C	32.97	35.62	2.65	2	1.976036	61.75	35.76	0.58						
T95R-15C	35.62	35.97	0.35	2	4.819856	150.62	58.19	0.39						
T95R-15C	35.97	36.43	0.46	2	2.35832	73.6975	na	na						
T95R-15C	36.43	36.97	0.54	2	1.19282	37.28	15.12	0.41						
T95R-15C	36.97	38.53	1.56	3	1.808204	56.51	20.5	0.36						
T95R-15C	38.53	38.87	0.34	3	2.479532	77.49	16.91	0.22						
T95R-15C	38.87	39.02	0.15	Coal Cleaning										
T95R-15C	39.02	41.20	2.18	C Seam	3.43058	107.20563	na	na			COAL			
T95R-15C	41.200	41.350	0.15	Coal Cleaning					Place underwater	Place underwater	1.42	Place underwater	Place underwater	Place underwater
T95R-15C	41.350	41.7	0.35	4	1.28606	40.19	15.12	0.38						
T95R-15C	41.70	42.97	1.27	4	0.8599532	26.9	36.7	1.36						
T95R-15C	42.97	45.12	2.15	4	0.7517948	23.5	30.4	1.29						
T95R-15C	45.12	45.87	0.75	4	1.00634	31.4	32.2	1.02						
T95R-15C	45.87	46.07	0.20	4	0.5242892	16	344	20.97						
T95R-15C	46.07	47.13	1.06	4	0.5392076	16.9	18.7	1.11						
T95R-15C	47.13	47.63	0.50	4	1.714964	53.59	23.19	0.43						
T95R-15C	47.63	47.92	0.29	5	1.929416	60.29	14.22	0.24		Place underwater	0.89	Place underwater		

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T95R-15C	47.92	48.43	0.51	5	1.323356	41.35	18.71	0.45	Place underwater				Place underwater	Place underwater
T95R-15C	48.43	49.79	1.36	5	0.9009788	28.2	34.9	1.24						
T95R-15C	49.79	50.66	0.87	5	0.666014	20.8	27.7	1.33						
T95R-15C	50.66	50.71	0.05	5	1.444568	45.14	29.48	0.65						
T95R-15C	50.71	50.86	0.15	Coal Cleaning										
T95R-15C	50.86	53.21	2.35	1U Seam	2.227784	69.61825	na	na			COAL			
T95R-15C	53.210	53.360	0.15	Coal Cleaning					Place underwater	Place underwater	9.57	Place underwater	Place underwater	Place underwater
T95R-15C	53.360	53.97	0.61	55	0.125222	3.9	25.0	6.39						
T95R-15C	53.97	54.85	0.88	55	0.0329144	1	33	32.15						
T95R-15C	54.85	55.57	0.72	55	-0.0183676	-1	171.2654	-298.38						
T95R-15C	55.57	56.40	0.83	55	0.07394	2.3	23	10.04						
T95R-15C	56.4	56.75	0.35	55	0.2296508	7.2	29.5	4.11						
T95R-15C	56.75	56.90	0.15	Coal Cleaning										
T95R-15C	56.90	61.23	4.33	1L Seam	0.512168	16.00525	na	na			COAL			
T95R-15C	61.230	61.380	0.15	Coal Cleaning					Place underwater	Place underwater	14.25	Place underwater	Place underwater	Place underwater
T95R-15C	61.380	61.83	0.45	6	0.0441032	1	35	25.29	non-PAG	non-PAG			non-PAG	non-PAG
T95R-15C	61.83	62.91	1.08	6	0.0674132	2.1	18	8.45	non-PAG	non-PAG			non-PAG	non-PAG
T95R-15C	62.91	63.54	0.63	6	0.0664808	2.1	21	10.30	non-PAG	non-PAG			non-PAG	non-PAG
T95R-15C	63.54	63.84	0.3	6	0.0385088	1	56	46.12	non-PAG	non-PAG			non-PAG	non-PAG
T95R-15C	63.84	66.24	2.4	6	-0.0174352	-1	59.9878	-110.10	non-PAG	non-PAG			non-PAG	non-PAG
T95R-28C	12.50	15.48	2.98	1	0.3844292	12.0	33.1	2.75	non-PAG	non-PAG	2.87	non-PAG	non-PAG	non-PAG
T95R-28C	15.48	20.68	5.20	1	0.185828	5.8	31.3	5.38	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-28C	20.68	23.70	3.02	1	0.390956	12.2	34.0	2.78	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-28C	23.70	26.79	3.09	1	0.526154	16.4	25.0	1.52	non-PAG	Place underwater		Place underwater	Place underwater	Place underwater

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T95R-28C	26.79	28.50	1.71	1A	0.950396	29.7	34.0	1.14	Place underwater	Place underwater	1.09	Place underwater	Place underwater	Place underwater
T95R-28C	28.50	30.56	2.06	1A	1.062284	33.2	34.9	1.05						
T95R-28C	30.56	32.86	2.30	2	0.5895572	18.4	50.1	2.72	Place underwater	Place underwater	1.43	Place underwater	Place underwater	Place underwater
T95R-28C	32.86	33.76	0.90	2	1.547132	48.35	27.68	0.57						
T95R-28C	33.76	34.16	0.40	2	2.628716	82.15	33.96	0.41						
T95R-28C	34.16	34.41	0.25	2	3.355988	104.87	33.07	0.32						
T95R-28C	34.41	34.95	0.54	2	2.190488	68.45275	na	na						
T95R-28C	34.95	35.25	0.30	3	1.230116	38.44	33.1	0.86						
T95R-28C	35.25	37.30	2.05	3	1.118228	34.94	27.68	0.79						
T95R-28C	37.30	38.25	0.95	3	1.211468	37.9	57.3	1.51	non-PAG					
T95R-28C	38.25	40.05	1.80	3	0.3872264	12.1	34.9	2.88	non-PAG	non-PAG			non-PAG	non-PAG
T95R-28C	40.05	40.30	0.25	3	0.4636832	14.5	31.3	2.16	non-PAG	non-PAG			non-PAG	non-PAG
T95R-28C	40.30	40.67	0.37	3	0.512168	16.00525	na	na	Blend into surrounding units	Blend into surrounding units			Blend into surrounding units	Blend into surrounding units
T95R-28C	40.67	40.92	0.25	3	0.0711428	2.2	17.8	8.01	non-PAG	non-PAG			non-PAG	non-PAG
T95R-28C	40.92	42.77	1.85	3	0.1121684	3.5	22.3	6.36	non-PAG	non-PAG			non-PAG	non-PAG
T95R-28C	42.77	43.50	0.73	3	0.0935204	3	61	20.83	non-PAG	non-PAG			non-PAG	non-PAG
T95R-28C	43.50	44.64	1.14	3	0.0758048	2	78	32.90	non-PAG	non-PAG			non-PAG	non-PAG
T95R-28C	44.64	46.17	1.53	3	1.388624	43.39	26.78	0.62	Place underwater	Place underwater			Place underwater	Place underwater
T95R-28C	46.17	46.52	0.35	3	3.365312	105.17	16.91	0.16						
T95R-28C	46.52	46.67	0.15	Coal Cleaning										
T95R-28C	46.67	48.62	1.95	C Seam	1.677668	52.427125	na	na			COAL			
T95R-28C	48.620	48.770	0.15	Coal Cleaning					Place underwater	Place underwater	2.48	Place underwater	Place underwater	Place underwater
T95R-28C	48.77	48.89	0.12	4	0.1196276	3.7	26.8	7.16	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-28C	48.89	51.18	2.29	4	0.5382752	16.8	47.4	2.82	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-28C	51.18	53.33	2.15	4	0.5103032	15.9	66.3	4.16	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T95R-28C	53.33	53.62	0.29	4	0.2865272	9	623	69.54	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T95R-28C	53.62	55.57	1.95	4	1.500512	46.89	28.58	0.61	Place underwater	Place underwater		non-PAG	Place underwater	Place underwater
T95R-28C	55.57	55.72	0.15	4	7.010996	219.09	36.66	0.17				non-PAG		
T95R-28C	55.72	57.54	1.82	5	1.575104	49.22	19.6	0.40	Place underwater	Place underwater	0.91	Place underwater	Place underwater	Place underwater
T95R-28C	57.54	59.00	1.46	5	0.666014	20.8	60.9	2.93						
T95R-28C	59	59.35	0.35	5	2.087924	65.25	14.22	0.22						
T95R-28C	59.35	59.50	0.15	Coal Cleaning										
T95R-28C	59.50	61.50	2.00	1U Seam	2.181164	68.161375	na	na			COAL			
T95R-28C	61.500	61.650	0.15	Coal Cleaning	0.1615856	5.0	23.2	4.59	Place underwater	Place underwater	1.60	Place underwater	Place underwater	Place underwater
T95R-28C	61.650	61.650	0.0	55										
T95R-28C	61.65	62.00	0.35	55	0.3555248	11.1	50.1	4.51						
T95R-28C	62	62.35	0.35	55	1.09958	34.36	16.02	0.47						
T95R-28C	62.35	62.50	0.15	Coal Cleaning										
T95R-28C	62.50	63.70	1.20	1L Seam	0.782564	24.455125	na	na			COAL			
T95R-28C	63.70	64.19	0.49	Parting	0.922424	28.83	23.19	0.80	Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T95R-28C	64.19	64.46	0.27	1L Seam	1.407272	43.98	24.09	0.55						
T95R-28C	64.46	64.99	0.53	Parting	0.2809328	8.8	26.8	3.05	Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T95R-28C	64.99	67.37	2.38	1L Seam	0.931748	29.117125	na	na						
T95R-28C	67.37	67.64	0.27	1L Seam	4.027316	125.85	15.12	0.12					Place underwater	
T95R-28C	67.640	67.790	0.15	Coal Cleaning					Place underwater	Place underwater	1.88	Place underwater	Place underwater	Place underwater
T95R-28C	67.790	68.24	0.45	6	1.89212	59.13	23.19	0.39						
T95R-28C	68.24	71.01	2.77	6	0.941072	29.4	57.3	1.95	non-PAG	non-PAG			non-PAG	
T95R-28C	71.01	72.60	1.59	6	0.2538932	8	186	23.40	non-PAG	non-PAG			non-PAG	
T95R-28C	72.60	74.52	1.92	6	0.5802332	18.1	69.0	3.80	non-PAG	non-PAG			non-PAG	
T95R-28C	74.52	74.67	0.15	6	3.29072	102.84	29.48	0.29		Place underwater				

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Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T95R-28C	74.67	75.7	1.03	6	1.873472	58.55	31.27	0.53	Place underwater				Place underwater	
T95R-28C	75.7	76.22	0.52	6	2.535476	79.23	21.4	0.27						
T95R-28C	76.22	77.01	0.79	6	1.6124	50.3875	na	na						
T95R-28C	77.01	77.37	0.36	6	3.458552	108.08	20.5	0.19						
T95R-28C	77.37	77.59	0.22	6	1.8455	57.67	26.78	0.46						
T95R-28C	77.59	77.97	0.38	6	2.582096	80.69	19.6	0.24						
T95R-28C	77.97	78.38	0.41	6	3.076268	96.133375	na	na						
T95R-39C	6.39	9.45	3.06	1	0.2893244	9.0	31.3	3.46	non-PAG	non-PAG	4.80	non-PAG		non-PAG
T95R-39C	9.45	11.55	2.10	1	0.1457348	4.6	33.1	7.26	non-PAG	non-PAG		non-PAG		non-PAG
T95R-39C	11.55	14.41	2.86	1	0.2026112	6.3	27.7	4.37	non-PAG	non-PAG		non-PAG		non-PAG
T95R-39C	14.41	17.49	3.08	1	0.2343128	7.3	73	9.91	non-PAG	non-PAG		non-PAG		non-PAG
T95R-39C	17.49	20.51	3.02	1	0.223124	7.0	66	9.50	non-PAG	non-PAG		non-PAG		non-PAG
T95R-39C	20.51	23.50	2.99	1	0.3471332	10.8	28.6	2.63	non-PAG	non-PAG		non-PAG		non-PAG
T95R-39C	23.50	26.60	3.10	1	0.6557576	20.5	59.1	2.88	non-PAG	non-PAG		non-PAG		non-PAG
T95R-39C	26.60	29.70	3.10	1A	1.3793	43.1	28.58	0.66	Place underwater	Place underwater	0.67	Place underwater	Place underwater	Place underwater
T95R-39C	29.70	30.24	0.54	1A	0.86648	27.1	26.8	0.99						
T95R-39C	30.24	31.83	1.59	1A	1.024988	32.0	34.9	1.09						
T95R-39C	31.83	32.08	0.25	1A	3.579764	111.87	28.58	0.26						
T95R-39C	32.08	32.35	0.27	1A	2.423588	75.74	6.14	0.08						
T95R-39C	32.35	32.72	0.37	2	2.49818	78.07	25.89	0.33	Place underwater	Place underwater	0.50	Place underwater	Place underwater	Place underwater
T95R-39C	32.72	35.81	3.09	2	2.106572	65.83	25.89	0.39						
T95R-39C	35.81	36.15	0.34	2	3.80354	118.86063	na	na						
T95R-39C	36.15	36.45	0.30	3	0.969044	30.28	7.94	0.26						
T95R-39C	36.45	37.15	0.70	3	2.861816	89.43	16.02	0.18						
T95R-39C	37.15	38.78	1.63	3	0.218462	6.8	46.5	6.82						
T95R-39C	38.78	38.94	0.16	3	1.062284	33.2	20.5	0.62						
T95R-39C	38.94	39.28	0.34	3	2.227784	69.62	20.5	0.29						
T95R-39C	39.28	39.63	0.35	Coal Cleaning	3.654356	114.2	11.53	0.10						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T95R-39C	39.63	39.78	0.15	3										
T95R-39C	39.78	41.43	1.65	C Seam	2.470208	77.194	na	na			COAL			
T95R-39C	41.430	41.580	0.15	Coal Cleaning					Place underwater	Place underwater	1.29	Place underwater	Place underwater	Place underwater
T95R-39C	41.58	41.86	0.28	4	0.2147324	6.7	30.4	4.53						
T95R-39C	41.86	44.79	2.93	4	0.1690448	5.3	26.8	5.07						
T95R-39C	44.79	45.75	0.96	4	3.458552	108.08	57.3	0.53						
T95R-39C	45.75	47.88	2.13	4	0.6762704	21.1	30.4	1.44						
T95R-39C	47.88	50.04	2.16	4	0.544802	17.0	33.1	1.94						
T95R-39C	50.04	50.29	0.25	4	2.12522	66.41	24.09	0.36						
T95R-39C	50.29	50.61	0.32	4	2.899112	90.59725	na	na						
T95R-39C	50.61	50.83	0.22	5	1.966712	61.46	11.53	0.19	Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T95R-39C	50.83	53.40	2.57	5	1.342004	41.94	30.37	0.72						
T95R-39C	53.4	53.75	0.35	5	3.132212	97.88	21.4	0.22						
T95R-39C	53.75	53.90	0.15	Coal Cleaning										
T95R-39C	53.90	55.98	2.08	1U Seam	2.059952	64.3735	na	na			COAL			
T95R-39C	55.98	56.44	0.46	55	2.852492	89.14	19.6	0.22	Place underwater	Place underwater	0.22	Place underwater	Place underwater	Place underwater
T95R-39C	56.44	57.11	0.67	1L Seam	4.577432	143.04475	na	na			COAL			
T95R-39C	57.110	57.260	0.15	Coal Cleaning					Place underwater	Place underwater	3.40	Place underwater	Place underwater	Place underwater
T95R-39C	57.260	57.42	0.16	Coal Cleaning	1.929416	60.29	14.22	0.24						
T95R-39C	57.42	59.18	1.76	6	0.2818652	8.8	32.2	3.65	non-PAG	non-PAG			non-PAG	non-PAG
T95R-39C	59.18	61.20	2.02	6	0.162518	5.1	30.4	5.98	non-PAG	non-PAG			non-PAG	non-PAG
T96R-04C	6.00	6.17	0.17	1	0.055292	2	329	190.53	non-PAG	non-PAG	5.53	non-PAG	non-PAG	non-PAG
T96R-04C	6.17	8.99	2.82	1	0.437576	13.7	56.4	4.12	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-04C	8.99	10.91	1.92	1A	2.432912	76.03	34.86	0.46	Place underwater	Place underwater	0.39	Place underwater	Place underwater	Place underwater
T96R-04C	10.91	12.59	1.68	1A	1.994684	62.33	17.81	0.29						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-04C	12.59	14.38	1.79	2	1.789556	55.92	24.09	0.43	Place underwater	Place underwater	0.31	Place underwater	Place underwater	Place underwater
T96R-04C	14.38	14.63	0.25	2	4.521488	141.297	9.733	0.07						
T96R-04C	14.63	15.17	0.54	2	3.2441	101.37813	na	na						
T96R-04C	15.17	16.74	1.57	3	1.668344	52.14	13.32	0.26						
T96R-04C	16.74	16.92	0.18	3	2.703308	84.478375	na	na						
T96R-04C	16.92	17.31	0.39	3	3.300044	103.13	33.07	0.32						
T96R-04C	17.31	17.46	0.15	Coal Cleaning										
T96R-04C	17.46	18.98	1.52	C Seam	2.190488	68.45275	na	na			COAL			
T96R-04C	18.980	19.130	0.15	Coal Cleaning					Place underwater	Place underwater	3.60	Place underwater	Place underwater	Place underwater
T96R-04C	19.13	19.37	0.24	4	0.176504	5.5	25.9	4.69	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-04C	19.37	20.41	1.04	4	0.316364	9.9	24.1	2.44	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-04C	20.41	21.77	1.36	4	0.111236	3.5	25.9	7.45	non-PAG	non-PAG	3.60	non-PAG	non-PAG	non-PAG
T96R-04C	21.77	24.26	2.49	4	0.381632	11.9	26.8	2.25	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-04C	24.26	26.14	1.88	4	0.26042	8.1	46.5	5.72	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-04C	26.14	26.45	0.31	4	2.833844	88.557625	na	na	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-04C	26.45	26.69	0.24	5	2.805872	87.68	11.53	0.13	Place underwater	Place underwater	0.89	Place underwater	Place underwater	Place underwater
T96R-04C	26.69	28.96	2.27	5	0.903776	28.2	32.2	1.14						
T96R-04C	28.96	29.11	0.15	Coal Cleaning										
T96R-04C	29.11	30.80	1.69	1U Seam	2.45156	76.61125	na	na			COAL			
T96R-04C	30.80	31.09	0.29	55	0.26042	8.1	46.5	5.72	Place underwater	Place underwater	5.72	Place underwater	Place underwater	Place underwater
T96R-04C	31.09	34.44	3.35	1L Seam	0.670676	20.958625	na	na			COAL			
T96R-04C	34.440	34.590	0.15	Coal Cleaing					Place underwater	Place underwater	1.97	Place underwater	Place underwater	Place underwater
T96R-04C	34.590	36.68	2.09	6	0.698648	21.8	27.7	1.27						
T96R-04C	36.68	37.06	0.38	6	2.833844	88.557625	na	na						
T96R-04C	37.06	38.88	1.82	6	0.195152	6.1	29.5	4.83						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-05C	12.88	21.80	8.92	1	0.269744	8.4	45.6	5.41	non-PAG	non-PAG	5.41	Non-PAG	non-PAG	non-PAG
T96R-05C	21.80	29.91	8.11	2	0.63338	19.8	50.1	2.53	non-PAG	non-PAG	2.17	Place underwater	non-PAG	non-PAG
T96R-05C	29.91	30.40	0.49	3	0.241772	8	571	75.52	non-PAG	non-PAG			non-PAG	non-PAG
T96R-05C	30.40	31.10	0.70	3	0.652028	20.4	25.0	1.23	non-PAG	Place underwater			Place underwater	Place underwater
T96R-05C	31.10	31.61	0.51	3	0.521492	16.3	27.7	1.70	non-PAG					
T96R-05C	31.61	32.52	0.91	3	1.323356	41.4	47.4	1.15	Blend into surrounding units					
T96R-05C	32.52	33.86	1.34	3	0.735944	23.0	31.3	1.36	non-PAG					
T96R-05C	33.86	37.26	3.40	3	0.95972	29.99	16.02	0.53	Place underwater					
T96R-05C	37.26	38.52	1.26	3	0.502844	15.7	18.7	1.19						
T96R-05C	38.52	39.36	0.84	3	1.397948	43.69	21.4	0.49						
T96R-05C	39.36	39.51	0.15	3										
T96R-05C	41.300	41.450	0.15	4					Place underwater	Place underwater	0.93	Place underwater	Place underwater	Place underwater
T96R-05C	41.450	42.12	0.67	5	0.521492	16.3	15.1	0.93						
T96R-05C	42.12	42.27	0.15	Coal Cleaning										
T96R-05C	42.27	44.40	2.13	1U Seam	0.54014	16.879375	na	na			COAL			
T96R-05C	44.98	45.62	0.64	1U Seam	1.668344	52.13575	na	na						
T96R-05C	45.620	45.770	0.15	Coal Cleaning					Place underwater	Place underwater	3.61	Place underwater	Place underwater	Place underwater
T96R-05C	45.770	46.53	0.76	55	0.157856	4.9	17.8	3.61						
T96R-05C	46.53	46.68	0.15	Coal Cleaning										
T96R-05C	46.68	50.84	4.16	1L Seam	0.847832	26.49475	na	na			COAL			
T96R-05C	50.840	50.990	0.15	Coal Cleaning					Place underwater	Place underwater	0.44	Place underwater	Place underwater	Place underwater
T96R-05C	50.990	51.51	0.52	6	1.323356	41.35	33.07	0.80						
T96R-05C	51.51	53.43	1.92	6	1.603076	50.1	20.5	0.41						
T96R-05C	53.43	53.97	0.54	6	0.838508	26.2	20.5	0.78						
T96R-05C	53.97	55.15	1.18	6	3.952724	123.52	25.89	0.21						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-05C	55.15	56.10	0.95	6	2.190488	68.45275	na	na						
T96R-05C	56.10	58.06	1.96	6	1.556456	48.64	42.9	0.88						
T96R-05C	58.06	58.52	0.46	6	4.1765	130.52	30.37	0.23						
T96R-05C	58.52	59.52	1.00	6	2.069276	64.66	24.99	0.39						
T96R-23C	12.23	14.62	2.39	1	1.342004	41.94	5.25	0.13	Place underwater	Place underwater	3.15	Place underwater	Place underwater	Place underwater
T96R-23C	14.62	17.07	2.45	1	1.080932	33.8	33.1	0.98						
T96R-23C	17.07	18.10	1.03	1	0.549464	17.2	29.5	1.72						
T96R-23C	18.10	18.83	0.73	1	0.512168	16.0	77.0	4.81						
T96R-23C	18.83	21.27	2.44	1	0.72662	22.7	24.1	1.06						
T96R-23C	21.27	24.90	3.63	1	0.9131	28.5	35.8	1.25	non-PAG					
T96R-23C	24.90	26.40	1.50	1	0.418928	13	357	27.27	non-PAG	non-PAG		non-PAG		non-PAG
T96R-23C	26.40	29.61	3.21	1	0.661352	20.7	37.6	1.82	non-PAG	non-PAG		Blend into surrounding units	Blend into surrounding units	Blend into surrounding units
T96R-23C	29.61	32.67	3.06	1	0.642704	20.1	44.7	2.23	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	32.67	35.70	3.03	1	0.409604	12.8	38.5	3.00	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	35.70	38.81	3.11	1	0.26042	8.1	54.6	6.71	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	38.81	41.87	3.06	1	0.176504	5.5	42.0	7.62	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	41.87	44.89	3.02	1	0.157856	4.9	38.5	7.79	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	44.89	47.97	3.08	1	0.148532	5	53	11.38	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	47.97	51.04	3.07	1	0.12056	4	43	11.40	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	51.04	54.05	3.01	1	0.157856	4.9	49	9.98	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	54.05	56.94	2.89	1	0.223124	7.0	69	9.89	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	56.94	60.01	3.07	1	0.465548	14.5	47.4	3.26	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-23C	60.01	62.98	2.97	1	0.735944	23.0	38.5	1.67	non-PAG	non-PAG		Place underwater	Place underwater	Place underwater
T96R-23C	62.98	64.56	1.58	1A	0.829184	25.91	13.32	0.51	Place underwater	Place underwater	0.75	Place underwater	Place underwater	Place underwater
T96R-23C	64.56	66.39	1.83	1A	1.556456	48.64	21.4	0.44						
T96R-23C	66.39	68.30	1.91	1A	2.162516	67.58	17.81	0.26						
T96R-23C	68.30	68.64	0.34	1A	1.258088	39.31525	na	na						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-23C	68.64	69.73	1.09	1A	0.689324	21.5	20.5	0.95						
T96R-23C	69.73	72.15	2.42	1A	1.435244	44.85	17.81	0.40						
T96R-23C	72.15	75.03	2.88	1A	0.204476	6.4	51.0	7.98	non-PAG	non-PAG			non-PAG	non-PAG
T96R-23C	75.03	78.08	3.05	2	0.251096	7.8	24.1	3.07	non-PAG	non-PAG			non-PAG	non-PAG
T96R-23C	78.08	80.93	2.85	3	0.2138	6.7	35.8	5.35	non-PAG	non-PAG			non-PAG	non-PAG
T96R-23C	80.93	82.32	1.39	3	0.26042	8.1	46.5	5.72	non-PAG	non-PAG			non-PAG	non-PAG
T96R-23C	82.32	83.45	1.13	3	2.610068	81.56	56.4	0.69			1.58	Place underwater		
T96R-23C	83.45	83.71	0.26	3	2.768576	86.52	20.5	0.24						
T96R-23C	83.71	84.29	0.58	3	1.817528	56.8	16.91	0.30	Place underwater	Place underwater			Place underwater	Place underwater
T96R-23C	84.29	84.44	0.15	Coal Cleaning										
T96R-23C	84.44	85.46	1.02	C Seam	1.89212	59.12875	na	na			COAL			
T96R-23C	85.460	85.610	0.15	Coal Cleaning					Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T96R-23C	85.61	87.99	2.38	4	0.344336	10.8	25.9	2.41	non-PAG	non-PAG		non-PAG		non-PAG
T96R-23C	87.99	89.05	1.06	4	0.68	21.3	46.5	2.19	non-PAG	non-PAG		non-PAG		non-PAG
T96R-23C	89.05	90.00	0.95	4	0.605408	19	199	10.52	non-PAG	non-PAG	3.61	non-PAG		non-PAG
T96R-23C	90.00	93.43	3.43	4	0.530816	16.6	40.2	2.43	non-PAG	non-PAG		non-PAG		non-PAG
T96R-23C	93.43	96.35	2.92	4	0.269744	8.4	40.2	4.77	non-PAG	non-PAG		non-PAG		non-PAG
T96R-23C	96.35	99.44	3.09	4	0.372308	11.6	42.9	3.69	non-PAG	non-PAG		non-PAG		non-PAG
T96R-23C	99.44	103.88	4.44	5	0.614732	19.2	44.7	2.33	non-PAG	non-PAG				non-PAG
T96R-23C	103.88	104.42	0.54	5	0.670676	21.0	63.6	3.03	non-PAG	non-PAG	2.41	Place underwater		non-PAG
T96R-23C	104.42	104.57	0.15	Coal Cleaning					Place underwater	Place underwater			Place underwater	Place underwater
T96R-23C	104.57	106.13	1.56	1 Seam	1.090256	34.0705	na	na			COAL			
T96R-23C	106.13	111.03	4.90	1 Seam	1.761584	55.0495	na	na						
T96R-23C	111.030	111.180	0.15	Coal Cleaning										
T96R-23C	111.180	115.17	3.99	6	1.42592	44.56	24.09	0.54	Place underwater	Place underwater	0.52	Place underwater	Place underwater	Place underwater
T96R-23C	115.17	116.07	0.90	6	3.281396	102.54	17.81	0.17						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-23C	116.07	116.37	0.30	6	2.740604	85.644	4.349	0.05						
T96R-23C	116.37	116.65	0.28	6	0.204476	6	151	23.57						
T96R-28C	12.50	14.32	1.82	1	0.530816	16.59	22.3	1.34	Place underwater	Place underwater	3.29	Place underwater	Place underwater	Place underwater
T96R-28C	14.32	14.68	0.36	1	0.707972	22.12	9.73	0.44						
T96R-28C	14.68	15.08	0.40	1	3.794216	118.57	47.42	0.40						
T96R-28C	15.08	17.07	1.99	1	0.791888	24.7	23.2	0.94						
T96R-28C	17.07	17.86	0.79	1	1.481864	46.31	19.6	0.42						
T96R-28C	17.86	18.40	0.54	1	1.024988	32.03	7.04	0.22						
T96R-28C	18.40	19.66	1.26	1	1.09958	34.36	21.4	0.62						
T96R-28C	19.66	20.11	0.45	1	0.26042	8.1	29.5	3.62	non-PAG	non-PAG	3.29	non-PAG	non-PAG	non-PAG
T96R-28C	20.11	20.99	0.88	1	0.101912	3	49	15.45	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	20.99	26.92	5.93	1	0.232448	7.3	36.7	5.05	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	26.92	35.09	8.17	1	0.614732	19.2	42.9	2.24	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	35.09	35.93	0.84	1	0.30704	10	416	43.38	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	35.93	45.03	9.10	1	0.418928	13.1	43.8	3.35	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	45.03	47.83	2.80	1	0.241772	7.6	43.8	5.80	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	47.83	55.72	7.89	1	0.12056	4	114	30.21	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	55.72	63.86	8.14	1	0.269744	8.4	44.7	5.31	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-28C	63.86	68.52	4.66	1A	1.220792	38.15	26.78	0.70	Place underwater	Place underwater	0.81	Place underwater	Place underwater	Place underwater
T96R-28C	68.52	68.64	0.12	1A	0.139208	4	550	126.42						
T96R-28C	68.64	69.73	1.09	1A	1.323356	41.35	27.68	0.67						
T96R-28C	69.73	72.08	2.35	1A	1.1462	35.82	27.68	0.77						
T96R-28C	72.08	73.19	1.11	1A	2.321024	72.53	24.99	0.34						
T96R-28C	73.19	73.61	0.42	1A	1.873472	58.546	na	na						
T96R-28C	73.61	81.69	8.08	2	0.857156	26.8	25.0	0.93	Place underwater	Place underwater	1.85	Place underwater	Place underwater	Place underwater
T96R-28C	81.69	81.90	0.21	2	0.092588	3	475	164.03	non-PAG	non-PAG			non-PAG	non-PAG
T96R-28C	81.90	88.42	6.52	3	0.40028	12.5	45.6	3.65	non-PAG	non-PAG			non-PAG	non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-28C	88.42	89.82	1.40	3	1.136876	35.53	32.2	0.91	Blend into surrounding units	Blend into surrounding units			Blend into surrounding units	Blend into surrounding units
T96R-28C	89.82	89.97	0.15	Coal Cleaning					Place underwater	Place underwater			Place underwater	Place underwater
T96R-28C	89.97	91.21	1.24	C Seam	1.314032	41.0635	na	na			COAL			
T96R-28C	91.210	91.360	0.15	Coal Cleaning					Place underwater	Place underwater	3.24	Place underwater	Place underwater	Place underwater
T96R-28C	91.36	99.03	7.67	4	0.549464	17.2	88.7	5.17	non-PAG	non-PAG		non-PAG	Non-PAG	non-PAG
T96R-28C	99.03	99.44	0.41	4	6.218456	194.327	10.631	0.05	Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T96R-28C	99.44	104.61	5.17	5	1.435244	44.9	42.9	0.96	Place underwater	Place underwater	0.96	Place underwater	Place Underwater	Place underwater
T96R-28C	104.61	104.76	0.15	Coal Cleaning										
T96R-28C	104.76	106.95	2.19	1U Seam	2.134544	66.7045	na	na			COAL			
T96R-28C	106.95	107.01	0.06	55	1.435244	44.9	42.9	0.96	Place underwater	Place underwater	0.96	Place underwater		Place underwater
T96R-28C	107.01	111.31	4.30	1L Seam	0.72662	22.706875	na	na			COAL			
T96R-28C	111.310	111.460	0.15	Coal Cleaning					Place underwater	Place underwater	2.41	Place underwater	Place underwater	Place underwater
T96R-28C	111.460	113.32	1.86	6	0.922424	28.8	40.2	1.40	Blend internally into non-PAG	Blend internally into non-PAG			Blend internally into non-PAG	Blend internally into non-PAG
T96R-28C	113.32	114.08	0.76	6	0.642704	20	302	15.05						
T96R-28C	114.08	115.46	1.38	6	1.388624	43.4	46.5	1.07						
T96R-28C	115.46	117.18	1.72	6	2.35832	73.6975	na	na						
T96R-28C	117.18	117.88	0.70	6	1.491188	46.6	27.68	0.59						
T96R-28C	117.88	118.50	0.62	6	1.780232	55.63225	na	na						
T96R-42C	12.50	14.26	1.76	1	0.176504	6	66	12.01	non-PAG	Place underwater	2.17	Place underwater	Place underwater	Place underwater
T96R-42C	14.26	17.42	3.16	1	0.4469	14.0	21.4	1.53	non-PAG					
T96R-42C	17.42	18.86	1.44	1	0.642704	20.1	21.4	1.07	Blend into surrounding units					
T96R-42C	18.86	25.45	6.59	1	0.605408	18.9	29.5	1.56	non-PAG					

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-42C	25.45	26.37	0.92	1	0.9131	28.53	20.5	0.72	Place underwater					
T96R-42C	26.37	31.53	5.16	1	0.390956	12.2	11.5	0.94						
T96R-42C	31.53	35.34	3.81	1	0.474872	14.8	42.9	2.89						
T96R-42C	35.34	36.04	0.70	1	0.624056	19.5	19.6	1.01						
T96R-42C	36.04	37.18	1.14	1	1.33268	41.65	33.07	0.79						
T96R-42C	37.18	39.46	2.28	1	1.444568	45.1	115.6	2.56						
T96R-42C	39.46	41.34	1.88	1	1.509836	47.18	13.32	0.28						
T96R-42C	41.34	42.50	1.16	1	1.258088	39.32	19.6	0.50						
T96R-42C	42.50	47.55	5.05	1	0.418928	13.1	74.3	5.68	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	47.55	56.44	8.89	1	1.034312	32.3	35.8	1.11	Place underwater	Place underwater		Place underwater	Place underwater	Place underwater
T96R-42C	56.44	62.11	5.67	1	0.605408	18.9	89.6	4.74	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	62.11	68.29	6.18	1	0.269744	8.4	64.5	7.65	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	68.29	69.24	0.95	1	0.157856	4.9	41.1	8.34	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	69.24	72.24	3.00	1	0.35366	11.1	105	9.49	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	72.24	76.44	4.20	1	0.185828	6	102	17.59	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	76.44	82.28	5.84	1	0.204476	6.4	21.4	3.35	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	82.28	87.19	4.91	1	0.344336	10.8	22.3	2.07	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	87.19	89.32	2.13	1	0.689324	21.5	19.6	0.91	Blend into surrounding units	Blend into surrounding units		Blend into surrounding units	Blend into surrounding units	Blend into surrounding units
T96R-42C	89.32	89.91	0.59	1	0.055292	2	663	383.73	non-PAG	non-PAG	2.17	non-PAG	non-PAG	non-PAG
T96R-42C	89.91	90.90	0.99	1	0.596084	18.6	42.0	2.26	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	90.90	91.56	0.66	1	2.246432	70.2	33.07	0.47	Blend into surrounding units	Place underwater		Place underwater	Place underwater	Place underwater
T96R-42C	91.56	96.33	4.77	1	0.670676	20.96	25.89	1.24	non-PAG					
T96R-42C	96.33	102.00	5.67	1	0.223124	7.0	47.4	6.80	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	102.00	103.24	1.24	1	0.07394	2	33	14.31	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-42C	103.24	105.99	2.75	1	0.456224	14.3	42.0	2.95	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-42C	105.99	107.60	1.61	1A	0.642704	20.1	27.7	1.38	Place underwater	Place underwater	1.38	Place underwater	Place underwater	Place underwater
T96R-42C	107.60	107.75	0.15	Coal Cleaning										
T96R-42C	107.75	108.12	0.37	1 Seam	2.03198	63.5	8.84	0.14			COAL			
T96R-42C	108.120	108.270	0.15	Coal Cleaning					Place underwater	Place underwater	4.81	Place underwater	Place underwater	Place underwater
T96R-42C	108.270	110.16	1.89	6	0.754592	23.6	68.1	2.89						
T96R-42C	110.16	110.81	0.65	6	1.164848	36.4015	na	na						
T96R-42C	110.81	112.10	1.29	6	1.621724	50.68	32.17	0.63						
T96R-42C	112.10	115.00	2.90	6	0.241772	7.6	32.2	4.26	non-PAG	non-PAG			non-PAG	non-PAG
T96R-42C	115.00	115.69	0.69	6	0.036644	1	540	471.65	non-PAG	non-PAG			non-PAG	non-PAG
T96R-42C	115.69	116.69	1.00	6	0.223124	7.0	30.4	4.36	non-PAG	non-PAG			non-PAG	non-PAG
T96R-42C	116.69	116.77	0.08	6	0.045968	1	74	51.76	non-PAG	non-PAG			non-PAG	non-PAG
T96R-42C	116.77	117.30	0.53	6	0.763916	23.872375	na	na	Blend into surrounding units	Blend into surrounding units			Blend into surrounding units	Blend into surrounding units
T96R-54C	7.23	11.01	3.78	1	0.58676	18.3	110.2	6.01	non-PAG	non-PAG	4.70	non-PAG	non-PAG	non-PAG
T96R-54C	11.01	16.43	5.42	1	0.512168	16.0	61.8	3.86	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-54C	16.43	17.94	1.51	1	0.596084	18.6	75.2	4.04	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-54C	17.94	22.90	4.96	1	0.372308	11.6	57.3	4.92	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-54C	22.90	30.83	7.93	1	0.223124	7.0	66	9.50	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-54C	30.83	35.66	4.83	1	0.157856	5	58	11.80	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-54C	35.66	41.50	5.84	1	0.269744	8.4	48.3	5.73	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-54C	41.50	45.56	4.06	1	0.456224	14.3	25.9	1.82	non-PAG	non-PAG		Blend into surrounding units	Blend into surrounding units	Blend into surrounding units
T96R-54C	45.56	50.39	4.83	1	0.857156	26.8	57.3	2.14	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-54C	50.39	51.15	0.76	1A	1.304708	40.77	29.48	0.72	Place underwater	Place underwater	0.48	Place underwater	Place underwater	Place underwater
T96R-54C	51.15	53.40	2.25	1A	1.696316	53.0	59.1	1.11						
T96R-54C	53.40	53.83	0.43	1A	2.507504	78.36	32.17	0.41						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-54C	53.83	57.52	3.69	1A	2.749928	85.94	21.4	0.25						
T96R-54C	57.52	57.67	0.15	1A	4.279064	133.721	2.554	0.02						
T96R-54C	57.67	58.11	0.44	2	0.894452	27.95	16.91	0.61	Place underwater	Place underwater	1.11	Place underwater	Place underwater	Place underwater
T96R-54C	58.11	58.44	0.33	2	3.19748	99.92	8.84	0.09						
T96R-54C	58.44	61.40	2.96	3	0.829184	25.9	42.0	1.62						
T96R-54C	61.40	61.55	0.15	Coal Cleaning										
T96R-54C	61.55	63.23	1.68	C Seam	2.069276	64.664875	na	na			COAL			
T96R-54C	63.230	63.380	0.15	Coal Cleaning					Place underwater	Place underwater	1.34	Place underwater	Place underwater	Place underwater
T96R-54C	63.380	71.29	7.91	4	0.68	21.3	28.6	1.34	Non-PAG					
T96R-54C	71.29	71.61	0.32	4	3.542468	110.70213	na	1.00	Place underwater					
T96R-54C	71.61	76.45	4.84	5	1.509836	47.18	41.1	0.87	Place underwater	Place underwater	0.87	Place underwater	Place underwater	Place underwater
T96R-54C	76.45	76.60	0.15	Coal Cleaning										
T96R-54C	76.60	78.25	1.65	1U Seam	3.113564	97.298875	na	na			COAL			
T96R-54C	78.25	78.60	0.35	55	1.509836	47.18	41.1	0.87	Place underwater	Place underwater	0.87	Place underwater	Place underwater	Place underwater
T96R-54C	78.60	82.40	3.80	1L Seam	0.409604	12.800125	na	na			COAL			
T96R-54C	82.400	82.550	0.15	Coal Cleaning					Place underwater	Place underwater	8.70	Place underwater	Place underwater	Place underwater
T96R-54C	82.550	84.14	1.59	6	1.09958	34.4	49.2	1.43	Blend internally into non-PAG	Blend internally into non-PAG			Blend internally into non-PAG	Blend internally into non-PAG
T96R-54C	84.14	85.05	0.91	6	2.134544	66.7045	na	na						
T96R-54C	85.05	88.49	3.44	6	0.129884	4.1	41	10.14						
T96R-54C	88.49	90.54	2.05	6	0.045968	1	196	136.72						
T96R-56C	12.50	19.47	6.97	1	0.735944	23.0	15.12	0.66	Place underwater	Place underwater	2.81	Place underwater	Place underwater	Place underwater
T96R-56C	19.47	23.47	4.00	1	0.502844	15.7	51.9	3.30						
T96R-56C	23.47	24.56	1.09	1	0.969044	30.28	14.22	0.47						
T96R-56C	24.56	24.92	0.36	1	2.21846	69.33	32.17	0.46						
T96R-56C	24.92	25.42	0.50	1	1.491188	46.6	3.45	0.07						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-56C	25.42	27.04	1.62	1	0.642704	20.08	14.22	0.71						
T96R-56C	27.04	27.80	0.76	1	1.649696	51.55	46.5	0.90						
T96R-56C	27.80	29.57	1.77	1	1.071608	33.49	20.5	0.61						
T96R-56C	29.57	36.42	6.85	1	0.381632	11.9	40.2	3.37	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-56C	36.42	38.65	2.23	1	0.670676	21.0	43.8	2.09	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-56C	38.65	39.47	0.82	1	0.763916	24	321	13.45	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-56C	39.47	43.97	4.50	1	0.885128	27.7	52.8	1.91	non-PAG	non-PAG		Blend into surrounding units	Blend into surrounding units	Blend into surrounding units
T96R-56C	43.97	44.86	0.89	1	0.30704	10	265	27.58	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-56C	44.86	50.95	6.09	1	0.698648	21.8	59.1	2.71	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-56C	50.95	57.09	6.14	1	0.35366	11.1	63.6	5.75	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-56C	57.09	60.34	3.25	1	0.2138	7	105	15.69	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-56C	60.34	63.80	3.46	2	0.16718	5	58	11.14	non-PAG	non-PAG			non-PAG	non-PAG
T96R-56C	63.80	65.71	1.91	2	0.568112	17.8	26.8	1.51	non-PAG	Blend into surrounding units	4.99	Place underwater	Blend into surrounding units	Blend into surrounding units
T96R-56C	65.71	66.22	0.51	2	0.652028	20.4	115.6	5.67	non-PAG	non-PAG			non-PAG	non-PAG
T96R-56C	66.22	69.09	2.87	4	1.024988	32.03	26.78	0.84	Place underwater	Place underwater	0.82	Place underwater	Place underwater	Place underwater
T96R-56C	69.09	69.23	0.14	4	1.3793	43.1	26.78	0.62						
T96R-56C	69.23	71.88	2.65	5	0.987692	30.87	26.8	0.87	Place Underwater	Place Underwater	0.66	Place Underwater	Place Underwater	Place Underwater
T96R-56C	71.88	74.44	2.56	5	1.397948	43.69	24.99	0.57						
T96R-56C	74.44	74.79	0.35	5	2.414264	75.45	29.48	0.39						
T96R-56C	74.79	74.94	0.15	Coal Cleaning										
T96R-56C	74.94	76.71	1.77	1U Seam	1.994684	62.333875	na	na			COAL			
T96R-56C	76.710	76.860	0.15	Coal Cleaning					Place underwater	Place underwater	0.39	Place underwater	Place underwater	Place underwater
T96R-56C	76.860	77.27	0.41	55	2.414264	75.45	29.48	0.39						
T96R-56C	77.12	77.27	0.15	Coal Cleaning										

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-56C	77.27	78.89	1.62	1L Seam	0.63338	19.793125	na	na			COAL			
T96R-56C	78.89	79.18	0.29	1L Seam	2.414264	75.45	29.48	0.39						
T96R-56C	79.18	82.63	3.45	1L Seam	0.661352	20.66725	na	na						
T96R-56C	82.630	82.780	0.15	Coal Cleaning					Place underwater	Place underwater	1.11	Place underwater	Place underwater	Place underwater
T96R-56C	82.780	82.87	0.09	6	0.129884	4.1	5.2	1.29						
T96R-56C	82.87	85.52	2.65	6	2.395616	74.86	42.04	0.56						
T96R-56C	85.52	86.18	0.66	6	3.169508	99.047125	na	na						
T96R-56C	86.18	86.48	0.30	6	0.372308	11.6	50.1	4.31						
T96R-56C	86.48	87.68	1.20	6	1.416596	44.3	130.0	2.94						
T96R-56C	87.68	88.13	0.45	6	2.40494	75.154375	na	na						
T96R-65C	18.90	21.12	2.22	1	0.502844	15.7	51.0	3.25	non-PAG	non-PAG	4.75	non-PAG	non-PAG	non-PAG
T96R-65C	21.12	27.56	6.44	1	0.689324	21.5	60.9	2.83	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-65C	27.56	36.00	8.44	1	0.297716	9.3	66.3	7.12	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-65C	36.00	44.16	8.16	1	0.204476	6.4	46.5	7.28	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-65C	44.16	48.83	4.67	2	0.335012	10.5	52.8	5.04	non-PAG	non-PAG	1.20	Place underwater	non-PAG	non-PAG
T96R-65C	48.83	51.90	3.07	3	0.847832	26.5	28.6	1.08	Place underwater	Place underwater			Place underwater	Place underwater
T96R-65C	51.90	53.20	1.30	3	1.127552	35.24	26.78	0.76						
T96R-65C	53.20	54.14	0.94	3	1.314032	41.06	28.58	0.70						
T96R-65C	54.14	55.96	1.82	3	1.677668	52.43	25.89	0.49						
T96R-65C	55.96	56.46	0.50	3	3.141536	98.17	25.89	0.26						
T96R-65C	56.46	60.23	3.77	3	0.829184	25.9	27.7	1.07						
T96R-65C	60.23	61.83	1.60	3	1.080932	33.8	32.2	0.95						
T96R-65C	61.83	61.98	0.15	Coal Cleaning										
T96R-65C	61.98	64.09	2.11	C Seam	1.6124	50.3875	na	na			COAL			
T96R-65C	64.090	64.240	0.15	Coal Cleaning					Place underwater	Place underwater	3.92	Place underwater	Place underwater	Place underwater
T96R-65C	64.24	65.72	1.48	4	0.409604	12.8	41.1	3.21	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-65C	65.72	75.14	9.42	4	0.35366	11.1	44.7	4.05	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-65C	75.14	83.23	8.09	5	0.829184	25.9	48.3	1.86	non-PAG	non-PAG	1.86	Place underwater	Place underwater	Place underwater
T96R-65C	83.23	83.38	0.15	Coal Cleaning					Place underwater	Place underwater				
T96R-65C	83.38	86.32	2.94	1U Seam	1.481864	46.30825	na	na			COAL			
T96R-65C	86.32	86.48	0.16	Coal Cleaning	0.829184	25.9	48.3	1.86	Place underwater	Place underwater	1.86	Place underwater	Place underwater	Place underwater
T96R-65C	86.48	92.34	5.86	1L Seam	0.642704	20.0845	na	na			COAL			
T96R-65C	92.340	92.490	0.15	Coal Cleaning					Place underwater	Place underwater	3.09	Place underwater	Place underwater	Place underwater
T96R-65C	92.490	93.11	0.62	6	2.0786	64.96	33.07	0.51	Blend into surrounding units	Blend into surrounding units			Blend into surrounding units	Blend into surrounding units
T96R-65C	93.11	94.51	1.40	6	0.530816	16.6	63.6	3.83	non-PAG	non-PAG			non-PAG	non-PAG
T96R-65C	94.51	96.39	1.88	6	0.223124	7	404	57.90	non-PAG	non-PAG			non-PAG	non-PAG
T96R-65C	96.39	98.86	2.47	6	0.838508	26.2	74.3	2.84	non-PAG	non-PAG			non-PAG	non-PAG
T96R-65C	98.86	100.16	1.30	6	2.115896	66.12	56.4	0.85	Place underwater	Place underwater	3.09		Place underwater	Place underwater
T96R-65C	100.16	101.37	1.21	6	2.992352	93.51	24.99	0.27						
T96R-65C	101.37	102.51	1.14	6	1.509836	47.2	54.6	1.16						
T96R-96C	18.6	20.27	1.67	3	1.640372	51.26	12.43	0.24	Place underwater	Place underwater	0.24	Place underwater	Place underwater	Place underwater
T96R-96C	20.27	20.42	0.15	Coal Cleaning										
T96R-96C	20.42	20.95	0.53	C Seam	2.852492	89.140375	na	na			COAL			
T96R-96C	20.950	21.100	0.15	Coal Cleaning					Place underwater	Place underwater	0.27	Place underwater	Place underwater	Place underwater
T96R-96C	21.100	24.29	3.19	5	2.17184	67.87	11.53	0.17						
T96R-96C	24.29	27.37	3.08	5	1.360652	42.52	18.71	0.44						
T96R-96C	27.37	27.52	0.15	Coal Cleaning										
T96R-96C	27.52	30.74	3.22	1U Seam	3.113564	97.298875	na	na			COAL			
T96R-96C	30.740	30.890	0.15	Coal Cleaning					Place underwater	Place underwater	0.70	Place underwater	Place underwater	Place underwater
T96R-96C	30.890	31.68	0.79	55	0.484196	15.13	10.63	0.70						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-96C	31.68	31.83	0.15	Coal Cleaning										
T96R-96C	31.83	37.20	5.37	1L Seam	0.4469	13.965625	na	na			COAL			
T96R-96C	37.200	37.350	0.15	Coal Cleaning					Place underwater	Place underwater	0.61	Place underwater	Place underwater	Place underwater
T96R-96C	37.350	38.26	0.91	6	0.763916	23.9	53.7	2.25						
T96R-96C	38.26	38.82	0.56	6	1.836176	57.38	24.09	0.42						
T96R-96C	38.82	41.34	2.52	6	1.33268	41.65	16.91	0.41						
T96R-96C	41.34	41.76	0.42	6	2.004008	62.63	17.81	0.28						
T96R-96C	41.76	44.05	2.29	6	1.714964	53.592625	na	na						
T96R-96C	44.05	46.33	2.28	6	0.381632	11.9	26.8	2.25						
T96R-96C	46.33	46.65	0.32	6	2.796548	87.39	24.99	0.29						
T96R-132C	2.40	3.93	1.53	4	0.111236	3	63	18.03	non-PAG	non-PAG	12.87	non-PAG	non-PAG	non-PAG
T96R-132C	3.93	4.64	0.71	4	0.223124	7.0	51.0	7.32	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T96R-132C	4.64	9.03	4.39	5	0.624056	19.5	48.3	2.48	non-PAG	non-PAG	2.48	Place underwater	non-PAG	non-PAG
T96R-132C	9.03	9.18	0.15	Coal Cleaning					Place underwater	Place underwater			Place underwater	Place underwater
T96R-132C	9.18	9.59	0.41	1U Seam	2.45156	76.61125	na	na			COAL			
T96R-132C	9.59	9.74	0.15	Coal Cleaning					Place underwater	Place underwater	0.32	Place underwater	Place underwater	Place underwater
T96R-132C	9.74	10.96	1.22	55	4.08326	127.6	40.25	0.32						
T96R-132C	10.96	11.11	0.15	Coal Cleaning										
T96R-132C	11.11	11.74	0.63	1L Seam	8.801204	275.03763	na	na			COAL			
T96R-132C	11.74	11.88	0.14	1L Seam	10.42358	325.73688	na	na						
T96R-132C	11.88	14.74	2.86	1L Seam	1.183496	36.98425	na	na						
T96R-132C	14.740	14.890	0.15	Coal Cleaning					Place underwater	Place underwater	2.10	Place underwater	Place underwater	Place underwater
T96R-132C	14.890	15.1	0.21	Coal Cleaning	1.062284	33.2	14.22	0.43						
T96R-132C	15.10	20.65	5.55	6	0.456224	14.3	47.4	3.33						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T96R-132C	20.65	21.93	1.28	6	0.922424	28.83	15.12	0.52	Blend internally into non-PAG	Blend internally into non-PAG			Blend internally into non-PAG	Blend internally into non-PAG
T96R-132C	21.93	22.34	0.41	6	2.73128	85.35	20.5	0.24						
T96R-132C	22.34	24.88	2.54	6	0.129884	4.1	23.2	5.71						
T97R-95C	1.00	2.03	1.03	4	1.295384	40.48	13.32	0.33	Blend internally into non-PAG	Place underwater	1.46	Place underwater	Place underwater	Place underwater
T97R-95C	2.03	2.81	0.78	4	0.605408	18.9	41.1	2.17						
T97R-95C	2.81	3.9	1.09	4	0.428252	13.4	52.8	3.95						
T97R-95C	3.9	4.17	0.27	4	3.533144	110.41075	na	na						
T97R-95C	4.17	5.66	1.49	5	1.043636	32.6	40.2	1.23	non-PAG	Place underwater	1.41	Place underwater	Place underwater	Place underwater
T97R-95C	5.66	5.89	0.23	5	0.512168	16.0	50.1	3.13	non-PAG					
T97R-95C	5.89	6.33	0.44	5	0.782564	24.5	39.3	1.61	non-PAG					
T97R-95C	6.33	6.48	0.15	Coal Cleaning					Place underwater					
T97R-95C	6.48	8.05	1.57	1U Seam	1.864148	58.254625	na	na			COAL			
T97R-95C	8.050	8.200	0.15	Coal Cleaning					Place underwater	Place underwater	9.99	Place underwater		Place underwater
T97R-95C	8.200	8.200	0	55	0.652028	20.4	18.7	0.92						
T97R-95C	8.200	8.93	0.73	55	0.101912	3	56	17.71						
T97R-95C	8.93	9.69	0.76	55	0.129884	4.1	17.8	4.39						
T97R-95C	9.69	11.05	1.36	55	0.139208	4.4	43	9.87						
T97R-95C	11.05	11.20	0.15	Coal Cleaning										
T97R-95C	11.2	13.72	2.52	1L Seam	0.437576	13.67425	na	na			COAL			
T97R-95C	13.720	13.870	0.15	Coal Cleaning					Place underwater	Place underwater	0.94	Place underwater	Place underwater	Place underwater
T97R-95C	13.870	14.23	0.36	6	0.12056	3.8	18.7	4.97						
T97R-95C	14.23	15.35	1.12	6	0.521492	16.296625	na	na						
T97R-95C	15.35	16.14	0.79	6	1.230116	38.44	27.68	0.72						
T97R-95C	16.14	16.4	0.26	6	1.640372	51.261625	na	na						
T97R-95C	16.40	17.11	0.71	6	1.024988	32.0	32.2	1.00						
T97R-95C	17.11	17.67	0.56	6	1.314032	41.0635	na	na						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T97R-100C	3	5.98	2.98	1	0.30704	9.6	51.9	5.41	non-PAG	non-PAG	8.85	non-PAG	non-PAG	non-PAG
T97R-100C	5.98	6.58	0.6	1	0.129884	4	376	92.61	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T97R-100C	6.58	8.53	1.95	1	0.269744	8.4	56.4	6.69	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T97R-100C	8.53	12	3.47	1	0.251096	7.8	49.2	6.27	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T97R-100C	12	14.49	2.49	2	0.223124	7.0	55.5	7.96	non-PAG	non-PAG	10.11	Place underwater	non-PAG	non-PAG
T97R-100C	14.49	14.72	0.23	2	0.07394	2	270	116.84	non-PAG	non-PAG			non-PAG	non-PAG
T97R-100C	14.72	20.33	5.61	3	0.195152	6.1	58	9.54	non-PAG	non-PAG			non-PAG	non-PAG
T97R-100C	20.33	23.42	3.09	4	0.409604	12.8	54.6	4.27	non-PAG	non-PAG	4.07	non-PAG	non-PAG	non-PAG
T97R-100C	23.42	26.71	3.29	4	0.390956	12.2	47.4	3.88	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T97R-100C	26.71	30.70	3.99	5	0.86648	27.1	50.1	1.85	non-PAG	non-PAG	1.85	Place underwater	Place underwater	Place underwater
T97R-100C	30.70	30.85	0.15	Coal Cleaning					Place underwater	Place underwater				
T97R-100C	30.85	31.41	0.56	1U Seam	3.094916	96.716	0.759	0.01			COAL			
T97R-100C	31.41	31.59	0.18	Parting	1.155524	36.11	30.37	0.84	Place underwater	Place underwater	0.84	Place underwater	Place underwater	Place underwater
T97R-100C	31.59	33.62	2.03	1U Seam	0.829184	25.91	2.55	0.10			COAL			
T97R-100C	33.62	34.92	1.3	1U Seam	0.661352	20.67	7.94	0.38						
T97R-100C	34.92	35.24	0.32	1U Seam	0.81986	25.62	4.35	0.17						
T97R-100C	35.24	35.71	0.47	55	1.836176	57.38	14.22	0.25	Place underwater	Place underwater	0.25	Place underwater	Place underwater	Place underwater
T97R-100C	35.71	36.73	1.02	1L Seam	1.248764	39.02	30.37	0.78			COAL			
T97R-100C	36.730	36.880	0.15	Coal Cleaning					Place underwater	Place underwater	10.04	Place underwater	Place underwater	Place underwater
T97R-100C	36.880	38.32	1.44	6	0.139208	4.4	26.8	6.16	non-PAG	non-PAG			non-PAG	non-PAG
T97R-100C	38.32	39.1	0.78	6	0.036644	1	49	42.98	non-PAG	non-PAG			non-PAG	non-PAG
T97R-100C	39.1	42.68	3.58	6	0.045968	1	57	39.89	non-PAG	non-PAG			non-PAG	non-PAG
T97R-100C	42.68	46.00	3.32	6	0.26042	8.1	34.0	4.17	non-PAG	non-PAG			non-PAG	non-PAG
T97R-108C	28.2	32.5	4.3	1	0.418928	13.1	25.9	1.98	non-PAG	non-PAG	4.37	non-PAG	non-PAG	non-PAG
T97R-108C	32.5	32.74	0.24	1	0.195152	6	587	96.21	non-PAG	non-PAG		non-PAG	non-PAG	non-PAG
T97R-108C	32.74	39.52	6.78	2	1.416596	44.27	16.91	0.38		Place underwater	0.32	Place underwater		

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T97R-108C	39.52	45.53	6.01	3	1.742936	54.47	16.91	0.31	Place underwater				Place underwater	Place underwater
T97R-108C	45.53	46.45	0.92	3	3.262748	101.96	13.32	0.13						
T97R-108C	46.45	46.60	0.15	Coal Cleaning										
T97R-108C	46.6	47.98	1.38	C Seam	1.015664	31.74	5.25	0.17			COAL			
T97R-108C	47.980	48.130	0.15	Coal Cleaning					Place underwater	Place underwater	0.65	Place underwater	Place underwater	Place underwater
T97R-108C	48.130	51.38	3.25	4	0.875804	27.37	16.02	0.59						
T97R-108C	51.38	55.65	4.27	4	0.512168	16.0	14.2	0.89						
T97R-108C	55.65	56.61	0.96	4	0.568112	17.75	14.2	0.80						
T97R-108C	56.61	56.91	0.3	4	2.0786	64.956	1.657	0.03						
T97R-108C	56.91	57.92	1.01	5	1.23944	38.7	37.6	0.97	Place underwater	Place underwater	0.35	Place underwater		Place underwater
T97R-108C	57.92	61.18	3.26	5	1.640372	51.26	10.63	0.21						
T97R-108C	61.18	61.90	0.72	5	1.342004	41.94	13.32	0.32						
T97R-108C	61.90	62.05	0.15	Coal Cleaning										
T97R-108C	62.05	64.57	2.52	1U Seam	1.42592	44.56	na	na			COAL			
T97R-108C	64.57	64.72	0.15	Coal Cleaning					Place underwater	Place underwater	3.87	Place underwater	Place underwater	Place underwater
T97R-108C	64.72	65.57	0.85	55	0.2138	6.7	25.9	3.87						
T97R-108C	65.57	65.72	0.15	Coal Cleaning										
T97R-108C	65.72	70.20	4.48	1L Seam	0.325688	10.17775	na	na			COAL			
T97R-108C	70.200	70.350	0.15	Coal Cleaning					Place underwater	Place underwater	0.98	Place underwater	Place underwater	Place underwater
T97R-108C	70.350	70.7	0.35	6	0.223124	6.97	5.2	0.75						
T97R-108C	70.7	73.50	2.8	6	1.118228	34.94	15.12	0.43						
T97R-108C	73.5	73.9	0.4	6	4.36298	136.34	81.53	0.60						
T97R-108C	73.9	74.26	0.36	6	0.148532	5	345	74.41						
T97R-108C	74.26	74.48	0.22	6	2.63804	82.439	2.554	0.03						
T97R-108C	74.48	75.3	0.82	6	2.237108	69.91	33.07	0.47						

Appendix J. Tenas Project Minig Material Management based on NPRs of 1.20, 1.80, and 2.0

Hole-ID	Sample Depth and thickness (m)			ABA Zones	ARD Inputs				Mining Plan at NPR of 1.20	Mining Plan at NPR of 1.80	NPR	EAC Application Plan	Mining Plan at NPR of 1.60	Mining Plan at NPR of 2.0
	From	To	Thick		Sulfide	AP	NP	NPR						
T97R-108C	75.3	75.87	0.57	6	0.49352	15.42	1.66	0.11						
T97R-108C	75.87	77.1	1.23	6	0.77324	24.2	27.7	1.15						

APPENDIX 16: TELKWA COAL TENAS PROJECT ENVIRONMENTAL ASSESSMENT APPLICATION – RESPONSES TO 2022 SUPPLEMENTAL GEOCHEMISTRY INFORMATION REQUESTS FROM THE MINISTRY OF ENERGY, MINES AND LOW CARBON INNOVATION, SRK

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FINAL

Technical Memo

To	Dan Farmer	**Client**	Telkwa Mining Limited
From	Michael Herrell, SRK Celine Michels, SRK Stephen Day, SRK	**Project**	CAPR002055
		Date	January 29, 2026
Subject	Telkwa Coal Tenas Project Environmental Assessment Application – Responses to 2022 Supplemental Geochemistry Information Requests from the Ministry of Energy Mines and Lower Carbon Innovation		

File name: TML_IR_Geochemistry_round2_responses_CAPR002055_20260129.docx

1 Introduction

This memorandum delivers SRK's responses to the Ministry of Energy, Mines and Lower Carbon Innovation (EMLI) subsequent information requests related to the Tenas project Environmental Assessment Certificate (EAC) application, submitted in May 2022.

2 Responses

2.1 Follow-up to Comment 136

Comment: Indicate what additional sampling and characterization studies are planned to meet sample frequency and representivity from BC ML/ARD Guidelines. For instance, Zone 4 is underrepresented in the static test database.

Response: It is unclear what is meant by "sample frequency and representivity from the BC ML/ARD Guidelines". Sampling of the rock has been designed to meet the specific requirements of the Project and the use of generic guidance is not appropriate. Additional samples will be collected as part of operational monitoring and confirmatory testing during blasting to inform the specific purpose of rock management. Details of the operational monitoring are provided in SRK (2025). This testing should address any concerns related to sample numbers collected from Zone 4.

2.2 Follow-up to Comments 140, 142, 143, 146 and 148

Comment: The ML/ARD Management Plan Section 6.4 specifies that all materials excavated from zones 1a and 2/3 will be managed as PAG. Material from zones 5, 55 and 6 were characterized as non-PAG but will be initially classified and managed as PAG unless testing can demonstrate otherwise. To facilitate the shorter turnaround times that are required to make operational decisions for placement of blasted rock, rejects and other materials, the results of the geochemical characterization are used to develop operational proxies for determining NP and AP in an onsite laboratory that will be equipped with a Leco furnace. Section 6.1.3 of the ML/ARD Management Plan specifies an average weighted NPR of 1.2 is proposed to classify PAG mine rock at the Project.

1. Provide clarifications and justifications for the proposed ML ARD management plan and use of weighed average NPR 1.2 and 2 criteria as cutoff for verification and planning purposes.
2. Clarify what NPR criterion of 1.2 or 2 will be applied to manage waste material from zones 5, 55, and 6 and define them as non-PAG or PAG.
3. Based on responses to comments EMLI 140, 142, 143 and 146 indicate if updates to the proposed Metal Leaching (ML) Acid Rock Drainage (ARD) management plan are needed to address blending of material.
4. Provide contingencies in the waste management plan or mine plan to maintain a consistent water cover and to coordinate staged flooding and PAG placement.

Response: Responses to questions 1 to 4 follow:

1. The neutralization potential ratio (NPR) used to identify material as PAG or non-PAG evolved as supplemental geochemical information became available for the Project. An NPR cut-off of 3.0 was initially selected for the Project until it could be determined that carbonate minerals were the minerals representing the bulk of the neutralization potential (NP). This was evidenced through a strong correlation of calcium plus magnesium in equivalent units (i.e., kg CaCO3/t) to the NP measured using the modified-NP method (Figure 2-1), which is designed to measure the amount of NP present in the fast neutralizing carbonate minerals (e.g., calcite and dolomite) and the most reactive silicate minerals (MEND 2009). Based on the static test work completed for the Project the NPR cut-off was then reduced to 2.0

   The NPR derived based on static geochemical tests does not account for reaction kinetics and represents a theoretical value derived from pyrite oxidation and carbonate dissolution stoichiometry. A humidity cell testing (HCT) program was initiated during the supplemental baseline characterization study. The carbonate molar ratios (CMR) in HCT can be used to estimate a site-specific NPR because it is a measure of the sulfide oxidation rates and carbonate dissolution rates prior to acid formation. The MEND (2009) prediction manual states “Humidity cell estimates of the relative rates of acidity production and NP consumption should be used to improve the estimates of the likelihood of ARD based on the ABA criteria for NPR. For example, if kinetic tests produce a stable carbonate molar ratio of 1.75 NP: AP consumption at non-acidic pH, then samples with NPR values less than 1.75 should be considered net acid generating (Table 18.2)”

The CMR is an empirical way of estimating the minimum NPR that can be used to distinguish PAG and non-PAG rock (MEND 2009) and can be used as a predictive tool to estimate lag times to the onset of acid generation in samples without kinetic data. As discussed in the response to EMLI comment 142, CMR vs. sulfate production rates follows an asymptotical curve that flattens at higher sulfate production rates (Figure 2-2) because at lower sulfate production rates carbonate dissolution is driven by carbonic acid which is artificially accelerated in humidity cells but at higher sulphate production rates sulphuric acid becomes the dominant source of acidity. The ratio in the flattening part of the curve shows the NPR required to neutralize sulfuric acid. CMRs calculated based on the HCT for the Tenas Project flatten at approximately 1.20 (Figure 2-2) and identifies the site-specific NPR for the Project.

TML has opted to continue to use the more conservative NPR criterion of 2.0 as a cutoff versus the site-specific value of 1.20 to identify exploration drillhole and blasthole rock as PAG (NPR<2) and non-PAG (NPR>=2) which was based on the static data collected for the Project. This criterion was selected to ensure that TML were overpredicting the amount of PAG rock that must be stored for dam design and stability analysis, liner design, and to ensure sufficient equipment was available for PAG rock handling. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, a revision to this NPR criterion will be requested. Furthermore, even if the NPR criterion of 2.0 is used for permitting it will be continued to be reviewed during the Operation phase as additional operational monitoring information is gathered to determine if a less conservative criterion is justified.

Mine planning and design and regulatory submissions advanced using an NPR cut-off of 2.0 based on the supporting static geochemical testing prior to completion of the HCT program and development of the site-specific NPR.

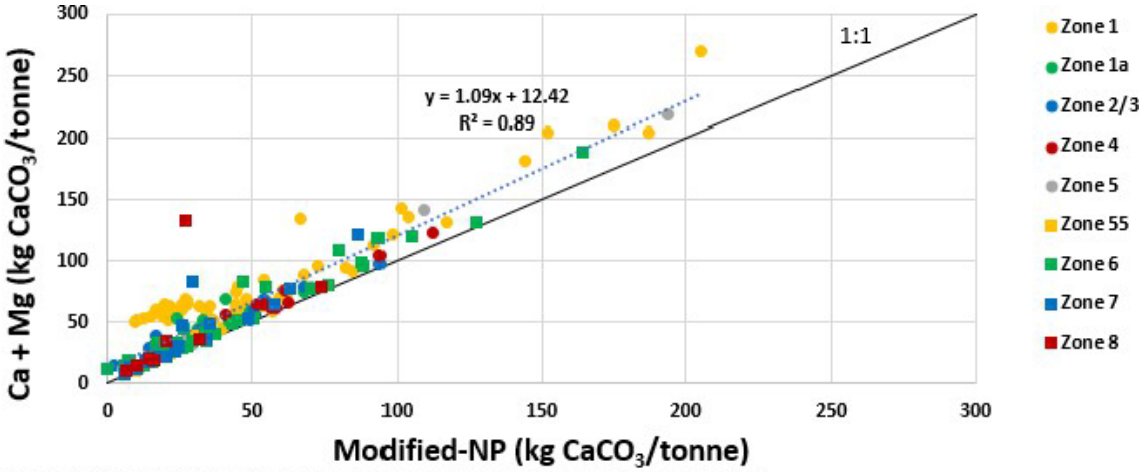
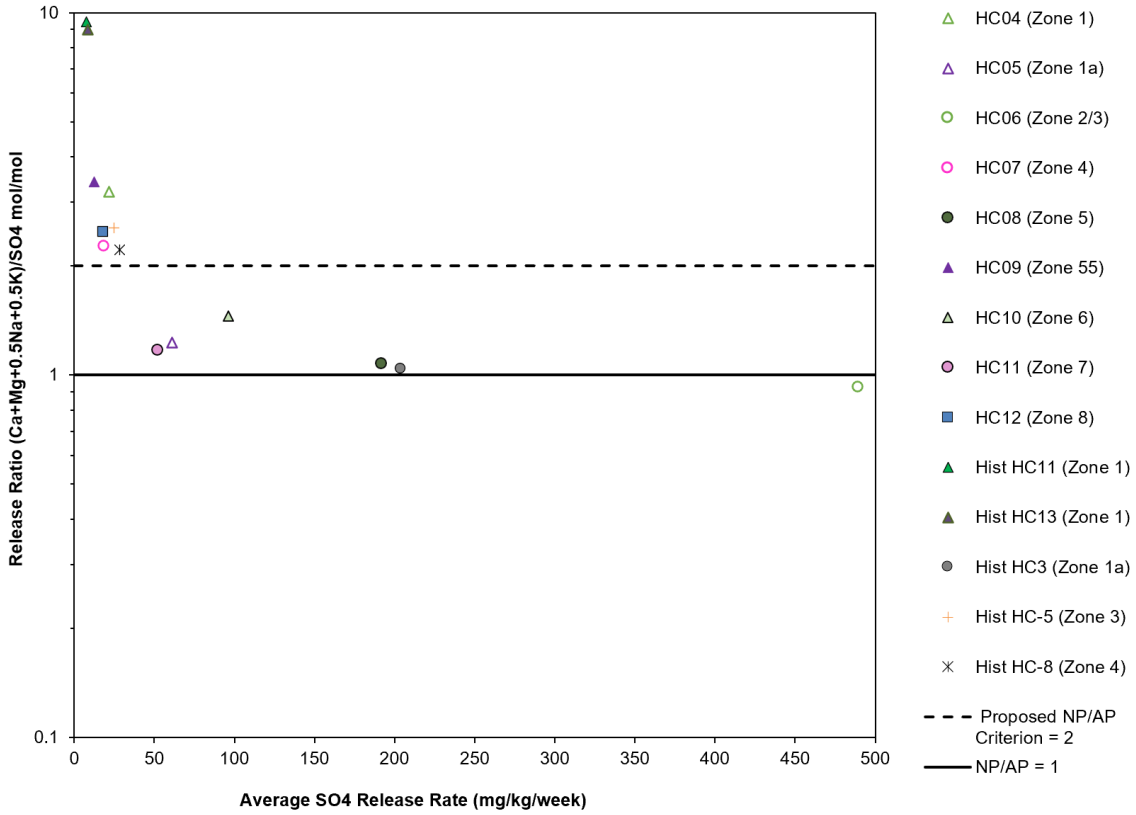


Figure 2-1 Modified-NP vs. Calcium + Magnesium



https://srk.sharepoint.com/sites/NA1CT027.002/Internal/0100 MLARD/020 Reinterpretation of Kinetic Test Database/06_NPR Crit Evaluation/[NPR_Crit_1CT027.002_JED_MKH_Rev00.xlsx]

Figure 2-2 Carbonate Molar Ratio vs. Sulfate Production Rate

2. An NPR criterion of 1.20 was previously used to characterize the bulk properties of zones 5, 55 and 6 and these zones were characterized as non-PAG based on their bulk properties in the initial ML/ARD Management Plan (SRK 2025). However, as noted above, TML has opted to continue to use the more conservative NPR criterion of 2.0 versus the site-specific value of 1.20 as a cutoff to identify exploration drillhole and blasthole rock as PAG and non-PAG until additional information is gathered to determine if a less conservative criterion is justified. Use of the criterion of 2.0 will change the geochemical classification of zones 5, 55, and 6 to PAG.. Despite the non-PAG classification of these zones in the initial ML/ARD Management Plan, they were managed as PAG in mine planning and the EAC application (i.e., the change in PAG classification using an NPR of 2 versus 1.20 does not result in a change to the mine plan or the EAC application). The ML/ARD Management Plan has been updated to include the NPR cut-off of 2.

   Telkwa Mining is not planning on undertaking any active blending of PAG and non-PAG materials to obtain the selected segregation NPR criterion of 2.0 or 1.20. Mixing of rock will occur naturally during excavation at the dig face and through the blasting process. To determine the NPR resulting

from this mixing, TML will sample blasthole chips during drilling as part of the operational geochemical testing program. The samples will be a composite of the rock over the blasthole interval.

3. The ML/ARD management plan has been updated to reflect that Telkwa Mining will be using an NPR cut off 2.0 with materials having an NPR less than 2.0 being designated as PAG and materials having an NPR greater than or equal to 2.0 being designated as non-PAG. The updated ML/ARD management plan has been provided in Appendix A.
4. Three management ponds have been designed to store PAG materials sub-aqueously, becoming operational sequentially throughout the life of mine and continuing to provide a water cover in closure and Post-closure phases for the PAG material. Details about the design of the Management Ponds is described in the Water Management Technical Design Report (SRK 2022a).

The following contingencies in the water management plan (Annex C - Water Management Technical Design Report, SRK 2022a) have been made to maintain a consistent water cover:

- Management and Control Ponds are lined with engineered liners and therefore designed to reduce groundwater seepage to the receiving environment.
- Management Ponds are constructed sequentially throughout the life of mine to allow for any PAG to be stored immediately sub-aqueously.
- Water covers have been projected to be maintained under extreme dry (1/10 and 1/100 year dry), and projected climate change conditions through water balance modelling (SRK, 2022b).
- Active flooding of a management pond is happening as PAG materials including processed rock are placed in Management Ponds, with water level controls in place to ensure saturation of PAG layer within an average of six months of PAG placement.
- Pump systems exists between Tenas Control Pond and open pit and the management ponds to always ensure sufficient water cover.
- The management ponds passively fill with water from upland run-off without the need for any pumping as the open pit fills with water during post-Closure.
- In the Management Ponds, the PAG and Processed rock materials will be covered with non-PAG material (approximately 1.5m) and overburden/topsoil (0.5 to 1.0m) upon closure of each facility. The non-PAG rock and overburden will also be flooded until the final water cover is 2.0 meters above PAG materials. This also reduces evaporation compared to an open water pond and prevents the turnover water due to wind.
- Spillways discharge naturally from West and East MPs to North MP, and from North to Tenas Control Ponds (no pumps needed), and spillways were designed above the non-PAG and overburden cover of approximately 2.0 meters.
- Management Ponds will be reclaimed at the end of operations with soil covers and vegetation to limit further evaporation, effectively reducing evaporation by 25% over an open-water body pond (Annex C - Water Management Technical Design Report, SRK 2022a).

- The Water and Load Balance model tested whether the water cover can be maintained under a range of climate conditions (stochastic climate, dry years). Specifically successive dry conditions are tested during the most water intensive years to see if water cover could be maintained (result section in WLBM report – SRK 2022b). Furthermore, the Water and Load Balance model includes a correction factor for climate change to account for change to the current synthetic record for precipitation and temperature applied in the model.

Other contingencies included in the water management plan are as follows:

- The Tenas Control Pond has storage of up to 800,000 m3, which can flood up to 2.4 M bcm of PAG material per annum.
- Once the North Management Pond is complete it provides a further 1.5 m of water in addition to the Tenas Control Pond (on average 150,000 m3) that can be pumped to the East and West Management Ponds while still maintaining at least a 0.5 m water cover to saturate PAG materials.
- This water contingency further increases once both the North and East Management Ponds are completed as both have a 1.5-m lift of water (on average 500,000 m3) in addition to the Tenas Control Pond while still maintaining at least a 0.5 m water cover to help saturate PAG materials being placed in the West Management Pond.
- The Project has included a further contingency of having access to 2.5% of the mean monthly flow values of Goathorn Creek in any given year which provides another 1.0 million cubic meters of water to help flood PAG material in any given year, if necessary to pump to maintain water cover in the Management Ponds.
- The actual water requirements of the operation have included a safety factor at 180,000 m3 per annum to provide an additional contingency of 50,000 m3 of water per year to flood PAG materials.
- Furthermore, water can be diverted from the C02 diversion channel that routes water to Four Creek to route water to the North, East and/or Tenas Control Pond to provide yet another 0.50 million cubic meters of water annually to help flood PAG material in any given year.
- Precipitation levels have been underestimated by about 22% in the EAC application versus the Final EAC Project Case (2024) based on further monitoring completed over the past 4 years for the Project which will provide additional water to submerge PAG material.
- Lastly water from the East and West Sedimentation ponds in the Goathorn Creek Valley can be pumped to the management ponds if further water is required up to 150,000 m3 per annum until these sedimentation ponds are reclaimed.

Contingencies included in the mine plan or waste management plan (SRK 2022a) are as follows:

- A swell factor of 30% was used for PAG rock and 15% used for processed rock streams has been used in the EAC application, both of which are conservatively estimated given the bottom-up methodology of placing rock lifts, lift thickness used, and compaction that will be incorporated into the actual placement of PAG materials. Reducing these swell values will require even less water to saturate them with 20% for PAG rock and 10% for processed rock streams being the expected swell factors for these materials. Furthermore, this will provide additional contingency of the active embankment above PAG placement elevations.

- The management dam elevations can be raised by approximately 2 meters above current EAC application design elevation and still provide a working width large enough for construction equipment if required which will allow for another 5% of the PAG rock present in the EA open pit to be submerged underwater.
- Finally, PAG material mining can be reduced if needed to reduce flooding requirements in any given year.

More details about construction and schedule can be found in the Water Management Technical Design Report (SRK 2022a) and more details about results maintaining water cover under a range of climate conditions can be found in the Water and Load Balance model report (SRK 2022b).

2.3 Follow-up to Comment 140, 142, 143, 146 and 145

Comment:

1. To address overestimation of available NP, please specify the best-fit linear regression of the data in Figure 8 and do not fix the line through the origin. A review of Figure 8 of Appendix 1.0- M that illustrates the relationship between TIC-Fe Corrected and Modified NP also indicates that the Modified NP may on occasion overestimate available NP and as a result, revising the NPR criterion to the minimum NPR cut-off value of 1.2 may result in PAG rock being managed as Non-PAG rock.
    a. Provide a greater range of percentile values in Table 2-4 and provide discussion of how spatially extensive a full PAG interval would be encountered for each zone in the pit.

Regulatory Clarification provided via email from Morgan Dyas on February 9th, 2024

The request to "provide a discussion of how spatially extensive a full PAG interval would be encountered for each zone in the pit" is based on the implications stemming from the statement in Appendix 1.0 M (SRK, 2022) that a unit is NPAG based on an average NPR > 1.2. The characterization results indicate that the Tenas Project geologic units contain both PAG and NPAG strata. For example, more than 10 of the 20 boreholes that intersected Unit 5 have NPR < 1.2, thus over ½ of the strata in this unit is PAG. By stating that overall, a unit is NPAG implies that the mixing and blending associated with the standard mining procedures of a unit will prevent localized ARD from forming within a waste rock pile. To prevent localized ARD, published blending studies (Andrina, 2009; Mehling, 1998) indicate that blended quantities greater than 1:1 are required. This could not be achieved for Unit 5 without active management and may be difficult for units such as Unit 6 or Unit 7 that have median NPR of 1.7 and 1.6, respectively.

An understanding of the spatial distribution of PAG and NPAG within a stratigraphic unit would be required to allow effective blending to occur. The request to provide the spatial distribution of PAG strata was to determine if there is currently enough data to support that units designated as NPAG could actually be handled and placed as NPAG. Handling the entire zone for units 1a, 2/3, 5,55 and 6 as PAG and placing them in permanent flooded storage the average thickness and aerial map extent of each unit within the pit limits is adequate. However, if another type of PAG management is considered, more detailed characterization and identification of NPAG zones would be requested.

Information required for units 1 and 4 where NPAG is proposed to be segregated from PAG provide a map with average thickness and extent of the PAG and NPAG zones within the pit limits and show data points that were used to define the zones. This information would be helpful to inform additional characterization that may be required to allow segregation decisions to be made during permitting and/or operations.

Reference:

Andrina, J., 2009. Physical and Geochemical Behaviour of Mine Rock Stockpiles in High Rainfall Environments. A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Graduate Studies (Mining Engineering), the University of British Columbia.

Mehling, P. 1998. BLENDING AND LAYERING WASTE ROCK TO DELAY, MITIGATE OR PREVENT ACID ROCK DRAINAGE AND METAL LEACHING: A CASE STUDY REVIEW MEND Project 2.37.1 April 1998.

b. Propose a more conservative development of the Tenas mine rock NP designation and the ARD criterion of NP/AP = 1.2.

EMLI Clarification provided on April 18, 2024

The EMLI request is requesting the proponent to determine a more conservative approach to define PAG strata for the Tenas Project. The request is based on the individual IRs provided in the Round 2 EMLI Geoscience IRs 140, 142, 143 and 146. The request may be fulfilled by revising the approach to calculate available NP and/or revising the NP/AP criterion for PAG strata. It may be best summarized by point 3 of IR 143 outlined below.

EMLI understands that the average weighted NPR of 1.2 did not account for other factors that may affect the onset of ARD, such as blended PAG and non-PAG strata in an unsaturated embankment or pile. EMLI understands that the NPR cutoff of NPR = 1.2 did not account for other factors that may affect the onset of ARD, such as available NP. The proponent should therefore provide an extended evaluation of these other factors if they wish to apply for an average weighted NPR less than 2.0. Until this demonstration is done the Proponent should use a uniform approach based on NPR criterion of 2 to designate zoning of material as PAG or non-PAG and ensure their ML ARD management plan is updated accordingly.

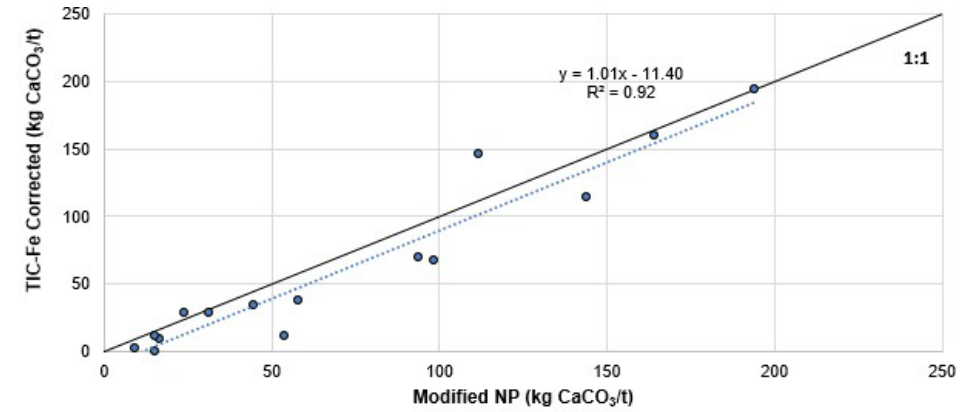
2. Conduct a geochemical characterization and monitoring program using methods to assess the ML potential.

    a. Specify what additional methods will be employed as part of the geochemical characterization the metal/contaminant leaching potential and duration at the expected pH of the material on the mine site.

3. Evaluate the metal/constituent leaching potential and duration at the expected pH from the samples already collected to characterize the overburden.

Response:

1. The requested adjusted Figure 8 from SRK (2022c) by not fixing the y-intercept is provided in Figure 2-1.



https://srk.sharepoint.com/sites/NA1CT027.002/Internal/0100 MLARD/030 Interpretation of Static Database/02_ResultsProcessing/[05_TenasXRD_1CT027.002_MKH_rev03.xlsx

Figure 2-1. Modified-NP versus TICFe-corrected

The results show there is a strong positive correlation (r=0.96) between the modified-NP and the TIC corrected for iron carbonates when the y-intercept is not fixed. When the y-axis is fixed to zero, a strong correlation (r=0.92) also occurs. The coefficient of correlation, near parity, supports that TIC corrected for iron carbonates can be used as a reasonable operational proxy to estimate the modified-NP. It is recognized that modified-NP exceeds the TICFe-corrected. This is common because the modified test will also target reactive silicate minerals that are present in the sample (MEND 2009). However, the relationship between modified NP and TICFe-corrected clearly shows that on average NP is nearly all provided by reactive calcium and magnesium carbonate minerals.

a. The update to Table 2-4 to include additional percentiles is provided in Table 2-1. The table has also been updated to include supplemental geochemical testing results from rock samples collected in 2019.

b. TML will use an NPR of 2.0 as the site-specific segregation criterion. This is more conservative since the geochemical testing results (SRK 2025) indicate an NPR of 1.2 can be used as a cut-off for segregating PAG and non-PAG rock.

Table 2-1. Weighted NPR by Stratigraphic Zone (shaded cells indicate an NPR≤2)

Zone	Min	P5	P10	P25	P50	Average	P75	P90	P95	Max	n
1	1.7	1.98	2.57	2.9	4.4	3.1	4.8	5.7	6.6	8.8	19
1a	0.39	0.39	0.39	0.58	0.79	0.74	0.82	1.09	1.1	1.1	11
2/3	0.20	0.24	0.27	0.36	0.87	0.80	1.8	2.9	5.6	11	19
4 (PAG)	0.05	0.15	0.25	0.45	0.58	0.61	0.76	0.83	0.85	0.86	8
4 (non-PAG)	3.1	3.1	3.4	4.0	5.1	4.9	6.2	12.0	14	21	18
4	0.65	0.82	1.29	1.5	3.1	2.6	3.9	4.8	10	13	21
5	0.27	0.37	0.52	0.76	0.93	1.2	1.6	2.4	2.5	3.0	24
55	0.32	0.36	0.42	0.79	3.7	1.9	8.7	22.0	25	27	12
6	0.39	0.46	0.62	0.94	2.0	1.8	4.4	9.5	12	64	25
7	0.27	0.33	0.36	0.76	1.7	1.7	4.7	36.0	78	293	19
8	0.39	3.2	5.5	6.4	10	5.0	11	19	31	45	12

2.4 Follow-up to Comment 142

Comment: Carbonate molar ratio (CMR) is a critical assessment because it has implications on estimates for the time to onset of ARD, the volume of PAG rock that requires management and the design of the ARD management facilities at site. As noted in the TCL response, the flattening of the CMR vs. sulphate trend shown on Figure 14 represents the minimum NPR cut-off as the CMR evaluation does not account for other factors that need to be accounted for when assigning NPR criteria such as NP availability and other factors as outlined in MEND 2009 ARD Prediction Manual. It is the opinion of the reviewer that assigning an NPR cutoff criterion solely based on the CMR and not taking into account other factors that may affect the on-set of ARD, such as available NP, is not supported by the presented data and contributing factors at a mine scale. This comment is related to Comment #140 #143, and #146.

Response:

TML has opted to continue to use the more conservative NPR criterion of 2.0 as a cutoff for segregating non-PAG and PAG waste rock and note the site-specific value of 1.2 established based on geochemical evidence. This criterion was selected to ensure that TML were overpredicting the amount of PAG rock that must be stored for dam design, stability analysis, liner design, and to ensure sufficient equipment was available for PAG rock handling. This criterion will be reviewed as additional information is gathered as part of the permitting application. If the additional data supports a modification to the NPR, a revision to this criterion will be applied for.

2.5 Follow-up to Comment 143

Comment: EMLI understands that the weighted NPR cutoff of NPR = 1.20 to define non-PAG zones 5, 55, and 6. This did not account for other factors that may affect the on-set of ARD, such as available NP, blended PAG, and non-PAG strata in an unsaturated embankment or pile.

1. Provide an extended evaluation of these other factors if an average weighted NPR less than2.0 is applied.
2. Provide a demonstration of the conservativeness of application of an average weighted NPR of 1.2.

Response:

1. TML has decided to move forward with a segregation criterion of 2.0. However, it is important to clarify that SRK (2025) describes that the material zones may have a component of non-PAG and PAG rock even if the bulk property of a zone classifies it as non-PAG. Rock in zones that are predominantly PAG will be classified and managed as PAG unless confirmatory testing is completed that identifies zones that can be efficiently segregated as non-PAG with the mining equipment selected. Entire zones that are identified as being predominantly non-PAG will not be classified and managed operationally as non-PAG in the absence of confirmatory testing. PAG rock in these zones will be identified through operational confirmatory testing as described in the metal leaching and acid rock drainage (ML/ARD) management plan (SRK 2025). Only rock that has an NPR greater than 2.0 will be classified as non-PAG with other rock being classified as PAG

and placed underwater for permanent storage. Natural mixing of rock may occur during blasting and mining; however, if this occurs, it will be designated as PAG or non-PAG using a cutoff NPR of 2.0 based on the composite of the chip samples from the blasthole.

Zones 5, 55, and 6 were previously identified as being predominantly non-PAG based on their geochemical properties using a site-specific NPR of 1.20 in the ML/ARD Management Plan. Using an NPR of 2.0, only zone 55 is predominantly non-PAG. However, this zone is adjacent to the main economic coal seams and unintended mixing of PAG coal material into this zone will occur during the mining of rock and coal (SRK 2025). Due to this mixing, rock mined from Zone 55 will be classified and managed as PAG unless verification testing of the mined material is demonstrated to be above an NPR of 2.0.

TML does not understand what EMLI is specifically asking related to “non-PAG strata in an unsaturated embankment or pile and how this may affect the on-set of ARD” and cannot address this component of the question in this response. However, using an NPR cut-off 2.0 in the ML/ARD management for both blastholes and for non-PAG lifts in a pile or embankment will prevent rock with an NPR < 2.0 from being stored subaerially.

If the above does not address EMLI’s concerns, TML request EMLI provide additional details on what information is being requested.

2. The previous proposed operational segregation (site specific) criterion of 1.2 had inherent conservatism built into it for several reasons:

   – An important consideration for uncertainty in the NPR criterion is that the sulfide in the rock will be depleted in parallel with NP and if a higher critical NPR (NPRcrit) is required for the project, much of the sulfide in the rock between the proposed NPRcrit and the higher field NPRcrit will be depleted. This was assessed by calculating the typical depleted sulphide content when NP is depleted assuming a higher relative of NP depletion implied by a higher NPR criterion. For initial weighted average sulfide concentrations for zones 5 and 7 of 1.13 w.t.% and 0.86 w.t.%, respectively, depleted sulphide content at NPR of 1.2 is 0.16 w.t.% and 0.03 w.t.%, respectively. At these sulphide contents, acid generation rates are low and can be buffered by reaction with silicate minerals which are not included in the carbonate NPR. Uncertainty in the NPR criterion is acknowledged but based on this calculation is not a significant concern.

   – The criterion is established as a segregation criterion, not a blending criterion. Therefore, if PAG rock is not detected at an NPR slightly higher than 1.20, this rock will be operationally blended with other non-PAG with much higher NPRs. The NPR of the subsequent rock facility will be significantly higher than 1.20 and will perform as non-PAG even with a component of PAG rock naturally blended in.

   – The above discussion focuses on available NP only; however, a portion of the sulfur will also not be available and effective sulfur will be less than the ICP-S used in the geochemical characterization (SRK 2024a).

The above is predicated on the assumption that the bulk rock properties are representative of blast material at the project and does not consider blast fractionation. However, there is no mechanism to evaluate blast fractionation until operations commences. Confirmatory geochemical testing will be completed on mine rock placed in the backfill and non-PAG rock storage areas and the ML/ARD management plan, and the segregation criterion, will be updated as required.

TML has opted to continue to use the more conservative NPR criterion of 2.0 as a cutoff versus the site-specific value of 1.2 to identify exploration drillhole and blasthole rock as PAG (NPR<2) and non-PAG (NPR>2=) which was based on the static data collected for the Project. This criterion was selected to ensure that TML were overpredicting the amount of PAG rock that must be stored for dam design and stability analysis, liner design, and to ensure sufficient equipment was available for PAG rock handling. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, a revision to this NPR criterion will be applied for. Furthermore, even if the NPR criterion of 2.0 is used for permitting it will be continued to be reviewed during the Operation phase as additional information is gathered to determine if a less conservative criterion is justified.

2.6 Comment 145

Comment: The Mine Plan indicates that 21.96 M BCM of Overburden will be disturbed during mine operations including 0.55 M BCM from the access road. Although the overburden is likely to have low ML/ARD as supported by the initial geochemical characterization results, the large quantities of material disturbance warrants more than a cursory evaluation. Please specify the locations on where the six overburden samples were collected and indicate what additional characterization of the material's metal leaching potential is planned.

Response:

Six overburden samples were collected from within the proposed footpring. These samples will be submitted for acid base accounting and elemental analysis. Additional samples within the overburden areas excavated with the pit will also be obtained during the 2026/27 exploration program.

2.7 Follow-up to Comment 145

Comment: "Conduct a geochemical characterization and monitoring program using methods to assess the ML potential.

a. Specify what additional methods will be employed as part of the geochemical characterization and monitoring program to characterize the metal/contaminant leaching potential at the expected pH of the material on the mine site.

b. Evaluate the metal/contaminant leaching potential and duration at the expected pH from the samples already collected to characterize the overburden.

Response:

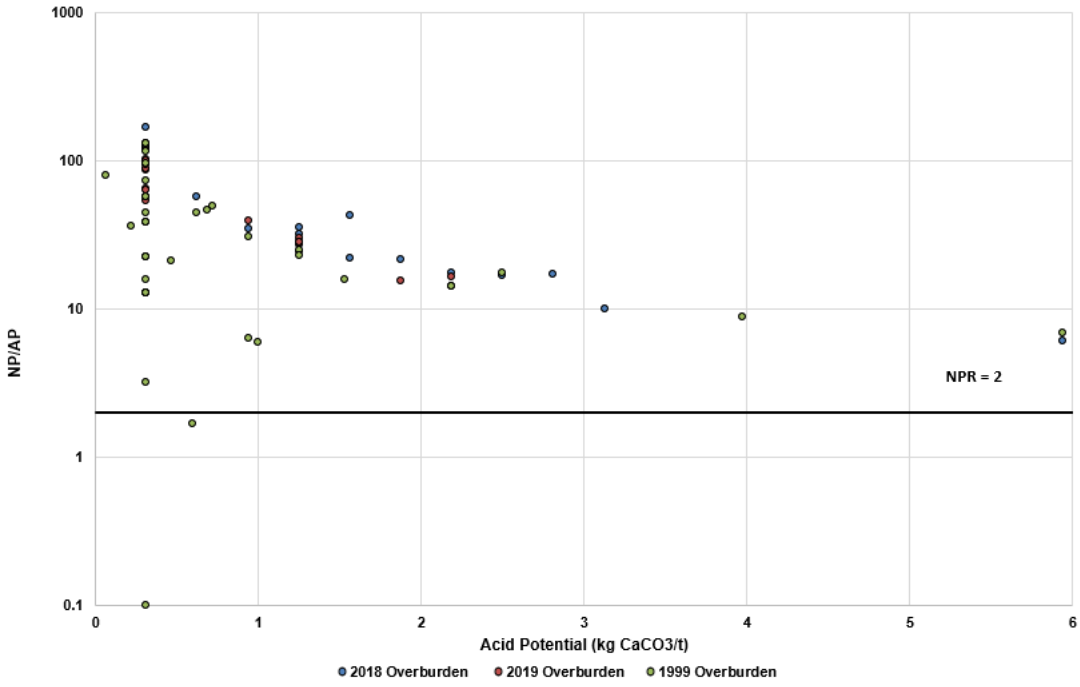
a. Metal leaching was assessed in two ways. As part of the baseline characterization (SRK 2024a), parameters were screened for enrichment relative to average crustal abundances (Smith and Huyck 1999). Humidity cell testing was also conducted and used to develop geochemical source terms (SRK 2024b). The source terms were input into a water and load balance to evaluate element leaching under expected conditions (i.e., alkaline drainage). To supplement these studies, TML initialed a field barrel testing program in October 2019, including a barrel containing overburden. The results of this study were used to further constrain the release rates derived based on humidity cell testing (SRK 2024b). TML will include additional elemental analysis as part of operational geochemical monitoring as per the ML/ARD Management Plan and operational water quality monitoring will be routinely conducted per an approved Environmental Management Act (EMA) permit to further evaluate element leaching at the Project. This information will be summarized and compared to EA predications in the annual environmental reports required for the Project.

b. Humidity cell testing, and field barrel testing of overburden is ongoing. The water and load balance has been updated to include loadings calculated based on monitoring data from the field barrel. Element leaching from overburden will be evaluated through this process. In addition, TML will collect additional overburden samples for static and kinetic testing as part of future exploration programs. The results of these studies will be used to update source terms for overburden, which will be used to evaluate ML from these materials.

c. An additional 34 overburden samples were collected as part of the initial NDM (1999) geochemical characterization program. These samples were not included in the SRK (2025) baseline dataset, as the NDM (1999) ABA testing was conducted using older testing methods (e.g., Sobek NP). Samples collected as part of the SRK (2025) geochemical study were based on current practices (e.g., modified ABA). Elemental analysis was not conducted on the NDM (1999) samples.

   The NDM (1999) results are consistent with the SRK (2025) results and indicate the majority of the overburden samples are non–PAG (Figure 2-3).Two samples (TRC96-09-A001 and TRC95-03-01) had NPRs<2 (0.0 and 1.7) and were classified as PAG. The total sulfur concentration of sample TRC96-09-A001 (NPR = 0) was below detection (<0.01%) and this sample is also considered to be non-PAG. Overburden sample TRC95-03 (NPR=1.7) also had a very low total sulfur concentration (0.02%). This sample is also considered non-PAG based on the total sulfur content since acid production rates at low total sulfur concentrations will be low. This sample is not likely to produce acidic drainage since silicate buffering is often sufficiently reactive to buffer pH at low acidity production rates.

   It is important to note that sulfur speciation was not conducted on the NDM (1999) samples and acid potential estimates were based on total sulfur. In weathered overburden, oxidized sulfur would be expected and use of total sulfur provides a conservative estimate of the acid generating potential of the samples.



https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Baseline_geochemistry/01_Results_processing/03 Overburden/[01_Tenas_Overburden_Results_1CT027.002_MKH_R3.xlsx

Figure 2-3. Overburden Sample NPR vs. AP

2.8 Follow-up to Comment 146

Comment: Please propose a more conservative development of the Tenas mine rock NP designation and the ARD criterion of NP/AP = 1.2 based on responses to comments EMLI 140, 142 and 143.

Response:

This IR is requesting the same information as IR#140b which has been responded to.

2.9 Follow-up to Comment 148

Comment: Please provide an updated management plan that addresses comments discussed in comments EMLI 140, 142, 143, and 146

Response:

An updated ML/ARD Management Plan is provided in Appendix A.

2.10 Follow-up to Comment 153

Comment: EMLI understands that precipitation of mineral phases, and the predicted concentrations, will be validated through operational water quality monitoring.

1. Specify how the minerals or other attenuation processes identified through speciation modelling will be confirmed by mineralogical or geochemical characterization of the material.
2. Describe the field or laboratory studies that will be conducted to validate these assumptions (e.g., field barrel program).

Response:

1. As discussed in the response to comment 153, secondary mineral phases are used to constrain predicted mass balance concentrations because coupling scaled humidity cell loading rates with predicted flows can result in unrealistically high concentrations for certain constituents because of very low water to rock ratios. The secondary mineral phases were not selected based on speciation modelling; they were selected based on professional judgment and experience at other mine sites. The approach is consistent with industry best practices.

   As noted above (see Section 2.4), TML initiated a barrel testing program in 2019 (SRK 2024a). The field barrel report is provided in Attachment A. The results of this program were compared to the scaled HCT release rates used to develop the geochemical source terms (SRK 2024b). The barrel testing and HCT results were appropriately scaled so the results were directly comparable (see Attachment A). The comparison indicated that release rates of most constituents were lower or like the HCT release rates used to develop the geochemical source terms (SRK 2024b) in the EAC application. However, the release rates of the following constituents were higher in the scaled barrel rates in comparison to the scaled HCTs: sulfate, arsenic, cobalt, lead, molybdenum, nickel, selenium, and uranium. Updated geochemical source terms were developed using the results of the barrel testing program (SRK 2024b) to evaluate if there are changes to water quality predictions based on scaled HCT release rates. As changes in the water quality predictions were observed the site-wide water quality model was updated incorporating these source terms.
2. A field barrel testing program was initiated in 2019 to constrain the scaling assumptions and secondary mineral phases used to constrain predicted concentrations using humidity cell release rates. Secondary mineral precipitation has been observed in the field barrels. However, so far from this program insufficient precipitate has been available for geochemical analysis. If additional precipitation occurs and enough mass is produced, this will be sampled and submitted for mineralogical and/or elemental analysis to confirm the secondary mineral phases included in the model predictions.

2.11 Follow-up to Comment 154 and 164

Comment:

1. Clarify what loading rates were used for developing mine rock source terms, including differences in Table 2-6 and Attachment 2 Table A-4.

2. Provide annual non-PAG material quantities required to construct the embankments and the location where this material will be sourced.

Response:

1. The loading rates for the humidity cells in Table 2-6 in the response to Comment 154 (SRK 2022d) were used in the derivation of the source terms. In the first iteration of the source terms, loading rates in humidity cells from Zone 7 (HC11) and 8 (HC-12) were included in the assignment of humidity cells to each zone. These HCTs were subsequently omitted from the analysis since these zones will not be mined as part of the EAC application; however, Table A- 4 was not updated to reflect this change. The corrected Table A-4 is provided below in Table 2- 2.

Table 2-2. Weighted Average Zone Sulfide Concentrations and Selected HCT

Zone	Sulfide (%)	Selected HCT
1	0.4	HC-04
1a	1.6	HC-08
2/3	0.9	HC-07
4 (PAG)	0.6	HC-04
4 (non-PAG)	0.3	HC-04
5	1.1	HC-07
55	0.9	HC-04
6	1.0	HC-07

As noted above (Section 2.5) the HCT release rates have been superseded to use loading rates from field barrels. A barrel was constructed that was representative of each zone, except where there was insufficient sample mass from these zones. In these instances, samples from other zones with similar geochemical properties based on static tests were combined to achieve the target minimum barrel mass. Release rates from each barrel were assigned to their corresponding zone in the source term update. Details of the updated barrel source terms are provided in SRK (2024b).

2. The annual non-PAG material quantities and sources for construction of the embankments is provided in Table 2-3.

Table 2-3. Embankment non-PAG Material Quantities and Sources

Year	Material Volume Required for Embankments and Buttresses (bcm)		Material Volume Required for Embankments only (bcm)		Source of Material		
	Zone 1 and 4 *non-PAG*	Overburden	Zone 1 and 4 *non-PAG*	Overburden	Location Phase	Zone 1 and 4 *non-PAG*	Overburden
-1	0	1,162,796	0	952,796	North	0	1,162,796
0	336,785	1,108,955	336,785	770,282	Start/North	336,785	1,108,955
1	640,805	469,494	640,805	369,494	Start/North	640,805	469,494
2	1,738,065	2,097,665	1,738,065	1,897,665	North	1,738,065	2,097,665
3	300,417	3,156,260	300,417	2,956,260	North	300,417	3,156,260
4	1,238,496	2,535,004	1,238,496	2,388,074	North	1,238,496	2,535,004
5	621,841	1,783,947	621,841	1,683,947	South	621,841	1,783,947
6	0	720,309	0	635,544	South	0	720,309
7	0	333,917	0	333,917	South	0	333,917
8	0	200,086	0	200,086	South	0	200,086
9 to 21	0	0	0	0	North and South Central	0	0
TOTAL	**4,876,409**	**13,568,433**	**4,876,409**	**12,188,065**		**4,876,409**	**13,568,433**
					Total Material Available		
					Location Phase	**Zone 1 and 4 *non-PAG***	**Overburden**
					North	6,222,260	9,919,794
					South	9,956,000	4,522,000
					North and South Central	13,139,149	6,479,615
					TOTAL	**29,317,623**	**22,296,208**
					EXCESS of Available versus required	24,441,214	8,727,775
					% EXCESS	**501%**	**64%**

2.12 Follow-up to Comment 157

Comment: The Zone 6 ABA sample set contains 45 of 77 samples with an NPR < 1.2, which indicates a significant portion of the unit is PAG. An acidic PAG rock source term has not been developed for the project. The current water quality model assumes that management is 100% effective and that all PAG exposed on pit walls or placed in a rock pile will not become acidic. The wall rock source term assumes that mitigation is 100% effective and will prevent acidic conditions from developing in PAG coal and rock exposed in the pit wall or placed outside of the Management Ponds. Not a conservative assumption. To understand how exposure of PAG may affect downstream water quality please provide a sensitivity in the water quality model to allow PAG exposures on pit wall.

Response:

Se Section 2.13 Follow-up to Comment 154, 157 and 161

2.13 Follow-up to Comment 154, 157 and 161

Comment:

1. Prepare a sensitivity within the WLBM to evaluate how a 4-meter thickness of PAG rock left exposed in a management pond during a period of early closure would affect water quality.
2. Provide a sensitivity in the water quality model to allow PAG exposures on pit wall to understand how exposure of PAG may affect downstream water quality.
3. Develop an upper-case prediction that is representative of challenging blasting conditions that could lead to higher nitrogen loading to blasted rock.

Response:

1. The WLBM was reviewed to determine the likelihood of having a 4-meter rock lift exposed in a management pond during a period of closure and found it was not possible given the passive nature of how the management ponds fill with water during operations and post-closure, as well as how the water cover in the management ponds has been prioritized in the water management plan. The WLBM always maintains a water cover of about 2m above PAG rock in the management ponds once PAG rock has been placed by pumping water from Tenas Control Ponds, which acts as a storage pond to ensure water covers in the management ponds. In addition to Tenas Control Pond, other contingencies exist to maintain water cover. For example, extra water is captured through channel 02 on site and is currently directed to Four Creek but can be used as an additional source of water if needed. The water cover in all three management ponds can be maintained even when multiple dry years both precede and follow this early closure period in the WLBM (SRK 2022b).

   The two ways that a 4-meter lift could become exposed in a management pond are:

   a. A pumping system was set up and maintained to keep water from raising inside of a management pond which is not likely outcome; or
   b. PAG material is placed higher than the planned water level in a management pond which again is not a likely outcome as the management pond dams are always built ahead of PAG

placement. TML will not place PAG rock in a location where it cannot be submerged underwater.

2. The model sensitivities run for PAG exposure in Pit Wall and as well as the upper case prediction for challenging blasting conditions will be detailed in SRK's response to IR 514, 351, 353, and 355 provided in the Tenas Project Information Requests related to the Surface Water Valued Component.

2.14 Follow-up to Comment 161

"As noted in section 3.10.4, the same N loads are applied to base case and high case scenarios with the following qualification:

The ANFO model assumptions do not account for operational controls and mitigation measures during blasting to reduce the potential release of blast residuals. The approach is conservative and therefore a high case scenario for these source terms have not been included.

The Ferguson and Leask (1988) methodology was derived from operating mines where typical surface coal mine blasting practices were in use. The methodology represents an expected case for annual N loading from blasted waste rock where operational controls during blasting are implemented. In the case of poor N source control, N loading may exceed F&L predicted levels. Given the duration of mining, assuming all N is released annually rather than a portion of the load, as has been observed at other coal mines in BC, may approximate the actual annual N loads in the later stages of mining. However, it does not follow that is a conservative modeling approach, particularly for waste rock that will be placed sub-aqueously. In addition, mining conditions may dictate that a higher proportion of emulsion than is planned is required for efficient blasting, in that case F&L would predict higher N loads than is currently predicted by the model. Please develop an upper case prediction that is representative of challenging blasting conditions that could lead to higher N loading to blasted rock (e.g., by assuming a higher proportion of emulsion use for an upper-case scenario). "

Response:

See Section 2.13 Follow-up to Comment 154, 157 and 161

2.15 Follow-up Comment 168

Comment: The model assumes that all rock will be submerged underwater within 6 to 12 months. Please provide the contingencies in the waste management plan or mine plan to ensure maintenance of a consistent water cover and to coordinate staged flooding and PAG placement.

Response:

Please see response #4 to 2.3 Follow-up to Comments 140, 142, 143, 146 and 148.

2.16 Follow-up to Comment 174

Comment: EMLI understands that, based on the conclusions made in Appendix 13.5-K, calcite precipitation is likely to occur in seepage from mine site facilities and in site water management ponds in varying degrees during operations, closure, and post-closure. However, predictions indicate that calcite precipitation is not expected to occur downstream of the proposed project footprint based on current observations and baseline conditions.

1. What are the uncertainty and gaps around the current assessment that calcite precipitation is not expected to occur downstream of the proposed project footprint based on current observations and baseline concentrations? Please describe how the baseline observations and related conclusions relate to the projected load from the mine and propose recommendations to address these uncertainties and gaps.
2. Please update the calcite conceptual model provided in App 13.5K to included seepage pathways through groundwater or provide a rationale for its omission.
3. Provide clarifications on the mechanisms and likelihood of calcite precipitation in the immediate downstream environment including all pathways (i.e., surface and groundwater) below end-of- pipe discharge location in Goathorn Creek.
4. Provide details of the calcite monitoring and management plan to prevent onset of calcite precipitation downstream of the project discharge and contingency measures to be implemented if specific triggers on the mine site are reached.

Response:

1. The following are the key uncertainties in the calcite precipitation evaluation:
   - Saturation indices (SIs) were calculated using predicted water quality in the management and control ponds based on an assumed temperature, pH, and oxidation-reduction potential.
   - The approach used assumes equilibrium occurs at a saturation index greater than zero and calcite precipitation is likely in waters having a calcite SI greater than this value. SIs calculated in watercourses downstream of the Project (SRK 2022e) indicate surface water under baseline conditions is already supersaturated with respect to calcite but there is no visible evidence of calcite formation in the pre-Project condition for any of the watercourses near the Project. This suggests a site-specific calcite SI may need to be established once sufficient monitoring data becomes available.
   - Equilibrium is assumed to be instantaneous and kinetic controls on calcite precipitation were not evaluated.

Site facility water that is identified to be supersaturated with respect to calcite may not actually precipitate calcite. The SRK (2022e) approach is only intended to evaluate the likelihood of, and not probability of calcite formation. The results are intended to determine if a calcite monitoring and management plan is needed which will be developed as part of the permitting applications. The above uncertainties will be addressed through operational monitoring.

2. Water along groundwater flow pathways will have a higher pCO2 in comparison to surface waters. The increased pCO2 causes the pH to decrease which increases calcite solubility. Groundwater is not in equilibrium with atmospheric gases and there is no reason for CO2 off- gassing to occur along groundwater pathways at the Project. Calcite is therefore not expected to precipitate in groundwater pathways and the conceptual model does not require updating. This assumption will be evaluated using operational monitoring data. The surface water quality model predictions account for groundwater seepage recharging downstream tributaries. In the model, surface water was assumed to be in equilibrium with atmospheric pCO2. Therefore, the influence of groundwater pathways on calcite precipitation is inherently accounted for in the evaluation.
3. The mechanisms for calcite precipitation are described in Section 2.1 of SRK (2022e) and the likelihood of calcite precipitation in these water courses is discussed in Section 4.4 of the same memo.
4. The presence of calcite will be included in the operational surface water quality monitoring program. The predictions provided in SRK (2022e) indicate that calcite is not expected to form in downstream tributaries since predicted alkalinity, calcium and magnesium concentrations are like existing conditions and there is currently no visual evidence of calcite precipitation even though surface water in these drainages is supersaturated with respect to calcite. If calcite formation is identified as part of the operational monitoring program, TML will develop a mitigation plan that will be submitted to EMLI for approval. The most common calcite prevention mitigation strategy is addition of antiscalant to site effluent. This would be the most likely mitigation strategy should it be required.

2.17 Follow-up to Comment 175

Comment: EMLI is consulting with ENV on water quality monitoring and water management measures for this project. Telkwa Coal will need to propose conceptual design of management structures as part of the current application to demonstrate that the Project as proposed is capable of managing water not suitable for discharge and meeting WQGs.

Response:

This is detailed in SRK's response to IR 175, 176, 514, 351, 353, and 355 provided in the Tenas Project Information Requests related to the Surface Water Valued Component which are provided in the Final Water and Load Balance Report.

2.18 Follow-up to Comment 176b

Comment: Provide conceptual design of alternative treatment options, mitigation measures, and management structures that can prevent the discharge of water that is not suitable for release to the environment (e.g., does not meet BC WQGs or another objective established by BC ENV).

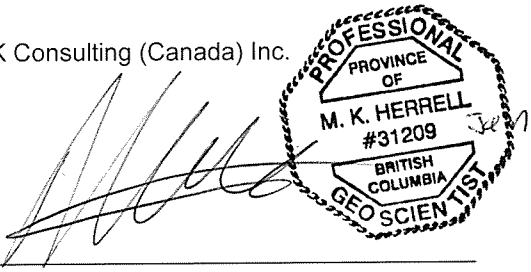
Response:

This is detailed in SRK's response to IR 175, 176, 514, 351, 353, and 355 provided in the Tenas Project Information Requests related to the Surface Water Valued Component which are provided in the Final Water and Load Balance Report.

3 Closing

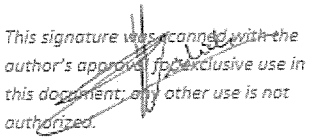
We trust this memo satisfies your current requirements. Should you require additional information please do not hesitate to contact the undersigned.

SRK Consulting (Canada) Inc.



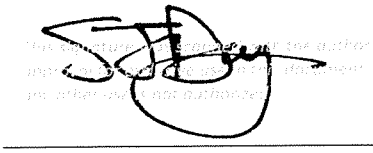
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SRK 2025. Tenas Project – Metal Leaching/Acid Rock Drainage Management Plan. Prepared for Telkwa Mining Limited. April 2025.

Attachment 1 Section 13.0 Management Plans Chapter 12 Metal Leaching/Acid Rock Drainage Management Plan

FINAL

Section 13.0 Management Plans

Chapter 12 Metal Leaching/Acid Rock Drainage Management Plan

Tenas Project, Telkwa B.C., Canada
Telkwa Mining Limited



SRK Consulting (Canada) Inc. ▪ CAPR002933 ▪ April 2025

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FINAL

Chapter 12 Metal Leaching/Acid Rock Drainage Management Plan

Tenas Project, Telkwa B.C., Canada

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File Name:
App P 13.12_MLARDMP_CAPR002933_FINAL_20250414.docx

Suggested Citation:
SRK Consulting (Canada) Inc. 2025. Chapter 12 Metal Leaching/Acid Rock Drainage Management Plan. FINAL. Prepared for : Canada BC. Project number: CAPR002933. Issued April. 2025.

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Appendices

Appendix 13.12A Tenas Project Geochemical Characterization Update, SRK

Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

ABA	Acid Base Accounting
AP	Acid Potential
ARD	Acid Rock drainage
TIC	Total Inorganic Carbon
BC MMCM	British Columbia Ministry of Energy, Mines and Lower Carbon Innovation
BC MECCS	British Columbia Ministry of Environment and Climate Change Strategy
ML/ARD	metal leaching and acid rock drainage
non-PAG	non-potentially acid generating
NP	Neutralization Potential
NPR	Neutralization Potential Ratio
PAG	Potentially Acid Generating
POPC	parameters of potential concern
SRK	SRK Consulting (Canada) Inc.
TC	Total Carbon
TIC	Total Inorganic Carbonate
TML	Telkwa Mining Limited

UNITS OF MEASURE

km	Kilometre
m	Metre

Executive Summary

The focus of this Metal Leaching (ML)/Acid Rock Drainage (ARD) Management Plan (ML/ARDMP) is the identification and management of potentially acid generating (PAG) materials and the management of metal leaching under neutral conditions from non-PAG rock for elements such as selenium. Geochemical test results (SRK 2024a) were used to develop source terms for material handled by the Project which were carried forward into a site wide water quality and quantity model (SRK 2024b) to evaluate ML under neutral conditions as the current designed method of submerging PAG material underwater and covering of Environmental Assessment (EA) Open Pit Walls by non-PAG materials are expected to prevent ARD. Management of ML is addressed through the Minesite Water Management Plan (S13.0-C11) (MWMP). This ML/ARDMP and the Selenium Management Plan is in Appendix 13.5-I of the Discharge Management Plan (S13.0-C5) (DMP) and 1.9.4.2.5 Mining of the EA Certificate Application. The primary purpose of the ML/ARDMP is to outline an operational ML/ARD monitoring and identification program of mined material for geochemical inventory and identification of trending geochemical parameters which may require changes to handling and/or management strategies. Roles and responsibilities are outlined to undertake this monitoring and identification programs, enable correct timing and depth of water cover in management ponds and alleviate any improper placement of PAG rock within the Project footprint.

Telkwa Mining for mine planning, regulatory applications, and operational verification testing will use an NPR criterion cut-off of 2.0 where material having an NPR greater than or equal to 2.0 will be classified as non-PAG and material with an NPR less than 2.0 will be classified as PAG and submerged underwater for permanent storage. SRK (2024a) characterized the deposit based on stratigraphic zones and identified zones that are predominantly PAG or non-PAG based on their bulk geochemical properties (i.e., average weighted NPRs). Regardless of the weighted average NPR of zone, the geochemical testing results indicate that all rock zones contain some PAG and non-PAG rock and operational monitoring and verification testing must be done for all non-PAG materials. In zones where the rock is predominantly PAG, operational testing may not be completed. If testing is not completed a zone will be treated as PAG and managed appropriately.

Management of PAG materials at the Tenas Project will be critical to meet the Environmental Assessment Certificate (EAC) and Mines Act, RSBC 1996, c 293 and Environmental Management Act, SBC 2003, c 53 (MA/EMA) permit conditions and ensure environmental protection from both potential metal leaching and PAG materials. Through implementation of this ML/ARDMP and relevant Standard Policies and Procedures (SPPs), TML will ensure sampling and verification testing is completed to identify and manage PAG and non-PAG rock so that PAG rock is placed permanently underwater for storage with the goal of preventing potential future ARD.

1 Introduction

The Tenas Project (Project) is a proposed open pit mine that will excavate overburden, mine rock, and Run-of-Mine Coal from the EAC Open Pit. Based on the work conducted over the past twenty-five years (i.e., Norecol Dames & Moore (1999), SRK (2022), SRK (2024)), some of these materials are identified to be potentially acid generating (PAG). Telkwa Mining Limited (TML) has developed the following Metal Leaching/Acid Rock Drainage Management Plan (ML/ARDMP) to address the management of PAG materials to prevent potential Acid Rock Drainage. The focus of this ML/ARDMP is on the identification and management of PAG rock. Geochemical testing results (SRK 2024a) were used to develop source terms which were carried forward into a site wide water quality model (SRK 2024b) to evaluate metal leaching (ML). Management of ML is addressed through the Minesite Water Management Plan (S13.0-C11) (MWMP). The ML/ARDMP will form a key component of TML's Environmental Management System (S13.0-C1) (EMS) for operation of the Project, located approximately 25 kilometres (km) southwest of the Town of Smithers, British Columbia (BC).

2 Purpose and Objectives

The objectives of the ML/ARDMP are to:

- Provide a summary of geochemical characteristics of mined materials and identification of Parameters of Potential Concern (POPC) for water quality;
- Outline an ML/ARD monitoring program of mined material for geochemical inventory and identification of trending geochemical parameters which may require changes to handling and/or management strategies; and
- Provide operational handling and management strategies which will minimize the potential of ML/ARD during operations.

3 Scope and Scale

The scope of the ML/ARDMP is defined within Project Area. This ML/ARDMP will be implemented during the Construction, Operation, Decommissioning and Reclamation, and Post-closure phases of the Project and ceases to be in force at the final closure of the Minesite as approved by the regulatory authorities.

4 Compliance Obligations

4.1 Regulatory Requirements

Several legislative requirements are applicable to management of materials that are metal leaching and/or produce ARD. A list of these requirements and their major applicable components are provided in Table 4-1 below.

Table 4-1: Legislation and Guidelines Relevant to the Metal Leaching/Acid Rock Drainage Management Plan (ML/ARDMP)

Legislation, Regulations, and Guidelines	Applicable Information
Environmental Management Act, SBC 2003, c. 53 (Government of British Columbia [GovBC] 2003) (*EMA*)	The *EMA* sets out requirements for disposal of oil and hazardous materials, spill prevention and reporting, and pollution abatement. Authority for provincial spill cost recovery is additionally provided by the *EMA*. Regulations will be applied to a reportable hydraulic or chemical spill, any spill in water, industrial accident, or environmental emergency.
Fisheries Act, 1985, c F-14 (Government of Canada [GovCan] 1985)	Prohibits the release of a deleterious substance to fish habitat.
Health, Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] 2021) (Code)	Part 3, 3.7.1 Mine Emergency Response Plan details components and testing requirements
Mines Act, RSBC 1996, c 293 (GovBC1996)	Regulates mines through the Code and permitting of roads on mineral claims registered to a proponent
Waste Discharge Regulation, BC Reg 320/2004 (GovBC 2004)	"Prescribes" which industries and trades are regulated under the *EMA* and prescribes annual fees.
Water Sustainability Act, B.C. Reg. 36/2016 (GovBC 2016)	Provides guidance on protecting aquatic ecosystems and handling wells and groundwater protection.

Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (British Columbia Ministry of Mining and Critical Minerals [BC MMCM] and British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019) (JAIR) provides requirements for obtaining *Mines Act,* RSBC 1996, c 293, and *Environmental Management Act,* SBC 2003, c 53 (*MA/EMA)* permits. This ML/ARDMP is designed to fulfill the JAIR objectives as well as EAC Application requirements

4.2 Standard Practices and Procedures (SPP)

TML Standard Practices and Procedures (SPPs) will conform to the British Columbia Health, Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Mining and Low Critical Minerals [BC MMCM] 2021) (Code).

In addition to BC MMCM regulatory and Code requirements, if the Project implements SPPs they will meet other required laws and regulations.

5 Relationship to Other Management Plans

The Project is governed by an EMS, an overarching management plan strategy comprising a set of processes and practices which enable TML to manage its environmental and safety performance in a holistic way, within an integrated framework of management plans on specific topics. The ML/ARDMP is a component of the EMS.

In addition to the overall guidance of the EMS, this ML/ARDMP has a relationship with other management plans that also present mitigation measures. Those management plans and their relationship to this ML/ARDMP are listed in Table 5-1

Table 5-1: Management Plans with Relationship to the Metal Leaching/Acid Rock Drainage Management Plan (ML/ARDMP)

Management Plans	Nature of Relationship
Environmental Management System (S13.0-C1) (EMS)	Management plans are part of the EMS.
Construction Environmental Management Plan (S13.0-C4) (CEMP)	Any materials excavated as part of construction will need to follow this ML/ARD
Discharge Management Plan (S13.0-C5) (DMP)	ML/ARD is an input into the overall Discharge Management Plan.
Mine Emergency Response Plan (S13.0-C9) (MERP)	Response to emergencies from storage, and disposal of materials are addressed in the MERP.
Minesite Water Management Plan (S13.0-C11) (MWMP)	The adequate management of ML/ARD is key component in the development of the MSWMP especially the management ponds.

6 Details of Metal Leaching and Acid Rock Drainage Management Plan (ML/ARDMP)

6.1 Tenas Deposit Geochemistry and Potentially Acid Generating (PAG) Classification Criteria

The following two (2) principal geochemical studies have been completed to characterize the potential acid generating and ML potential of the Tenas Deposit:

- Norecol Dames and Moore (1999). Draft Report. Assessment of ARD Potential and Water Quality Predictions. Telkwa Coal Project; and
- SRK (2024a). Telkwa Coal – Tenas Project Geochemical Characterization Update.

The Norecol Dames and Moore (1999) study included the collection and analysis of over 700 samples. An additional 173 samples were collected as part of a supplemental geochemical characterization study (SRK 2024) in 2018 and 2019. The supplemental samples were used to confirm the results of the 1999 study and correlate the test results to more up-to-date testing methods. For example, analysis on samples collected as part of the Norecol Dames and Moore (1999) study was limited to total sulfur and neutralization potential using the Sobek-NP (1978) method. Furthermore, onsite barrel tests were initiated in late 2019 to provide additional information on the geochemical reactivity of PAG and non-PAG rock under ambient conditions. The testing results to the end of 2023 are provided in Appendix 13.12-A Tenas Project, Geochemical Characterization Update. Results from the two studies were combined to form a robust geochemical characterization for the Project that is reported in Appendix 13.12-A Tenas Project, Geochemical Characterization Update of this report. The reader is referred to Appendix 13.12-A for additional detail on the geochemical characterization program including sample selection, collection, testing, and results.

The outcomes of these studies indicated that a large volume of the material that will be excavated from the Tenas Deposit is PAG. Furthermore, ARD potential is stratigraphically constrained in zones that are generally separated by identifiable coal seams. The geochemical properties of the deposit were therefore described based on these mineable stratigraphical zones. The geochemical testing results indicate that all rock zones contain some PAG and *non-PAG* rock as illustrated by Figure 6.1 below; however, there are zones that are predominantly PAG versus *non-PAG.* Table 6-1 below summarizes the bulk weighted geochemical NPR results for the stratigraphical zones for the Tenas Deposit.

PAG material is identified as material that has an NPR less than a cut-off value of 2.0 for this management plan and the Tenas Project as a whole. The NPR is the ratio of the neutralization potential (NP) to the acid potential (AP). NP is measured in the lab through digestion of a small volume of sample in acid and titration of the sample to determine how much neutralizing mineral was consumed during the digestion. AP was estimated based on measured sulfide concentrations using a combination of Leco furnace and ICP-MS methods (SRK 2024a). Testing using these methods requires samples to be sent to offsite laboratories, which can have lengthy turn around times that are not amenable to making operational mine rock management decisions (i.e., the permanent storage location of blasted mine rock). To facilitate the shorter turnaround times that are required to make

operational decisions for the placement of blasted rock, processed rock, and other materials, the results of the geochemical characterization (Appendix 13.12-A) were used to develop operational proxies for determining NP and AP by an onsite laboratory that will be equipped with a Leco furnace. The following subsections provide the derivation details of the NP and AP proxies.

Table 6-1: Bulk Geochemical NPR for Material Zones for the Tenas Deposit

Material Zone Name	Stratigraphic Location	Material Designation	Bulk Weighted NPR
Zone 0	Till and overburden – topography to bedrock surface	*non-PAG*	**17.5**
Zone 1	Bedrock surface to top of Seam e (minus Zone 1a)	*non-PAG* with potential separable PAG portions	**3.1**
Zone 1a	Select area above Seam e to bottom of Seam e	PAG	**0.7**
Zone 2 & 3	Bottom of Seam e to bottom of Seam c	PAG	**0.8**
Zone 4	Bottom of Seam c to top of Seam b	*non-PAG* with potential separable PAG portions	**2.6**
Zone 5	Top of Seam b to top of Seam 1U	PAG	**1.2**
Zone 55	Top of Seam 1U to bottom of Seam 1L	PAG	**1.9**
Zone 6	Bottom of Seam 1L to bottom of Seam 1Lc	PAG	**1.8**
Zone 7**	Below Seam 1Lc to the bottom of Seam 1Ld	PAG	**1.7**
Zone 8**	Below Seam 1Ld	*non-PAG* with potential separable PAG portions	**5.0**

[1] Note: Zones 7 and 8 are not currently recovered within the EA Open Pit design

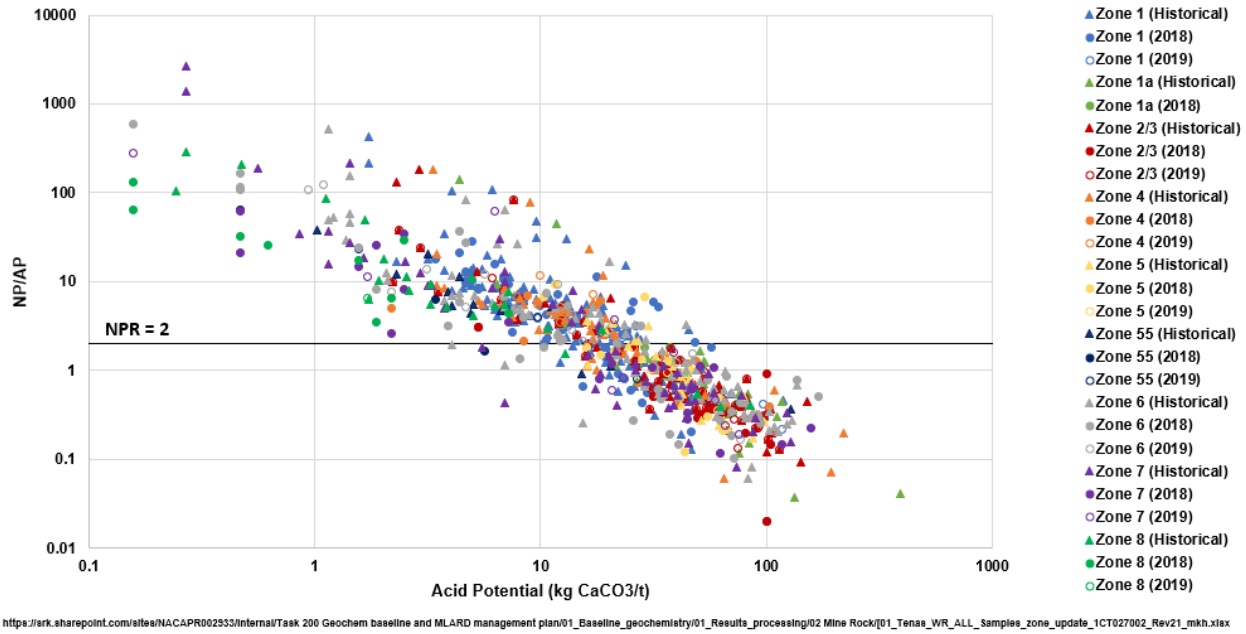


Figure 6-1: Neutralization Potential Ratio (NPR) versus Acid Potential for the Tenas Project

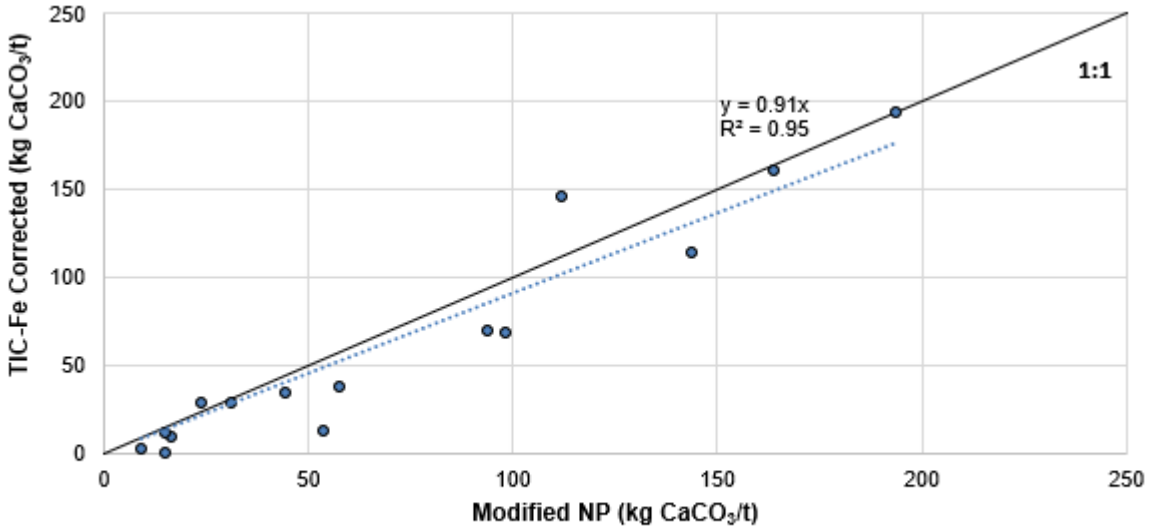
6.1.1 Neutralization Potential (NP)

Mineralogical testing of mine rock samples indicates that iron carbonates (e.g., siderite) are present in varying percentages in stratigraphic zones (SRK 2024a). As iron carbonates do not provide effective NP, a correction was developed to account for the effective NP available from Ca-Mg carbonates (e.g., calcite, dolomite) ($TIC_{XRD\text{-}corrected}$).

A strong positive correlation (r=0.95) exists between the modified-NP and total inorganic carbon (TIC), when corrected for iron carbonates ($TIC_{Fe\text{-}corrected}$) as illustrated by Figure 6-2below. The modified-NP results exceed the $TIC_{Fe\text{-}corrected}$ results indicating some silicate influence.

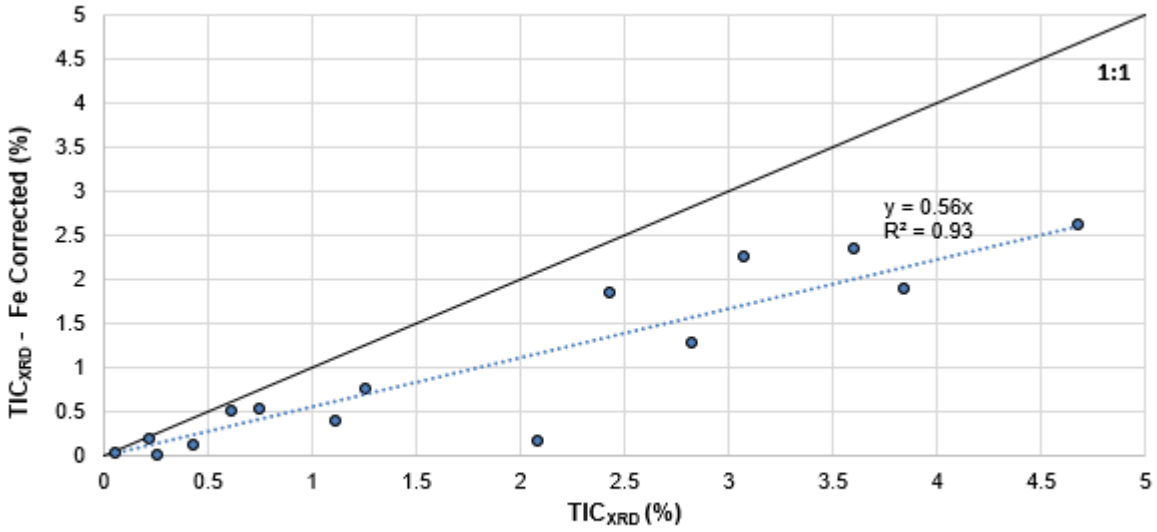
The relationship between TIC_{XRD}-Fe corrected and modified-NP can be used to correct total TIC concentrations measured by Leco. A strong correlation also exists between the TIC concentrations, estimated from XRD (TIC_{XRD}-total), to TIC_{XRD}-Fe corrected as illustrated by Figure 6 3 below. This relationship indicates the carbonate-NP, or the effective-NP ($NP_{effective}$) can be estimated using the following equation (EQ1):

$$NP_{effective}(kg\ CaCO_3/t) = 0.56 \times TIC_{Leco}(\%) \times 83.3 \quad \text{(EQ1)}$$



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Figure 6-2: Modified-NP versus TICXRD-Fe corrected



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Figure 6-3: TICXRD versus TICXRD-Fe corrected

6.1.2 Acid Potential (AP)

Sulfur in the mine rock for the Project occurs as mineralogical sulfur (sulfide and sulfate minerals) as well as organic sulfur which commonly occurs in coal deposits. The definition of sulfur species and sulfur analysis at the Project are as follows:

- S_{ICP} – sulfur from ICP-MS analysis representing mineralogical sulfur as sulfide and sulfate (also referred to as total inorganic sulfur);
- S_{HCl} – sulfur which occurs as sulfate as measured following HCl leach;
- S_{XRD} – sulfur as determine by mineralogy using XRD; and
- S_{Leco} – total sulfur (i.e., inorganic + organic) analyzed by Leco furnace.

Mineralogical sulfur was estimated using ICP-MS following an aqua regia digestion (S_{ICP}). The aqua regia digestion is used to estimate total inorganic sulfur in lieu of total sulphur by Leco due to the presence of organic sulfur species (SRK 2024a). To account for the presence of non-sulfide inorganic sulfur, sulfur as sulfate is measured by analysis of sulfur following an HCl digestion (S_{HCl}). Sulfide (S^{2-}) was calculated as the difference of total inorganic sulfur and sulfate according to the following equation (EQ2):

$$S^{2-}\ (\%) = S_{ICP}\ (\%) - S_{HCl}\ (\%) \qquad \text{(EQ2)}$$

Much of the total sulfur is present as sulfide in the material zones as illustrated by Figure 6-4 below. Highest total sulfur concentrations typically occur in Zone 2/3 and in the footwall Zones 6 and 7 as illustrated by Figure 6-4 below. Sulfate is generally low (average of 0.03%) in the samples as indicated by the difference of S_{ICP} (open symbols presented by Figure 6-4 below) and the calculated sulfide concentrations (solid symbols presented by Figure 6-4 below) using Equation 2. Sulfate concentrations

increase at higher total sulfur concentrations; however, sulfide is still the dominant sulfur species. At higher total sulfur concentrations, larger deviations from the 1:1 line occur indicating the presence of organic sulfur.

A regression analysis of samples indicates there is a strong positive correlation (i.e., r=0.99) between total sulfur and sulfide sulfur as illustrated in Figure 6-4. Total sulfur can therefore be used as a proxy for estimating sulfide using the following mathematical relationship:

$$S^{2-}\ (\%) = 0.93 \times \text{Total-}S_{Leco}\ (\%) \quad \text{(EQ3)}$$

Mineralogical analyses (SRK 2024a) indicate pyrite is the predominant sulfide mineral in the samples. Based on estimated pyrite content, total sulfur calculated using the XRD results generally corresponds to the total sulfur by Leco as demonstrated by Figure 6-5. Therefore, use of Equation 3 to estimate sulfide sulfur is considered reasonable.

S_{XRD} generally exceeds S_{Leco} as illustrated by Figure 6-5. This can occur because the XRD results are normalized to 100%. XRD does not detect amorphous phases and minerals at lower percentages and the normalization of detectable mineral species to 100% can result in an overestimation of the detectable species.

The calculated sulfide sulfur can subsequently be used to estimate AP by the following equation (EQ4):

$$AP\ (\frac{kgCaCO_3}{t}) = S^{2-}(\%) \times 31.25 \quad \text{(EQ 4)}$$

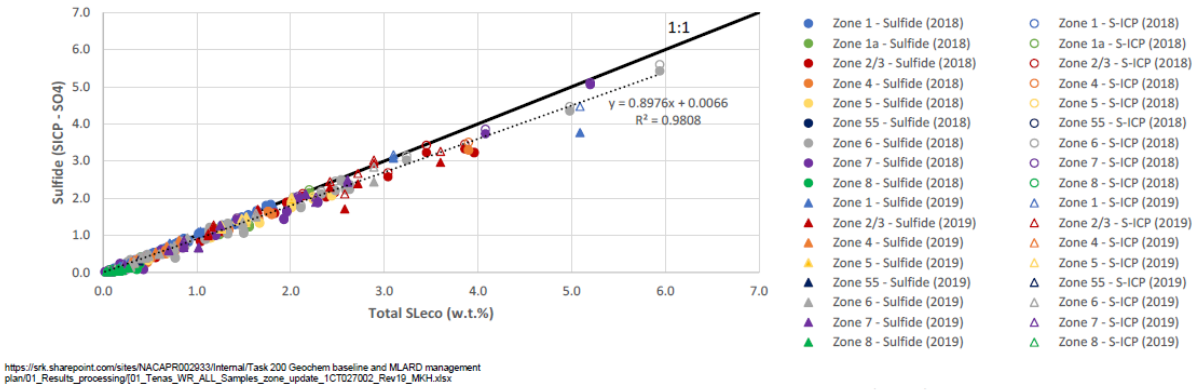


Figure 6-4: SLeco versus Total Inorganic Sulfur and S^{2-}

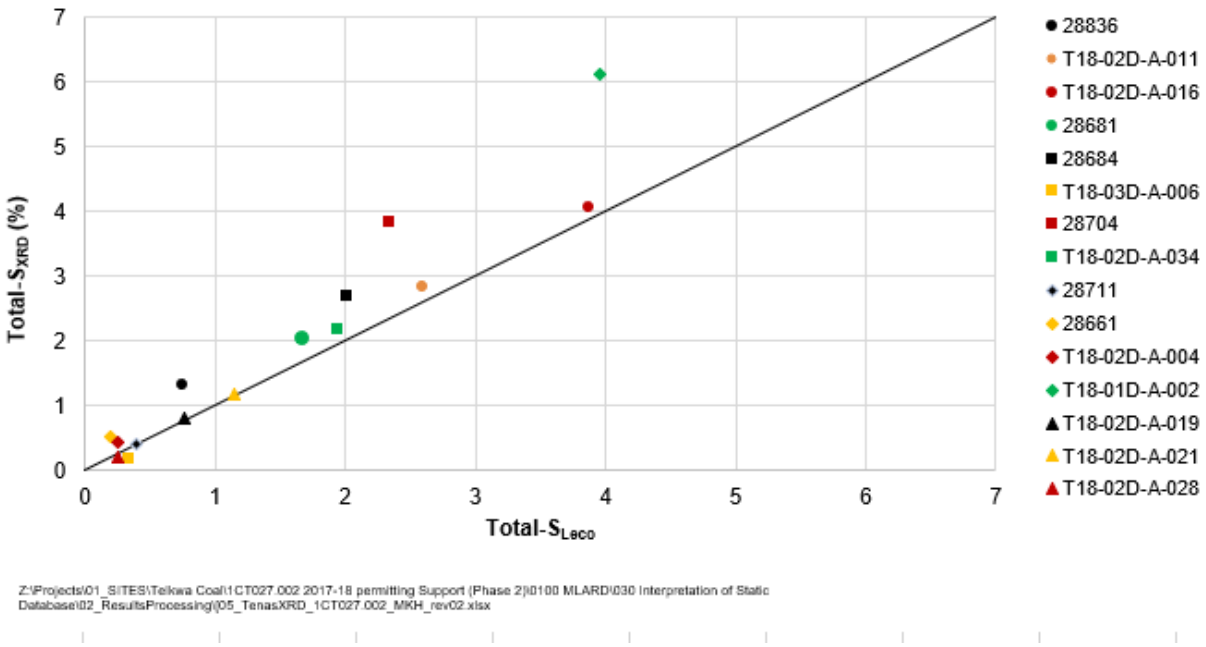


Figure 6-5: Leco Sulfur versus XRD Sulfur

6.1.3 Potentially Acid Generating (PAG) Classification Criterion

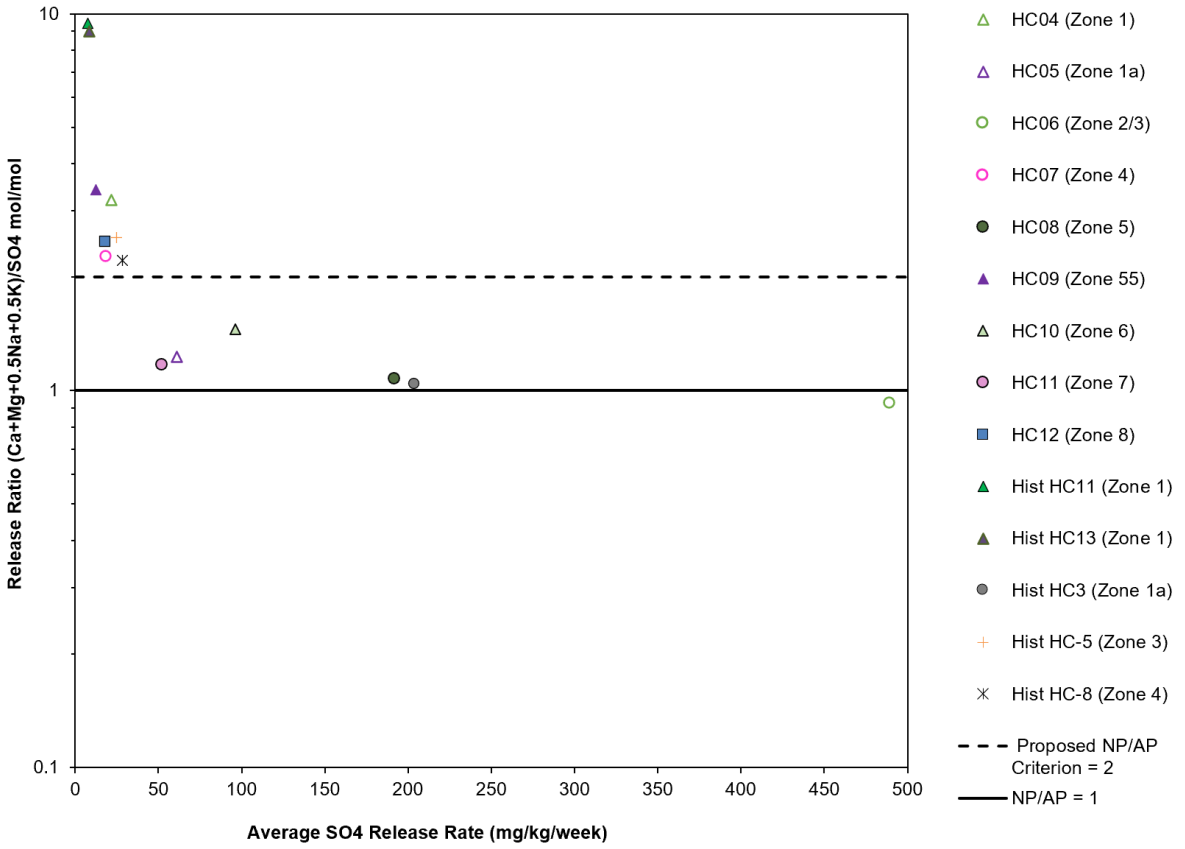
Humidity cell tests (HCTs) were initiated on representative mine rock material from the Project (SRK 2024a). The HCT results were used to calculate the carbonate molar ratio (CMR), which is the ratio of calcium and magnesium from carbonates to the sulphate production rates, expressed as follows:

$$(Ca+Mg)SO_4 \text{ mol/mol} (Ca+Mg)SO4 \text{ mol/mol}$$

The CMR is used to develop site-specific criteria for the classification of ARD potential for a particular deposit. If it is determined that the calcium and magnesium loads in the humidity cell tests are released from carbonate dissolution, the CMR represents the site-specific NPR when the pH in the test is neutral. SRK (2024a) demonstrated that a strong positive correlation exists between NP_{XRD}, following correction for iron carbonates, and modified-NP and a strong positive correlation exists between modified-NP and calcium plus magnesium. These lines of evidence provide confidence that the modified-NP is a measure of calcium and magnesium carbonate dissolution (i.e., the effective-NP). CMRs were calculated based on the stable average non-acidic loading rates from the HCTs. Due to the presence of clay minerals (i.e., illite, muscovite and kaolinite) in the rock at the Project (SRK 2024a), sodium and potassium were included in the CMRs to account for cation exchange. Figure 6-6 provides a plot of the CMR, accounting for cation exchange, versus the sulfate production rate. The CMRs in this figure indicate a site-specific NPR of 1.20 can be used to classify mine rock for the Project as PAG versus *non-PAG*.

Telkwa Mining has opted for the time being to continue to use an NPR criterion of 2.0 as a cut off for exploration drillhole rock with an NPR less than 2.0 being classified as PAG and materials with an NPR >= 2.0 being classified as *non-PAG*. This criterion was selected to ensure that the Project will not classify PAG material as *non-PAG* and is also overpredicting the amount of PAG rock that must be stored for geotechnical dam design and stability analysis, liner design, and to ensure sufficient equipment was available for PAG rock handling. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, an application to revise the proposed NPR criterion will be submitted to the BC MMCM and BC MECCS.

SRK (2024a) determined for planning, regulatory, and operational phases an NPR cut off criterion of 2.0 for this deposit is both appropriate and defensible to use as a cut off for other materials besides rock with materials with an NPR less than 2.0 being classified as PAG and materials with an NPR >= 2 being classified as *non-PAG* for other materials such as overburden, construction non-rock materials, surface soils (topsoil), coal, and processed rock.



https://srk.sharepoint.com/sites/NA1CT027.002/Internal/0100 MLARD/020 Reinterpretation of Kinetic Test Database/06_NPR Crit Evaluation/[NPR_Crit_1CT027.002_JED_MKH_Rev00.xlsx]

Figure 6-6: Carbonate Molar Ratios Accounting for Cation Exchange versus Sulfate Release Rates

6.1.4 Potentially Acid Generating (PAG) Material Lag Time and Submersion Timing

A key aspect of the ML/ARDMP is the flooding of PAG materials in the management ponds prior to the onset of acidic drainage. The estimated lag times to acidic conditions and details of the derivation of the lag times are provided in Appendix 13.15-A.

Based on the average bulk properties of PAG materials, the minimum lag time is approximately 4.2 years under laboratory conditions. The predicted lag times, based on the HCTs were conservative and underestimate the lag times that would be expected under field conditions. The 2019 field barrel test program provided additional empirical evidence and supported the initial lag times predictions (SRK 2024a). For example, based on the results up to November 2023, except for the Zone 6 barrel, all barrels produced alkaline drainage over the four-year testing period. The Zone 6 barrel started producing acidic drainage in October 2023 (i.e., four years into the testing period).

Based on the lag times expected under operational conditions, PAG material will be placed and flooded in the management ponds within an average of 6 months after excavation but no longer than 12 months.

Processed rock (e.g., tailings) will also be placed in the management ponds. Depletion calculations using the empirical open system at near neutral pH method (MEND 2009) on these materials (SRK 2024a) indicate the lag time to acidic drainage is 6 years under laboratory conditions. Again, lag times would be longer under operational conditions due to differences in field and laboratory conditions (e.g., lower average field temperature, larger size of material, etc.).

Coal samples were not included in the SRK (2024a) study. Historical testing of Tenas Coal samples was conducted on three coal samples (Norecol Dames and Moore 1999) and indicated that coal can produce acidity immediately with one (1) sample producing acidic drainage at the start of the test. The other two coal samples did not produce acidic conditions during the 14-week testing period. Based on these testing results, there is uncertainty in the timing of the onset of acidic conditions in coal and drainage from coal stockpiles will be monitored and if acidic drainage occurs, some of the stockpiled material will be covered with tarping, and the drainage will be subjected to lime water treatment.

Table 6-2: Estimated Acid Generation Lag Times in Months under Laboratory Conditions

Zone	Minimum	P5	P25	Average	P75	P95	Max
1	141	162	---	---	---	---	---
1a	32	32	47	60	65	67	91
2/3	16	19	30	66	71	145	---
4 (PAG)	4	12	37	50	48	62	69
4 (non-PAG)	---	---	---	---	---	---	---
5	54	67	119	---	---	---	---
55	22	30	63	101	76	135	---
6	26	29	65	154	---	---	---
7	32	38	77	151	161	---	---
8	22	27	62	138	140	---	---

6.1.5 Metal Leaching (ML)

Solid-phase analysis was completed on the mine material samples to identify elements that were elevated in the solid-phase. An element was screened as elevated if it was greater than 10 times the average crustal abundance (Smith and Huyck 1999). The following is a summary of constituents that were screened to be elevated in each material type (SRK 2024a):

- Mine rock – arsenic (20% of the samples), phosphorus (1% of the samples), selenium (1% of the samples) and sulfur (54% of the samples);
- Overburden:
- +2 mm-25 mm fraction – arsenic (67% of the samples) and cadmium (17% of the samples);
- -2 mm fraction – arsenic (17% of the samples), gold (17% of the samples) and tellurium (83% of the samples);
- +25 mm fraction – no elevated element concentrations;
- Processed Rock – arsenic (86% of the samples), selenium (86% of the samples), sulfur (100% of the samples) and tellurium (100% of the samples); and
- Construction material samples – no elevated element concentrations.

An elevated element concentration in the solid phase does not necessarily imply an elevated concentration will occur in the liquid phase since element leachability is dependent on several factors (e.g., mineralogy, pH, redox, etc.). Leachability of constituents was evaluated by scaling humidity cell and field barrel testing results to field conditions and coupling them with modelled site facility volumes to develop source terms for each material type that will be mined. The source terms were carried forward into the site water and load balance (SRK 2024b) to identify if element concentrations would be present at concentrations that would require additional mitigation (e.g., water treatment). The outcomes of this modelling indicate that water treatment will not be required if site drainage is neutral (SRK 2024b).

A key assumption in water quality modelling is the proposed PAG management strategy will prevent acid generating conditions and source terms were developed assuming neutral drainage conditions. If the PAG management strategy is not effective and pH is depressed, concentrations of several parameters (e.g., sulfate, aluminum, arsenic, cadmium, copper, iron, etc.) will increase (SRK 2024a). The efficacy of the PAG management strategy will be evaluated through ongoing operational water quality modelling. Water treatment is included as a Project mitigation strategy and will be implement should acidic drainage occur.

6.2 Mine Plan

The locations of major Project components for the Project's mine plan configuration are shown on Figure 6-1. The Project will employ a conventional shovel and truck extraction operation, like other rock quarry and surface mine operations in the region. To develop the EA Open Pit, TML will salvage surface soils (topsoil), excavate overburden, and drill and blast the rock in horizontal layers (or benches) and recover Run-of-Mine (ROM) Coal.

ROM coal will be extracted using conventional mining equipment and trucked to an onsite Coal Processing Plant (CPP) constructed north of the EA Open Pit on the west side of Goathorn Creek. Process water fed into the CPP will be reused or recycled or entrained in the processed rock and processed coal materials. The CPP will require makeup water to replace any water that is entrained in the processed coal and/or in the coarse and fine processed rock. The fine processed rock will be dewatered and combined with coarse processed rock material that will be able to be trucked to final storage locations which will be submerged underwater in the management ponds.

Mining of the Tenas Project will produce surface soils (topsoil), overburden, mine rock and ROM Coal from the EA Open Pit and processed rock and coal from the CPP. The following is the proposed management strategies for these materials:

- **Surface Soils (topsoil):** This is approximately the top 35 cm of material that contains the bulk of organic material and allows the growth of vegetation. Soil salvaged will be temporarily stored in stockpiles for use in reclamation or will be "direct placed" on reclaimed external or backfilled mine rock piles as per the Construction Environmental Management Plan in S13.0-C4 (CEMP) and Reclamation and Closure Plan S13.0-C15 (RCP). Surface soil has been classified as *non-PAG* (SRK 2024a);
- **Overburden:** This is the non-rock material between topsoil and rock that consists of gravel and till material with almost no organic material. Overburden material has been classified as *non-PAG* (SRK 2024a). Some will be placed within the embankments/buttresses of the management ponds or used as cover for *non-PAG* rock backfill to limit oxygen ingress or as cover material for the management ponds. The rest will be backfilled into the EA Open Pit;
- **Construction Materials**: The Tenas Project will be using materials from within the Project Footprint (Goathorn Gravel Quarry/Rock Quarry/Non-rock materials found along the Tenas Access Corridor and Rail Infrastructure) and offsite gravel deposits owned by independent third parties like Vihar. These materials have been classified as *non-PAG* (SRK 2024a);
- PAG rock: These are mine materials with an NPR of less than 2.0 (see Figure 6-1 and section 6.1.3). PAG rock will be placed into management ponds and submerged with a minimum of 0.5 m of water within an average of 6 months after excavation but no longer than 12 months. This management option minimizes the potential to form ARD by placement in a subaqueous setting to limit interaction with oxygen. PAG rock will be managed as follows:
  - In advance of, and during mining, TML proposes to progressively construct management ponds. The purpose of these ponds is to permanently store PAG material in subaqueous conditions to minimize sulfide oxidation and formation of acidic drainage;

  - The North Management Pond which is constructed first will be external to the north of the EA Open Pit. The East Management Pond is constructed next and will be external to the open pit and will be south of the North Management Pond, and northeast of the EA Open Pit. The West Management Pond is constructed last and will encompass the northern portion of the EA Open Pit plus an embankment to provide sufficient storage for PAG material (
  - PAG material will first be placed in the North Management Pond. PAG material will be progressively placed in lifts and then flooded so that exposure of PAG material to atmospheric oxygen is minimized. TML is proposing to place PAG rock underwater before it becomes acid generating. The timing to the onset of acid generation is discussed in section 6.1.4;
  - Once the storage capacity of the North Management Pond has been reached, storage will begin in the East Management Pond and subsequently in the West Management Pond. The Management Ponds will be maintained with at a 0.5m water cover during active use and under at least 1.5 m of water once the management pond's PAG rock storage capacity has been reached;
  - Once the ponds have reached the maximum PAG rock storage capacity, TML will place a 1 to 2 m layer of *non-PAG* rock on top of the submerged PAG material below the active water level of the management pond, followed by a 0.5 m overburden layer to create a dry landform above water, followed by approximately a 30 cm layer of reclamation materials (surface soils) to reduce evaporative losses from the water cover above the saturated PAG rock;
- ***Non-PAG* rock:** This is mine rock with low sulphur levels with an NPR that is greater than or equal to 2.0 (see 6.1.3). The *non-PAG* rock will be used as open pit backfill, in management pond embankments, buttresses or used as interim cover material over the management ponds at closure;
- **Processed Rock (tailings):** This is coarse and fine rock material separated from the processed coal during coal processing. These materials are classified as PAG and will be placed subaqueously into the management ponds.
- **ROM Coal:** This is coal that is excavated from the open pit and placed into several stockpiles for feeding into the Coal Processing Plant (CPP). This material is classified as PAG. Historical testing (Norecol, Dames & Moore 1999) indicates that coal can become acid generating in a shorter timeframe than processed rock; however, this was not confirmed as part of the SRK (2024a) study. Drainage from the coal stockpiles will be monitored and if for some reason ROM Coal is not processed, it will be placed in the management ponds;
- **Processed Coal:** This is coal that is produced by the CPP for the marketplace and is classified as PAG. Drainage from the processed coal stockpiles will be monitored and if for some reason becomes acidic this drainage will be collected and treated; and
- **EA Open Pit Walls:** Pit walls will be covered with *non-PAG* material to limit oxygen and water ingress from contacting open pit wall rock surfaces. Much of the open pit will be backfilled during the Operation and the Decommissioning and Reclamation Phases. Meteoric water contacting the

non-PAG covered open pit walls will report to an End Pit Lake, which will subsequently drain northwards by gravity and mix with Management Pond water prior to discharging.

Surface water management features (i.e., channels, sedimentation ponds and storage ponds) are illustrated in Figure 6-7 below. Upslope diversion channels will divert non-contact water away from the material stockpiles and surface mine areas, into existing natural watercourses. Downslope collection channels will collect runoff from the material storage areas and divert it into the sedimentation ponds for treatment with approved flocculants/coagulants to reduce total suspended solid levels to regulatory levels. No water treatment is anticipated beyond normal sediment control (SRK 2024b); discharge water from the site will achieve the water quality criteria required to protect drinking water and fish and aquatic life downstream of the project.

The estimated material production schedule is provided in Table 6-3 below.

Table 6-3: Material Production Schedule

Year	Construction Materials (kBCM/Material)	Reclamation Materials (surface soils/topsoil) (kBCM)	Overburden (kBCM)	PAG Rock (kBCM)	*Non-PAG* Rock (kBCM)	Run-of-Mine Coal (ktonnes)	Processed Coal (ktonnes)	Processed Rock (ktonnes)
-0.5	125.0/OVB Haulroads	797	1,423	0	0	0	0	0
	16.4 Well Graded Base (WGB) Tenas Access Corridor (TAC)							
	10.0 Open Graded Base (OGB) TAC							
	4.0 ballast Rail Infrastructure							
	6.0 sub ballast Rail Infrastructure							
	7.0 high fines TAC							
0	175.0/OVB Haulroads	83	1032	327	0	263	196	67 (38m^3)
	21.6 high fines TAC							
	45.0 OGB TAC							
1	67.0/OVB Haulroads	140	1,082	1214	337	1050	768	282 (161m^3)
	5.0 high fines TAC							
	15.0 OGB TAC							
2	67.0/OVB Haulroads	366	3729	1549	641	1050	764	286 (163m$^{3)}$
	5.0 high fines TAC							
	15.0 OGB TAC							
3	67.0/OVB Haulroads	140	1,668	1,712	1,738	1,050	803	247 (141m^3)
	5.0 high fines TAC							
	15.0 OGB TAC							
4	50.0/OVB Haulroads	28	904	1,769	741	1,050	773	277 (158m^3)
	5.0 high fines TAC							
	15.0 OGB TAC							
5	5.0 high fines TAC	25	815	1,980	1,238	1,050	776	274 (157m^3)
	15.0 OGB TAC							
6 to10	25.0 high fines TAC	194	4,242	7,819	9,760	5,250	3,809	1,441 (823m^3)
	75.0 OGB TAC							
11 to 15	25.0 high fines TAC	292	4,709	7,753	7,434	5,250	3,968	1,282 (733m^3)
	75 OGB TAC							
16 to 21	30.0 high fines TAC	199	1,805	6,783	6,817	6,003	4,418	1,585 (906m^3)
	90.0 OGB TAC							
Total	551.0/OVB Haulroads	2,264	21,409	30,906	28,706	22,016	16,275	5,741 (3,280m^3)
	133.6 high fines TAC							
	16.4 WGB TAC							
	370.0 OGB TAC							
	4.0 ballast Rail Infrastructure							
	6.0 sub ballast Rail Infrastructure							

Note: kBCM=thousand bank cubic metres; ktonnes=thousand tonnes

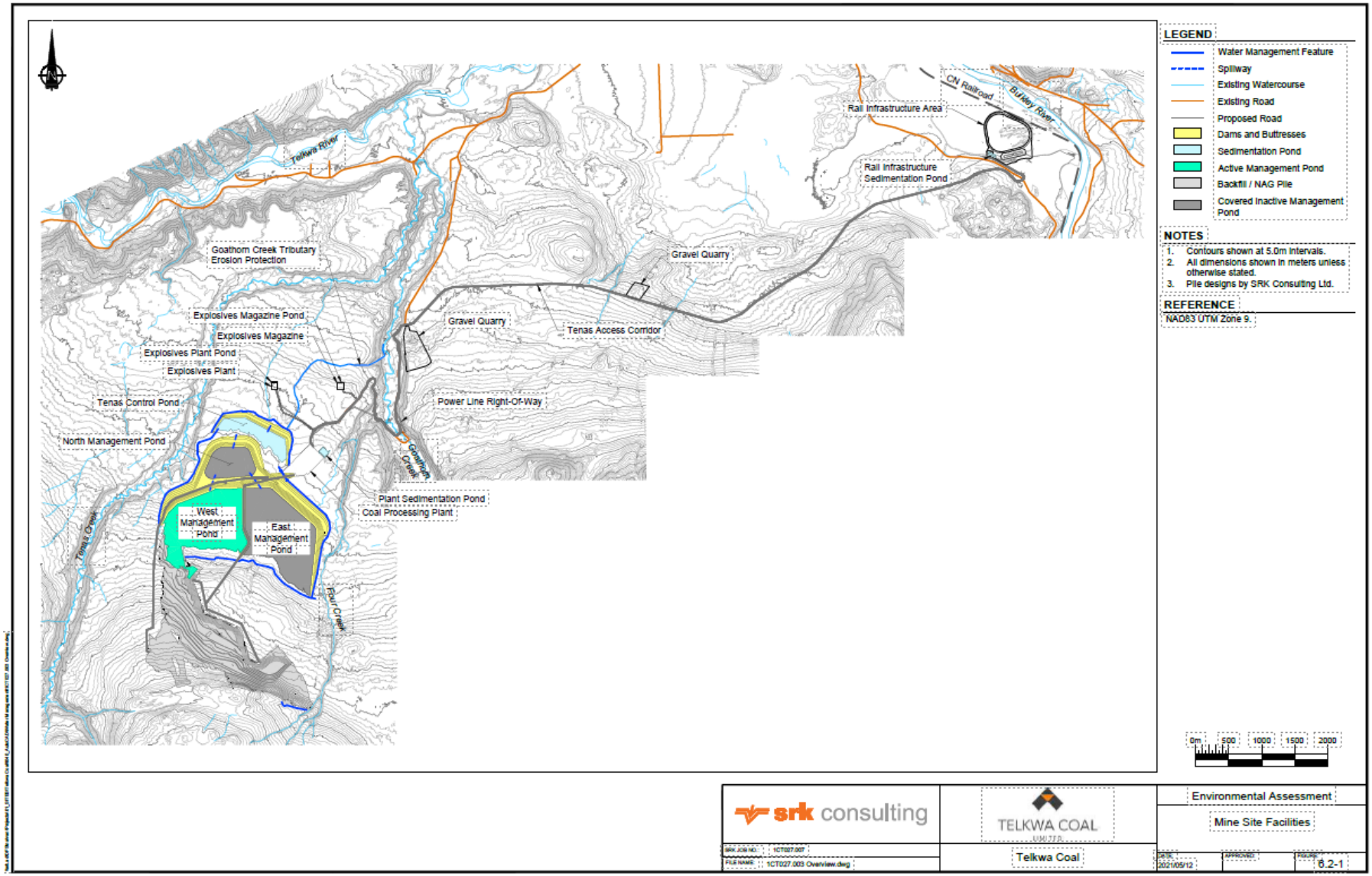


Figure 6-7: Tenas Project Components and Water Management Features

6.3 Material Handling and Coal Processing

Figure 6-8 below provides a flow chart for the material handling methodology for the Project. As presented, any surplus overburden and *non-PAG* material will be placed within the critical backfill portions and/or buttress area of the embankments for the management ponds or backfilled into the open pit.

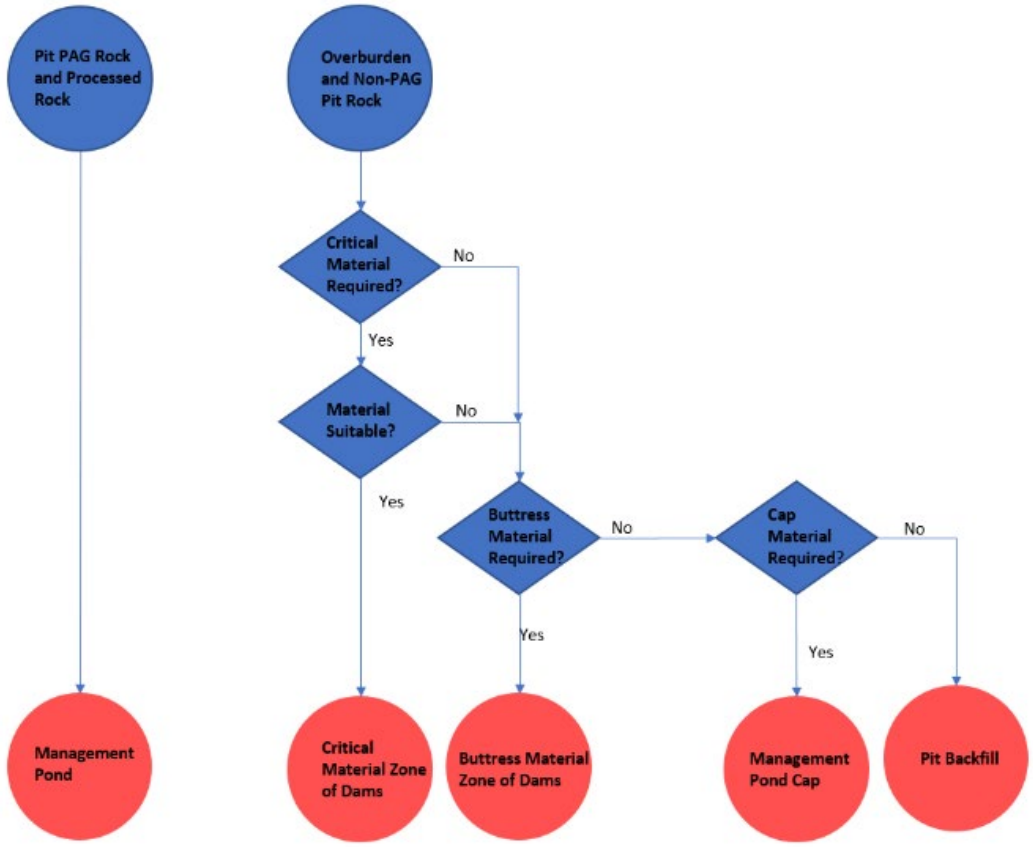


Figure 6-8: Material Management Decision Matrix

The Coal Processing Plant (CPP) flowsheet is provided below in Figure 6-9 below. The proposed flowsheet is typical of other western Canadian metallurgical coal operations; however, TML will use centrifuges for processed coal dewatering versus coal and/or natural gas fueled coal dryers to minimize GHG and dust emissions. As shown, material entering the CPP leaves in one of two streams, processed coal, or processed rock, with the former being sold on the marketplace and the latter being disposed of in the management ponds

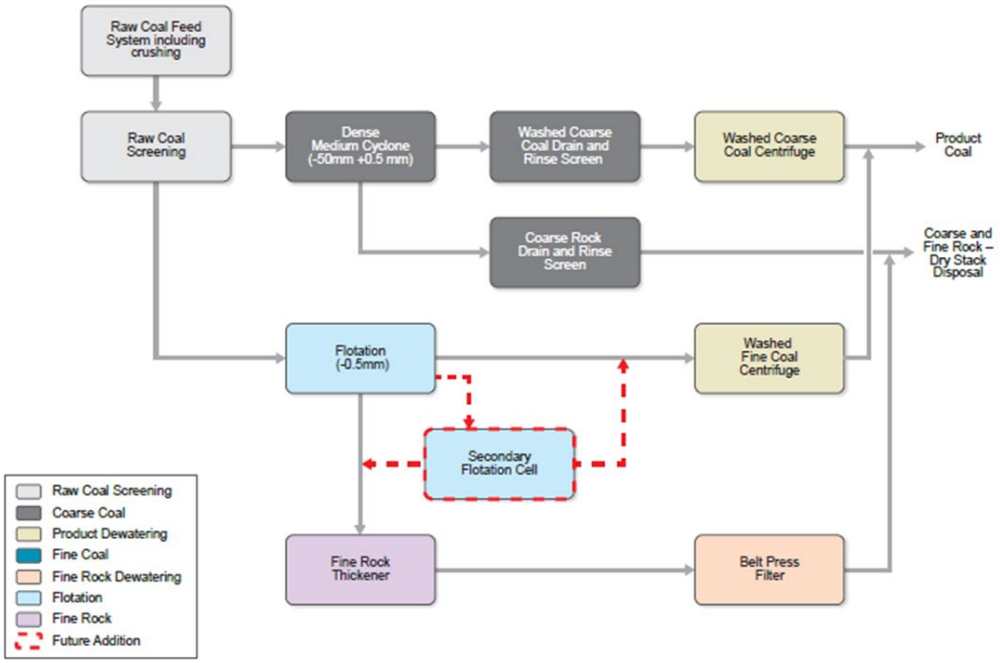


Figure 6-9: Coal Processing Flowsheet

6.4 Operational Monitoring & Geochemical Classification Criteria

6.4.1 Scope of Criteria

These criteria apply to chip samples collected during the drilling of blastholes and to free dig materials (e.g., overburden/surface soils/construction materials), and from processed rock/coal. Classification of ARD is based on zone, material type, and the NPR for the chip sample collected and their distribution within the blast pattern.

6.4.2 Classification Based on Material Type

Rock excavated during mining from all zones and materials will be considered PAG unless operational verification testing demonstrates it is *non-PAG* using the NPR classification provided in Section 6.4.3. Processed rock, processed coal and ROM coal are also considered PAG.

Overburden, surface soils (topsoil), and construction materials will be considered *non-PAG* but will still need verification testing.

6.4.3 Classification Based on Neutralization Potential Ratio (NPR)

As stated earlier in section 6.1.3 SRK (2024a) determined that an NPR cut off criteria of 1.20 for this deposit could be used to classify rock as PAG or non-PAG during verification testing. However, Telkwa Mining will continue to use the more conservative NPR criterion of 2.0 as a cut off versus the site-specific value of 1.20 to identify exploration drillhole and blasthole rock as PAG and *non-PAG*. Rock with an NPR less than 2.0 being classified as PAG and rock with an NPR >= 2.0 being classified as *non-PAG*. This criterion was selected to ensure that Telkwa Mining is overpredicting the amount of PAG rock that must be stored for geotechnical dam design and stability analysis, liner design, and to ensure sufficient equipment was available for PAG rock handling. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, TML will apply for an amendment to the NPR criterion.

SRK (2024a) determined for both planning, regulatory, and operational phases an NPR cut off criterion of 2.0 for this deposit is both appropriate and defensible to use as a cut off for other materials besides rock with materials with an NPR less than 2.0 being classified as PAG and materials with an NPR >= 2 being classified as *non-PAG* for other materials such as overburden, construction non-rock materials, surface soils (topsoil), coal, and processed rock.

6.4.4 Operational Monitoring Procedures for Materials

6.4.4.1 Mine Rock

Portions of Zones 1, and 4 might be classified as *non-PAG* based on their exploration drillhole or blasthole properties (SRK 2024a) and an operational NPR cut-off of 2.0. As noted in **section 6.1** all rock zones potentially contain a component of PAG and *non-PAG* materials. PAG rock in Zones 1, and 4 will be identified using the site-specific NPR of 2.0 through sample monitoring in advance of excavation of material via blasthole sampling. Rock with an NPR less than 2.0 will be classified as PAG and placed underwater in the management ponds. Mine rock with an NPR greater than or equal to 2.0 will be classified as *non-PAG* and will either be used as open pit backfill, used in management and/or control pond embankments and buttresses, placed inside the management ponds, or used as the final cover material for the management ponds and/or EA Open Pit walls. The following sections provide the procedures for sample collection, testing and analysis. If verification is not completed on rock excavated this material will be assumed to be PAG and placed in the management ponds for permanent disposal.

6.4.4.2 Sample Collection

Each blast will consist of the following approximate attributes:

- Blast hole depth of 13 m;
- Blast hole spacing of 9.3 m; and
- Blast hole burden of 8.0 m.

A blast pattern will be approximately 140 m by 60 m, producing approximately 100,000 bank cubic meters (BCM) of rock per blast.

Geochemical samples will be collected from blast hole drill cuttings at intervals of approximately 18.6 m or two times blast hole spacing distance and 16 m or two times the burden distance along burden. Composite samples throughout the entire drillhole length of designated blastholes should be created through collection of chips from the blasthole and coning and quartering the sample to create a homogenized sample representative of the entire blast hole. If multiple zones are intersected in one drillhole, composite samples of thickness of each zone will be collected from the blastholes. Samples are to be bagged and labelled with a unique sample ID and the location, time, date, drill rig, and stratigraphic unit the sample was collected from. Approximately 3 to 5 kilograms (kg) of sample should be collected and stored in case future analysis is required.

6.4.4.1.2 Determine the Blast hole Neutralization Potential Ratio (NPR)

The following are the steps to calculate the NPR of each sample:

- Measure total carbon and total inorganic carbon using standard procedures (MEND 2009):
- Measure total carbon using standard Leco furnace procedures;

- Measure total inorganic carbon (TIC) through evolving CO_2 with an HCl leach;
- Calculate the NP of the sample using Equation 1 below;

  〖NP〗_effective (〖kg CaCO〗_3/t)=0.56×〖TIC〗_LECO (%)×83.3 (EQ1)

- Measure total sulfur using standard Leco furnace procedures;
- Calculate the AP of the sample using Equations 3 and 4 below; and

  〖"S" ^"2-" 〗_"calculated " "(%) = 0.93×" 〖"Total-S" 〗_"measured" " (%) - 0.02 " (EQ3)

  $$\text{AP } (kg\ CaCO_3/\text{t}) = S^{2-}_{\text{calculated}}\ (\%) \times 31.25 \qquad \text{(EQ4)}$$

- Calculate the NPR of the sample by dividing the NP by the AP.

Blast holes with an NPR<2.0 are classified as PAG while holes with an NPR>=2.0 are classified as *non-PAG*.

6.4.4.1.3 Delineate Potentially Acid Generating (PAG) and non-PAG Rock

Blasts may consist of a mix of PAG and *non-PAG* rock, as defined by blasthole sample results. Rock is only considered *non-PAG* in the blast hole grid where the package of rock is contained within four *non-PAG* blastholes. Rock adjacent to PAG holes is considered PAG. An example of PAG and *non-PAG* rock delineation is provided in Figure 6-10. If verification testing shows increasing variability the sampling program can be increased to take a sample from every blasthole versus every second blasthole as illustrated in Figure 6-10.

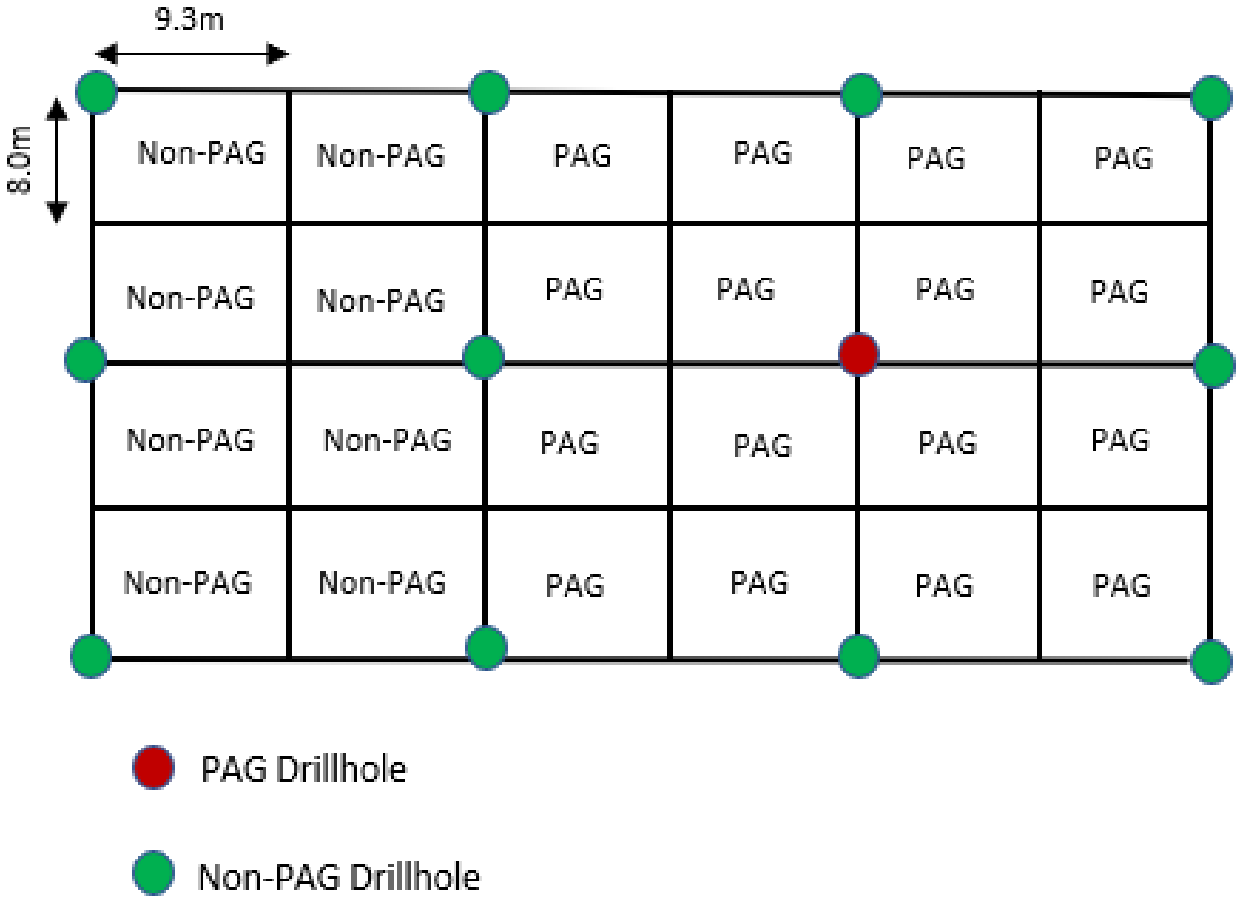


Figure 6-10: Example of Blast Grid non-PAG and PAG Rock

6.4.4.1.4 Laboratory Testing

Application of the above criteria will require collection of samples to confirm and/or update, as necessary, the operational NP and AP calculation methods. A minimum of one (1) confirmation sample per blast should be collected for testing as follows:

- If all blastholes are classified as either *non-PAG* or PAG, one (1) confirmation sample should be collected for confirmatory analysis; or
- If a blast is classified as having both *non-PAG* and PAG blastholes, one (1) *non-PAG*, and one (1) PAG sample should be collected for confirmatory analysis.
- These samples should be submitted to an accredited lab for the following analyses:
- Paste pH;
- Total sulphur by Leco furnace;
- Sulfur as sulfate following HCl leach;
- TIC measured from evolved CO_2; and
- Elemental analysis using ICP-MS following an aqua regia digestion using ultra low detection limits to understand metal leaching potential.

6.4.4.1.5 Non-PAG Rock Pile Testing

Random quarterly non-PAG rock pile samples will be taken from active non-PAG rock lifts in areas where rock has been placed during the last quarter. The number of samples will be based on using roughly a 200 by 200-m grid pattern and taking a sample on every node of this grid. The same criteria will be used as for operational blasthole verification testing with material having an NPR < 2.0 being designated as PAG, while materials with an NPR >= 2.0 being designated as non-PAG. If PAG material is identified by these grid points additional sampling will be conducted in 25-m offset concentric circles from this location until a non-PAG sample is measured as illustrated by Figure 6-11 below.

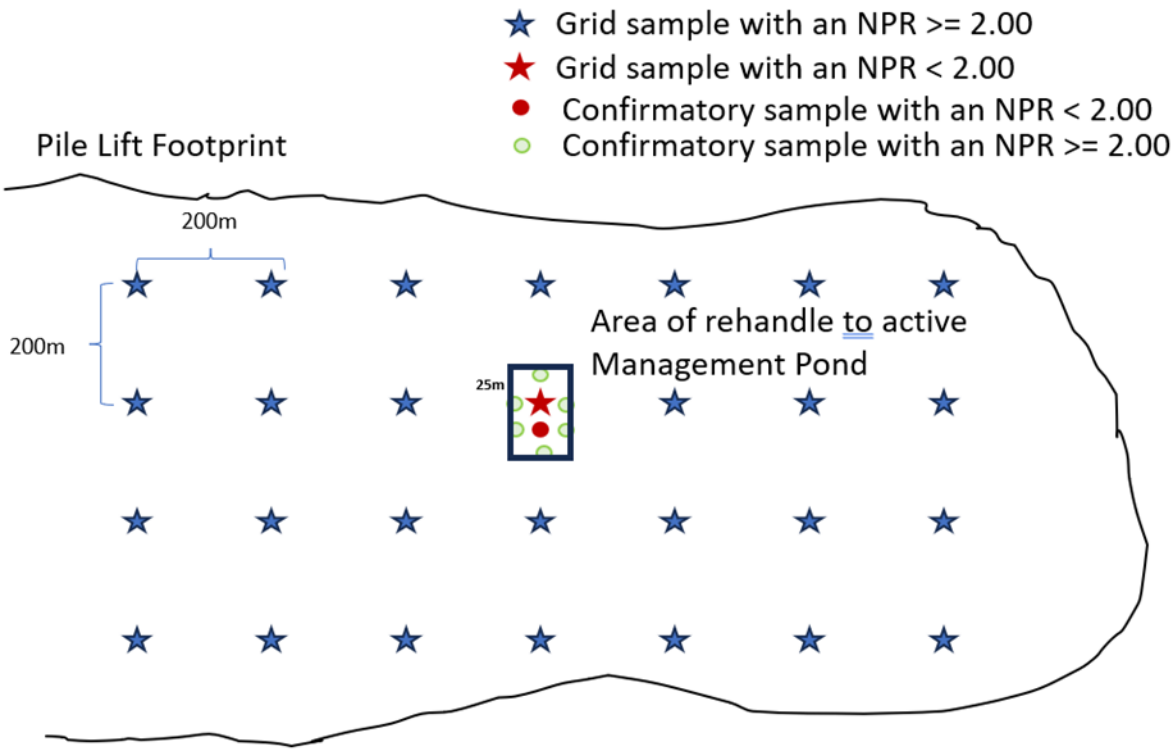


Figure 6-11: Non-PAG Pile Lift Material Confirmation Testing

Once the *non-PAG* rock pile area is defined by confirmatory testing and a bulk NPR and sulfur % has been calculated based on the sample testing completed; the following actions will be taken:

- If the bulk NPR for the sample is less than 2.0 an investigation will be completed, including a survey of the material's location and review of material that was placed there via the site electronic tracking system, and
- Then a risk assessment will be conducted to determine if this this material will be rehandled and placed underwater in one of the active management ponds.

6.4.4.3 Overburden

Geochemical testing (SRK 2024a) indicates that overburden is depleted in sulfide and is *non-PAG*. Overburden samples collected as part of the supplemental geochemical characterization (SRK 2024a) were *non-PAG*. Overburden is expected to be *non-PAG* with confirmatory testing planned at a frequency of one sample per 10,000 m^3 of excavated overburden. Composite samples from the excavation are to be bagged and labelled with a unique sample ID and the location, time, date, and stratigraphic unit the sample was collected from. Approximately 3 to 5 kg of sample should be collected and stored in case future analysis is required. Laboratory testing will be conducted on one sample per month when over 10,000 m^3 of overburden is excavated and these samples should be submitted to an accredited lab for the following analyses:

- Paste pH;
- Total sulphur by Leco furnace;
- Sulfur as sulfate following HCl leach;
- TIC measured from evolved CO_2; and
- Elemental analysis using ICP-MS following an aqua regia digestion using ultra low detection limits to understand metal leaching potential.

6.4.4.4 Surface Soils (topsoil)

Surface soils (*topsoil)* for the Project area are expected to be *non-PAG* due to the lack of sulfur present in this unit. Confirmatory testing planned at a frequency of one sample per 100,000 m^3 of salvaged surface soils will be completed.

6.4.4.5 Run-of-Mine (ROM) Coal, Processed Rock, and Processed Coal

Geochemical testing (SRK 2024a) indicates that coal materials for the Project have an excess of sulfur above neutralizing minerals and has been classified as PAG. Samples collected as part of the supplemental geochemical characterisation (SRK 2024a) were PAG. No verification testing is required as ROM, Processed coal and rock will be classified as PAG, and processed rock will be placed underwater into the management ponds while ROM Coal is processed into processed rock and processed coal with processed coal being shipped off site to market prior to material producing acid rock drainage.

6.4.4.6 Construction Materials

Geochemical testing (SRK 2024a) indicates that construction materials selected for this Project are depleted in sulfide and are *non-PAG*. Construction materials can be considered *non-PAG* with confirmatory testing of one sample per 10,000 m^3 of provided construction materials. Composite samples from the excavation are to be bagged and labelled with a unique sample ID and the location, time, and date. Approximately 3 to 5 kg of sample should be collected and stored in case future analysis is required. Laboratory testing will be conducted on one sample per month when over 10,000 m^3 of construction materials is excavated and these samples should be submitted to an accredited lab for the following analyses:

- Paste pH;
- Total sulphur by Leco furnace;
- Sulfur as sulfate following HCl leach;
- TIC measured from evolved CO_2; and
- Elemental analysis using ICP-MS following an aqua regia digestion using ultra low detection limits to understand metal leaching potential.

In the event of blasting being required for construction materials the same confirmatory sampling for rock will be used for blastholes.

7 Monitoring

TML will conduct regular inspections of the laboratory equipment, sampling equipment, results collected and personnel carrying out the tasks to ensure proper procedures are being followed and there is no potential for PAG material being placed in the incorrect location. Inspections will be recorded and provided to the Environmental Coordinator and Mine Manager.

Performance Objectives

Table 7-1 below highlights the performance objectives and targets required to ensure the proper implementation of this ML/ARDMP.

Table 7-1: Performance Objectives

Objectives	Target
Inductions completed	Metal leaching/acid rock drainage (ML/ARD) induction complete and additional training complete for those that require it
Samples taken of blasted rock and results recorded in the geochemical database	Target zero with no samples missed.
Potentially acid generating (PAG) volumes placed in correct location	Incorrect placement; target zero
Actual PAG volumes reconciled, and results assessed versus models	Targets met
Inspection of management ponds completed	Improvement: for more frequent inspections made, if needed; continual improvement
PAG rock submerged within 6 months	Verify timely water cover
Tracking documents and volumetrics	Up to date and are being completed; target met
Management pond PAG requirements met	Management ponds were covered with *non-PAG* material on top of the submerged PAG material followed by a 1 to 2 m *non-PAG* layer followed by an 0.5 m overburden layer to create a dry landform above water, followed by approximately a 30 cm layer of reclamation materials(soil) to reduce evaporative losses from the water cover above the saturated PAG rock

8 Reporting

8.1 General Reporting

Reporting completed by TML will confirm consistent implementation of the MLARDMP. Summary reports of evaluation activities and results will be compiled and reviewed annually.

8.2 Compliance Reporting

Compliance reporting will be subject to the Environmental Assessment Certificate (EAC), and *MA/EMA* permit conditions. The information gathered during monitoring practices will be summarized with information from other management plans into an Annual Environmental Management Summary Report and upon permitting completion, the Annual Environmental Reports as required by *MA/EMA* permits. Community engagement activities will be an aspect of the Socio-economic Management Plan (S13.0-C16) (SEMP). The SEMP will have requirements related to reporting on community engagement programs.

Furthermore, events requiring emergency response have other regulatory reporting responsibilities and they will be fulfilled as required.

8.3 Internal Reporting

Details of monitoring will be reported internally on an annual basis according to the adaptive management framework of the EMS. The EMS annual report will provide results of monitoring, assessment of performance objectives where applicable, and any other pertinent information.

TML staff or contractors will be strongly encouraged to report any inefficiencies to management for evaluation consideration.

8.4 Geochemical Database

A geochemical database will be developed to maintain operational monitoring results. The database will include the following information:

Sample attributes:

- Collection date and time;
- Sample location;
- Sample depth intervals;
- Drillhole ID for mine rock;
- Sample mass;
- Sample zone;

- A description of the lithological composition of the sample;
- Any other visible attributes of the sample;
- Blast volume, ARD classification and storage location;
- Testing results: total sulfur, TIC and calculated NP, AP, and NPR values; and
- Confirmatory ABA and elemental analysis results including: paste pH, total sulfur, sulfate sulfur, TIC, NP, NPR, ICP-MS elemental analysis results.

8.5 Monthly Reporting

ML/ARD results will be reviewed monthly by environmental/engineering staff and discussed with the Environmental Coordinator and Mine Superintendent. The results including raw data and QA/QC will be provided in the Annual Reclamation Report.

8.6 Annual Reporting Requirements

Results from implementation of this plan, as approved by BC MMCM's Chief Inspector of Mines, will be provided in annual reporting for the *Mines Act* permit and submitted by March 31 each year. For mined rock, the annual reporting will ensure requirements for inventorying of mine rock as specified in Section 10.5.7 of the Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMLI 2021) are met. This will include:

- The quantities (mass and volume) of each type of mine rock (specified as each stratigraphical zone);
- The location and cumulative areas of storage facilities based on the past and the current reporting year; and
- Results of the monitoring specified in this plan.

Annual seep surveys will be conducted along the toe of mine rock storage areas during the freshet to identify any new seeps. Freshet provides the best opportunity to observe seepage. If new seeps are identified, water is collected and analyzed for major ions and dissolved trace elements. A specific seep survey sampling procedure with sample locations will be developed as seep locations are identified following placement of materials.

8.7 General Reporting

Reporting completed by TML will confirm consistent implementation of the MLARDMP. Summary reports of evaluation activities and results will be compiled and reviewed annually.

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Compliance reporting will be subject to the Environmental Assessment Certificate (EAC), and *MA/EMA* permit conditions. The information gathered during monitoring practices will be summarized with information from other management plans into an Annual Environmental Management Summary Report and upon permitting completion, the Annual Environmental Reports as required by *MA/EMA* permits. Community engagement activities will be an aspect of the Socio-economic Management Plan (S13.0-C16) (SEMP). The SEMP will have requirements related to reporting on community engagement programs.

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- Sample mass;
- Sample zone;
- A description of the lithological composition of the sample;
- Any other visible attributes of the sample;
- Blast volume, ARD classification and storage location;
- Testing results: total sulfur, TIC and calculated NP, AP, and NPR values; and
- Confirmatory ABA and elemental analysis results including: paste pH, total sulfur, sulfate sulfur, TIC, NP, NPR, ICP-MS elemental analysis results.

8.11 Monthly Reporting

ML/ARD results will be reviewed monthly by environmental/engineering staff and discussed with the Environmental Coordinator and Mine Superintendent. The results including raw data and QA/QC will be provided in the Annual Reclamation Report.

8.12 Annual Reporting Requirements

Results from implementation of this plan, as approved by BC MMCM's Chief Inspector of Mines, will be provided in annual reporting for the *Mines Act* permit and submitted by March 31 each year. For mined rock, the annual reporting will ensure requirements for inventorying of mine rock as specified in Section 10.5.7 of the Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMLI 2021) are met. This will include:

- The quantities (mass and volume) of each type of mine rock (specified as each stratigraphical zone);
- The location and cumulative areas of storage facilities based on the past and the current reporting year; and
- Results of the monitoring specified in this plan.

Annual seep surveys will be conducted along the toe of mine rock storage areas during the freshet to identify any new seeps. Freshet provides the best opportunity to observe seepage. If new seeps are identified, water is collected and analyzed for major ions and dissolved trace elements. A specific seep survey sampling procedure with sample locations will be developed as seep locations are identified following placement of materials.

Primary responsibilities have been assigned to the following roles or groups:

8.13 Mine Manager

The Mine Manager bears overall responsibility for all phases of the Project, and responsibility for onsite environmental monitoring and compliance relating to Construction, Operation, Decommissioning and Reclamation, and Post-Closure phase activities. The Mine Manager reports to the executive steering committee for TML and will coordinate with this group to ensure that Project objectives are being met.

Specifically, the Mine Manager will:

- Complete an annual review of the ML/ARDMP;
- Provide personnel, equipment, or other assistance to ensure compliance with applicable regulations, acts, guidelines, permits and policies for the protection of the environment;
- Investigate improvements in any trend and assess whether the practices responsible for the improvements can be applied to other areas of the Project; and
- Deteriorating trends will be studied to determine the root cause. When the cause is identified, the Mine Manager or their delegate will implement a suitable corrective action.

8.14 Mine Superintendent

- The Mine Superintendent reports to the Mine Manager:
- Complete quarterly inspections of management pond infrastructure;
- Provide equipment and personnel to carry out sampling and monitoring of PAG materials and water management infrastructure when requested; and
- Review ML/ARD results monthly by environmental/engineering staff and discuss with the Environmental Coordinator.

8.15 Environmental Coordinator

The Environmental Coordinator reports to the Mine Superintendent:

- Oversee compliance with regulations, acts, guidelines, permits and policies;
- Provide expertise for decisions regarding protection of the environment and ML/ARD management;
- Oversee appropriate monitoring and inspections are performed as required or needed;
- Complete an annual review of the ML/ARDMP;
- Ensure compliance of ML/ARD monitoring programs with the approved *MA/EMA* permits and SPPs; and
- Complete reporting for regulatory agencies and for the Annual Environmental Management Summary Report to Indigenous groups as related to this ML/ARDMP.

8.16 Quality Assurance /Quality Control (QA/QC) Technician and Environmental Technician

The QA/QC Technician and Environmental Technician report to the Environmental Coordinator and will:

- Participate in required training;
- Understand and perform assigned tasks and duties;
- Report to the Environmental Coordinator any discrepancies, concerns, or questions regarding tasks, duties, or procedures in a prompt manner; and
- Sample mine rock, processed rock, ROM coal and open pit surfaces.

8.17 Employees

TML staff as outlined above have primary responsibility for ensuring *MA/EMA* permits, EMS and related management plans, operation maintenance and surveillance programs for open pits, material storage piles, management, and control ponds, and SPP requirements are met with respect to sampling, analysis of mine material classification, mine material placement, and confirmatory monitoring.

9 Communication

Communication of the ML/ARDMP at TML will be based on internal requirements and will primarily take place through this ML/ARDMP and relevant SPPs. Any significant change to the ML/ARDMP will be communicated to the Project's employees and contractors through a site-wide email, announcements over radio channels by Minesite supervision and bulletins posted around the Project's Minesite. When effective to do so, maps will be marked with changes.

9.1 Training and Awareness

ML/ARD management requires special handling, monitoring, and tracking. Employees, contractors, and subcontractors who are involved in implementation of the ML/ARDMP at the Project will be provided with appropriate training or be required under contract to have that training.

9.2 Employee and Contractor Training

The training of personnel involved in Construction, Operation, Decommissioning and Reclamation phase activities on the Project who are dealing with PAG and *non-PAG* material to understand it is a critical factor in achieving the objectives outlined in this ML/ARDMP. Those responsible for the management, implementation, and operation of any aspect of this ML/ARDMP will be competent for their role. Prior to the commencement of work onsite, employees and contractors, including those responsible for dealing with material movement onsite, will:

- Attend an induction session that will provide a brief overview of the types of materials mined on site and how they are managed; and
- Review and understand the requirements of the ML/ARDMP and the Code.

In addition, workers will receive additional training specific to concepts and sampling requirements for ML/ARD, if required for the work they are undertaking.

9.3 Visitor Training

Visitors will not be required to be knowledgeable of this ML/ARDMP as they will be under the direction of TML employees and will not be allowed to be in a situation involving PAG material management.

10 Evaluation and Adaptive Management

10.1 Evaluation

A review of the ML/ARDMP will be completed by the Mine Manager and Environmental Coordinator on an annual basis to compare data, trends, and implementation of the management plans and their objectives. This process will include a review of the management plan deliverables and input received from stakeholders.

10.2 Adaptive Management

A philosophy of adaptive management will be adopted to make sure that management plans and mitigation measures are consistently meeting or exceeding performance targets. This will be achieved through periodic reviews of the ML/ARDMP and the results of monitoring programs.

10.3 Continual Improvement

TML will work towards continual improvement at the Minesite to ensure the accurate tracking and segregation of PAG and *non-PAG* materials and ensure appropriate handling of materials. The Mine Manager or delegate will investigate improvements in any trend and assess whether the practices responsible for the improvements can be applied to other areas of the Project. Deteriorating trends will be studied to determine the root cause. When the cause is identified, the Mine Manager or their delegate will implement a suitable corrective action.

Examples of corrective actions could include:

- additional supervision and control of material management;
- additional training of employees and contractors on procedures;
- enhancement of maintenance or monitoring measures; and
- additional supervisory oversight.

TML will amend the ML/ARDMP as required based on annual evaluations and feedback from relevant stakeholders. Any proposed changes will be sent out for review by stakeholders before being finalized and implemented into the ML/ARDMP.

11 Change Management

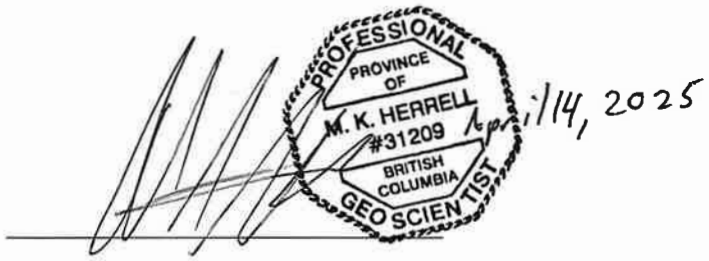
Changing any part of the ML/ARDMP requires the use of a formalized process. If significant changes are being planned to objectives, management plan structure, operational milestones, communication and/or information management, it is required that the Management of Change (MOC) procedure in the EMS be followed. Minor edits and/or updates to this ML/ARDMP will be controlled through version control and content approval functions.

12 Conclusion

Management of PAG materials at TML is important to meet future EAC and *MA/EMA* permit conditions and ensure environmental protection from ML/ARD. Through implementation of this ML/ARDMP and relevant SPPs, TML will ensure the efficient sampling of PAG rock, correct placement, and timing on provision of water cover over PAG rock in management ponds.

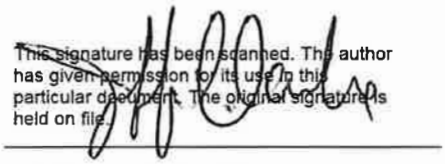
Closure

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EGBC Permit to Practice Reg. No.: EGBC 1003655

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix 13.12A Tenas Project Geochemical Characterization Update, SRK

TELKWA COAL
LIMITED

Telkwa Coal – Tenas Project Geochemical Characterization Update

Prepared for

Telkwa Mining Ltd.

Prepared by

srk consulting

SRK Consulting (Canada) Inc.
CAPR002933
November 2024

Telkwa Coal – Tenas Project
Geochemical Characterization Update

November 2024

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File Name: Telkwa_MLARD_Characterization_Update_CAPR002933_FINAL_20241115.docx

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srk consulting

Executive Summary

A comprehensive historical geochemical characterization program was completed for the Tenas Project located near the town of Telkwa, British Columbia for Manalta Coal Ltd. This program (Norecol Dames and Moore 1999) included geochemical testing of over 700 samples. However, this program had several limitations including:

- Total sulfur was used to calculate acid potential (i.e., sulfate was not measured, and sulfide could not be estimated);
- Neutralization potential was determined using the Sobek-NP method;
- Total inorganic carbon content was not evaluated; and,
- Selenium and other elemental data were limited in the solid-phase and kinetic testing program.

TML retained SRK Consulting (Canada) Inc. to collect supplemental samples to calibrate the historic dataset to current methods. SRK reviewed the core and logs with TML geologists in February 2018 and identified 173 samples for geochemical testing. Additional infill drill core samples were collected in 2019 to expand the geochemical dataset by a further 79 samples.

During the geochemical testing program, TML also collected and sent the following samples to the analytical lab for geochemical testing:

- Overburden
  - Six overburden samples (2018);
  - 19 overburden samples (2019); and,
  - One overburden sample (2023) collected during sonic drilling from the management ponds in 2021.
- Processed Rock
  - Three samples of coarse processed rock (2018 and 2019); and,
  - Four samples of fine processed rock (2018 and 2019).
- Construction Material
  - Two samples of rock material that will be used to construct the surfacing material for the Tenas Access Corridor;
  - Five overburden samples collected from five test pits along the proposed Tenas Access Corridor that will be used for constructing the base and subbase portions of this road; and,
  - Nine samples from four test pits in the vicinity of the Rail Infrastructure.

The results are summarized as follows.

Drill Core Results

The results of the mine rock geochemical characterization showed that a strong correlation exists between total sulfur and sulfide and between Sobek-NP and modified-NP. Regression equations derived from correlating these parameters allows sulfide and modified NP to be calculated in the historical dataset.

The mineralogical results confirmed the presence of iron carbonates in the mine rock samples. A strong positive relationship exists between modified-NP and calcium plus magnesium suggesting that modified-NP provides a reasonable estimate of the effective-NP.

The static geochemical testing results indicate that acid generating potential is controlled by stratigraphic rock zones. This is consistent with the historical geochemical test results (Norecol Dame and Moore 1999). Using an NPR criterion of 2.0 to characterize materials as potentially acid generating (PAG) or non-PAG, the following zones were identified to be PAG and non-PAG based on the zones' average weighted neutralizing potential ratio:

- **Non-PAG**– Zone 1, parts of zone 4, and zone 8; and
- **PAG** – Zones 1a, 2/3, parts of zone 4, 5, 55, 6, and 7.

All non-PAG rock zones contain both PAG and non-PAG material and verification testing of blastholes is required for final determination of material type and if verification testing is not completed rock zones will be treated as PAG.

Elemental concentrations were compared to the average crustal abundance (Smith and Huyck 1999) to identify parameters that are elevated in the solid phase. A parameter was screened as elevated if its concentration was greater than 10 times the average crustal abundances. The following elements were screened to be elevated in the solid phase:

- 14% of arsenic analyses;
- <1% of phosphorus, and selenium analyses; and
- 56% of sulfur analyses.

Loadings of the following parameters are expected to increase as pH decreases: acidity, sulfate, aluminum, cadmium, copper, iron, lead, nickel, strontium, and zinc. The concentrations of these parameters were evaluated in the water and load balance developed for the Project.

TML proposes to store PAG Rock under saturated conditions to limit sulfide oxidation. The sulfide oxidation rates in the humidity cell samples were used to estimate the lag time acid generation. The evaluation indicated that for the average bulk properties of PAG Rock, the minimum lag time of the average bulk properties of PAG rock under laboratory conditions is approximately 4.2 years. A minimum lag time of 0.3 years is estimated for PAG Rock units with minimum NPRs less than or equal to 0.1.

Overburden

The overburden samples had NPRs greater than two and were classified as non-PAG.

The following elements were screened to have concentrations greater than 10 times the average crustal abundances and were screened to be elevated in the solid phase:

- +2 mm to -25 mm fraction:
  - 67% (4 of 6 samples) of arsenic measurements; and
  - 17% (1 of 6 samples) of cadmium measurements.
- -2 mm fraction
  - 17% (1 of 6 samples) of arsenic and gold measurements; and,
  - 83% (5 of 6 samples) of tellurium measurements.

There were no elevated concentrations in the +25 mm fraction. A higher frequency of elevated parameters was observed in the +2 to -25 mm fraction in comparison to the -2 mm and +25 mm fractions.

Tellurium was the only element to be elevated in the 2019 and 2023 overburden samples. The 2019 and 2023 humidity cells maintained a circumneutral to alkaline pH throughout the 40 and 35 weeks of testing respectively. Except for aluminum, chromium, and iron, loadings of constituents maintained slight decreasing trends throughout the testing period.

Processed Rock

TML provided three coarse and four fine processed rock samples to Bureau Veritas. One fine processed rock was classified as non-PAG, and the remaining samples were classified as PAG. The historical processed rock samples were PAG and TML proposes to manage processed rock as PAG.

Humidity cell testing was completed on the combined coarse and the combined fine processed rock samples as well as on a subsequent fine processed rock sample produced in 2019. The coarse processed rock sample became acidic after 68 weeks (i.e., 1.3 years) of testing. An associated increase of several constituent loadings also occurred as the pH decreased. The fine processed rock samples remained alkaline for the duration of the testing period and, constituent loadings remained generally consistent for the duration of the testing period. Processed rock loadings were used to develop source terms that were carried forward into the water and load balance (SRK 2021).

As noted above, the coarse processed rock sample became acid generating after 1.3 years of testing. Depletion calculations on the 2018 processed rock sample indicate the sulfide in the sample will be depleted prior to the NP and the sample is classified as non-PAG. The 2019 fine processed rock sample is predicted to become acidic after 20 years under laboratory conditions.

Construction Materials

Construction material samples had low sulfur content and modified NPs exceeding AP. As a result, construction materials are classified non-PAG. No solid-phase concentrations were screened to be greater than 10 times the average crustal abundances in the construction samples.

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1 Introduction

Telkwa Mining Ltd. (TML) submitted an Environmental Assessment Certificate (EAC) application for the Tenas Project in 2022, located for the Telkwa Property, near the town of Telkwa, British Columbia (Figure 1-1).TML proposes to mine coal using open pit methods. Mining and washing of coal will produce the following mine material streams that will need to be managed:

- Surface Soils (topsoil);
- Overburden;
- Mine rock;
- Processed rock (tailings);
- Run-of-Mine Coal; and
- Processed coal.

The baseline geochemical characteristics of materials to be produced from mining the deposit have been established through two previous geochemical studies (Norecol, Dames and Moore 1999; SRK 2022a). Geochemical testing data indicate that both potentially acid generating (PAG) and non-potentially acid generating (non-PAG) materials will be produced during operations and acid rock drainage potential is constrained by sedimentary packages, with acid potential increasing with proximity to coal seams.

Since completion of the baseline geochemical characterization study, TML have collected and submitted additional mine rock, overburden, processed rock, and processed coal samples for geochemical testing. This report provides an update to the baseline geochemical characterization study incorporating testing results that have become available since the completion of the SRK (2022a) baseline characterization study.

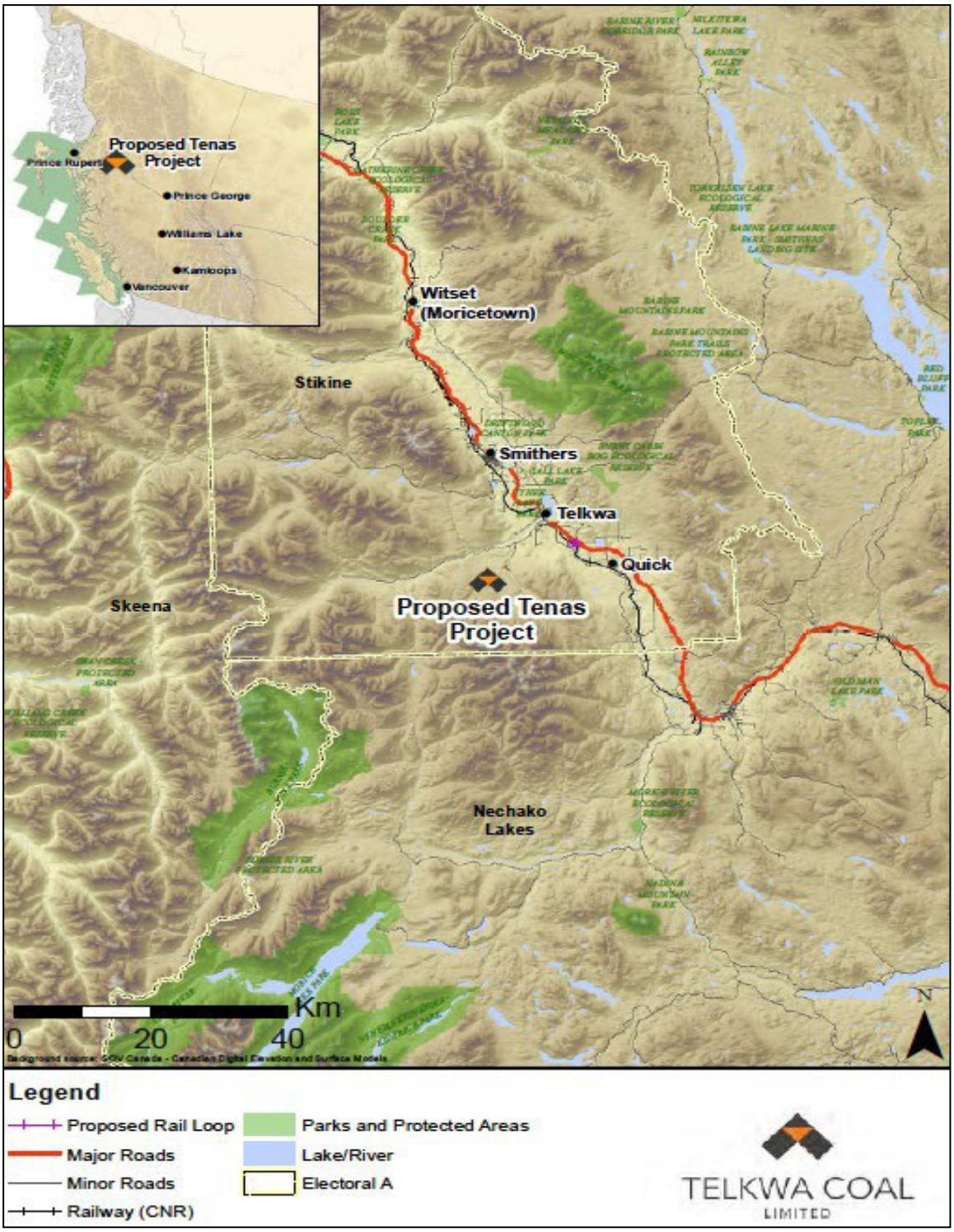


Figure 1-1: Location of the Telkwa Coal Tenas Project

2 Project Background

2.1 Bedrock Geology

The Tenas Project is located within the northeast/southwest trending Skeena Arch, which separates Jurassic-age sedimentary rocks of the Bowser Basin in the north from the Jurassic to Cretaceous-age sedimentary rocks of the Nechako Basin to the south. The coal-bearing sedimentary rock sequence of the Project is associated with the Lower Cretaceous age Skeena Group, and unconformably overlies the Jurassic-age Hazelton volcanic group. A simplified stratigraphic column of the Tenas deposit is presented in Figure 2-1.

2.1.1 Jurassic Hazelton Volcanic Group

The volcanic rocks include andesite, trachyte, and basalt with associated tuffs and breccias.

2.1.2 Lower Cretaceous Skeena Group

The Lower Cretaceous Skeena Group includes marine and continental sediments interbedded with coal seams, often correlated over long lateral distances. It is subdivided into four units (Units I through IV) and a unit of undivided sediments overlying the four units (Figure 2-1).

The economic coal seams in the Tenas area are in Coal Zone 1 of Unit I and includes two seams: C seam and 1 seam (upper and lower). Coal Zones 2 through 10, located in Unit III (Figure 2-1), are absent from the Tenas area. Units I through IV are summarized below.

Unit I (modified after Ledda, 1998)

The basal unit, Unit I, was deposited in a fluvial environment and, in the Telkwa Property, rests unconformably over the eroded Hazelton volcanic basement of Jurassic age. Because it was deposited over an undulating surface the Unit I stratigraphy has been observed to display variability in thickness, often over short lateral distances. This variability is most evident in the lower sedimentary assemblage, between the basement contact and the lowermost Unit I coals. As such, Unit I can be more than 100 m in thickness and consists mainly of conglomerate, sandstone, mudstone, and coal.

Coals within this unit, collectively referred to as Coal Zone 1, formed in poorly drained backswamps and are characterized by lateral variation throughout the study area. The Unit I coals can consist of up to 12 individual seams that collectively contribute up to 11.9 m of coal to the unit's overall thickness. Sands and gravels were typically deposited in braided channels and bars while mudstones accumulated in floodplains. Indications are that there was periodic marine influence during deposition of the unit. Deposition of Unit I ended with a marine transgression and deposition of Unit II.

Unit II (Ledda, 1998)

Unit II was deposited within a deltaic / shallow marine environment and consists of up to 140 m of sandstone, silty mudstone and occasional thin coaly mudstone. Sands were deposited in

distributary channels and mouth-bars while mudstones and silty mudstones accumulated in interdistributary bays. Thin discontinuous peat beds, none of which are of economic significance, accumulated in local salt marshes.

Unit III (modified after Ledda, 1998)

Unit III is indicative of the second regressive episode for the area and represents the deposition of the 2nd main coal-bearing stratigraphic sequence. The unit averages 85 m in thickness and is comprised of sandstone, siltstone, carbonaceous mudstone, and thick, laterally extensive coal seams. Restricted nearshore marine, tidal flat and coastal swamp environments persisted throughout much of the deposition of Unit III. Sandstone units were deposited within tidal channels while interbedded sandstones and siltstones were deposited nearshore within intertidal environments. Mudstones are representative of tidal flat deposits. Significant marine influence during deposition of the entire unit is indicated.

Coal Zones 2 through 11 are represented in Unit III, collectively contributing to up to 17 coal seams of economic significance. The coal zones were likely formed in freshwater peat swamps, located landward of the tidal flat, somewhat isolated from influxes of brackish water. The presence of sulfur in some of the coal seams suggests, however, that the peat was infiltrated periodically by marine water. Thus, the major coal seams are interpreted to have formed from peat accumulated in a freshwater marsh that was proximal to a brackish environment. The Snuggedy Swamp of South Carolina is considered a modern analogue for the paleoenvironment in which Unit III was deposited.

2.1.3 Intrusions

Tertiary and Cretaceous-age porphyritic dykes and sills commonly intrude this sequence, the most notable of which includes a Tertiary granodiorite intrusion located on the north side of the Telkwa River. These intrusions are not present in the Tenas area.

2.1.4 Geological Structures

The sedimentary sequence in the Tenas area is folded into a syncline in which the gently (typically 10 to 20°) northeast-dipping western limb of the syncline subcrops on the western side of the pit area, while the moderately (40 to 45°) southwest-dipping eastern limb subcrops on the eastern side of the pit. Faulting is generally near-vertical, and can be subdivided into two main groups, one which strikes approximately northwest/southeast and the other which strikes approximately northeast/southwest.

2.2 Surficial Geology

The surficial geology in the Project area consists primarily of two types of deposits, glacial clay- or silt-rich till, and sand and glaciofluvial sand and gravel outwash. At upper elevations and south of the proposed pit, the terrain is mapped as having bedrock outcrops to a limited extent or thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick. North of the proposed pit and towards Tenas Creek and Goathorn Creek, drillholes report thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick underlain by a thick sand and gravel outwash deposit that can exceed 100 m.

Other types of deposits are present locally. Patches of glaciolacustrine deposits are scattered throughout the morainal landscape in low ridges and in depressions; the sediments comprise bedded and laminated mud, and minor sand and gravel (Clague 1984). Recent fluvial deposits form the narrow floodplains of Goathorn Creek and Tenas Creek, which are 40 m to 80 m deep incised into the subdued morainal landscape, and the wide floodplains of the Telkwa and Bulkley Rivers. The fluvial deposits range from extremely coarse, poorly sorted gravel on steep alluvial fans to moderately to well-sorted sand and mud on low-gradient floodplains (Clague 1984).

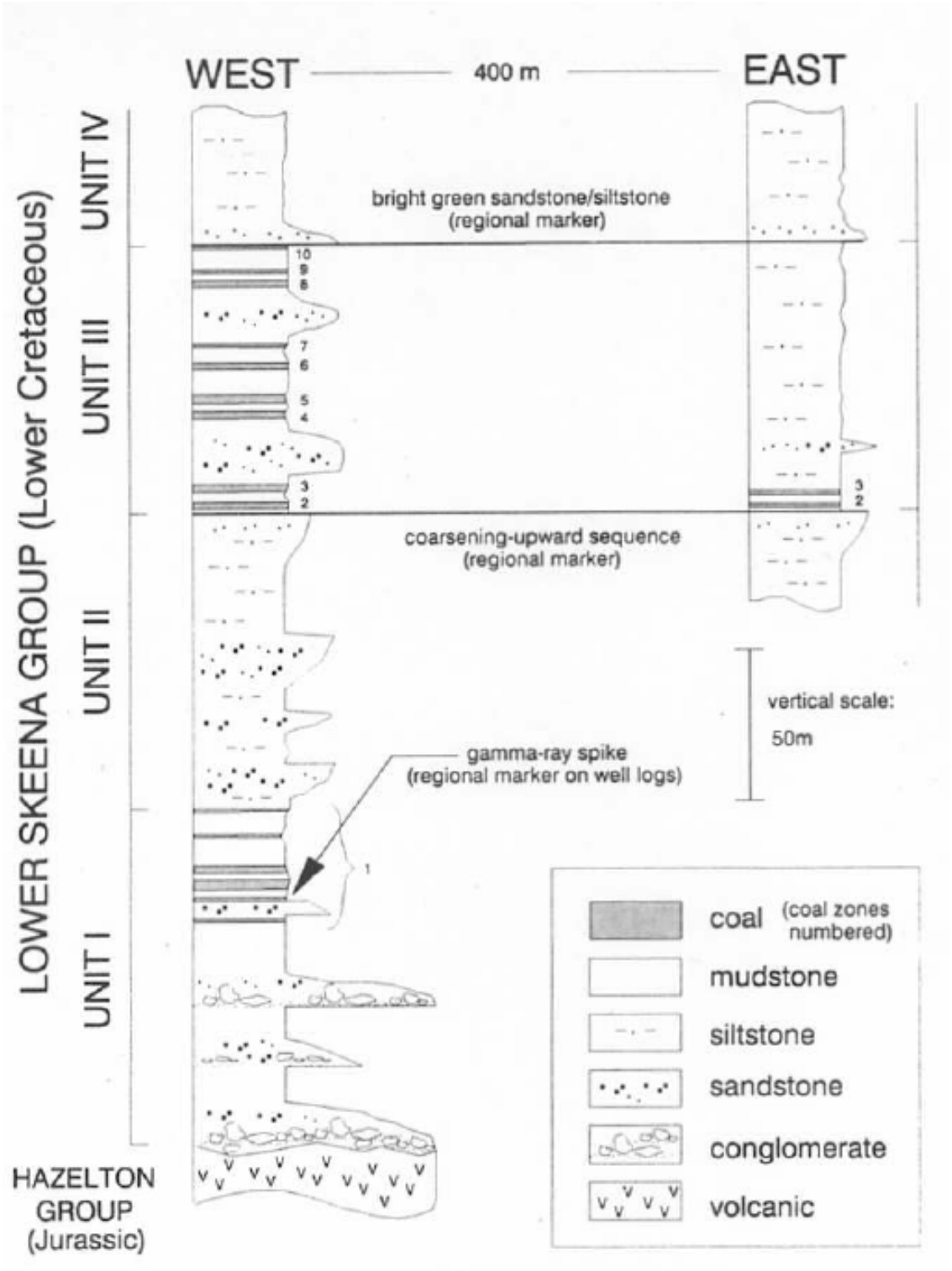


Figure 2-1: Stratigraphic Sequence of Lower Cretaceous Skeena Group Sediments. Source: Telkwa Coal Ltd

2.3 Historic Geochemical Testing

Norecol Dames and Moore (1999) completed a comprehensive geochemical characterization program of the Telkwa Mine for Luscar Coal Ltd. The geochemical characterization included geochemical testing of samples collected from Tenas, Telkwa North, and Goathorn Deposits. TML is only proposing to mine the Tenas deposit as part of the current EAC application and the historical geochemical results for this deposit are summarized here.

Approximately 700 samples of mine rock, overburden, and coal (including cleaning intervals) were collected continuously down drillholes in the proposed pit boundary of the Tenas Deposit. Samples were submitted for the following analyses:

- Acid base accounting (total sulfur, Sobek-NP and paste pH);
- Laboratory kinetic tests including MEND humidity cell tests and column trickle tests; and
- On-site kinetic tests were also developed.

Due to the use of Sobek-NP, a neutralization potential ratio (NPR) cut-off of three (3.0) was used to characterize samples as PAG or non-PAG with samples less than 3.0 being classified as PAG.

The historical geochemical testing results indicated the following:

- Acid rock drainage (ARD) potential is characterized according to stratigraphic “zones”, with zones being delineated by the coal seams;
- Zones can be classified as dominantly PAG or dominantly non-PAG, but all rock zones contain PAG and non-PAG material;
- ARD potential is driven by sulfur content with zone medians varying from 0.6 % to 1.7 %; and,
- Neutralising potential (NP) zone medians varied from 30 to 42 kg $CaCO_3$/t.

Based on the acid base accounting (ABA) results, Norecol Dames and Moore (1999) characterized the following zones as non-PAG or PAG:

- Non-PAG: Zone 0 (overburden), Zone 1, Zone 4, and Zone 7/8, and
- PAG: Zone 1a, Zone 2/3, Zone 5, Zone 55, and Zone 6.

Process rock (reject/tailing) samples were also collected. Acid base accounting (ABA) of these samples indicated these materials were uniformly PAG.

The bulk element contents of the samples showed no enrichments above crustal values; however, there was only limited selenium data. Water samples collected from a seep downstream of a bulk sample site were used to evaluate metal leaching. The seeps were non-acidic and indicated metal concentrations indicative of pyrite weathering under basic weathering conditions. At sulfate concentrations typically in the hundreds of mg/L range, selenium concentrations were <0.0002 mg/L.

Based on the results, Norecol Dames and Moore (1999) concluded that ARD management will be required for the Tenas Project.

2.4 Supplemental Mine Rock Sampling Programs

TML retained SRK to collect supplemental samples in 2018 to calibrate the historic dataset to current methods. SRK reviewed the core and logs with TML geologists in February 2018 and identified 173 samples for geochemical testing.

Further mine rock samples were collected in 2019 to expand the dataset.

2.5 Other Sampling

Sampling of overburden, processed rock, and material to be used in construction was completed between 2018 and 2024 to expand the dataset and to ensure all materials exposed during the mining operations are geochemically characterized.

3 Summary of Mine Material Management Plan

Mining of the Tenas deposit will produce surface soils (topsoil), mine rock, processed rock (tailings) and overburden. Previous geochemical testing (Norecol Dames & Moore 1999; SRK 2022a) indicates that a large volume of mine rock that will be excavated from the Tenas Deposit, along with the coal and processed rock, will be PAG with ARD potential stratigraphically constrained in zones that are generally separated by coal seams. The previous geochemical testing results indicate that PAG management will be required.

Management of mine rock and processed rock is summarized in the following sections.

3.1 Management of PAG Rock, Processed Rock, and Processed Coal

In advance of, and during mining, TML proposes to progressively construct management ponds. The purpose of the ponds is to store PAG and processed rock permanently in saturated conditions to minimize sulfide oxidation, limiting acidic drainage from occurring. Three management ponds will be constructed. The North Management Pond (NMP) will be constructed first and will be external to the open pit, located north of the open pit. The East Management Pond (EMP) will be constructed next and will be external to the EA Open Pit and will be south of the NMP, and northeast of the open pit. The West Management Pond (WMP) will be constructed last and will encompass the northern portion of the EA Open Pit plus an embankment to provide sufficient storage for PAG rock (Figure 3-1).

PAG and processed rock will be placed in the management ponds while Run-of-Mine Coal is processed into processed rock and processed coal with processed coal being shipped off site to market prior to producing ARD.

PAG rock will first be placed in the NMP. PAG rock will be progressively placed in lifts and then flooded so that exposure of PAG rock to atmospheric oxygen is minimized. TML is proposing to place all PAG Rock underwater before it becomes acid generating. The timing to the onset of acid

generation is discussed in Section 6.2.7; PAG Rock will be placed in the management ponds and submerged with a minimum of 1.0 m of water within an average of 6 months after excavation but no longer than 12 months. Once the storage capacity of the NMP has been reached, storage will begin in the EMP and subsequently in the WMP. The management ponds will be maintained with a one-metre water cover during active use and under at least two-meters of water once the maximum management pond PAG Rock storage capacity has been reached.

Once the ponds have reached the maximum PAG Rock storage capacity, TML will place a one to two metre layer of non-PAG Rock on top of the submerged PAG Rock below the active water level of the management pond, followed by at least one metre overburden layer to create a dry landform above water, followed by approximately a 30 cm layer of reclamation materials (surface soils) to reduce evaporative losses from the water cover above the saturated PAG Rock.

3.2 Management of Non-PAG Rock and Overburden

Non-PAG Rock and overburden will be used as open pit backfill, in management pond embankments, buttresses or used as interim cover material over the management ponds at closure.

3.3 Open Pit Walls

The open pit walls will be covered with non-PAG Rock and overburden to limit oxygen and water ingress from contacting open pit wall rock surfaces. Much of the open pit will be backfilled during the Operation and the Decommissioning and Reclamation Phases. Meteoric water contacting the non-PAG covered open pit walls will report to an end pit lake, which will subsequently drain northwards by gravity and mix with Management Pond water prior to discharging.

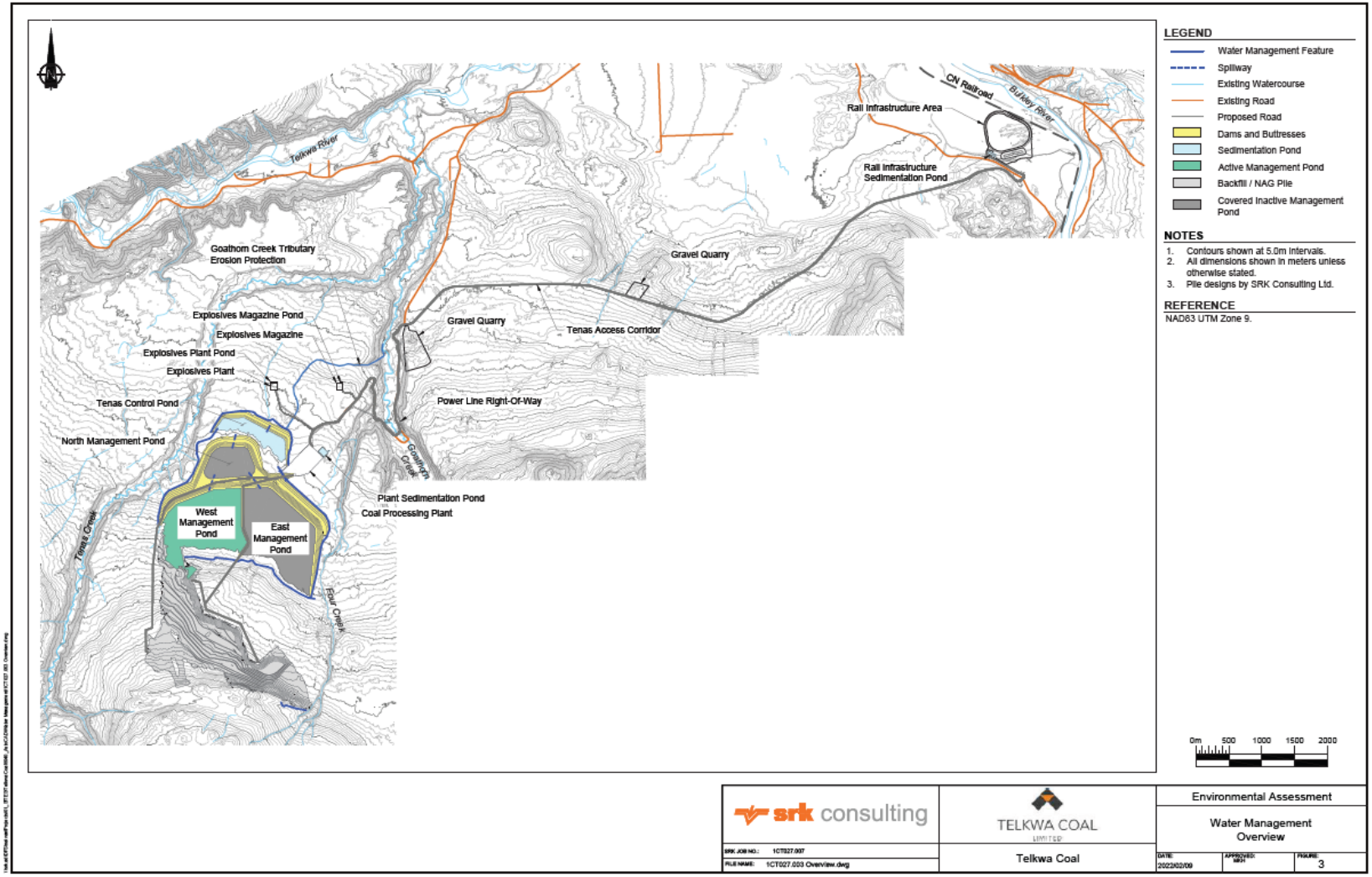


Figure 3-1: Tenas Project Mine Site Facilities at Closure

4 Conceptual Geochemical Model

4.1 Management Ponds

Mining of the Tenas deposit will produce pyrite (FeS_2) bearing PAG Rock. Under natural conditions, the pyrite is stable in bedrock where it is isolated from atmospheric oxygen. However, following blasting and mining of the bedrock, pyrite in the mine rock will be exposed to atmospheric oxygen prior to being placed in the management ponds. Similarly, pyrite in processed rock will be oxygen unlimited until submerged underwater in the management ponds. Under these conditions, pyrite will oxidize in the presence of oxygen and water according to the following reaction:

$$FeS_{2\,(s)} + 3\tfrac{1}{2}O_{2\,(g)} + H_2O_{\,(l)} \leftrightarrow Fe^{2+}{}_{(aq)} + 2SO_4^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \text{ (Rxn 1)}$$

As seen in Rxn 1, pyrite oxidation produces sulfate, iron, and acidity. The iron liberated from the sulfide can subsequently oxidize to ferric iron in neutral pH water according to the following reaction:

$$Fe^{2+}{}_{(aq)} + \tfrac{1}{4}O_{2\,(g)} + 2\tfrac{1}{2}H_2O_{\,(l)} \leftrightarrow Fe(OH)_{3\,(s)} + 2H^+{}_{(aq)} \text{ (Rxn 2)}$$

The above reaction also produces acidity. Mineralogical testing indicates pyrite is the main sulfide mineral at the Tenas Project, Reactions 1 and 2 are plausible mechanisms for acid production in mine rock mined from the Tenas Pit or in processed rock produced from washing of Run-of-Mine coal.

Acidic conditions do not immediately form since acid production can be neutralized inthe presence of carbonate minerals according to the following reactions:

$$CaCO_{3(s)} + H^+{}_{(aq)} \leftrightarrow HCO_3^-{}_{(aq)} + Ca^{2+}{}_{(aq)} \text{ (Rxn 3)}$$

$$CaCO_{3(s)} + 2H^+{}_{(aq)} \leftrightarrow H_2CO_{3(aq)} + Ca^{2+}{}_{(aq)} \text{ (Rxn 4)}$$

Some metal carbonates (e.g., siderite, and ankerite) offer limited buffering potential, since during dissolution, oxidation of the metal cation produces acidity, which offsets the neutralization produced from the carbonate ion. Buffering by Reactions 3 and 4 results in a lag time to the onset of acid generation. For example, acid conditions will not occur until carbonate minerals are consumed.

Acidity can also be neutralized through dissolution of oxyhydroxide and aluminosilicate minerals; however, due to the dissolution kinetics of these minerals, they often produce insufficient neutralization potential to produce neutral drainage (i.e., these minerals are more reactive under acidic conditions). A detailed assessment of the carbonate mineralogy is provided in Section 6.2.2 of this report. Carbonate minerals have been identified at the Tenas Project and Reactions 3 and 4 are the predominant neutralization reactions for the project.

TML proposes to manage PAG Rock through placement in the management ponds prior to becoming acidic, thereby lowering oxygen availability limiting the rates of Reaction 1.

4.2 Processed Rock

Processed rock is expected to be PAG and oxidize according to Reaction 1. TML proposes to place the PAG rock in the management ponds to limit oxygen and water contact. Prior to placement in the management ponds, processed rock will oxidize producing soluble load by Reaction 1 (section 4.1) that will flush from the processed rock during placement into the management ponds. After the processed rock is placed in the management ponds, oxygen content will be limited, reducing the rate of Reaction 1.

4.3 Non-PAG Rock and Overburden

Overburden and non-PAG Rock will be placed within the critical backfill portions and/or buttress areas of the embankments for the management ponds or backfilled into the open pit. Overburden and non-PAG Rock will oxidize according to Reaction 1. However, as the non-PAG Rock contain more neutralization potential than acid generating potential, the sulfide will be consumed prior to the neutralization potential and acidic drainage from these materials will not occur. Oxidation products will still be produced and will be flushed by water in contact with non-PAG Rock. This load will mix with other mine site water sources prior to being used in the Coal Processing Plant or discharged from site.

4.4 Open Pit Wall Rock Runoff

At closure, an end pit lake will form in the backfilled open pit. A high wall will exist above the pit lake composed mainly of Zone 6 sedimentary rock. Based on the site-specific criterion (see Section 6.2.6.1), this unit is PAG. The end pit lake will be a mixture of open pit wall rock runoff, direct precipitation, and runoff from non-PAG backfill. The end pit lake will drain by gravity and mix with the management pond before being discharged during Post-closure.

4.5 Explosives Usage

Nitrogen load will be produced from explosives usage. The source of nitrogen comes from ammonium nitrate fuel oil (ANFO) during misfires or spillage during the loading of blastholes or from incomplete detonation of ANFO. The wasted ANFO will report to the open pit sumps and stored in mine rock. As ammonium nitrate (AN) is highly soluble, water in contact with wasted ANFO will dissolve AN producing ammonia, nitrite, and nitrate.

5 Methods

5.1 Sample Selection

5.1.1 2018 Drill Core

TML completed five drill holes for the Tenas deposit in January 2018.

Figure 5-1 presents the location of the 2018 drill holes. Historical drill holes are also provided. Drilling was planned to be spatially representative of the open pit and to ensure that all stratigraphic zones were sampled (e.g., not all holes encountered every zone).

Following completion of the drill holes, Stephen Day (SRK Geochemist) visited the site to inspect the core and select intervals for geochemical sampling. Intervals ranged from approximately 15 centimetres (cm) near the coal seams up to nine metres (m) in interbedded material between the coal seams. The average sample thickness was 2.1 m. Sample intervals are provided in Appendix A.

5.1.2 2019 Drill Core

TML completed four drill holes for the Tenas Deposit in 2019. TML collected 74 samples from these drillholes for geochemical testing. Figure 5-1 presents the location of the 2019 drill holes. Drilling was planned to be spatially representative of the open pit.

5.1.3 Overburden

Six overburden samples were collected from four test pits by TML in 2018 to geochemically characterize glacial materials planned to be removed by mining. Different size fractions were evaluated to determine if carbonate and sulfur minerals fractionate to inform blending studies should TML decide to consider this management strategy in the future.

In 2019, 19 overburden samples were collected by TML. The samples were collected to incorporate sample variability in the sampling program. The 19 samples were combined by Bureau Veritas to form one composite sample for humidity cell testing.

In 2021, 30 overburden samples were collected by TML within the footprint of the management ponds. The samples were collected to incorporate sample variability in the sampling program. The 30 overburden samples were combined by SNC Lavalin to form one composite sample for humidity cell testing. The sample was collected to characterize material beneath the management ponds which should be like what is within the adjacent open and submitted for laboratory test work in 2023.

5.1.4 Processed Rock

In 2018, TML provided two samples of fine and coarse processed rock to Bureau Veritas. Due to limited sample masses, the two fine and two coarse processed rock samples were combined into bulk fine and bulk coarse processed rock samples for humidity cell testing. Acid base accounting and elemental analyses were completed on the individual samples prior to the samples being combined.

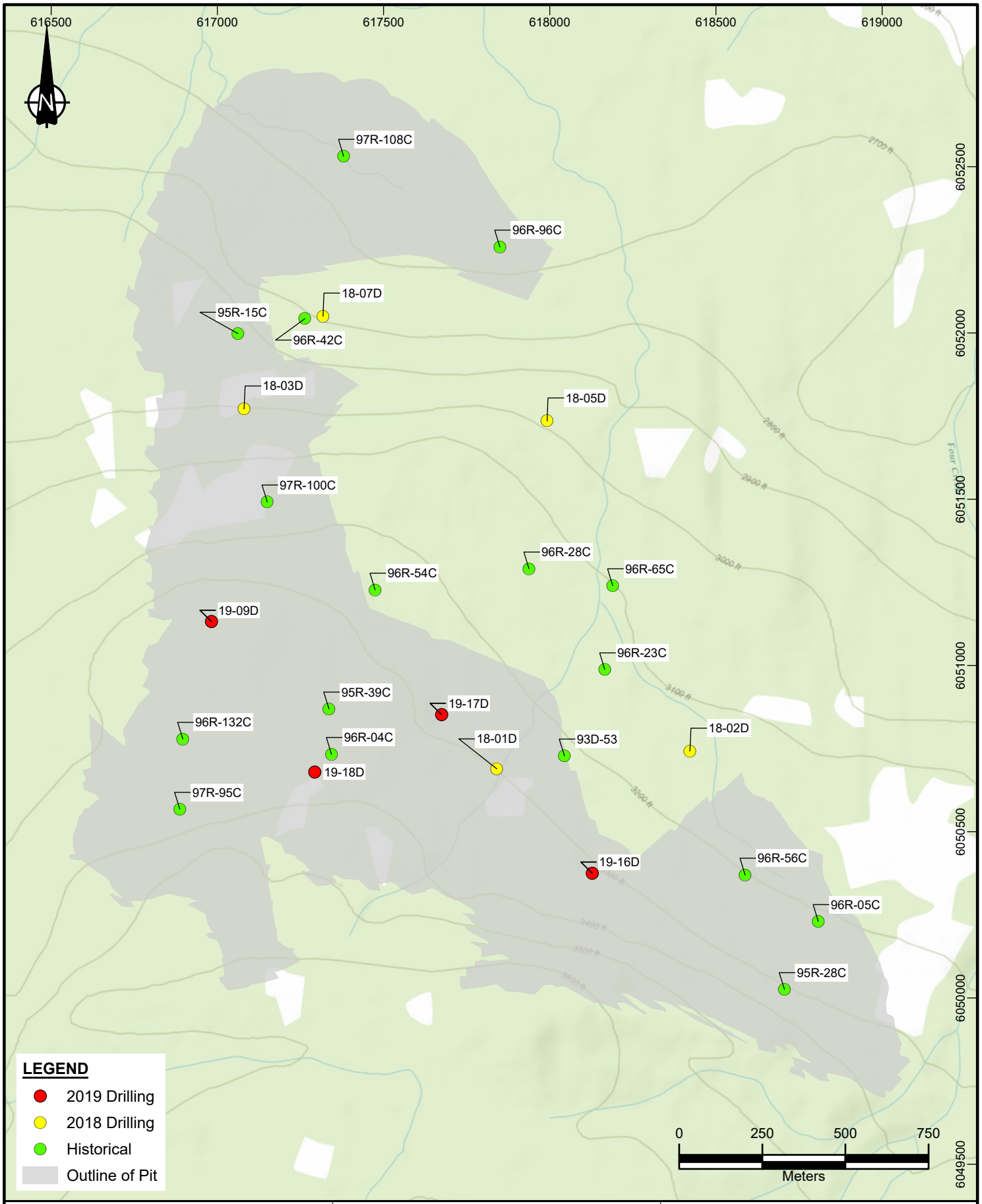
In 2019, TML provided two additional fine and one coarse processed rock samples for acid base accounting and elemental analyses to confirm the static results of the 2018 samples. A subsequent fine processed rock humidity cell test (HCT) was initiated in 2019 as the 2018 fine processed rock HCT results indicated this sample was non-PAG, which is not consistent with the historical dataset (Norecol, Dames and Moore 1999).

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5.1.5 Construction Materials

TML provided the following samples, intended to be used as construction material for the Project, for geochemical testing:

- Two samples of rock that will be used to construct the surfacing material for the Tenas Access Corridor;
- Five overburden samples collected from five test pits along the proposed Tenas Access Corridor that will be used for constructing the base and sub-base portions of this road; and
- Nine samples from four test pits in the vicinity of the Rail Infrastructure which will be used for constructing the base and sub-base portions of the rail right of way and loading area.



C:\Users\MSMITH\SRK Consulting\FS873 Telkwa - Internal\1040_AutoCAD\GIS\Projects\CAPR002933_Tenas_Drilling\CAPR002933_Tenas_Drilling.aprx - L-Geochem Sampling

srk consulting

SRK JOB NO.: CAPR002933

LAYOUT: L-Geochem Sampling

TELKWA MINING LIMITED

Tenas Project Supplemental Geochemical Characterization

Location of the Tenas Project 2018, 2019 and Historic Drill Holes

DATE:	APPROVED:	FIGURE:
Nov 2024	MH	5-1

5.2 Sample Analysis

Samples were shipped to Bureau Veritas, formerly Maxxam Analytics, in Burnaby, British Columbia, for geochemical testing. The following sections provide the analysis completed on each sample type.

5.2.1 2018 Drill Core

2018 drill core samples were analyzed for the following:

- Paste pH, paste conductivity, total sulfur, total carbon, total carbonate, sulfate by hydrochloric acid method, neutralization potential (standard Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

Two neutralization potential determinations (standard Sobek and modified ABA) were completed on the drill core samples to evaluate if the historical NP results, which were based on the standard Sobek method, could be corrected to the modified ABA method (MEND 1991).

A subset of the 2018 samples was submitted for HCTs and mineralogical analyses based on the results of the above analyses. Except for overburden (Zone 0), one humidity cell was selected from each interburden zone. Samples were selected to evaluate the timing to the onset of acid generation and bulk leaching content, with respect to selenium and arsenic. Therefore, the sample selection was biased to samples that had one of the following:

- Samples that had higher sulfur contents and lower NP;
- Samples that had relatively elevated solid-phase selenium concentrations; or
- Samples that had elevated solid-phase arsenic concentrations.

Appendix B provides a list of the samples that were selected for HCT and a rationale for the selection of the sample.

Each sample selected for HCT was also submitted for mineralogical analysis by X-ray diffraction (XRD) with Rietveld refinement.

An additional six samples from 2018 were selected for mineralogical analysis from samples with modified- NP exceeding Sobek-NP. The mineralogical analysis (Appendix B) was to confirm the carbonate content of the samples because the ABA results indicated that modified-NP exceeded Sobek-NP in several samples with Sobek-NPs between 60 and 80 kg $CaCO_3$/tonne (see Section 6.2.4.1). It is possible that these unusual results occurred because the selection of the acid normality for use in the sample digestion was based on an incorrect fizz rating and the short duration of the Sobek-NP test is insufficient to digest all carbonate minerals present in the sample. Additionally, titration does not occur until the pH is less than 2.5 in the modified ABA test whereas the Sobek (1978) procedure only requires 3 millilitres (mL) of acid to be added. It is possible that insufficient acid was added in the Sobek-NP determinations to digest all the carbonate minerals.

5.2.2 2019 Drill Core

2019 drill core samples were analyzed for the following:

- Paste pH, total sulfur, total carbon, total carbonate, sulfate by hydrochloric acid method, neutralization potential (modified Sobek method), total inorganic carbon and trace element scan by ICP-MS following aqua regia digestion.

Unlike the 2018 samples, which were in part used to evaluate if the historical NP measurements using the standard Sobek method could be correlated to the modified ABA method, the neutralization potential of the 2019 samples was only determined by modified ABA method as the 2018 program provided data that the correlation was valid for the samples recovered prior to 2018.

5.2.3 Overburden Samples

A split of the 2018 overburden samples was collected and evaluated for moisture content. Subsequently, samples were air dried and dry sieved into -2 mm, +2-25 mm and +25 mm fractions and weighed. A split of the +25 mm fraction was also wet sieved to -25 mm. The -2 mm and -25 mm fractions were analyzed for the following:

- Paste pH, total sulfur, total carbonate, sulfate by hydrochloric acid method, neutralization potential (Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

Only one sample had +25 mm grains (Maxxam, 2018, pers. Comm.). Therefore, the +2-25 mm fraction was also analyzed for the geochemical tests in the above bullet.

The 2019 and 2023 overburden samples were submitted for static geochemical tests as above. HCTs were initiated on the 2019 composite sample and the 2023 composite sample based on samples recovered in 2021.

5.2.4 Processed Rock

The processed rock samples (fine and coarse) were submitted for the following tests:

- Paste pH, total sulfur, total carbonate, sulfate by hydrochloric acid method, neutralization potential (Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

Three of the processed rock samples were also submitted for HCTs.

5.2.4.1 Construction Materials

The samples of material intended to be used as construction material for the Project were submitted for the following tests:

- Paste pH, total sulfur, total carbonate, sulfate by hydrochloric acid method, neutralization potential (Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

6 Results

6.1 Quality Assurance/Quality Control

SRK screened the 2018 and 2019 static test and kinetic test results against its internal QA/QC procedures. Table 6-1 presents a summary of the QA/QC results for mine rock. While some data failed quality SRKs screening criteria, the number of failures is considered acceptable. Tables are not presented for other material types since most of the other tests passed the screening criteria. The one exception to this was one coarse reject sample (UI3970) had a fizz test rating not consistent with the measured NP.

Based on the number of samples collected versus those that failed SRK's QA/QC criteria, it is SRK's opinion that data quality is acceptable for the purpose of the Project.

Table 6-1. Summary of QA/QC Result for 2018 and 2019 Samples

QC Test	SRK QC Criteria	Results
Paste pH		
Lab Duplicate (n=29)	For any samples, +/- 0.5 difference pH unit	All passed
Split Duplicate(n=17)	For any samples, +/- 0.5 difference pH unit	0.64
Standard Reference Material (n=6)	Within specified tolerance ranges	All passed
TIC		
Lab Blank (n=9 for Total Carbon, n=3 for TIC)	<2X detection limit (DL)	All passed
Carbon balance (Total C > TIC) (n=247)	For samples > 10X the detection limit (DL), Total Carbon should be greater than Total Inorganic Carbon, if not the % difference should be within +/-20%	All passed
Lab Duplicate (n=16 for TIC, n=8 for Total Carbon)	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed
Split Duplicate (n=17 for TIC, n=17 for Total Carbon)	For samples > 10X the detection limit (DL), % RPD within +/-30%	T18-03D A-010 - SPLIT DUP (Maxxam ID=TD4057) in Total Carbon has RPD=54%
Standard Reference Material (n=19 for Total C, n=12 for TIC)	Within specified tolerance ranges.	All passed
Total S & Total Sulfate		
Lab Blank (n= 9 for Total S, n=6 for Total Sulfate)	<2X detection limit (DL)	All passed
Sulfur balance (total S > sulfate S) (n=247)	For samples > 10X the detection limit (DL), Total Sulfur should be greater than Total Sulfate, if not the % difference should be within +/-20%	All passed
Lab Duplicate (n=8 for Total S, n=15 for Total Sulfate)	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed
Split Duplicate (n=17 for Total S, n=17 for Total Sulfate)	For samples > 10X the detection limit (DL), % RPD within +/-30%	29521 - SPLIT DUP RPD% is 34%
Standard Reference Material (n=19 for Total S, n=8 for Total Sulfate)	Within specified tolerance ranges.	All passed
Modified-NP		
NP consistent with paste pH (n=247)	Negative NP has paste pH <= 5	Samples T18-02D-A-016, 28674, 28677, 28683, 28687, 28691, 28692, 28700 have a positive NP while pH is below 5
Lab Duplicate (n=27 for NP, n=28 for fizz test)	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/- 20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed
Split Duplicate (n=17 for Total for fizz test, n=17 for NP)	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/- 20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	T18-02D A-034 - SPLIT DUP (Maxxam ID=TD4015) and T18-03D A-010 - SPLIT DUP (Maxxam ID=TD4057) have RPD over 30% in NP
Fizz test rating with NP (n=247)	Max NP does not exceed fizz test rating	Samples T18-01D-A-002, T18- 02D-A-019, 28661, 28670, 28670 - SPLIT DUP, 28685, 28694, 28704 exceed max NP values
Modified-NP and TIC		
Comparison between Modified-NP and TIC (n=247)	Check for trends/co-relation	TIC higher than NP
Elements		
Lab Blank (n=22)	<2X Detection Limit	All passed
Lab Duplicate (n=8)	For samples >10X detection limit (DL), % RPD within +/- 30%, ok 10% of metal scan failing.	All passed
Split Duplicate (n=107)	For samples >10X detection limit (DL), % RPD within +/- 30%, ok 10% of metal scan failing.	Less than 10% of metal scan failing
Standard Reference Material (n=31)	Within specified tolerance ranges.	All passed

/srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[Telkwa_RptTables_1CT027.002_MKH_R2.xlsx]Compiled Summary QAQC Results

6.2 Drill Core Samples

The following sections present select acid base accounting (ABA) and element content results as they relate to acid generating potential. Mineralogical testing results are also presented. Results here are evaluated based on stratigraphic zones.

Detailed ABA and elemental results are provided in Appendix C and D, respectively.

6.2.1 Elemental Content

To evaluate parameters that were elevated in the solid-phase and may have the potential to leach, elemental concentrations for the samples were compared to the average crustal abundances (Smith and Huyck 1999). This dataset represents a consensus of the overall crustal abundance and does not consider abundances in lithological units. An element was screened as enriched in the solid phase if its concentration was greater than 10 times the average crustal abundances. The following elements were screened to be elevated in the solid phase:

- 14% of arsenic analyses;
- <1% of phosphorus and selenium analyses; and
- 56% of sulfur analyses.

Detailed comparisons are provided in Appendix D. Trace element concentrations were not available for the historical results and the above percentages are based on the samples collected as part of the supplemental geochemistry characterization program.

An elevated solid-phase concentration does not necessarily imply it will be elevated in contact waters. The solid-phase screening is completed to flag parameters that need to be evaluated in other geochemical tests.

6.2.2 Mineralogy

Mineralogical results for the 2018 samples are provided in Table 6-2. Sample T18-02D-A-002 (Zone 2) reported 49 % amorphous material (UBC 2019). Mineralogical results are normalized to 100% by convention which does not include amorphous material. As this can provide an overestimate of mineral species related to acid generation potential, mineral percentages for sample T18-02D-A-002 were normalized to 100% considering the amorphous material was present in the sample. This approach was considered reasonable since sulfur and carbonate contents were more aligned with the acid base accounting results when sample T18-02D-A-002 was corrected for amorphous material content.

The samples are predominantly composed of quartz, plagioclase feldspar clay minerals illite-muscovite and kaolinite. Kaolinite content increases with depth in the stratigraphic sequence with mineral content increasing to greater than 50 % below Zone 5. Illite-muscovite concurrently decreases with depth in the stratigraphic sequence and was not detected in the samples collected below Zone 55. Plagioclase feldspar content also decreases with depth and was only detected in one sample below Zone 5 suggesting that that most feldspathic rock deeper in the stratigraphic

sequence has been weathered to kaolinite. Quartz content was generally consistent in all the samples collected (Table 6-2).

Pyrite (FeS_2) and marcasite (FeS_2) were the only sulfide minerals detected in the mineralogical analysis. Pyrite was highest in the samples collected from Zone 2/3 (Table 6-2). Gypsum was the only other sulfur species detected in the mineralogical analysis in quantities less than 2.5 % in the Zones 2/3, 5 and 6 samples.

The following carbonate minerals were detected in one or more samples: ankerite-dolomite ($Ca(Fe,Mg,Mn)(CO_3)_2$ – $CaMg(CO_3)_2$), calcite ($CaCO_3$), siderite ($FeCO_3$), siderite/calcian ($(Fe,Ca)CO_3$), dolomite ($CaMg_{0.75}Fe_{0.25}(CO_3)_2$), and ankerite ($CaCO_3.FeCO_3$). The mineralogical results indicate that iron carbonates are important and total inorganic carbon (TIC) content may not be suitable for use as a direct proxy for neutralization potential.

The sulfide and carbonate mineralogical results, as they relate to acid potential and neutralization potential, are discussed in more detail in the following sections.

Table 6-2. Mineralogy X-Ray Diffraction Results for the 2018 samples

Mineral Name	Empirical Formula	Unit	Zone														
			1		1a		2/3		4		5		55	6		7	8
			28836	28661	T18-02D-A-011	T18-02D-A-004	T18-02D-A-016	T18-01D-A- 002	28681	T18-02D-A-019	28684	T18-02D-A-021	T18-03D-A-006	28704	T18-02D-A-028	T18-02D-A-034	28711
Anatase	TiO_2	%	1.7	0.80	1.3	1.1	1.9	---	1.6	1.1	1.5	0.80	1.7	1.4	0.80	1.7	1.8
Ankerite-Dolomite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2 – CaMg(CO_3)_2$	%	---	21	---	14	---	40	---	12	---	24	---	---	23	---	---
Brookite	TiO_2	%	---	---	1.1	---	---	---	---	---	---	---	---	---	---	---	---
Calcite	$CaCO_3$	%	4.4	0.20	---	---	---	---	---	0.50	0.40	3.9	---	2.0	1.4	---	1.0
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	%	5.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Cristobalite	SiO2	%	---	---	---	---	0.50	---	0.50	---	---	---	---	---	---	---	---
Dawsonite	$NaAl(CO_3)(OH)_2$	%	---	---	---	---	0.60	---	---	---	---	---	---	---	---	---	---
Gorceixite	$BaAl_3(PO_4)(PO_3OH)(OH)_6$	%	---	---	---	---	---	---		---	---	0.40		---	---		
Gypsum	$CaSO_4·2H_2O$	%	---	---	---	---	1.9	---	---	---	1.2	---	---	2.4	---	---	---
Illite-Muscovite	$K_{0.65}Al_{2.0}Al_{0.65}Si_{3.35}O_{10}(OH)_2$	%	19	12	15	15	21	---	12	6.0	16	5.2	2.2	---	---		
Kaolinite	$Al_2Si_2O_5(OH)_4$	%	16	11	16	15	22	25	22	25	26	20	58	50	54	56	64
Magnetite	Fe_3O_4	%	---	---	---	---	0.50	---	0.20	---	0.40	---	---	---	---	---	---
Marcasite	FeS_2	%	---	---	0.80	---	---	---	---	---	---	---	---	---	---	---	---
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	%	12	7.8	8.5	8.0	5.6	---	4.5	4.7	6.1	3.3	---	---	1.5	---	---
Pyrite	FeS_2	%	2.5	1.0	4.5	0.80	7.0	22	3.8	1.5	4.7	2.2	0.3	6.4	0.40	4.1	0.8
Quartz	SiO_2	%	36	34	4.0	35	36	13	35	31	39	28	37	29	18	36	29
Rutile	TiO_2	%	0.86	0.50	0.80	0.70	0.60	---	0.70	---	0.70	0.30	---	---	---	---	---
Siderite	$Fe^{2+}CO_3$	%	---	7.3	5.4	6.8	2.5	---	9.2	---	2.1	6.3	0.3	0.30	1.3	0.20	0.20
Siderite, calcian	$(Fe^{2+},Ca)\ CO_3$	%	2.0	5.2	1.1	4.0	---	---	7.4	6.6	---	6.3	---	---	---	---	---
Dolomite	$CaMg_{0.75}Fe_{0.25}(CO_3)_2$	%	---	---	3.5	---	---	---	---	11	---	---	---	---	---	1.6	2.7
Ankerite	$CaCO_3.FeCO_3$	%	0.39	---	---	---	---	---	2.8	---	2.0	---	0.3	8.9	---	---	1.3
Sum		%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

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6.2.3 Sulfur Species

Figure 6-1 provides a comparison of total sulfur to sulfide sulfur where the sulfide sulfur (S^{2-}) has been calculated using the following equation (EQ1):

$$S^{2-} = S_{ICP} - S_{HCl} \quad \text{(EQ1)}$$

Where:

- S_{ICP} is the total sulfur content determined during the trace element scan.
- S_{HCl} is the acid soluble sulfur (sulfate) determined by Leco during the ABA testing.

Estimating sulfide concentrations by this method, rather than using Leco sulfur minus acid soluble sulfur (S_{HCl}), is preferred because the S_{ICP} does not include organic sulfur species whereas Leco sulfur includes all sulfur species. Organic sulfur is present in coal deposits and therefore, using EQ1 avoids overestimating the sulfide content.

As can be seen in Figure 6-1, the majority of the total sulfur is present as sulfide in all zones. Highest total sulfur concentrations typically occur in Zone 2/3, in the footwall Zones 6 and 7 (Figure 6-1). Sulfate is generally low (average of 0.045%) in the samples as indicated based on the difference between S-ICP (open circles for 2018 samples and open triangles for 2019 samples on Figure 6-1), which is a measure of sulfide plus sulfate, and the calculated sulfide concentrations using EQ1. Sulfate concentrations increase at higher total sulfur concentrations; however, sulfide is still the dominant sulfur species. At higher total sulfur concentrations, larger deviations from the 1:1 line occur indicating the presence of organic sulfur, which is common in coal deposits.

A regression analysis of the samples indicates there is a strong correlation (i.e., r=0.99) between total sulfur and sulfide sulfur (Figure 6-1). Total sulfur can therefore be used as a proxy for estimating sulfide using the following mathematical relationship:

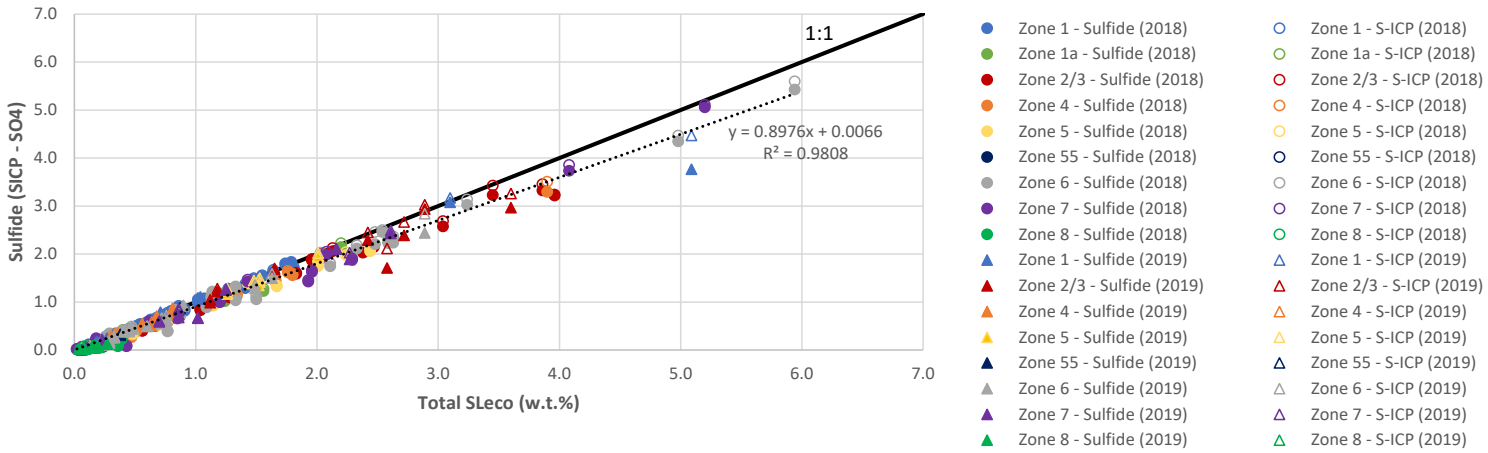
$$S^{2-}_{calculated} = 0.90 \times \text{Total-}S_{measured} - 0.01 \quad \text{(EQ2)}$$

Mineralogical analyses (Table 6-2) for the 2018 samples indicate pyrite is the predominant sulfur mineral in the samples. Based on estimated pyrite content, total sulfur calculated using the mineralogical analysis (S_{XRD}) generally corresponds to the total sulfur by Leco (Figure 6-2). Therefore, use of EQ2 to estimate sulfide sulfur is reasonable.

S_{XRD} generally exceeds S_{Leco} (Figure 6-2). This can occur because the mineralogical results are normalized to 100%. XRD does not detect amorphous phases and minerals at lower percentages and the normalization of detectable mineral species to 100% can result in an overestimation of the detectable species.

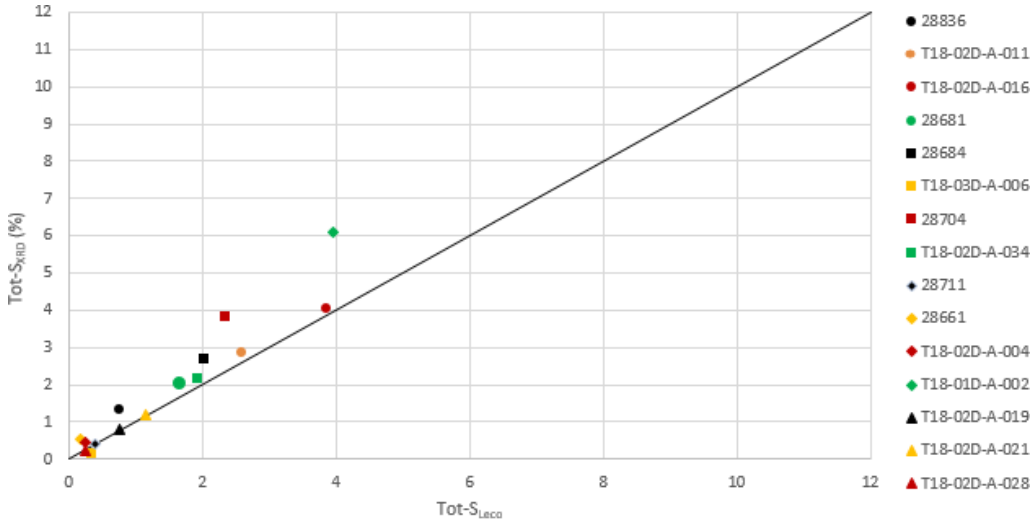
The calculated sulfide sulfur can subsequently be used to estimate AP by the following equation (EQ3):

$$AP = S^{2-}_{calculated} \times 31.25 \quad \text{(EQ3)}$$



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Figure 6-1: Total Sulfur versus Calculated Sulfide Sulfur (2018 & 2019 Samples)



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Figure 6-2: Leco Total Sulfur versus Mineralogical Sulfur (2018 Samples)

6.2.4 Neutralization Potential

Neutralization potential (NP) was estimated using the following three methods:

- MEND (1991) Modified-NP determination;
- Sobek (1978) NP determination; and
- Estimated based on total inorganic carbonate (TIC) content (referred to as Carbonate-NP).

The historical geochemical testing program (Norecol Dames & Moore 1999) used the Sobek (1978) method for determining NP. This method was included as part of the 2018 supplemental characterization program to evaluate if the historical NP results could be calibrated to the modified-NP method, which is more commonly used in current practice. The modified-NP method is preferred for the following reasons:

- The sample is not boiled which minimizes the extent of silicate-NP digestion, which is typically not readily reactive under ambient conditions;
- The initial pH of the solution must be less than 2.5 prior to titration to ensure dissolution of all available carbonates. The Sobek-NP method only requires 3 mL of acid be added to the sample regardless of the pre-titration pH; and
- The 24-hour testing period, in comparison to 3 hours in the Sobek (1978) method, provides sufficient time for oxidation of ferrous iron liberated through iron carbonate digestion.

Carbonate-NP (CNP) was estimated assuming that all the total inorganic carbon is present as calcium carbonate. A key objective of this approach was to determine if a relationship exists between measured-NP (i.e., modified-NP) and theoretical-NP estimated from TIC since measurement of TIC is more practical than other lab intensive methods under operating conditions.

Details of the NP determinations are presented in the following subsections.

6.2.4.1 Comparison of Sobek and Modified-NP Determinations

Modified-NP versus Sobek-NP for the 2018 samples is presented in Figure 6-3. Sobek-NP generally exceeds modified-NP except between values of approximately 60 to 80 kg $CaCO_3$/t (Figure 6-3.). As discussed in Section 5.2.1., these unusual results may be occurring because of the selection of the acid normality used in the sample digestion. Mineralogical testing was completed on the following six samples with modified-NP values exceeding Sobek-NP values: 28661 (Zone 1), T18-02D-A-004 (Zone 1a), T18-01-A-002 (Zone 2/3), T18-02D-A-019 (Zone 4), T18-02D-A-021 (Zone 5) and T18-02D-A-028.

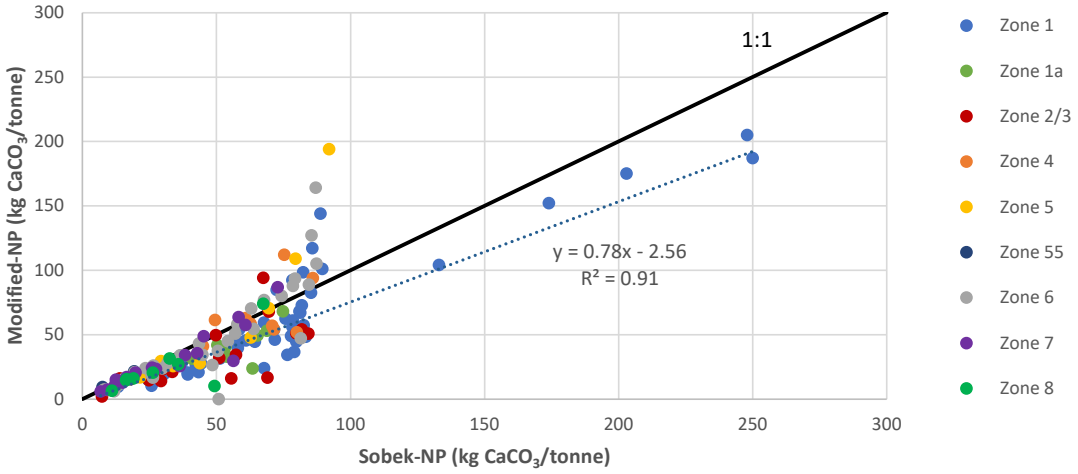
The mineralogical results identified relatively high concentrations of ankerite-dolomite and siderite in these samples and lower relative concentrations of calcite and dolomite (Table 6-2). Calculation of CNP following iron carbonate correction using the method of Day (2009) indicates a strong positive correlation (r=0.97) between the modified-NP method and TIC, estimated based on mineralogical results ($TIC_{Fe\text{-}corrected}$) (Figure 6-4). Based on the agreement of these two approaches, including samples where modified-NP exceeds Sobek-NP, it is likely that the Sobek-NP is

underestimated between 60 and 80 kg $CaCO_3$/t, likely because of insufficient acid addition during sample digestion.

A strong positive correlation (r=0.91) exists between Sobek-NP and modified-NP methods for samples where modified-NP does not exceed Sobek-NP. Modified-NP can be mathematically estimated from the following equation:

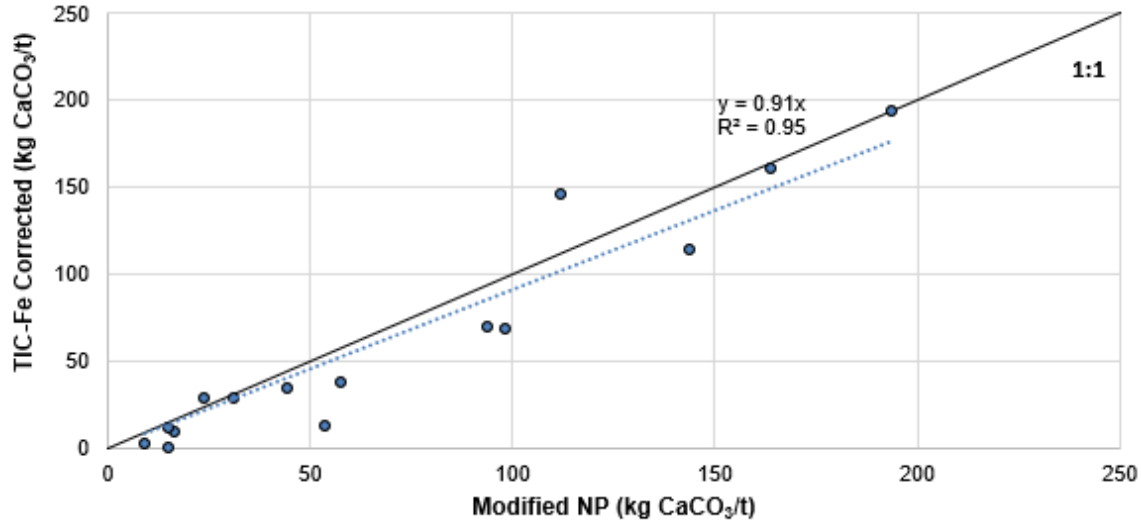
$Modified_{NP}=0.8*Sobek_{NP}-2.6$ (EQ4)

Although modified-NP exceeds Sobek-NP between approximately 60 and 80 kg $CaCO_3$/t (Figure 6-3.), Equation 4 (EQ4) was used to adjust the historical data since this will provide a conservative estimate of the corrected-NP (e.g., the corrected-NP would be higher if there was closer agreement between Sobek and modified-NP methods in this range).



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Figure 6-3: Modified-NP versus Sobek-NP (2018 Samples)



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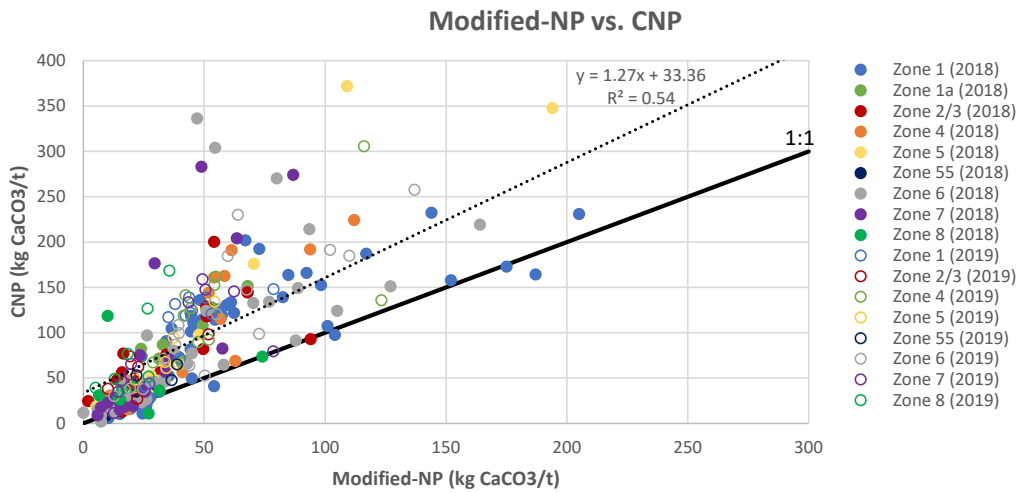
Figure 6-4: Modified-NP versus $TIC_{Fe\text{-}corrected}$

6.2.4.2 Comparison of Carbonate-NP (CNP) and Modified-NP Determinations

Modified-NP versus CNP, estimated from total inorganic content (TIC), is presented in Figure 6-5. A positive correlation (r=0.54) exists between CNP and modified-NP. CNP exceeds modified-NP in almost all 2018 samples, indicating the presence of iron carbonates in the samples. This is consistent with the mineralogical results that identified the presence of iron carbonates (e.g., ankerite and siderite) to varying degrees in each of the stratigraphic zones (Table 6-2). Like the 2018 samples, CNP exceeds modified-NP in 97% of the 2019 samples, suggesting that iron carbonates are also present in these samples. (Figure 6-6)

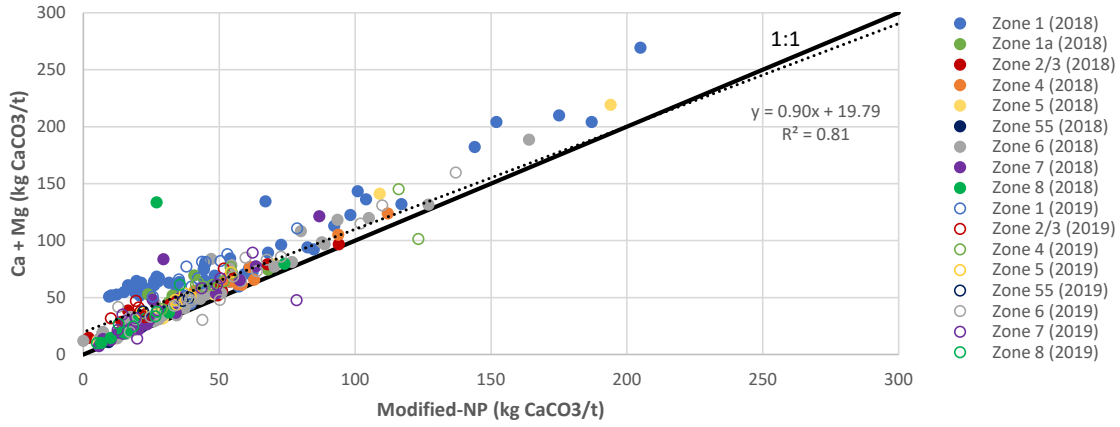
A strong correlation also exists between the TIC concentrations, estimated from the mineralogical results ($TIC_{XRD\text{-}total}$), to $TIC_{Fe\text{-}corrected}$ (Figure 6-7). This relationship indicates the carbonate-NP, or the effective-NP ($NP_{effective}$) can be estimated using the following equation (EQ5):

$$NP_{effective}(kg\ CaCO_3/t)=0.56\times TIC_{Leco}(\%)\times 83.3 \quad (EQ5)$$



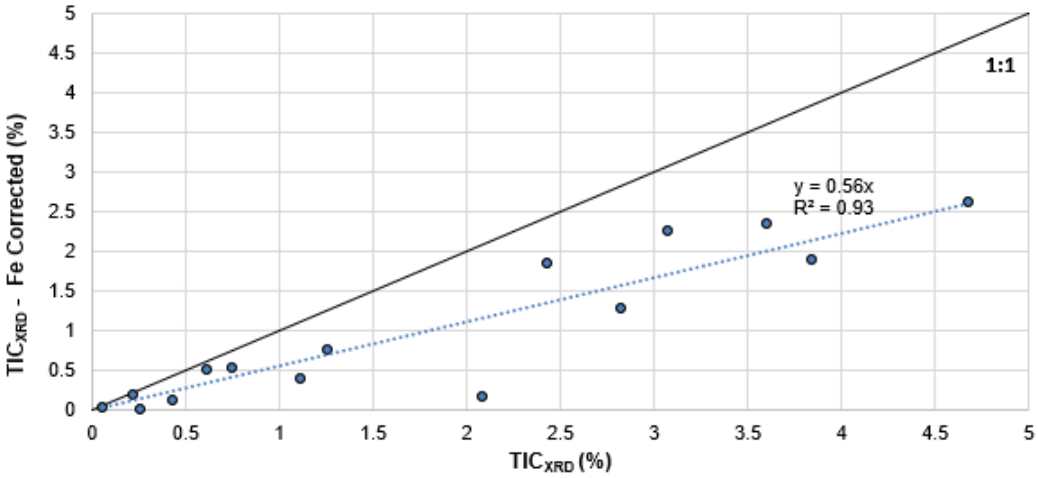
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Figure 6-5: Modified-NP versus CNP



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Figure 6-6: Modified-NP versus Ca+Mg



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Figure 6-7: TIC_{XRD} versus TIC_{XRD}-Fe corrected (2018 Samples)

6.2.4.3 Summary of NP Determinations

Based on a comparison of the three NP determination approaches completed as part of the supplemental geochemistry program the following conclusions can be made:

- A positive correlation exists between modified-NP and Sobek-NP and the regression equation derived from this relationship can be used to "calibrate" the historic dataset to modified-NP methods;
- A strong positive correlation exists between modified-NP and calcium plus magnesium (in equivalent units) and modified-NP is interpreted to represent dissolution of calcium and magnesium carbonates (i.e., effective-NP); and
- Mineralogical results for the 2018 samples indicate there is a strong positive correlation between the modified-NP and TIC when corrected for the presence of iron carbonates. The mineralogical results can be used to estimate the effective-NP from analytical TIC measurements by Leco.

6.2.5 Constituent Leaching Potential

Loading rates calculated using the HCT results can be used to evaluate trends of elements to provide a qualitative indication of the leaching potential of these parameters. The loading rates can also be used to develop water and load balance input source terms to evaluate if constituent concentrations pose environmental risk when accounted for in the context of the proposed mine waste and water management strategies. The development of the source terms for use in the water and load balance are documented separately (SRK, 2022b). Loadings are interpreted here to provide a qualitative interpretation of elemental leaching potential.

6.2.5.1 Historic HCTs

The historical dataset (Norecol Dames & Moore 1999) included five mine rock humidity cells composed of samples collected from test pits and drill holes. The sample depths were not provided in the historical dataset; however, a sample interval number was provided for some of the samples. Where it was possible to relate the sample interval number to the corresponding static test sample ID and stratigraphic zone from the historic drill hole logs, the historic humidity cells were considered as part of the current study. All other humidity cells were not interpreted. The following historical humidity cell test results from Norecol Dames & Moore (1999) were carried forward into the current study:

- Two humidity cells (HC-11 and HC-13) from Zone 1.
- One humidity cell for each of the following zones:
  - Zone 1a (HC-3);
  - Zone 2/3 (HC-5); and
  - Zone 4 (HC-8).

6.2.5.2 HCTs

Nine mine rock humidity cells, one per zone, were initiated as part of the 2018 program and were subsequently discontinued at different times once the objectives of the tests were achieved. Table 6-3 provides the test duration of the discontinued humidity cell tests.

One humidity cell sample (HC-10; Zone 6) and the QA/QC method blank humidity cell (HC-3) continued up to week 130 of testing but were temporarily paused in April 2021 at the request of TML. These HCTs were nitrogen purged and placed in cold storage. Both cells were reactivated in September 2023 and have reached testing week 188.

Table 6-3. Humidity Cell Test Durations

Humidity Cell Number	Zone	Testing Duration (weeks)
HC-3	Method Blank	188
HC-4	Zone 1	66
HC-5	Zone 1a	66
HC-6	Zone 2/3	106
HC-7	Zone 4	106
HC-8	Zone 5	66
HC-9	Zone 55	66
HC-10	Zone 6	188
HC-11	Zone 7	66
HC-12	Zone 8	66
HC-13	Overburden	40

Figure 6-8 provides a plot of the humidity cell pH and loadings for select parameters. Select parameters are defined as those that provide insight to acid generation potential (alkalinity, acidity, and sulfate), were screened to be greater than 10 times the average crustal abundances (arsenic, phosphorus, and selenium) or had increasing concentrations during the testing period (aluminum, cadmium, copper, iron, lead, nickel, strontium and zinc). The historic humidity cell results are presented in Figure 6-8 as dashed lines for comparison purposes.

Except for the Zone 2/3 and 5 humidity cells, all cells maintained alkaline pH values (Figure 6-8). The Zone 5 humidity cell has maintained a circumneutral pH near 7 and the Zone 2/3 pH decreased to a minimum of 2.2 during the testing period.

The Zone 2/3 humidity cell pH decreased to less than 4.5 after 18 weeks of testing and reached its minimum pH at week 47. The pH slightly increased after week 47 but maintained a pH less than 3 for the remainder of the testing period. As the pH decreased, there was an associated increase in several constituent loadings, including: acidity, sulfate, aluminum, cadmium, copper, iron, lead, nickel, strontium, and zinc (Figure 6-8). The results suggest that if acidic drainage occurs from mine rock prior to placement of PAG Rock in the Management Ponds, concentrations of these parameters will increase. After approximately 50 weeks of testing, several constituent loadings began to decrease and a decreasing trend in loadings was maintained until the end of the testing period, implying the mass inventory of these constituents is becoming depleted.

In other cells, alkalinity loadings remained generally consistent during the testing period. Zone 5 had a slight initial decreasing trend in alkalinity but stabilized after approximately week 40.

Loadings of other constituents generally decreased throughout the testing period (Figure 6-8). This generally occurs when the pH remains stable, and the mass inventory is depleted through time. One exception was strontium in Zones 1a and 4. This constituent had an increasing trend for these zones over the testing period.

After the zone 6 HCT was restarted, there was a second flush of constituent load, like the initial weeks of testing (e.g., weeks 1 to 5). This flush was evident in the following constituents: alkalinity, sulfate, arsenic, cadmium, copper, iron, lead, nickel, selenium, strontium, and zinc. This indicates that the sample continued to oxidize while it was in cold storage despite being nitrogen purged. Once the stored oxidized mass was flushed from this sample, post-restart release rates were comparable to the release rates prior to the sample being temporarily placed in cold storage.

The long-term steady state constituent concentrations were used to develop source terms, which were carried forward into a water and load balance to evaluate site facility and discharge water quality during operations and in post-operations. Details of the source term derivation and results of the water and load balance are documented in SRK (2021).

Consistent with 2018 humidity cell testing results, except for the 2018 Zone 2/3 HCT that is producing acidic drainage, the historical humidity cell tests maintained circumneutral to alkaline pH values throughout the 58-week testing period. Loadings of alkalinity, acidity, sulfate, nickel, strontium, and zinc were similar to the loadings calculated from the 2018 humidity cell testing results. However, loadings of the following parameters were higher in the historical humidity cells:

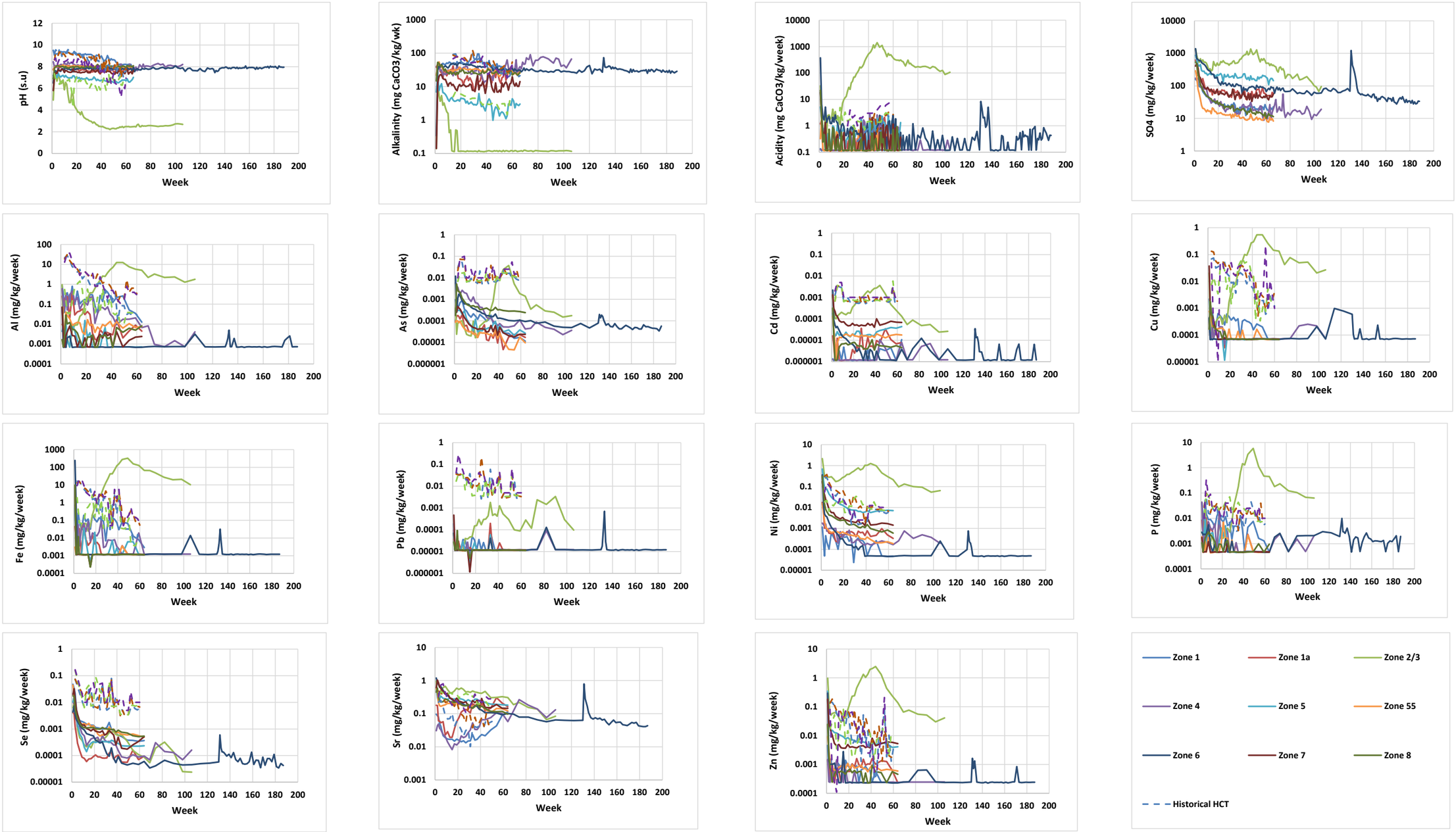
aluminum, arsenic, cadmium, copper, iron, lead, phosphorus, and selenium. It is possible the loadings are higher in the historical humidity cell tests because of a smaller samples size (200 grams) being used in the test and the grain size of the sample being finer than <1/4", resulting in additional flushing of the sample.

6.2.5.3 Field Barrel Tests

The kinetic testing programme was expanded in 2019 to include nine field barrel tests to evaluate release rates and acidic lag times from materials under ambient conditions. Nine field barrels were constructed at the Project site and have been monitored intermittently between October 2019 and November 2023 (SRK, 2024). A summary of the program and results is provided below. Full details of the testing program are provided in Appendix E.

Apart from Barrel 6 (Zone 6/7), all barrels remained alkaline during the four-year data collection period. Sulfate loadings were higher in barrels that are characterized as PAG based on the weighted NPRs. in comparison to non-PAG barrels. In addition, the calcium and magnesium release rates were also higher in PAG barrels relative to non-PAG barrels. Release rates of these constituents as well as the alkaline pH of the leachates and alkalinity production rates indicate carbonate mineral dissolution is buffering acid production from sulfide oxidation. Acidity and sulfate release rates increased during the last sampling round (October 2023) in Barrel 4 (Zone 2/3) indicating this barrel may go acidic soon.

The PAG management strategy for the project is to place all PAG Rock underwater in the management ponds within a period of 12 months. Barrel 6 became acid generating in October 2023, four years after the barrel testing program was constructed and all other barrels maintained alkaline pH values. The barrel results support the proposed period for inundation of PAG Rock is reasonable.



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Figure 6-8: Select Parameter Humidity Cell Loading Rates – Mine Rock Samples

6.2.6 Acid Generating Potential

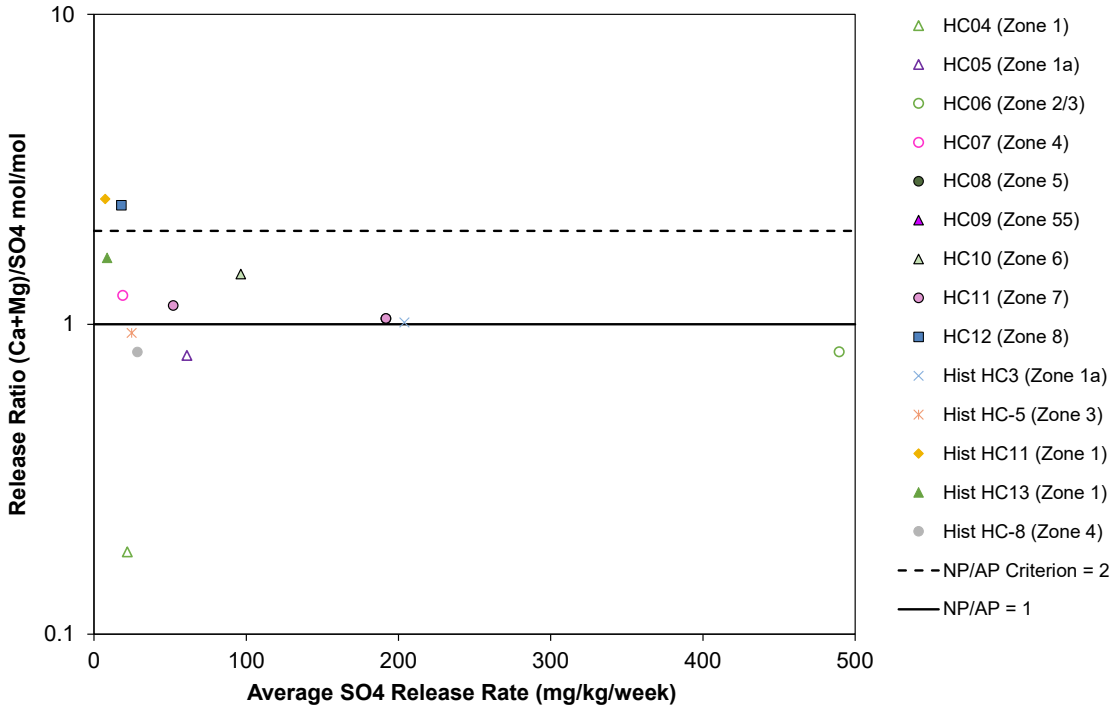
The neutralization potential ratio (NPR), the ratio of the neutralization potential (NP) to the acid potential (AP) is used to classify mine waste rock as PAG), non-PAG or as having uncertain acid generating potential. The following sections provide the acid generating potential of the drill core samples.

6.2.6.1 Classification Criteria

HCT results can be used to calculate the carbonate molar ratio (CMR), which is the ratio of calcium and magnesium from carbonates to the sulfate production rate, expressed as follows:

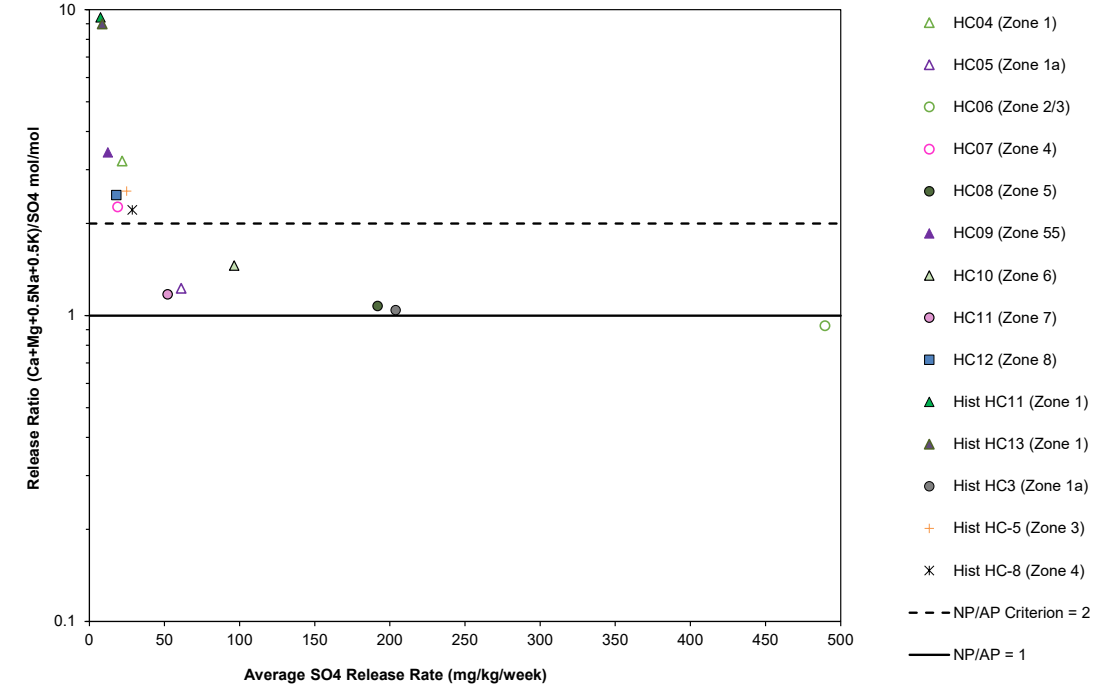
$$\frac{(Ca+Mg)}{SO_4} \text{ mol/mol}$$

If it is determined that the calcium and magnesium loads in the humidity cell test are attributed to carbonate minerals, this ratio represents the NPR when the pH in the test is neutral. As discussed in Section 6.2.4.1, a strong positive correlation exists between NP_{XRD}, following correction for iron carbonates, and modified NP. In addition, a strong positive correlation exists between modified-NP and calcium plus magnesium (see Section 6.2.4.2). These lines of evidence provide confidence that the modified-NP is a measure of calcium and magnesium carbonate dissolution (i.e., the effective-NP). CMRs for the humidity cell tests were calculated based on the stable average non-acidic loading rates observed in humidity cell tests. Figure 6-9 provides a comparison of the CMR to the average sulfate release rate. This figure indicates there are very low CMRs at low sulfate production rates (e.g., Zone 1). This is indicative of cation exchange which is expected based on the presence of the clay minerals illite-muscovite and kaolinite (Table 6-2) present in the samples. Figure 6-10 provides a plot of the CMR, accounting for cation exchange, versus the sulfate production rate. The CMRs indicate that the critical NPR for mine rock at the Tenas project is 1.20. However, an NPR of 2.0 has been selected to conservatively classify mine rock as either PAG or non-PAG.



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Figure 6-9: Carbonate Molar Ratios versus Sulfide Release Rates



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Figure 6-10: Carbonate Molar Ratios Accounting for Cation Exchange versus Sulfide Release Rates

It is standard convention to classify samples with an NPR less than 1 as PAG and samples between the PAG and non-PAG cut-offs (i.e., between 1 and 2) as having uncertain acid generating potential. Operationally, all rock having an NPR less than 2 will be managed as PAG Rock.

6.2.6.2 Acid Generating Potential

Figure 6-11 provides a plot of the NPR versus acid potential content. Historical samples, corrected using Equations 2 and 4, are presented as triangle symbols, 2018 samples are presented as filled circles and 2019 samples are presented as open circles. All stratigraphic zones had PAG or non-PAG samples; however, a higher density of PAG samples occurs in Zones 1a, 2/3, 5, 6, and 7 (Figure 6-12). A higher density of non-PAG samples occurs in Zones 1, 4, 55, and 8 (Figure 6-13). The samples plotted in Figure 6-11 to Figure 6-13) cannot be weighted equally since sample lengths varied from a few centimetres to several metres (see Section 5.1.1). To evaluate the overall acid generating potential of stratigraphic zones, the modified-NP and AP were weighted to sample intercept lengths in each zone and summed to calculate a zonal average NPR. The weighted average NPRs for each zone are provided in Table 6-4.

As can be seen in Table 6-4, seven out of nine zones (Zones 1a, 2/3, 4, 5, 55, 6 and 7) have mean NPRs less than or equal to 2.0 and are classified as PAG, even though all zones, with the exception of Zone 1a, have a component of non-PAG Rock (i.e., the non-PAG Rock is included in the PAG estimates as part of the mine plan). Zones 1 and 8 are classified as non-PAG based on their weighted NPR value. All minimum NPR values were PAG, and the 5th percentile NPRs were greater than 2.0 in all zones apart from Zone 8. Zone 4 contains quantities of both PAG and non-PAG Rock.

PAG Rock in Zone 4 is generally limited to the western and northern areas of the open pit as shown by color coded maps provided by Appendix F. Samples from other areas in this open pit were identified to be non-PAG. These zones were delineated in the mine plan when estimating quantities of PAG and non-PAG Rock.

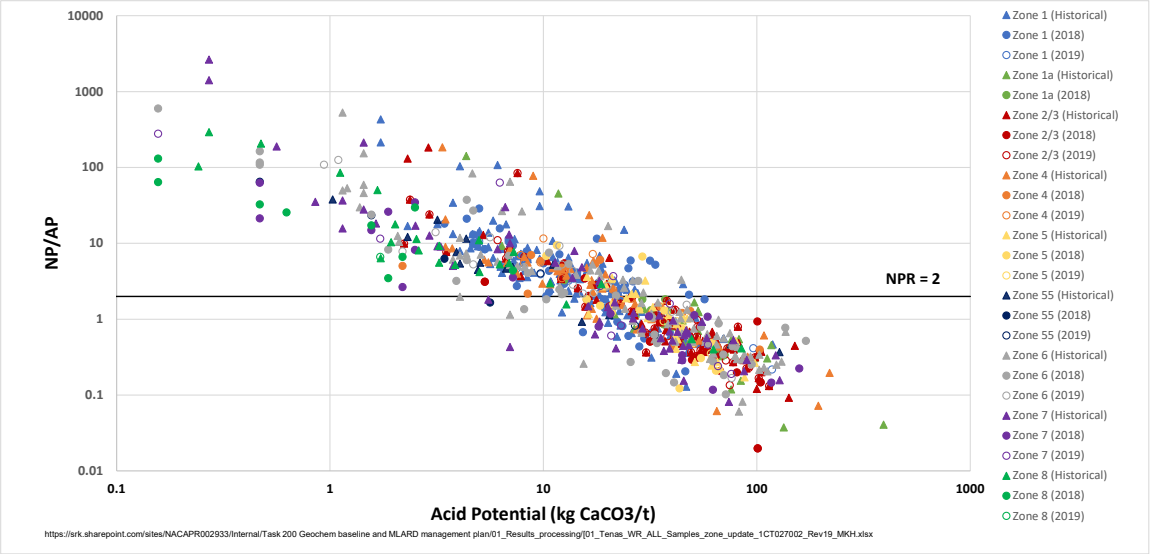


Figure 6-11: Acid Potential versus NPR

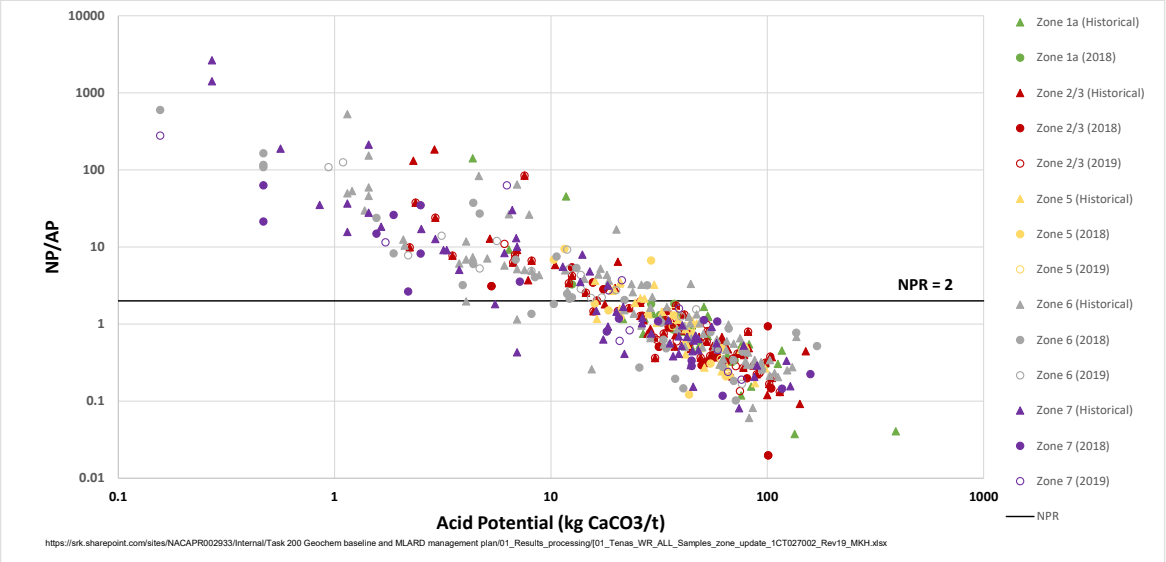


Figure 6-12: NPR versus Acid Potential for primarily PAG zones of 1a, 2/3, 5, 6, and 7

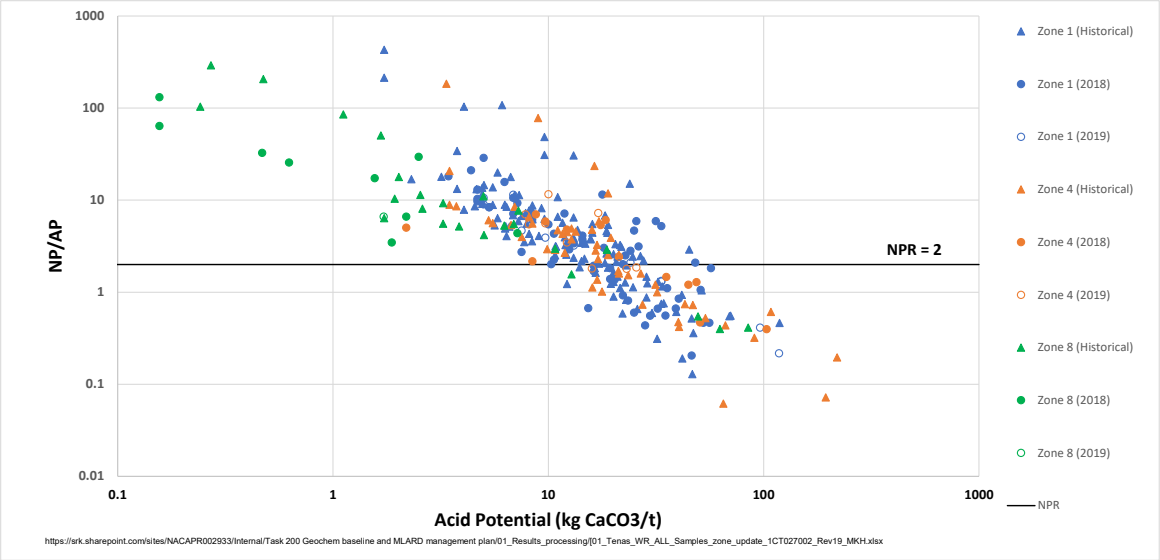


Figure 6-13: NPR versus Acid Potential for primarily non-PAG zones of Zones 1, 4, 55 and 8

Table 6-4: Weighted NPR by Stratigraphic Zone (shaded cells indicate an NPR≤2)

Zone	Count	Minimum	P5	P25	Mean	P75	P95	Max
1	19	1.7	1.98	2.9	3.1	4.8	6.6	8.8
1a	11	0.39	0.39	0.58	0.74	0.82	1.1	1.1
2/3	19	0.20	0.24	0.36	0.80	1.8	5.6	11
4 (PAG)	8	0.05	0.15	0.45	0.61	0.76	0.85	0.86
4 (non-PAG)	18	3.1	3.1	4.0	4.9	6.2	11	21
4	21	0.65	0.82	1.5	2.6	3.9	10	13
5	24	0.27	0.37	0.76	1.2	1.6	2.5	3.0
55	12	0.32	0.36	0.79	1.9	8.7	25	27
6	25	0.39	0.46	0.94	1.8	4.4	12	64
7	19	0.27	0.33	0.76	1.7	4.7	78	293
8	12	0.39	3.2	6.4	5.0	11	31	45

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[Telkwa_RptTables_1CT027.002_MKH_R2.xlsx]

6.2.7 Lag Times to the Onset to Acid Generation

A large volume of the mine rock to be mined at the Tenas Project is PAG rock (Section 6.2.6.2). As discussed in Section 2.4, PAG Rock will be placed in management ponds and submerged to reduce the rate of oxidation of sulfides. This strategy requires PAG rock to be flooded prior to the onset of acid generating conditions. Therefore, the timing to the onset of acid generation is key to the proposed PAG management strategy. Another consideration to the placement of the PAG Rock in the management ponds is flushing of oxidation products prior to the onset of acid generating conditions. The timing of exposure of PAG Rock to oxygen is directly proportional to the oxidative mass that will be flushed during placement, which can also degrade the water quality in the

management ponds. Flushing of soluble oxidation products in the management ponds is addressed in the site water and load balance provided in SRK (2022c).

The time or delay to onset of ARD (t_{onset}) depends on both the site-specific availability of reactive neutralization potential (NP*) and the rate at which reactive neutralization potential (R_{NP*}) is depleted. For PAG rock samples, the onset of acid generating conditions can be calculated using the following equation:

$$t_{onset} = NP^*/R_{NP^*} \quad (EQ6)$$

The rate at which carbonate is depleted is a function of the acid generation (sulfide oxidation) rate (R_S). In molar terms, the rate of carbonate depletion to sulfide depletion is the same as the NP/AP criterion for PAG Rock ($\{NP^*/AP^*\}_{crit}$).

$$R_{NP*}/ R_S = \{NP^*/AP^*\}_{crit} \quad (EQ7)$$

Assuming a direct linear relationship between oxidation rate and sulfur content and conservatively a zero-order chemical reaction, then

$$R_S = k.AP^*_0 \quad (EQ8)$$

where k is the slope of the line and the rate constant; and AP_0 is the initial sulfide content. A non-zero intercept is implied because if no sulfide is present then the rate of sulfide oxidation is zero.

When equations 6, 7 and 8 are combined, the delay to onset is:

$$t_{onset} = \frac{\left(NP^*/AP^*\right)_0}{k.\left(NP^*/AP^*\right)_{crit}} \quad (EQ\ 9)$$

Therefore, the delay to onset is function of NP*/AP* of the sample, the overall rate of oxidation of sulfide (k) and the effectiveness of neutralization ($\{NP^*/AP^*\}_{crit}$). Longer delays are indicated for rock higher NP*/AP* assuming constant values for the two other factors.

The NP^*/AP^*_{crit} was assigned a value of 2.0 (see Section 6.2.6.1) and the overall oxidation of sulfide (k) (Figure 6-14) was estimated based on steady-state oxidation rates in the 2018 and historic humidity cell test results, and the static test sulfide concentrations for these samples. One historic humidity cell sample (Zone 4 HC-8) was excluded from the analysis since this sample had a sulfide oxidation rate that was atypical for a sample with a high sulfide concentration, which did not fit the trend of the other samples. The Zone 2/3 sample was also eliminated because the loading rate from this humidity cell was representative of acidic conditions.

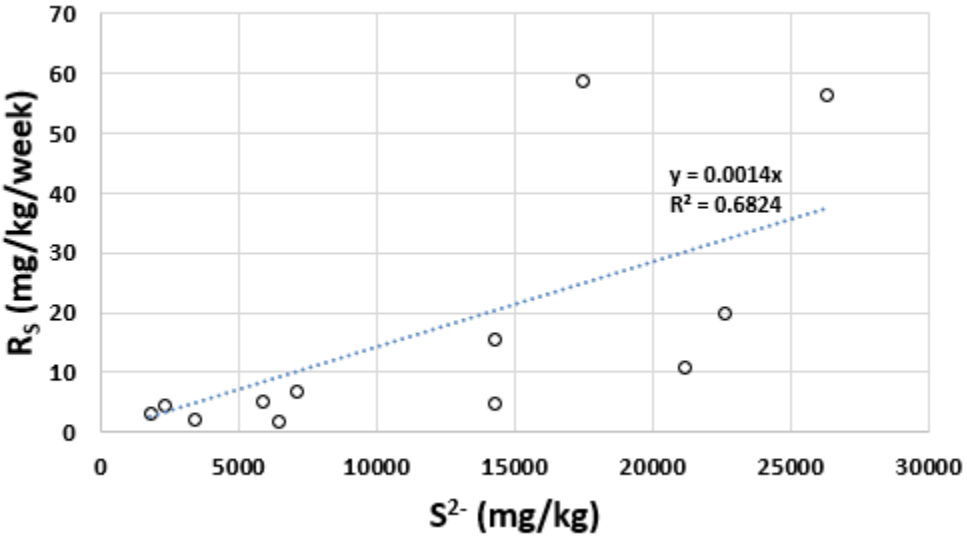
The onset to acid generation for PAG Rock was estimated using Equation 9 and the range of weighted NPRs for each zone (Table 6-5). Based on the geographical distribution of PAG and non-PAG Rock in Zone 4 (see Section 6.2.6.2), the PAG rock component of this zone is split out using

an NPR of 2.0 to avoid bias (i.e., underestimation) in the depletion calculations in PAG areas of Zone

The evaluation indicates that for the average bulk properties of PAG Rock, the minimum lag time is approximately 4.2 years based on laboratory conditions. A minimum lag time of 0.4 years is estimated for PAG Rock areas with minimum NPRs of 0.1.

It is important to note that lag times are estimated based on oxidation rates measured under laboratory conditions. The humidity cell testing is designed to accelerate weathering under controlled conditions. There are several factors that can reduce the oxidation rate under ambient conditions, including temperature differences and oxygen ingress into freshly blasted mine rock.

The predicted lag times, based on the HCTs were conservative and overestimate the lag times that would be expected under field conditions. The 2019 field barrel test program provided additional empirical evidence and supported the initial lag times predictions (SRK 2024).



https://srk.sharepoint.com/sites/NA1CT027.002/Internal/0100 MLARD/020 Reinterpretation of Kinetic Test Database/03_ResultsProcessing/01_WR/[WR_HCT_Interpretation_1CT027002_MKH_R5.xlsx

Figure 6-14: Sulfide Oxidation Rate vs. Sulfide Concentration

Table 6-5: Estimated Acid Generation Lag Times in Months under Laboratory Conditions

Zone	Minimum	P5	P25	Average	P75	P95	Max
1	141	162	---	---	---	---	---
1a	32	32	47	60	65	67	91
2/3	16	19	30	66	71	145	---
4 (PAG)	4	12	37	50	48	62	69
4 (non-PAG)	---	---	---	---	---	---	---
5	22	30	63	101	76	135	---
55	26	29	65	154	---	---	---
6	32	38	77	151	161	---	---
7	22	27	62	138	140	---	---
8	32	---	---	---	---	---	---

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[01_Tenas_WR_ALL_Samples_zone_update_1CT027002_Rev20_JCE.xlsx]

6.3 Overburden Samples

The following sections present a summary of the geochemical testing results for overburden samples. Full ABA and elemental content results are provided in Appendix G and H, respectively.

6.3.1 Grain Size

The mass of each of the six 2018 overburden sample size fraction following sieving is presented in Table 6-6. The + 2 mm– 25 mm fraction represents the largest size fraction ranging from 74 % to 83 % of the samples. The -2 mm fraction represents the second largest size fraction ranging from 16 % to 26 % of the total sample. Only one sample (T18-10-S-BLK-02 9.0-9.5m) reported grains in the +25 mm fraction; however, this was a minor fraction (1.5 %) of the entire sample (Table 6-6).

Table 6-6. 2018 Overburden Sample Size Fraction Masses and Percentages

Sample ID	+25mm (kg)	-25mm+2mm (kg)	-2mm (kg)	+25mm (%)	-25mm+2mm (%)	-2mm (%)
T18-03-S-SPT4 6.0-6.45m	0	0.66	0.14	0	83	17
T18-10-S-SPT2 3.0-3.45m	0	0.57	0.17	0	77	23
T18-13-S-SPT2 4.5-4.95m	0	0.64	0.22	0	74	26
T18-13-S-SPT5 12.0-12.45m	0	0.52	0.19	0	74	26
T18-10-S-BLK-02 9.0-9.5m	0.12	6.5	1.3	1.5	82	16
T18-02-S SPT-14 6.0-6.45m	0	0.58	0.18	0	77	23

6.3.2 Sulfide and Carbonate Mineral Fractionation

The distribution of sulfide sulfur and carbonate content by size fraction for the 2018 overburden samples are presented in Figure 6-15 and Figure 6-16, respectively. Only the -2 mm and +2 mm–25 mm fractions are presented since only one sample result was available from the +25 mm fraction.

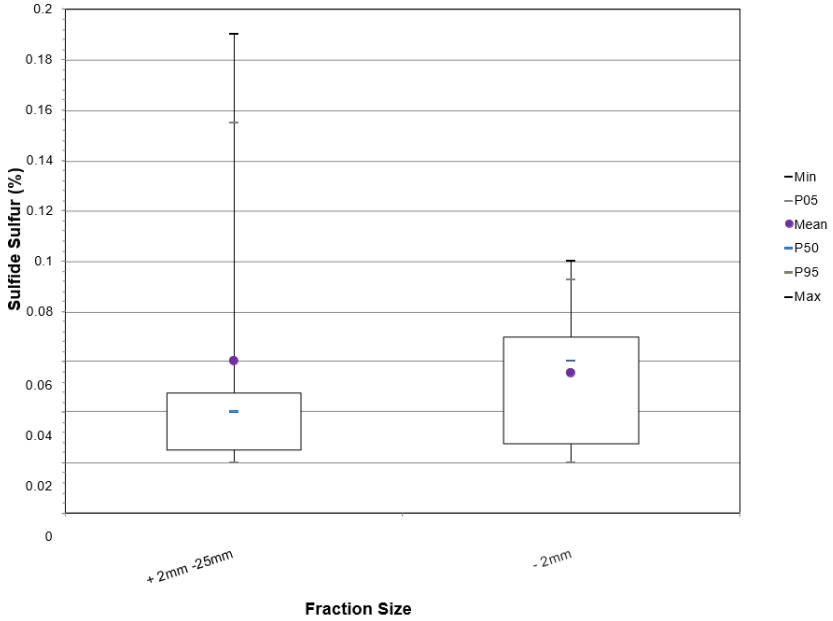
A larger range in sulfide sulfur concentrations is seen in the +2 mm–25 mm fraction in comparison to the -2 mm fraction (Figure 6-15). The maximum concentration (0.19%) in the +2 mm–25 mm fraction is higher than the maximum in the -2 mm fraction (0.10) but the minimum, P05, mean, median concentrations are similar between these two size fractions (Figure 6-15) indicating that sulfide does not preferentially fractionate to one size fraction. The sulfide concentration (0.02%) in the +25 mm fraction is equal to the minimum in the other two fractions.

Similar to the sulfide concentrations, a larger TIC range of concentrations is seen in the +2 mm–25 mm fraction in comparison to the -2 mm fraction (Figure 6-16). The median concentrations are similar between the two populations, and it therefore cannot be concluded confidently that TIC fractionates in the overburden samples. The +25 mm sample had a TIC concentration of the 0.21%, which is comparable to the 25th percentile value in the +2 mm–25 mm fraction.

The NPR in the +2 mm–25 mm and the -2 mm was similar (Figure 6-17). The NPR ranged from 5.5 to 89 in the +2 mm–25 mm fraction and from 18 to 86 in the -2 mm fraction. All samples had NPRs greater than two and are therefore classified as non-PAG. The NPR of the sample from the +25 mm was 128 and is therefore, also classified as non-PAG.

All of the 2019 samples were classified as non-PAG based on the low sulfide concentrations which ranged from below the reporting detection limit to 0.060 %, with a median of 0.015 and high NPRs which ranged between 13 and 74, with a median of 28 (Table 6-7).

The 2023 overburden sample is classified as non-PAG based on the low sulfide concentration (0.065 %) and NPR of 15 (Table 6-7).



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Figure 6-15: Sulfide Sulfur Size Fraction Box and Whisker Plot

Note: boxes represent the 25th and 75th percentiles. Whiskers provided the statistical spread on extrema and 5th and 95th percentiles

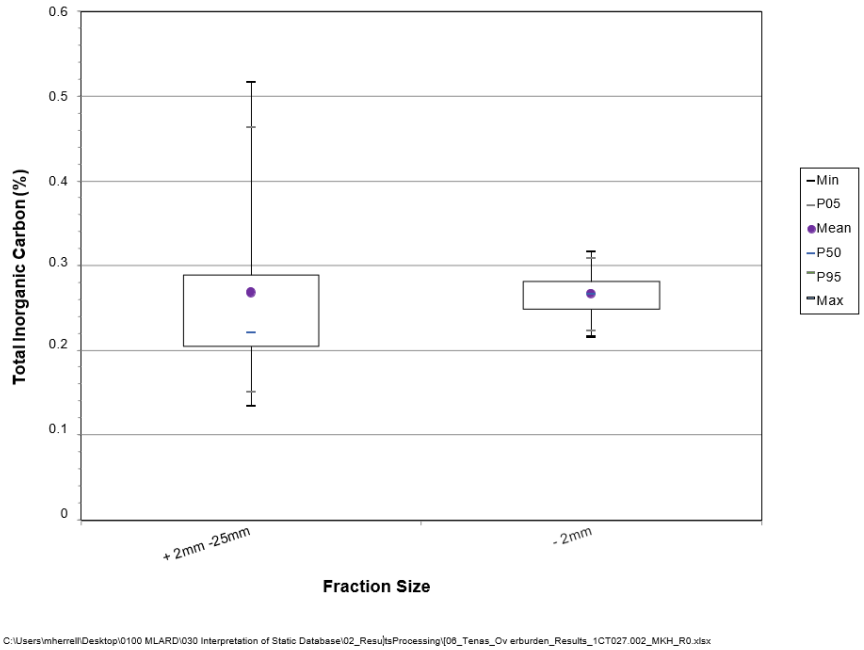


Figure 6-16: Total Inorganic Carbon Fraction Box and Whisker Plot

Note: boxes represent the 25th and 75th percentiles. Whiskers provided the statistical spread on extrema and 5th and 95th percentiles.

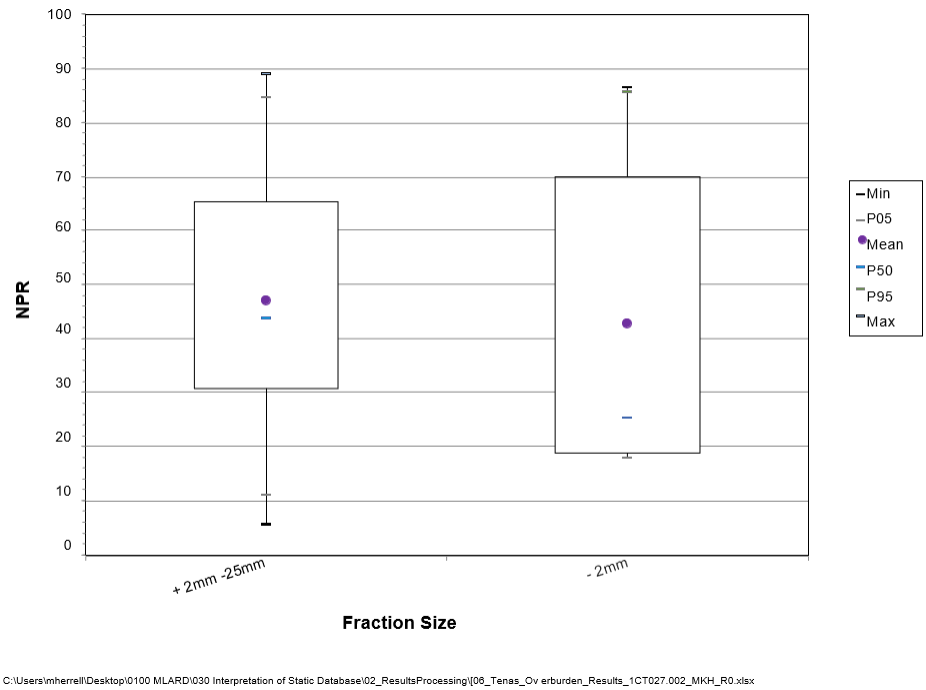


Figure 6-17: NPR Fraction Box and Whisker Plot

Note: boxes represent the 25th and 75th percentiles. Whiskers provided the statistical spread on extrema and 5th and 95th percentiles.

Table 6-7: Summary of Overburden Acid Base Accounting Results

Sample ID	Bureau Veritas (formerly Maxxam) Sample ID	Sample Depth (m)		Paste pH (s.u.)	Carbon Species (w.t.%)			Sulfur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios	
		From	To		Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulfate	S_{ICP}	Sulfide (S_{ICP} – SO_4)	AP (Sulfide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek-NPR (Sulfide)
2018																
+25mm fraction																
+25MM - T18-10-S-BLK-02 9.5	UJ3985	9	9.5	8.8	---	0.21	0.77	<0.020	0.010	<0.020	0.010	0.31	18	33	56	104
+2mm-25mm fraction																
+2MM - T18-03-S-SPT4 6.0-6.45	UJ3987	6	6.45	7.9	---	0.23	0.84	0.19	0.020	0.19	0.17	5.3	19	29	3.6	5.5
+2MM - T18-10-S-SPT2 3.0-3.45	UJ3988	3	3.45	8.1	---	0.20	0.74	0.030	0.010	0.020	0.010	0.31	17	28	54	89
+2MM - T18-13-S-SPT2 4.5-4.95	UJ3989	4.5	4.95	8.2	---	0.31	1.1	0.040	0.010	0.040	0.030	0.94	26	39	27	41
+2MM - T18-13-S-SPT5 12.0-12.45	UJ3990	12	12.45	8.3	---	0.21	0.78	<0.02	<0.010	<0.02	0.015	0.47	18	34	38	71
+2MM - T18-10-S-BLK-02 9.0-9.5	UJ3991	9	9.5	8.5	---	0.13	0.49	0.04	<0.010	0.040	0.035	1.1	11	30	10	27
+2MM - T18-02-S SPT-14 6.0-6.45m	UJ3993	6	6.45	8.3	---	0.52	1.9	0.05	<0.010	0.050	0.045	1.4	43	66	31	47
-2mm fraction																
-2MM - T18-03-S-SPT4 6.0-6.45	TO9565	6	6.45	8.0	0.75	0.26	0.95	0.070	0.020	0.070	0.050	1.6	22	28	14	18
-2MM - T18-10-S-SPT2 3.0-3.45	TO9566	3	3.45	8.3	0.87	0.25	0.90	0.020	0.010	<0.02	0.010	0.31	20	26	65	83
-2MM - T18-13-S-SPT2 4.5-4.95	TO9567	4.5	4.95	8.0	0.62	0.32	1.2	0.080	0.050	0.10	0.050	1.6	26	32	17	21
-2MM - T18-13-S-SPT5 12.0-12.45	TO9568	12	12.45	8.3	0.43	0.22	0.79	<0.020	0.010	<0.020	0.010	0.31	18	27	57	86
-2MM - T18-10-S-BLK-02 9.0-9.5	TO9570	9	9.5	8.2	0.73	0.27	1.0	0.040	0.020	0.050	0.030	0.94	23	28	24	30
-2MM - T18-02-S SPT-14 6.0-6.45m	TO9571	6	6.45	8.1	0.89	0.28	1.0	0.060	0.020	0.070	0.050	1.6	24	28	15	18
Bulk Samples																
ORIGINAL - T18-03-5-SPT2	TV0022	3	3.45	8.2	0.63	0.19	0.70	<0.020	0.010	<0.020	0.010	0.31	16	23	51	75
ORIGINAL - T18-03-5-SPT6	TV0175	10.5	10.95	8.4	1.0	0.43	1.6	0.10	0.010	0.10	0.090	2.8	36	37	13	13
ORIGINAL - T18-03-5-SPT5	TV0176	7.5	7.95	8.4	0.75	0.38	1.4	0.090	0.010	0.090	0.080	2.5	32	38	13	15
2019																
29632	VW1525	---	---	7.9	0.49	0.0082	0.030	<0.02	<0.01	<0.02	0.015	0.47	0.68	7.7	1.5	16
29633	VW1526	---	---	8.4	0.48	0.13	0.46	<0.02	<0.01	<0.02	0.015	0.47	10	19	22	39
29634	VW1527	---	---	8.3	0.67	0.20	0.73	<0.02	<0.01	<0.02	0.015	0.47	17	18	35	37
29635	VW1528	---	---	8.4	0.50	0.15	0.54	<0.02	<0.01	<0.02	0.015	0.47	12	21	26	45
29636	VW1529	---	---	8.4	0.68	0.25	0.90	<0.02	<0.01	<0.02	0.015	0.47	20	27	44	57
29637	VW1530	---	---	8.5	0.72	0.23	0.86	0.040	<0.01	0.050	0.045	1.4	20	28	14	20
29638	VW1531	---	---	8.4	0.77	0.29	1.1	0.040	<0.01	0.050	0.045	1.4	24	30	17	21
35029	VW1532	---	---	8.2	0.47	0.08	0.28	<0.02	<0.01	<0.02	0.015	0.47	6.4	14	14	30
35030	VW1533	---	---	8.3	0.77	0.24	0.88	0.060	0.01	0.070	0.060	1.9	20	25	11	13
35031	VW1534	---	---	8.4	0.74	0.27	0.98	0.070	0.01	0.070	0.060	1.9	22	28	12	15
29655	VW1535	---	---	8.3	0.50	0.068	0.25	<0.02	<0.01	<0.02	0.015	0.47	5.7	13	12	27
29656	VW1536	---	---	8.4	0.78	0.20	0.72	<0.02	<0.01	<0.02	0.015	0.47	16	29	35	61
29657	VW1537	---	---	8.4	0.79	0.29	1.1	0.030	<0.01	0.040	0.035	1.1	25	30	22	28
29658	VW1538	---	---	8.3	0.83	0.31	1.1	0.040	0.01	0.070	0.060	1.9	25	28	14	15
29659	VW1539	---	---	8.3	0.82	0.27	0.98	0.040	<0.01	0.050	0.045	1.4	22	27	16	19
29660	VW1540	---	---	8.4	0.73	0.26	0.96	0.040	<0.01	0.030	0.025	0.78	22	29	28	38
35021	VW1541	---	---	8.0	0.52	0.035	0.13	<0.02	<0.01	<0.02	0.015	0.47	3.0	12	6	25
35022	VW1542	---	---	8.5	0.51	0.27	0.99	<0.02	<0.01	<0.02	0.015	0.47	23	31	48	65
35024	VW1543	---	---	8.6	0.59	0.30	1.1	<0.02	<0.01	<0.02	0.015	0.47	25	35	53	74
2023																
Overburden Composite Sample from Sonic Drilling Program in 2021 for Management Ponds	UJ3986	---	---	8.4	0.94	0.24	0.88	0.060	<0.010	0.070	0.065	2.0	20	31	10	15

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[Telkwa_RptTables_1CT027.002_MKH_R2.xlsx]

6.3.3 Elemental Content

To identify parameters that were elevated in the solid-phase and may have the potential to leach, elemental concentrations of the 2018 samples were compared to the average crustal abundances (Smith and Huyck (1999). The following elements were screened to have concentrations greater than 10 times the average crustal abundances (Appendix H):

- +2 mm–25 mm fraction:
  - 67% (4 of 6 samples) of arsenic measurements;
  - 17% (1 of 6 samples) of bismuth and cadmium measurements; and
  - 33% (2 of 6 samples) of tellurium measurements.
- -2 mm fraction
  - 17% (1 of 6 samples) of arsenic and gold measurements; and,
  - 83% (5 of 6 samples) of tellurium measurements.
- There were no elevated concentrations in the +25 mm fraction

Detailed comparisons are provided in Appendix H. A higher frequency of elevated parameters was observed in the +2–25 mm fraction in comparison to the -2 mm and +25 mm fractions.

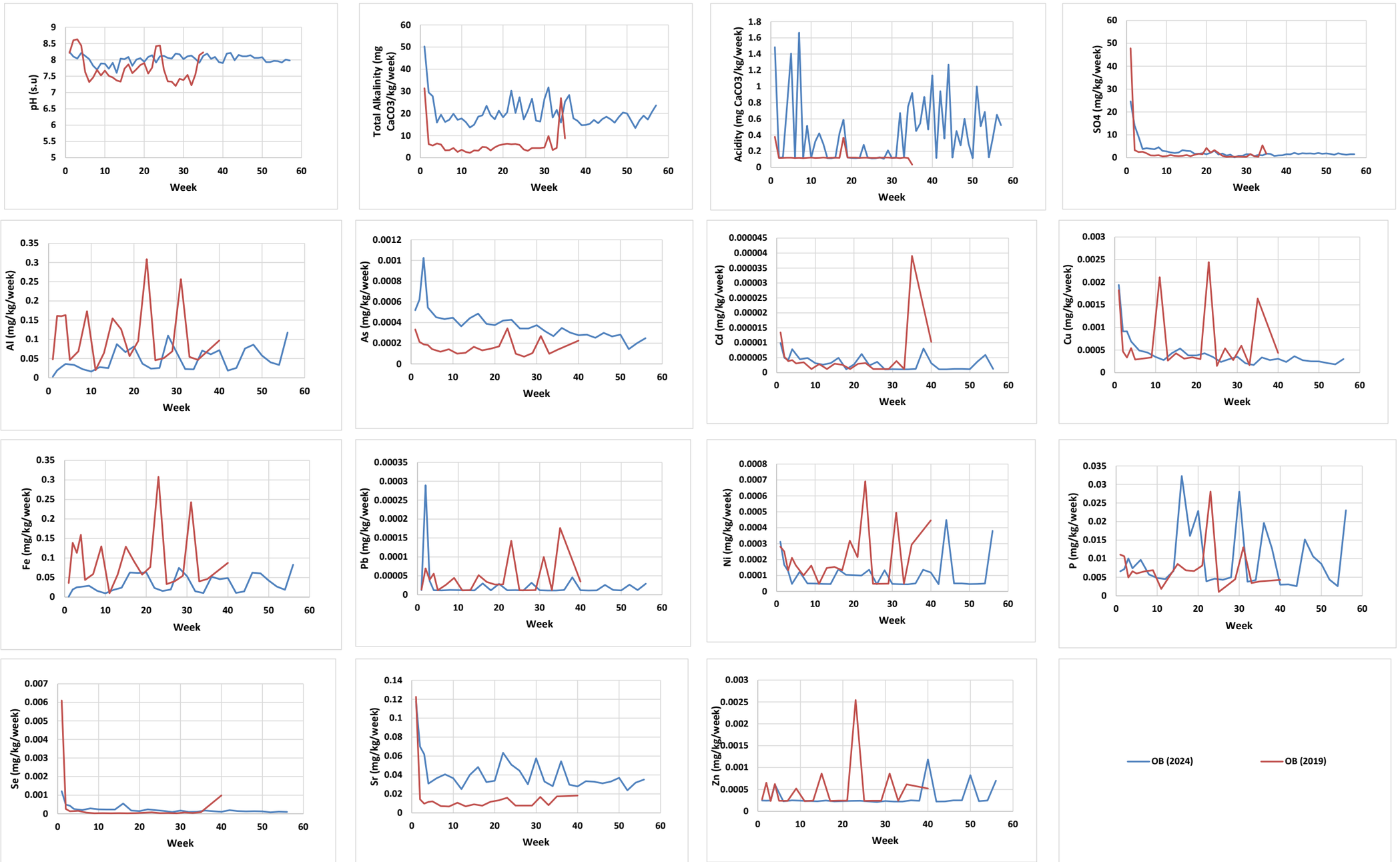
Tellurium was the only element screened to have a concentration greater than 10 times the average crustal abundance in all the 19 overburden samples and the 2023 overburden sample.

6.3.4 Constituent Leaching Potential

A humidity cell was initiated on the 2019 composite sample and ran for 40 weeks before it was terminated. An additional overburden humidity cell was initiated in 2023. At the time this report was produced, data were available up to week 57. Figure 6-18 provides a plot of the humidity cell pH and loadings for the same select parameters identified for mine rock (Section 6.2.5).

Both the 2019 and 2023 cells maintained a circumneutral to alkaline pH. The pH of the 2019 cell ranged between 7.2 and 8.6 and after the initial first flush of the cell, alkalinity decreased before becoming reasonably stable after week 2 (Figure 6-18). The pH of the 2023 cell ranged between 7.6 and 8.2 and after the initial first flush of the cell in the first 5 weeks of testing, alkalinity decreased before becoming reasonably stable after week 4 (Figure 6-18).

Loadings of other constituents maintained slight decreasing trends throughout the testing period (Figure 6-18). An exception to this can be seen in loadings of aluminium, chromium, and iron which see an overall increasing trend.



https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 300 Humidity Cell testing/05 HCT Figures/1_Overburden/[OB_Select_Parameter_Loads_CAPR002933_MKH_R0.xlsx

Figure 6-18: Select Parameter Humidity Cell Loading Rates – Overburden Samples

6.4 Processed Rock

The following sections present the processed rock geochemical test results. Detailed ABA and elemental analysis results are provided in Appendices I and J, respectively.

6.4.1 Mineralogy

One coarse processed rock sample was submitted for mineralogy by Rietveld XRD. Results of this analysis are provided in Table 6-8. Most of the coarse processed rock were present as amorphous minerals. Most of the crystalline phases were kaolinite and quartz.

Sulfur is present in the sample as pyrite and iron carbonates ankerite, and siderite were also detected. This implies that a component of the NP in the processed rock will not provide net neutralizing potential.

Table 6-8. Coarse Processed Rock Mineralogical Results

Mineral	Relative %
Kaolinite	20
Quartz	11
Ankerite	2.3
Siderite	1.2
Pyrite	1.7
Amorphous	65

6.4.2 Acid Base Accounting

A summary of the processed rock acid base accounting results is provided in Table 6-9. Total sulfur concentrations in the coarse processed rock ranged from 2.8 to 4.1 % and from 1.9 to 3.9 % in the fine processed rock. Nearly all the total sulfur was present as sulfide, which calculated using EQ1 ranged from 1.8 to 3.4 % in the fine processed rock and from 3.0 to 3.7 % in the coarse processed rock. The sulfide concentration (3.0%) of one coarse processed rock sample (UI3971) was greater than the total sulfur concentration (2.8%), perhaps because of some organic sulfur being lost on ignition.

The NP was higher in the fine processed rock (61 to 192 kg $CaCO_3$/t) in comparison to the coarse fraction (36 to 111 kg $CaCO_3$/t). Except for one coarse processed rock sample (UI3970), carbonate-NP was like the modified-NP indicating, that for most samples, the modified-NP provides a reasonable estimate of the effective-NP of the samples. The carbonate-NP in samples WT7431 and WP0671 was greater than the modified-NP indicating the presence of siderite in the sample. This was confirmed by mineralogy in the coarse processed rock (see Section 6.4.1) In addition, the carbonate-NP in sample UI3970 (56 kg $CaCO_3$/t) was approximately half of the modified-NP value of 111 kg $CaCO_3$/t. The NP of the processed coal sample was 3.2 kg $CaCO_3$/t. The carbonate-NP (2.5 kg $CaCO_3$/t) was like the modified-NP indicating, that the modified-NP overestimated the effective-NP of the sample.

Both coarse processed rock samples and all but one fine processed rock samples (UI3972) had NPR values less than two and are classified as PAG. Fine processed rock sample UI3972 had an NPR of 3.4 and is classified as non-PAG. Previous testing of processed rock samples (Norecol Dames and Moore 1999) indicated all processed rock samples are PAG and confirmed the classification of most of the processed rock samples as PAG. Even though one fine processed rock sample is non-PAG, TML plans to manage all processed rocks as PAG.

6.4.3 Elemental Content

The element content of the seven processed rock samples was compared to the average crustal abundances (Smith and Huyck, 1999) to identify parameters that were elevated in the solid phase. The following elements were screened to have concentrations greater than 10 times the average crustal abundances (Appendix J): sulfur and tellurium in all processed rock samples, arsenic in five of seven samples and selenium in six of the seven processed rock samples. Coarse processed rock sample WP0671 was not elevated in arsenic and selenium.

6.4.4 Constituent Leaching Potential

Loading rates for the processed rocks were calculated using the four humidity cell results to evaluate trends of elements to provide a qualitative indication of the leaching potential of these parameters. Figure 6-19 provides a plot of the humidity cell pH and loadings for the same select parameters identified for mine rock (Section 6.2.5). No new parameters were screened to be greater than the average crustal abundances in the processed rock samples and no additional constituents were included in the select parameter list..

The coarse processed rock sample was tested for 140 weeks before being terminated. Although this sample became acidic and constituent concentrations are increasing, TML plans to manage all processed rock as PAG and place them in the management pond before they become acidic. Therefore, the objective of this sample (i.e., to evaluate the lag time to the onset of acid generation) has been achieved. The 2018 and 2019 fine processed rock samples were tested for 74 and 55 weeks, respectively. The processed coal sample was initiated in March 2024 with the test still running.

The pH of the coarse processed rock sample HCT remained circumneutral until a steep decline in pH began at week 68 in the testing period. The pH rapidly decreased to a pH of 4 and then continued to decrease at a slower rate. (Figure 6-19). A corresponding increase in several constituent loadings occurred as the pH decreased in the coarse processed rock sample (Figure 6-19).

The pH in the fine processed rock humidity cell samples remained alkaline for the duration of the testing period and constituent loadings were generally stable.

6.4.5 Lag Times to the Onset of Acid Generation

Processed rock will be placed in the management ponds with mine rock to limit oxidation of these materials. A key aspect of the mine plan is to have the processed rock submerged in the management ponds prior to the onset of acid generation. To test the efficacy of this management strategy, the humidity cell test results were used to estimate the timing to the onset of acid generation.

The 2018 coarse processed rock sample became acidic after approximately 68 weeks (i.e., 1.3 years) of testing. This represents a minimum timeframe to the onset of acid generation of these materials because the test was conducted under laboratory conditions. Under ambient conditions, lag times will be longer since oxidation rates will be lower under field temperature.

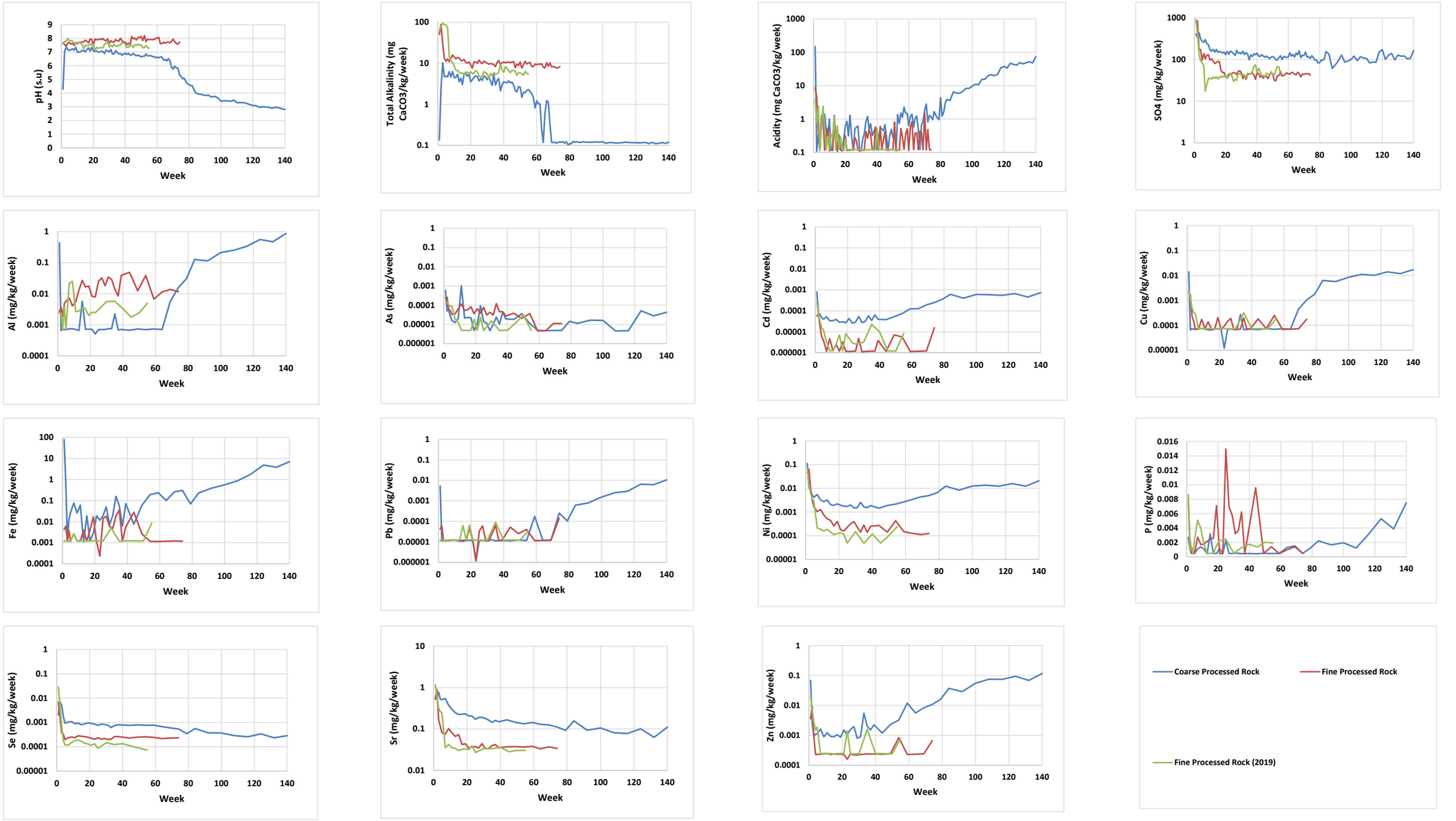
The 2018 and 2019 fine processed rock samples did not become acid generating during the testing period. Lag times to acidic conditions were calculated based on sulfide and NP depletion rates using sulfate, calcium, and magnesium production rates in the humidity cell tests of these sample. The sulfide in the 2018 fine processed rock sample is predicted to be consumed prior to the NP in this sample, indicating this sample is non-PAG. Depletion calculations completed on the 2019 fine processed rock sample indicate this sample is PAG. However, the carbonate-NP is estimated to be depleted after 20 years under laboratory conditions, indicating there is a long lag time prior to fine processed rock becoming acid generating.

Although one sample of fine processed rock was classified as non-PAG based on the static and kinetic test results, TML plans to manage all processed rock as PAG. Based on the timing to onset of acid generation of the coarse processed rock, it is recommended that the processed rock be placed in the management ponds within 1.3 years of being produced.

Table 6-9: Summary of Processed Rock Acid Base Accounting Results

Year	Sample ID	Bureau Veritas (formerly Maxxam) Sample ID	Description	Paste pH (s.u.)	Carbon Species (w.t.%)			Sulfur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios		HCT Reference
					Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulfate	S_{ICP}	Sulfide ($S_{ICP} - SO_4$)	AP (Sulfide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek-NPR (Sulfide)	
Fine Fraction																	
2018	183104	UI3972	Fine Processed Rock	7.8	26	2.3	8.6	1.9	0.02	1.8	1.8	57	196	192	3.4	3.4	2018 Fine Processed Rock
2018	182962	UI3973	Fine Processed Rock	7.6	16	1.8	6.7	2.7	0.02	2.7	2.7	84	151	157	1.8	1.9	
2019	TAILINGS	WP0672	Fine Processed Rock	6.2	43	0.8	3.1	3.0	0.05	3.1	3.0	95	71	61	0.7	0.6	2019 Fine Processed Rock
2019	TELKWA TAILINGS COMPOSITE	WT7431	Fine Processed Rock	7.6	22	2.3	8.6	3.9	0.07	3.5	3.4	109	194	158	1.8	1.4	-
Coarse Fraction																	
2018	183104	UI3970	Coarse Processed Rock	6.2	35	0.7	2.5	3.8	0.05	3.7	3.7	116	56	111	0.5	1.0	2018 Coarse Processed Rock
2018	182962	UI3971	Coarse Processed Rock	6.8	33	0.4	1.4	2.8	0.03	3.1	3.0	96	32	36	0.3	0.4	
2019	JIG CCR	WP0671	Coarse Processed Rock	3.7	47	0.5	1.9	4.1	0.16	3.8	3.6	119	43	30	0.4	0.3	-

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[Telkwa_RptTables_1CT027.002_MKH_R2.xlsx]



https://srk.sharepoint.com/:x:/r/sites/NACAPR002933/Internal/Task%20300%20Humidity%20Cell%20testing/05%20HCT%20Figures/Telkwa_RptFigures_1CT027.002_MKH_R3.xlsx?d=w4d5a4e87ce9b4f239aa274a99f5f8a6c&csf=1&web=1&e=TNkC8S

Figure 6-19: Select Parameter Humidity Cell Loading Rates – 2018 & 2019 Processed Rock Samples

6.5 Construction Materials

TML provided the following samples that will be used in construction of the haul road and the rail load out area:

- One sample representative of rock to be used to construct the haul road;
- Five test pit samples collected along the proposed alignment of the haul road; and
- Nine samples from four test pits around the proposed Rail Infrastructure.

Due to similarities in their geochemical properties, as will be discussed below, these samples are collectively referred to here as construction materials. The following section provides a summary of the construction material results. Detailed acid base accounting and elemental results are provided in Appendices F and G, respectively.

6.5.1 Acid Base Accounting

Table 6-10 provides a summary of the construction material acid base accounting results. Apart from one Rail Infrastructure sample (TP18-20 0.7-0.8), all the samples had alkaline paste pH results. Total sulfur and sulfide were low in all the samples. Sulfide was only detected in four of 15 of the samples (Table 6-10) and was below detection in the remaining 11 samples.

Modified-NP exceeded carbonate-NP in all the samples (Table 6-10). The NP far exceed the AP in all samples resulting in NPRs much greater than two (Table 6-10). Therefore, all the construction materials are characterized as non-PAG.

6.5.2 Elemental Content

Compared to 10 times the average crustal abundances (Smith and Huyck 1999), tellurium was observed to be enriched in the solid phase in 60% (9 of 15 samples) of the measurements.

Table 6-10: Summary of Construction Material Acid Base Accounting Results

Sample ID	Maxxam Sample ID	Sample Depth (m)			Paste pH (s.u.)	Carbon Species (w.t.%)			Sulfur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios	
		From	To	Thickness		Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulfate	S_{ICP}	Sulfide (S_{ICP} – SO_4)	AP (Sulfide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek-NPR (Sulfide)
Quarry Sample																	
ROCK ROAD CONSTRUCTION	UU1350	---	---	---	8.8	0.2	0.1	0.36	<0.02	<0.01	<0.02	0.01	0	8	15	52	93
ROCK MATERIAL FOR ROADS	ZB0881	---	---	---	8.7	0.8	0.6	2.3	<0.02	<0.01	<0.02	0.01	0	53	45	339	289
Road Samples																	
T18-29	VH0513	---	---	---	8.1	1.0	0.35	1.3	0.03	<0.01	0.02	0.01	0	30	40	189	257
T18-32	VH0514	---	---	---	7.9	1.0	0.3	1.2	0.04	0.01	0.04	0.01	0	26	39	84	124
T18-35	VH0515	---	---	---	7.5	0.7	0.01	<0.08	<0.02	<0.01	<0.02	0.01	0	1	8	5.8	49
T18-36	VH0516	---	---	---	7.7	0.4	0.01	<0.08	0.02	<0.01	0.02	0.01	0	1	6	5.8	38
T18-39	VH0517	---	---	---	7.6	0.2	0.01	<0.08	0.04	<0.01	0.03	0.01	0	1	7	2.9	23
Rail Loop Samples																	
TP18-23, 1.3-1.4	VH0584	1.3	1.4	0.10	8.3	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	9	5.8	56
TP18-23, 2.6-2.7	VH0585	2.6	2.7	0.10	8.3	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	6	5.8	40
TP18-24 1.9-2.1	VH0586	1.9	2.1	0.20	8.5	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	7	5.8	45
TP18-24 1-1.2	VH0587	1	1.2	0.20	8.5	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	7	5.8	43
T18-25, 2.1-2.3	VH0588	2.1	2.3	0.20	8.5	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	9	5.8	57
T18-25 3.2-3.4	VH0589	3.2	3.4	0.20	8.7	0.1	0.011	<0.08	0.1	<0.01	<0.02	0.01	0	1	8	5.8	48
TP18-20 0.3-0.4	VH0590	0.3	0.4	0.10	7.1	0.4	0.011	<0.08	<0.02	<0.01	<0.02	0.01	0.2	1	7	6	46
TP18-20 0.7-0.8	VH0591	0.7	0.8	0.10	6.9	0.4	0.011	<0.08	<0.02	<0.01	<0.02	0.01	0	1	6	5.8	40
TP18-20 1.8-2.0	VH0592	1.8	2	0.20	8.3	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.01	0	1	5	5.8	33

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7 Summary

The following sections provide a summary of the supplemental geochemical test results for each sample type.

7.1 PAG Classification Criteria

Geochemical testing of drill core samples indicates there is a strong correlation between NP_{XRD}, following correction for iron carbonates, and modified NP. In addition, a strong positive correlation exists between modified-NP and calcium plus magnesium. Therefore, the calcium and magnesium loads in the humidity cell test are attributed to carbonate dissolution under neutral conditions. An NPR of 2.0 was used to classify all material as PAG or non-PAG.

7.2 Drill Core

7.2.1 Sulfur Content

Geochemical testing of drill core samples indicate that most of the total sulfur is present as sulfide and a strong positive correlation exists between these two parameters. Therefore, the regression equation (Equation 2) can be used to calibrate the historical data set to sulfide concentrations to estimate acid potential more accurately. Additionally, this relationship can be used operationally.

7.2.2 Neutralization Potential

The mineralogical results indicate that iron carbonates are abundant in the drill core samples. Correction of the TIC for iron carbonates results in a strong positive correlation to the modified-NP and additionally, calcium plus magnesium is also strongly positively correlated to modified-NP indicating that the modified-NP provides a reasonable estimate of the effective-NP. The mineralogical results can be used to estimate the effective-NP from analytical TIC measurements by Leco.

A strong positive correlation exists between Sobek-NP and modified-NP and the regression equation (Equation 4) from correlating these parameters can be used to calculate modified-NP from the historical dataset.

7.2.3 Acid Generating Potential

Consistent with the historical geochemical characterization (Norecol, Dames and Moore 1999) the supplemental geochemical testing results indicate that acid generating potential is controlled by stratigraphic units. All units contain some component of PAG Rock or non-PAG rock; however, when the bulk properties of each stratigraphic unit are considered, the following zones were identified to be PAG and non-PAG based on the mean NPR in each zone:

- **Non-PAG** – Zones 1 and 8.
- **PAG** – Zones 1a, 2/3, 4, 5, 55, 6, and 7.

During operations zones 1a, 2/3, 5, 55, 6 and 7 will be treated operationally as PAG. The PAG potential of all other units will need to be determined through operational geochemical testing.

7.2.4 Leaching Potential

The following elements were screened to be elevated in the solid phase:

- 14% of arsenic analyses;
- <1% of phosphorus and selenium analyses; and
- 56% of sulfur analyses.

The concentrations of these parameters will be evaluated in the water and load balance that is currently being developed.

7.2.5 Lag Time to Acid Generation

The sulfide oxidation rates in the humidity cell samples were used to estimate the lag time acid generation. The evaluation indicated that for the average bulk properties of PAG Rock, the lag time varies from approximately 4.2 to 13 years under laboratory conditions. A minimum lag time under laboratory conditions of 0.4 years is estimated for PAG Rock units with minimum NPR of 0.1.

7.3 Overburden

7.3.1 Grain Size, Acid generating Potential and Neutralizing Potential

Overburden samples were collected during the 2018 supplementary program. Different size fractions were evaluated to determine if carbonate and sulfur minerals fractionate to inform blending studies. Based on six samples collected from four test pits, a larger range was observed in sulfide and NP in the +2 mm–25 mm fraction in comparison to the -2 mm fraction. Based on the similarities to central statistics of the two samples sets, it cannot be concluded with confidence that sulfide and NP preferentially fractionate to one grain size. All the samples and size fractions had NPRs greater than two and are characterized as non-PAG.

Additional overburden samples collected in 2019 and 2023 were also classified as non PAG due to low sulfide content and NPR values above 2.0.

7.3.2 Leaching Potential

A higher frequency of elevated parameters was observed in the +2–25 mm fraction in comparison to the -2 mm and +25 mm fractions. The following elements were screened to have concentrations greater than 10 times the average crustal abundances and were screened to be elevated in the solid phase:

- +2 mm–25 mm fraction:
  - 67% (4 of 6 samples) of arsenic measurements; and,
  - 17% (1 of 6 samples) of bismuth and cadmium measurements.
- -2 mm fraction

  - 17% (1 of 6 samples) of arsenic and gold measurements; and,
  - 83% (5 of 6 samples) of tellurium measurements
- There were no elevated concentrations in the +25 mm fraction.

For the 2019 and 2023 overburden samples, tellurium was greater than 10 times the average crustal abundance (Smith and Huyck 1999). Data for the HCTs of both samples show that the cells maintained a circumneutral to alkaline pH throughout the testing period. Except for aluminum, chromium and iron, loadings of constituents maintained slight decreasing trends throughout the testing period.

7.4 Processed Rock

7.4.1 Acid Generating Potential

Acid base accounting results indicate that six out of the seven processed rock samples are PAG using an NPR criterion of 2.0. Depletion calculations on the humidity cell tests indicate that NP will be consumed prior to sulfide in the coarse processed rock sample and the 2019 fine processed rock sample. Sulfide will be consumed prior to NP in the 2018 fine processed rock sample. These results indicate the coarse and 2019 processed rock samples are PAG and the 2018 fine processed rock sample is non-PAG. The historical results (Norecol Dames and Moore 1999) indicated that all processed rock were PAG. Based on the samples collected as part of this study and the historical testing results, TML will manage all processed rock as PAG.

7.4.2 Leaching Potential

Arsenic, sulfur, selenium, and tellurium were greater than 10 times the average crustal abundances (Smith and Huyck 1999). The coarse processed rock sample became acidic after 68 weeks of testing. An associated increase in several constituents was also observed to occur as the pH in this sample declined. TML proposes to place processed rock in the Management Ponds prior to the onset of acid generation. If the processed rock is inundated with water prior to acid generation, increases in constituent loads associated with a decline in pH will not occur.

The pH in the fine processed rock samples remained alkaline for the duration of the testing period. Loadings of all constituents decreased to steady-state conditions.

The loadings from the processed rock humidity cells were used to develop source terms that are carried forward into the water and load balance for the project (SRK 2021).

7.4.3 Lag Time to Acid Generation

The coarse processed rock sample became acidic after 1.3 years of testing. This occurred under laboratory conditions and represents a minimum lag time to acid generation for coarse processed rock. The 2018 fine processed rock sample sulfide is predicted to be depleted prior to the NP confirming the non-PAG classification of this sample based on the ABA results. The 2019 fine processed rock sample is expected to become acidic; however, based on the humidity cell reaction

rates, long lag times are expected (i.e., 20 years under laboratory conditions) prior to acid generation occurring.

7.5 Construction Materials

TML provided the following construction material samples to Bureau Veritas, formerly Maxxam Analytics for geochemical testing:

- Two samples representative of rock to be used for surfacing material for the Tenas Access Corridor;
- Five test pit samples collected along the proposed alignment of the Tenas Access Corridor that represent material that will be used for base and subbase materials; and
- Nine samples from four test pits around the proposed Rail Infrastructure.

All samples had lower sulfur content and modified NPs exceeding AP. As a result, all construction materials are non-PAG.

Compared to 10 times the average crustal abundances (Smith and Huyck 1999), tellurium was observed to be enriched in the solid phase in 60 % (9 of 15 samples) of the measurements

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A – Mine Rock Sample Intervals for Static Testing

2018 Mine Rock Samples: Sample Selection for Static Test Work					
Hole-ID	**Sample ID**	**Sample Type**	**From (m)**	**To (m)**	**Mass (kg)**
T18-01D	T18-01D-A-001	ARD	9.98	12.03	27.4
T18-01D	T18-01D-A-002	ARD	12.03	13.29	16.9
T18-01D	T18-01D-A-003	ARD	13.29	15.8	33.6
T18-01D	T18-01D-A-004	ARD	15.8	17.2	18.7
T18-01D	T18-01D-A-005	ARD	17.2	21.31	55.0
T18-01D	T18-01D-A-006	ARD	21.89	22.08	2.5
T18-01D	T18-01D-A-007	ARD	24.7	24.84	1.9
T18-01D	T18-01D-A-008	ARD	24.84	27.7	38.3
T18-01D	T18-01D-A-009	ARD	27.7	30.1	32.1
T18-01D	T18-01D-A-010	ARD	30.1	33.7	48.2
T18-01D	T18-01D-A-011	ARD	33.7	36.53	37.9
T18-01D	T18-01D-A-012	ARD	38.52	39.2	9.1
T18-01D	T18-01D-A-013	ARD	40.3	43.93	48.6
T18-01D	T18-01D-A-014	ARD	43.93	44.39	6.2
T18-01D	T18-01D-A-015	ARD	44.75	47.2	32.8
T18-01D	T18-01D-A-016	ARD	47.2	50	37.5
T18-01D	T18-01D-A-017	ARD	50	50.72	9.6
T18-01D	T18-01D-A-018	ARD	51.02	53.2	29.2
T18-01D	T18-01D-A-019	ARD	53.2	56.2	40.1
T18-02D	T18-02D-A-001	ARD	8.35	12.03	49.2
T18-02D	T18-02D-A-002	ARD	12.03	15.3	43.8
T18-02D	T18-02D-A-003	ARD	15.3	18.58	43.9
T18-02D	T18-02D-A-004	ARD	18.58	21.3	36.4
T18-02D	T18-02D-A-005	ARD	21.3	24.3	40.1
T18-02D	T18-02D-A-006	ARD	24.3	27.3	40.1
T18-02D	T18-02D-A-007	ARD	27.3	28.8	20.1
T18-02D	T18-02D-A-008	ARD	28.8	30.3	20.1
T18-02D	T18-02D-A-009	ARD	30.3	32.88	34.5
T18-02D	T18-02D-A-010	ARD	32.88	33.94	14.2
T18-02D	T18-02D-A-011	ARD	33.94	36.86	39.1
T18-02D	T18-02D-A-012	ARD	36.86	39.3	32.6
T18-02D	T18-02D-A-013	ARD	39.3	41.75	32.8
T18-02D	T18-02D-A-014	ARD	41.75	45.18	45.9
T18-02D	T18-02D-A-015	ARD	45.18	48.3	41.7
T18-02D	T18-02D-A-016	ARD	48.3	48.76	6.2
T18-02D	T18-02D-A-017	ARD	50.44	50.5	0.8
T18-02D	T18-02D-A-018	ARD	50.5	52.8	30.8
T18-02D	T18-02D-A-019	ARD	52.8	54.3	20.1
T18-02D	T18-02D-A-020	ARD	54.3	58.08	50.6
T18-02D	T18-02D-A-021	ARD	58.08	60.3	29.7
T18-02D	T18-02D-A-022	ARD	60.3	63.3	40.1
T18-02D	T18-02D-A-023	ARD	63.3	66.3	40.1
T18-02D	T18-02D-A-024	ARD	66.3	67.8	20.1
T18-02D	T18-02D-A-025	ARD	67.8	68.56	10.2
T18-02D	T18-02D-A-026	ARD	75.62	78.3	35.9
T18-02D	T18-02D-A-027	ARD	78.3	79.35	14.0
T18-02D	T18-02D-A-028	ARD	79.35	79.54	2.5
T18-02D	T18-02D-A-029	ARD	79.54	80.72	15.8
T18-02D	T18-02D-A-030	ARD	79.54	84.3	63.7
T18-02D	T18-02D-A-031	ARD	84.3	84.53	3.1
T18-02D	T18-02D-A-032	ARD	84.53	86.64	28.2
T18-02D	T18-02D-A-033	ARD	86.64	87.48	11.2
T18-02D	T18-02D-A-034	ARD	87.48	88.8	17.7
T18-02D	T18-02D-A-035	ARD	88.8	90.3	20.1
T18-02D	T18-02D-A-036	ARD	90.3	90.93	8.4
T18-02D	T18-02D-A-037	ARD	90.93	92.52	21.3
T18-02D	T18-02D-A-038	ARD	92.52	94.29	23.7
T18-02D	T18-02D-A-039	ARD	94.29	94.8	6.8
T18-02D	T18-02D-A-040	ARD	94.8	96.3	20.1
T18-02D	T18-02D-A-041	ARD	96.3	97.8	20.1

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
T18-02D	T18-02D-A-042	ARD	97.8	99.3	20.1
T18-02D	T18-02D-A-043	ARD	99.3	100.8	20.1
T18-02D	T18-02D-A-044	ARD	100.8	102.3	20.1
T18-02D	T18-02D-A-045	ARD	102.3	103.8	20.1
T18-02D	T18-02D-A-046	ARD	103.8	105.3	20.1
T18-02D	T18-02D-A-047	ARD	105.3	106.8	20.1
T18-02D	T18-02D-A-048	ARD	106.8	107.92	15.0
T18-02D	T18-02D-A-049	ARD	107.92	108.3	5.1
T18-02D	T18-02D-A-050	ARD	108.3	109.8	20.1
T18-02D	T18-02D-A-051	ARD	109.8	111.21	18.9
T18-02D	T18-02D-A-052	ARD	111.21	111.3	1.2
T18-02D	T18-02D-A-053	ARD	111.3	111.95	8.7
T18-02D	T18-02D-A-054	ARD	111.95	112.6	8.7
T18-02D	T18-02D-A-055	ARD	112.6	112.8	2.7
T18-02D	T18-02D-A-056	ARD	112.8	114.3	20.1
T18-02D	T18-02D-A-057	ARD	114.3	114.91	8.2
T18-02D	T18-02D-A-058	ARD	114.91	115.8	11.9
T18-02D	T18-02D-A-059	ARD	115.8	117.3	20.1
T18-02D	T18-02D-A-060	ARD	117.3	118.8	20.1
T18-02D	T18-02D-A-061	ARD	118.8	120.3	20.1
T18-02D	T18-02D-A-062	ARD	120.3	121.8	20.1
T18-02D	T18-02D-A-063	ARD	121.8	123.3	20.1
T18-02D	T18-02D-A-064	ARD	123.3	124.8	20.1
T18-03D	T18-03D-A-005	ARD	10.78	10.8	0.3
T18-03D	T18-03D-A-006	ARD	12.57	12.82	3.3
T18-03D	T18-03D-A-007	ARD	12.82	13.44	8.3
T18-03D	T18-03D-A-008	ARD	13.44	14.08	8.6
T18-03D	T18-03D-A-009	ARD	17.54	18.46	12.3
T18-03D	T18-03D-A-010	ARD	19.02	19.37	4.7
T18-03D	T18-03D-A-011	ARD	19.37	19.97	8.0
T18-03D	T18-03D-A-012	ARD	19.97	20.5	7.1
T18-03D	T18-03D-A-013	ARD	20.5	22.25	23.4
T18-03D	T18-03D-A-014	ARD	22.25	23.16	12.2
T18-03D	T18-03D-A-015	ARD	23.16	23.56	5.4
T18-03D	T18-03D-A-016	ARD	23.56	25	19.3
T18-03D	T18-03D-A-017	ARD	25	26.12	15.0
T18-03D	T18-03D-A-018	ARD	26.12	28	25.2
T18-03D	T18-03D-A-019	ARD	28	29.06	14.2
T18-03D	T18-03D-A-020	ARD	29.06	30	12.6
T18-03D	T18-03D-A-021	ARD	30	32.5	33.5
T18-03D	T18-03D-A-022	ARD	32.5	32.9	5.4
T18-03D	T18-03D-A-023	ARD	32.9	33.05	2.0
T18-03D	T18-03D-A-024	ARD	33.05	34.53	19.8
T18-03D	T18-03D-A-025	ARD	34.53	35.5	13.0
T18-03D	T18-03D-A-026	ARD	35.5	36.26	10.2
T18-03D	T18-03D-A-027	ARD	36.26	38.5	30.0
T18-03D	T18-03D-A-028	ARD	38.5	39.08	7.8
T18-03D	T18-03D-A-029	ARD	39.08	40.49	18.9
T18-03D	T18-03D-A-030	ARD	40.49	41.5	13.5
T18-03D	T18-03D-A-031	ARD	41.5	43	20.1
T18-03D	T18-03D-A-032	ARD	43	44.4	18.7
T18-03D	T18-03D-A-033	ARD	44.4	46.4	26.8
T18-05D	28651	ARD	13.5	22.5	120.4
T18-05D	28652	ARD	22.5	23.2	9.4
T18-05D	28653	ARD	23.2	30.6	99.0
T18-05D	28654	ARD	30.6	33.5	38.8
T18-05D	28655	ARD	33.5	37.4	52.2
T18-05D	28656	ARD	37.4	38.9	20.1
T18-05D	28657	ARD	38.9	42.4	46.8
T18-05D	28658	ARD	42.4	46	48.2
T18-05D	28659	ARD	46	49.6	48.2

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
T18-05D	28660	ARD	49.6	53.2	48.2
T18-05D	28661	ARD	53.2	56.8	48.2
T18-05D	28662	ARD	56.8	59.6	37.5
T18-05D	28663	ARD	59.6	62.3	36.1
T18-05D	28664	ARD	62.3	65.3	40.1
T18-05D	28665	ARD	65.3	68.4	41.5
T18-05D	28666	ARD	68.4	71.4	40.1
T18-05D	28667	ARD	71.4	75.1	49.5
T18-05D	28668	ARD	75.1	78.6	46.8
T18-05D	28669	ARD	78.6	82.1	46.8
T18-05D	28670	ARD	82.1	85.6	46.8
T18-05D	28671	ARD	85.6	88.3	36.1
T18-05D	28672	ARD	88.3	91.4	41.5
T18-05D	28673	ARD	91.4	93.55	28.8
T18-05D	28674	ARD	93.55	94.25	9.4
T18-05D	28675	ARD	94.25	96.9	35.5
T18-05D	28676	ARD	96.9	99.2	30.8
T18-05D	28677	ARD	99.2	99.4	2.7
T18-05D	28678	ARD	101.6	101.9	4.0
T18-05D	28679	ARD	101.9	106.3	58.9
T18-05D	28680	ARD	106.3	108.7	32.1
T18-05D	28681	ARD	108.7	111.1	32.1
T18-05D	28682	ARD	111.1	111.3	2.7
T18-05D	28683	ARD	111.3	111.8	6.7
T18-05D	28684	ARD	111.8	112.3	6.7
T18-05D	28685	ARD	112.3	115.5	42.8
T18-05D	28686	ARD	115.5	118.7	42.8
T18-05D	28687	ARD	118.7	118.9	2.7
T18-05D	28688	ARD	126.2	126.4	2.7
T18-05D	28689	ARD	126.4	128.8	32.1
T18-05D	28690	ARD	128.8	131.2	32.1
T18-05D	28691	ARD	131.2	131.4	2.7
T18-05D	28704	ARD	131.4	132.2	10.7
T18-05D	28692	ARD	132.2	132.4	2.7
T18-05D	28693	ARD	132.4	133.2	10.7
T18-05D	28694	ARD	133.2	133.4	2.7
T18-05D	28695	ARD	133.4	134.4	13.4
T18-05D	28696	ARD	134.4	134.6	2.7
T18-05D	28697	ARD	134.6	135.3	9.4
T18-05D	28698	ARD	135.3	139.1	50.8
T18-05D	28699	ARD	139.1	139.3	2.7
T18-05D	28700	ARD	139.3	140.5	16.1
T18-05D	28705	ARD	140.5	141.2	9.4
T18-05D	28706	ARD	141.2	141.4	2.7
T18-05D	28707	ARD	141.4	142.1	9.4
T18-05D	28708	ARD	142.1	142.5	5.4
T18-05D	28709	ARD	142.5	143.9	18.7
T18-05D	28710	ARD	143.9	144.1	2.7
T18-05D	28711	ARD	144.1	144.4	4.0
T18-05D	28712	ARD	144.4	147.4	40.1
T18-05D	28713	ARD	147.4	147.7	4.0
T18-05D	28714	ARD	147.7	150.4	36.1
T18-05D	28715	ARD	150.4	151.7	17.4
T18-05D	28716	ARD	151.7	154.8	41.5
T18-05D	28717	ARD	154.8	158	42.8
T18-07D	28836	ARD	6.9	10.4	46.8
T18-07D	28837	ARD	10.4	14.8	58.9
T18-07D	28838	ARD	14.8	18.3	46.8
T18-07D	28839	ARD	18.3	22.2	52.2
T18-07D	28840	ARD	22.2	26.1	52.2
T18-07D	28841	ARD	26.1	30	52.2

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
T18-07D	28842	ARD	30	33.9	52.2
T18-07D	28843	ARD	33.9	38.2	57.5
T18-07D	28844	ARD	38.2	42.3	54.9
T18-07D	28845	ARD	42.3	44.2	25.4
T18-07D	28846	ARD	44.2	49.8	74.9
T18-07D	28847	ARD	49.8	52.8	40.1
T18-07D	28848	ARD	52.8	57.15	58.2
T18-07D	28849	ARD	57.15	61.5	58.2
T18-07D	28850	ARD	61.5	63.4	25.4
T18-07D	29501	ARD	63.4	66.8	45.5
T18-07D	29502	ARD	66.8	69.6	37.5
T18-07D	29503	ARD	69.6	72.4	37.5
T18-07D	29504	ARD	72.4	75.6	42.8
T18-07D	28786	ARD	75.6	78.8	42.8
T18-07D	29505	ARD	78.8	84	69.6
T18-07D	29506	ARD	84	86.9	38.8
T18-07D	29507	ARD	86.9	92.2	70.9
T18-07D	29508	ARD	92.2	96.3	54.9
T18-07D	29509	ARD	96.3	104.7	112.4
T18-07D	29510	ARD	104.7	107.8	41.5
T18-07D	29511	ARD	107.8	111.1	44.2
T18-07D	29512	ARD	111.1	114.2	41.5
T18-07D	29513	ARD	114.2	117.4	42.8
T18-07D	29514	ARD	117.4	120.6	42.8
T18-07D	29515	ARD	120.6	123.8	42.8
T18-07D	29516	ARD	123.8	127.5	49.5
T18-07D	29517	ARD	127.5	129.3	24.1
T18-07D	29518	ARD	129.3	132.4	41.5
T18-07D	29519	ARD	132.4	133.8	18.7
T18-07D	29520	ARD	133.8	134	2.7
T18-07D	29521	ARD	134	134.6	8.0
T18-07D	29522	ARD	134.6	135.55	12.7
T18-07D	29523	ARD	135.55	135.6	0.7
T18-07D	29524	ARD	135.6	136.4	10.7
T18-07D	29525	ARD	136.4	137	8.0
T18-07D	29526	ARD	137	140.1	41.5
T18-07D	29527	ARD	140.1	140.5	5.4
T18-07D	29528	ARD	140.5	141.5	13.4
T18-07D	29529	ARD	141.5	141.7	2.7
T18-07D	29530	ARD	141.7	143.6	25.4
T18-07D	29531	ARD	143.6	146	32.1
T18-07D	29532	ARD	146	146.5	6.7
T18-07D	29533	ARD	146.5	150.3	50.8
T18-07D	29534	ARD	150.3	153.7	45.5
T18-07D	29535	ARD	153.7	158.3	61.5

2019 Mine Rock Samples: Sample Selection for Static Test Work					
Hole-ID	**Sample ID**	**Sample Type**	**From (m)**	**To (m)**	**Mass (kg)**
19-09D	1146024	ARD	4.45	5.9	19.4
19-09D	1146025	ARD	5.9	8	28.1
19-09D	1146026	ARD	8.0	10.75	36.8
19-09D	1146030	ARD	13.25	14.75	20.1
19-09D	1146034	ARD	18.85	20.2	18.1
19-09D	1146035	ARD	20.2	21.9	22.7
19-09D	1146036	ARD	21.9	23.4	20.1
19-09D	1146037	ARD	23.4	24.9	20.1
19-09D	1146038	ARD	24.9	26.4	20.1
19-09D	1146046	ARD	26.4	26.8	5.4
19-09D	1146039	ARD	26.8	27.75	12.7
19-09D	1146040	ARD	27.9	28.7	10.7

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
19-09D	1146041	ARD	28.85	30.7	24.8
19-09D	1146042	ARD	30.7	32.7	26.8
19-09D	1146043	ARD	32.7	34	17.4
19-09D	1146044	ARD	34	35.4	18.7
19-09D	1146045	ARD	35.4	35.9	6.7
19-16D	1146051	ARD	6.4	8	21.4
19-16D	1146052	ARD	8.0	9.4	18.7
19-16D	1146053	ARD	9.4	11.7	30.8
19-16D	1146054	ARD	11.7	14.7	40.1
19-16D	1146055	ARD	14.7	17.7	40.1
19-16D	1146056	ARD	17.7	20.9	42.8
19-16D	1146057	ARD	20.9	22.1	16.1
19-16D	1146058	ARD	22.1	24.7	34.8
19-16D	1146059	ARD	24.7	26.3	21.4
19-16D	1146060	ARD	26.3	28.3	26.8
19-16D	1146061	ARD	28.3	30.2	25.4
19-16D	1146062	ARD	30.2	32.2	26.8
19-16D	1146063	ARD	32.2	34	24.1
19-16D	1146064	ARD	34	34.45	6.0
19-16D	1146068	ARD	36.35	38.7	31.4
19-16D	1146069	ARD	38.7	40.4	22.7
19-16D	1146070	ARD	40.4	43.2	37.5
19-16D	1146071	ARD	43.2	45.6	32.1
19-16D	1146072	ARD	45.6	49.2	48.2
19-16D	1146073	ARD	49.2	50.05	11.4
19-16D	1146079	ARD	56.55	58.75	29.4
19-16D	1146080	ARD	58.9	61	28.1
19-16D	1146081	ARD	61.15	61.85	9.4
19-16D	1146082	ARD	62	63.9	25.4
19-16D	1146083	ARD	64.05	67.6	47.5
19-16D	1146084	ARD	67.6	70	32.1
19-17D	1146085	ARD	8.4	8.7	4.0
19-17D	1146086	ARD	8.85	11.45	34.8
19-17D	1146087	ARD	11.6	12	5.4
19-17D	1146088	ARD	12.15	14.5	31.4
19-17D	1146089	ARD	14.5	17.45	39.5
19-17D	1146090	ARD	19.6	22	32.1
19-17D	1146091	ARD	22	25	40.1
19-17D	1146092	ARD	25	26.4	18.7
19-17D	1146093	ARD	26.4	29.5	41.5
19-17D	1146095	ARD	29.5	31.05	20.7
19-17D	1146098	ARD	37.05	38.8	23.4
19-17D	1146099	ARD	38.8	41.5	36.1
19-17D	1146100	ARD	41.5	42.75	16.7
19-17D	1146401	ARD	42.75	45.75	40.1
19-17D	1146402	ARD	45.75	47.5	23.4
19-17D	1146403	ARD	47.5	48.7	16.1
19-17D	1146404	ARD	48.7	50.5	24.1
19-17D	1146405	ARD	50.5	53.5	40.1
19-17D	1146406	ARD	53.5	54.95	19.4
19-17D	1146407	ARD	55.1	55.6	6.7
19-17D	1146408	ARD	55.75	56.75	13.4
19-17D	1146409	ARD	56.75	58.25	20.1
19-17D	1146410	ARD	58.25	59.2	12.7
19-18D	1146411	ARD	3	5.45	32.8
19-18D	1146414	ARD	7.35	9.2	24.8
19-18D	1146415	ARD	9.2	10	10.7
19-18D	1146416	ARD	10	13	40.1
19-18D	1146417	ARD	13	15.2	29.4
19-18D	1146418	ARD	15.2	17.75	34.1
19-18D	1146421	ARD	19.85	20.15	4.0

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
19-18D	1146422	ARD	23.4	23.5	1.3
19-18D	1146423	ARD	23.5	25.8	30.8
19-18D	1146424	ARD	25.8	28.7	38.8
19-18D	1146425	ARD	28.7	31.3	34.8
19-18D	1146426	ARD	31.3	33.3	26.8
19-18D	1146427	ARD	33.3	35.5	29.4

Appendix B – Mine Rock Sample Selection for Kinetic Testing

Mine Rock Samples: Sample Selection for Kinetic Test Work

Zone	Sample Number	Zone Check	Rock Type	Sample Selected for XRD	Sample Selected for HCT	Paste pH	Sulfide (%)	AP (kg CaCO3/t)	Mod-NP (kg $CaCO_3$/t)	Sobek-NP (kg CaCO3/t)	CO3-NP (kg CaCO3/t)	Carbonate/ Mod-NP	NPR	As (ppm)	Se (ppm)	ARD Classification	Comments
1	28836	1	siltstone	x	x	8.24	0.71	22.1875	44.8	54.5	50	1.1	2.46	8.2	0.4	non-PAG	70th percentile S2- median NP 35% NPR 25th percentile As 95th percentile Se
	28661	1	siltstone	x		9.39	0.16	5	144	88.8	232	1.6	17.76	9.9	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
1a	T18-02D-A-011	1A	mudstone	x	x	8.22	2.26	70.625	23.8	63.5	82	3.5	0.90	13.5	0.3	PAG	75th percentile S2- minimum mod-NP Median NPR median As and Se Can be used to estimate AG onset (neutral paste pH, low NP)
	T18-02D-A-004	1A	mudstone	x		9.59	0.2	6.25	98.3	82.3	153	1.6	13.17	14	0.1	non-PAG	Mod-NP>>>>Sobek-NP
2-3	T18-02D-A-016	3	mudstone	x	x	3.78	3.33	104.0625	8	18	30	3.7	0.17	29.8	0.3	PAG	95th percentile S2- Low NP 75th percentile As and Se
	T18-01D-A-002	2	mudstone	x		6.65	3.22	100.625	90.3	67.5	93	1.0	0.67	6.8	0.2	PAG	Mod-NP>>>>Sobek-NP
4	28681	4	siltstone	x	x	8.24	1.43	44.6875	54	71.5	161	3.0	1.60	75.5	<0.1	Uncertain	80th percentile S2- Median NP 35th percentile NPR 90th percentile As Minimum/median Se
	T18-02D-A-019	4	mudstone	x		8.88	0.59	18.4375	112	75.3	224	2.0	4.08	8.8	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
5	28684	5	siltstone	x	x	6.13	1.75	54.6875	16.8	21.5	35	2.1	0.39	43.3	0.3	PAG	80th percentile S2- 20th percentile NP & NPR 80th percentile As 70th percentile Se
	T18-02D-A-021	5	bentonite layer	x		8.84	0.93	29.0625	194	92	348	1.8	3.17	9.7	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
55	T18-03D-A-006	55	mudstone	x	x	7.68	0.18	5.625	9.3	7.5	8	0.9	1.33	1.4	<0.1	Uncertain	Uncertain ARD potential 70th percentile S2- Minimum NP Median As Minimum Se
6	28704	6	siltstone	x	x	5.98	2.12	66.25	58	57.8	65	1.1	0.87	55.5	0.4	PAG	PAG 80th percentile S2- 75th percentile NP 80th percentile As 75th percentile Se
	T18-02D-A-028	6	mudstone	x		9.24	0.14	4.375	164	87	219	1.3	19.89	1.4	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
7	T18-02D-A-034	7	mudstone	x	x	6.51	1.43	44.6875	15	12.5	15	1.0	0.28	21	0.2	PAG	75th percentile S2- 30th percentile NP Mod NP>>>Sobek-NP 10th percentile NPR 80th percentile As 10th percentile Se
8	28711	8	siltstone	x	x	7.62	0.23	7.1875	31.5	32.5	36	1.1	4.52	28.1	0.4	non-PAG	60th percentile S2- 40th percentile NPNP>>>Sobek-NP 25th percentile NPR Maximum As 90th percentile Se

Appendix C – Mine Rock ABA Analysis Results

Mine Rock Samples: ABA Results

Drill Hole	Sample Number	Maxxam Sample ID	Sample Depth (m)			ABA Zone	Class	Lithology	Paste pH (su)	Paste EC (µs/cm)	Carbon Species (w.t.%)				Sulphur Species (w.t.%)							Potentials (kg CaCO3/tonne)					Neutralization Potential Ratios					Mine Plan Inputs			
			From	To	Thickness						Total-C	Total Inorganic Carbon	CO2	CO3	Total-S	Sulphate	SICP	Sulphate (DL)	SICP (DL)	Sulphide (Total - SO4)	Sulphide (SICP - SO4)	AP (Total Sulphur)	AP (Sulphide)	CO3-NP	Sobek-NP	Modified Sobek-NP	CO3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)	Sulphide-S	AP	NP	NPR
2018 Sampling Programme																																			
T18-02D	T18-02D-A-001	TD3978	8.35	12.03	3.68	1	waste	MDST	8.8	709	2.8	1.2	4.5	6.1	0.23	0.02	0.19	0.02	0.19	0.21	0.17	7.2	5.3	101	64	45	14	8.9	6.2	12	8.4	0.2	5	45	8.4
T18-02D	T18-02D-A-002	TD3979	12.03	15.3	3.27	1	waste	MDST	9.1	955	3.4	1.3	4.9	6.7	0.21	0.01	0.16	0.01	0.16	0.2	0.15	6.6	4.7	111	61	46	17	9.3	6.9	13	9.7	0.2	5	46	9.7
T18-02D	T18-02D-A-003	TD3980	15.3	18.58	3.28	1	waste	MDST	9.5	1020	3.7	2.0	7.3	9.9	0.19	0.02	0.16	0.02	0.16	0.17	0.14	5.9	4.4	166	78	92	28	13	16	18	21	0	4	92	21
T18-02D	T18-02D-A-004	TD3981	18.58	21.3	2.72	1	waste	MDST	9.6	1040	3.9	1.8	6.7	9.1	0.26	0.01	0.21	0.01	0.21	0.25	0.2	8.1	6.3	153	82	98	19	10	12	13	16	0	6	98	16
T18-02D	T18-02D-A-005	TD3983	21.3	24.3	3	1	waste	MDST	8.9	1230	3.8	1.3	4.9	6.6	0.43	0.02	0.36	0.02	0.36	0.41	0.34	13	11	111	72	46	8.2	5.3	3.4	6.8	4.3	0.3	11	46	4.3
T18-02D	T18-02D-A-006	TD3984	24.3	27.3	3	1	waste	MDST	8.8	1770	2.7	1.5	5.6	7.6	0.55	0.02	0.48	0.02	0.48	0.53	0.46	17	14	126	72	54	7.3	4.2	3.1	5.0	3.7	0.5	14	54	3.7
T18-05D	28651	TH0788	13.5	22.5	9	1	waste	SLST	8.4	2210	2.2	0.89	3.25	4.4	0.42	0.05	0.39	0.05	0.39	0.37	0.34	13	11	74	68	24	5.6	5.2	1.8	6.4	2.3	0.3	11	24	2.3
T18-05D	28652	TH0789	22.5	23.2	0.7	1	waste	SLST	8.1	3350	2.8	1.1	4.0	5.4	1.4	0.09	1.4	0.09	1.4	1.3	1.3	44	40	91	77	34	2.1	1.7	0.78	1.9	0.85	1.29	40	34	0.85
T18-05D	28653	TH0790	23.2	30.6	7.4	1	waste	SLST	9.2	2040	3.3	1.7	6.4	8.7	0.8	0.04	0.81	0.04	0.81	0.76	0.77	25	24	145	81	68	5.8	3.2	2.7	3.4	2.8	0.8	24	68	2.8
T18-05D	28654	TH0791	30.6	33.5	2.9	1	waste	SLST	9.5	2080	3.4	1.6	6.0	8.2	0.19	0.02	0.17	0.02	0.17	0.17	0.15	5.9	4.7	136	83	48	23	14	8.1	18	10	0	5	48	10
T18-05D	28655	TH0792	33.5	37.4	3.9	1	waste	SLST	9.4	1690	2.9	1.3	4.6	6.3	0.41	0.02	0.42	0.02	0.42	0.39	0.4	13	13	104	79	37	8.1	6.2	2.8	6.3	2.9	0.4	13	37	2.9
T18-05D	28656	TH0793	37.4	38.9	1.5	1	waste	SLST	9.5	1480	2.8	1.4	5.0	6.9	0.33	0.02	0.34	0.02	0.34	0.31	0.32	10	10	114	82	55	11	7.9	5.3	8.2	5.5	0.3	10	55	5.5
T18-05D	28657	TH0794	38.9	42.4	3.5	1	waste	SLST	9.3	1700	2.7	1.6	5.7	7.8	0.5	0.03	0.49	0.03	0.49	0.47	0.46	16	14	130	68	59	8.3	4.3	3.8	4.7	4.1	0.5	14	59	4.1
T18-05D	28658	TH0795	42.4	46	3.6	1	waste	SLST	8.0	1510	2.7	1.5	5.5	7.5	0.63	0.02	0.6	0.02	0.6	0.61	0.58	20	18	124	80	55	6.3	4.1	2.8	4.4	3.03	0.58	18	55	3.0
T18-05D	28659	TH0796	46	49.6	3.6	1	waste	SLST	9.5	1500	2.8	1.7	6.1	8.3	0.86	0.02	0.86	0.02	0.86	0.84	0.84	27	26	139	85	83	5.2	3.2	3.1	3.2	3.1	0.8	26	83	3.1
T18-05D	28660	TH0797	49.6	53.2	3.6	1	waste	SLST	9.4	1420	2.9	1.4	5.2	7.1	0.45	0.02	0.44	0.02	0.44	0.43	0.42	14	13	118	80	45	8.4	5.7	3.2	6.1	3.4	0.4	13	45	3.4
T18-05D	28661	TH0799	53.2	56.8	3.6	1	waste	SLST	9.4	1350	4.3	2.8	10.2	14	0.19	0.02	0.18	0.02	0.18	0.17	0.16	5.9	5.0	232	89	144	39	15	24	18	29	0.16	5	144	29
T18-05D	28662	TH0800	56.8	59.6	2.8	1	waste	SLST	9.4	1300	3.2	1.6	5.9	8.0	0.17	0.01	0.16	0.01	0.16	0.16	0.15	5.3	4.7	133	79	61	25	15	11	17	13	0	5	61	13
T18-05D	28663	TH0801	59.6	62.3	2.7	1	waste	SLST	9.3	1360	3.1	1.4	5.0	6.9	0.25	0.02	0.24	0.02	0.24	0.23	0.22	7.8	6.9	114	78	49	15	10.0	6.3	11	7.1	0.2	7	49	7.1
T18-05D	28664	TH0802	62.3	65.3	3	1	waste	SLST	9.4	1220	3.0	1.5	5.4	7.3	0.12	0.01	0.12	0.01	0.12	0.11	0.11	3.8	3.4	122	76	62	32	20	17	22	18	0	3	62	18
T18-05D	28665	TH0803	65.3	68.4	3.1	1	waste	SLST	9.2	1300	3.2	1.5	5.5	7.5	0.28	0.02	0.28	0.02	0.28	0.26	0.26	8.8	8.1	126	78	56	14	8.9	6.4	9.6	6.9	0.3	8	56	6.9
T18-05D	28666	TH0804	68.4	71.4	3	1	waste	SLST	9.2	1310	4.1	2.4	8.9	12.1	0.26	0.02	0.25	0.02	0.25	0.24	0.23	8.1	7.2	202	81	67	25	10	8.2	11	9.3	0.2	7	67	9.3
T18-05D	28667	TH0805	71.4	75.1	3.7	1	waste	SLST	9.3	1300	4.4	2.3	8.5	11.5	0.25	0.02	0.24	0.02	0.24	0.23	0.22	7.8	6.9	192	82	73	25	10	9.3	12	11	0	7	73	11
T18-05D	28668	TH0806	75.1	78.6	3.5	1	waste	SLST	9.2	1790	3.6	2.0	7.2	9.8	0.44	0.02	0.4	0.02	0.4	0.42	0.38	14	12	164	73	85	12	5.3	6.2	6.1	7.1	0.4	12	85	7.1
T18-05D	28669	TH0807	78.6	82.1	3.5	1	waste	SLST	8.5	1840	2.8	1.4	5.3	7.2	0.78	0.02	0.75	0.02	0.75	0.76	0.73	24	23	119	83	57	4.9	3.4	2.4	3.6	2.5	0.7	23	57	2.5
T18-05D	28670	TH0808	82.1	85.6	3.5	1	waste	SLST	9.1	1710	3.4	2.2	8.2	11.2	0.89	0.03	0.83	0.03	0.83	0.86	0.8	28	25	187	86	117	6.7	3.1	4.2	3.4	4.7	0.8	25	117	4.7
T18-07D	28836	TH0854	6.9	10.4	3.5	1	waste	MDST	8.2	1400	2.0	0.59	2.18	3.0	0.74	0.02	0.73	0.02	0.73	0.72	0.71	23	22	50	55	45	2.1	2.4	1.9	2.5	2.0	0.7	22	45	2.0
T18-01D	T18-01D-A-002	TD3951	13.6	14	0.4	2	1	C	6.7	89	67	1.1	4.1	5.6	4.0	0.02	3.2	0.02	3.2	3.9	3.2	124	101	93	68	90	0.75	0.55	0.73	0.67	0.9	3.22	101	90	0.9
T18-01D	T18-01D-A-001	TD3950	12.38	13.6	1.22	2	waste	MDST	6.8	1701	4.3	0.67	2.47	3.4	2.4	0.06	2.1	0.06	2.1	2.3	2.0	74	63	56	51	32	0.76	0.69	0.43	0.8	0.5	2.03	63	32	0.5
T18-02D	T18-02D-A-012	TD3990	36.86	39.3	2.44	2	waste	SLST	8.5	1140	4.8	0.58	2.12	2.9	2.5	0.02	2.2	0.02	2.2	2.5	2.2	77	67	48	29	14	0.62	0.38	0.18	0.44	0.21	2.15	67	14	0.21
T18-02D	T18-02D-A-013	TD3991	39.3	41.75	2.45	2	waste	SLST	8.2	877	18	0.35	1.3	1.8	1.8	0.02	1.6	0.02	1.6	1.8	1.6	57	50	30	25	15	0.52	0.43	0.25	0.5	0.29	1.59	50	15	0.29
T18-05D	28673	TH0812	91.4	93.97	2.57	2	waste	MDST	6.8	2920	4.2	0.59	2.16	2.9	2.1	0.07	2.1	0.07	2.1	2.1	2.1	67	64	49	34	21	0.74	0.5	0.32	0.52	0.33	2.06	64	21	0.33
T18-05D	28674	TH0813	93.97	94.61	0.64	2	waste	C	3.4	710	67	0.15	0.56	0.76	3.0	0.11	2.7	0.11	2.7	2.9	2.6	95	81	13	14	15	0.13	0.15	0.15	0.17	0.18	2.58	81	15	0.18
T18-01D	T18-01D-A-006	TD3955	18.70	19.000	0.3	3	1	C	8.7	824	2.8	0.92	3.38	4.6	0.24	0.02	0.19	0.02	0.19	0.22	0.17	7.5	5.3	77	69	17	10	9.2	2.2	13	3.1	0.2	5	17	3.1
T18-01D	T18-01D-A-003	TD3952	14.00	15.8	1.8	3	waste	MDST	8.3	865	3.3	0.67	2.47	3.4	1.2	0.02	1.0	0.02	1.0	1.1	1.0	36	32	56	56	16	1.5	1.5	0.44	1.8	0.51	1.01	32	16	0.51
T18-01D	T18-01D-A-004	TD3953	15.8	17.2	1.4	3	waste	MDST	8.5	871	3.1	1.5	5.7	7.7	1.3	0.02	1.1	0.02	1.1	1.3	1.1	40	34	129	84	51	3.2	2.1	1.3	2.5	1.5	1.1	34	51	1.5
T18-01D	T18-01D-A-005	TD3954	17.2	18.70	1.5	3	waste	MDST	8.4	824	4.7	1.4	5.2	7.1	1.0	0.02	0.85	0.02	0.85	1.0	0.83	33	26	118	80	51	3.6	2.5	1.6	3.1	2.0	0.8	26	51	2.0
T18-01D	T18-01D-A-007	TD3956	19.000	21.31	2.31	3	waste	MDST	8.7	829	5.6	2.4	8.8	12.0	0.67	0.02	0.52	0.02	0.52	0.65	0.5	21	16	200	82	54	9.6	3.9	2.6	5.2	3.5	0.5	16	54	3.5
T18-02D	T18-02D-A-014	TD3992	41.75	45.18	3.43	3	waste	MDST	9.3	1120	4.7	1.7	6.4	8.7	0.56	0.01	0.41	0.01	0.41	0.55	0.4	18	13	144	70	68	8.3	4.0	3.9	5.6	5.4	0.4	13	68	5.4
T18-02D	T18-02D-A-015	TD3994	45.18	48.3	3.12	3	waste	MDST	9.1	855	4.3	0.98	3.6	4.9	0.7	0.01	0.57	0.01	0.57	0.69	0.56	22	18	82	50	50	3.7	2.3	2.3	2.8	2.8	0.6	18	50	2.8
T18-02D	T18-02D-A-016	TD3995	48.3	48.76	0.46	3	waste	MDST	3.8	2900	6.6	0.36	1.31	1.8	3.9	0.13	3.5	0.13	3.5	3.7	3.3	121	104	30	18	8	0.25	0.15	0.07	0.17	0.08	3.33	104	8	0.08
T18-05D	28675	TH0814	94.61	96.9	2.29	3	waste	MDST	7.5	1400	5.1	0.52	1.92	2.6	2.0	0.03	1.9	0.03	1.9	1.9	1.9	61	58	44	30	23	0.71	0.49	0.37	0.51	0.39	1.87	58	23	0.39
T18-05D	28676	TH0815	96.9	97.61	0.71	3	waste	SLST	6.6	2950	8.5	0.91	3.33	4.5	2.0	0.1	2.0	0.1	2.0	1.9	1.9	64	60	76	57	34	1.2	0.9	0.54	0.96	0.57	1.92	60	34	0.57
T18-05D	28677	TH0816	97.61	99.97	2.36	3	waste	SLST	3.4	2360	7.6	0.29	1.07	1.5	3.5	0.2	3.4	0.2	3.4	3.3	3.2	108	101	24	7.3	-0.3	0.23	0.068	-0.003	0.072	-0.003	3.23	101	0	-0.003
T18-01D	T18-01D-A-008	TD3957	22.89	27.7	4.81	4	waste	MDST	9.0	910	4.1	2.3	8.4	11.5	0.7	0.02	0.58	0.02	0.58	0.68	0.56	22	18	192	86	94	8.8	3.9	4.3	4.9	5.4	0.6	18	94	5.4
T18-01D	T18-01D-A-009	TD3958	27.7	30	2.3	4	waste	MDST	7.8	1593	10	1.7	6.3	8.6	1.3	0.04	1.2	0.04	1.2	1.3	1.1	42	35	144	80	52	3.4	1.9	1.2	2.3	1.5	1.1	35	52	1.5
T18-02D	T18-02D-A-017	TD3996	50.44	50.5	0.06	4	waste	MDST	7.8	1520	10	0.19	0.68	0.93	0.47	0.03	0.3	0.03	0.3	0.44	0.27	15	8.4	15	19	18	1.1	1.3	1.2	2.2	2.2	0.3	8	18	2.2
T18-02D	T18-02D-A-018	TD3997	50.5	52.8	2.3	4	waste	MDST	9.2	790	3.5	2.0	7.2	9.7	0.51	0.01	0.4	0.01	0.4	0.5	0.39	16	12	163	63	58	10	3.9	3.7	5.2	4.8	0.4	12	58	4.8
T18-02D	T18-02D-A-019	TD3998	52.8	54.3	1.5	4	waste	MDST	8.9	1110	4.3	2.7	9.9	13.4	0.77	0.01	0.6	0.01	0.6	0.76	0.59	24	18	224	75	112	9.3	3.1	4.7	4.1	6.1	0.6	18	112	6.1
T18-02D	T18-02D-A-020	TD3999	54.3	58.08	3.78	4	waste	MDST	9.2	1710	4.3	0.83	3.03	4.1	1.8	0.03	1.6	0.03	1.6	1.8	1.6	56	49	69	61	63	1.2	1.1	1.1	1.2	1.3	1.6	49	63	1.3
T18-05D	28678	TH0817	101.97	102.17	0.2	4	waste	SLST	8.6	968	5.4	0.37	1.34	1.8	0.12	0.01	0.08	0.01	0.08	0.11	0.07	3.8	2.2	30	13	11	8.1	3.5	2.9	6.1	5.0	0.1	2	11	5.0
T18-05D	28679	TH0818	102.17	106.3	4.13	4	waste	SLST	9.5	1270	3.0	1.4	5.1	6.9	0.32	0.02	0.33	0.02	0.33	0.3	0.31	10	9.7	115	71	57	12	7.1	5.7	7.3	5.9	0.3	10	57	5.9
T18-05D	28680	TH0819	106.3	108.7	2.4	4	waste	SLST	9.5	946	3.9	2.3	8.4	11.5	0.29	0.01	0.29	0.01	0.29	0.28	0.28	9.1	8.8	191	63	61	21	7.0	6.8	7.2	7.0	0.3	9	61	7.0
T18-05D	28681	TH0821	108.7	111.1	2.4	4	waste	SLST	8.2	1310	4.9	1.9	7.1	9.6	1.7	0.03	1.5	0.03	1.5	1.6	1.4	52	45	161	72	54	3.1	1.4	1.0	1.6	1.2	1.4	45	54	1.2
T18-05D	28682	TH0822	111.1	111.9	0.8	4	waste	MDST	8.1	1460	5.2	0.45	1.65	2.2	1.8	0.03	1.7	0.03	1.7	1.7	1.6	55	51	38	28	24	0.68	0.51	0.43	0.55	0.47	1.62	51	24	0.47
T18-05D	28683	TH0823	111.9	112.1	0.2	4	waste	C	3.7	1780	52	0.68	2.49	3.4	3.9	0.21	3.5	0.21	3.5	3.7	3.3	122	103	57	45	41	0.46	0.37	0.34	0.44	0.4	3.3	103	41	0.4
T18-01D	T18-01D-A-010	TD3959	30	33.7	3.7	5	waste	SLST	8.1	889	2.2	0.64	2.33	3.2	0.68	0.02	0.61	0.02	0.61	0.66	0.59	21	18	53	44	28	2.5	2.1	1.3	2.4	1.5	0.6	18	28	1.5
T18-01D	T18-01D-A-011	TD3961	33.7	36.39	2.69	5	waste	SLST	8.0	953	2.6	0.39	1.44	2.0	0.82	0.02	0.69	0.02	0.69	0.8	0.67	26	21	33	34	26	1.3	1.3	1.0	1.6	1.2	0.7	21	26	1.2
T18-02D	T18-02D-A-021	TD4000	58.08	60.3	2.22	5	waste	SLST	8.8	831	6.0	4.2	15.3	21	1.2	0.01	0.94	0.01	0.94	1.1	0.93	36	29	348	92	194	9.7	2.6	5.4	3.2	6.7	0.9	29	194	6.7
T18-02D	T18-02D-A-022	TD4001	60.3	63.3	3	5	waste	SLST	9.0	1030	2.4	0.48	1.77	2.4	0.68	0.02	0.53	0.02	0.53	0.66	0.51	21	16	40	29	29	1.9	1.4	1.4	1.8	1.8	0.5	16	29	1.8
T18-02D	T18-02D-A-023	TD4002	63.3	66.3	3	5	waste	SLST	9.2	577	3.9	2.1	7.7	10.6	0.48	0.02	0.35	0.02	0.35	0.46	0.33	15	10	176	70	71	12	4.6	4.7	6.7	6.8	0.3	10	71	6.8
T18-02D	T18-02D-A-024	TD4003	66.3	67.8	1.5	5	waste	SLST	7.6	1030	5.1	0.41	1.49	2.0	1.7	0.02	1.4	0.02	1.4	1.7	1.3	52	42	34	24	23	0.65	0.46	0.44	0.58	0.55	1.33	42	23	0.55
T18-02D	T18-02D-A-025	TD4005	67.8	68.56	0.76	5	waste	SLST	5.3	1780	5.0	0.27	0.98	1.34	2.4	0.06	2.1	0.06	2.1	2.4	2.1	76	64	22	14	14	0.29	0.18	0.18	0.21	0.21	2.06	64	14	0.21
T18-03D	T18-03D-A-005	TD4051	10.5	10.8	0.3	5	waste	MDST	6.4	1470	3.5	0.56	2.07	2.8	2.2	0.06	2.0	0.06	2.0	2.2	2.0	70	62	47	33	30	0.67	0.48	0.43	0.54	0.49	1.98	62	30	0.49
T18-05D	28684	TH0824	112.1	112.6	0.5	5	waste	SLST	6.1	2660	5.2	0.42	1.55	2.1	2.0	0.1	1.9	0.1	1.9	1.9	1.8	63	55	35	22	17	0.56	0.34	0.27	0.39	0.31	1.75	55	17	0.31
T18-05D	28685	TH0825	112.6	115.5	2.9	5	waste	SLST	9.2	674	6.6	4.5	16.4	22	0.44	0.02	0.39	0.02	0.39	0.42	0.37	14	12	372	80	109	27	5.8	7.9	6.9	9.4	0.4	12	109	9.4
T18-05D	28686	TH0826	115.5	119.3	3.8	5	waste	SLST	8.1	865	4.8	1.2	4.3	5.8	1.3	0.02	1.2	0.02	1.2	1.2	1.2	39	37	98	63	48	2.5	1.6	1.2	1.7	1.3	1.2	37	48	1.3
T18-05D	28687	TH0827	119.3	119.5	0.2	5	waste	SLST	4.8	1810	6.5	0.22	0.82	1.12	1.4	0.07	1.5	0.07	1.5	1.4	1.4	45	43	19	8.3	5.3	0.42	0.19	0.12	0.19	0.12	1.39	43	5	0.12
T18-03D	T18-03D-A-010	TD4056	18.6	19.4	0.8	6	1	C	8.3	228	5.3	0.15	0.55	0.75	0.2	<0.01	0.13	0.005	0.13	0.2	0.13	6.3	3.9	13	13	13	2.0	2.0	2.0	3.3	3.2	0.1	4	13	3.2
T18-03D	T18-03D-A-011	TD4058	19.4	19.6	0.2	6	1	C	8.3	474	34	0.32	1.17	1.6	0.77	0.01	0.4	0.01	0.4	0.76	0.39	24	12	27	27	26	1.1	1.1	1.1	2.2	2.1	0.4	12	26	2.1
T18-03D	T18-03D-A-022	TD4070	32.25	32.65	0.4	6	8	SHC	7.6	662	30	0.18	0.66	0.9	1.3	0.02	1.3	0.02	1.3	1.3	1.3	42	41	15	12	6.0	0.36	0.28	0.14	0.29	0.15	1.31	41	6	0.15
T18-01D	T18-01D-A-012	TD3962	38.52	40.71	2.19	6	waste	FLT	7.6	1890	13	1.5	5.5	7.4	5.0	0.12	4.5	0.12	4.5	4.9	4.4	156	136	124	87	105	0.8	0.56	0.67	0.64	0.77	4.35	136	105	0.77
T18-01D	T18-01D-A-013	TD3963	40.71	43.93	3.22	6	waste	MDST	8.7	928	5.2	1.8	6.6	8.9	1.1	0.03	0.92	0.03	0.92	1.1	0.89	34	28	149	85	89	4.4	2.5	2.6	3.0	3.2	0.9	28	89	3.2
T18-01D	T18-01D-A-014	TD3964	43.93	44.75	0.82	6	waste	MDST	8.9	424	5.3	4.0	14.8	20	0.27	0.01	0.23	0.01	0.23	0.26	0.22	8.4	6.9	336	82	47	40	9.7	5.6	12	6.8	0.2	7	47	6.8
T18-02D	T18-02D-A-026	TD4006	75.62	78.3	2.68	6	waste	SLST	8.3	592	2.6	0.93	3.39	4.6	0.87	0.02	0.72	0.02	0.72	0.85	0.7	27	22	77	54	45	2.8	2.0	1.6	2.5	2.0	0.7	22	45	2.0
T18-02D	T18-02D-A-027	TD4007	78.3	79.35	1.05	6	waste	SLST	6.8	1100	3.7	0.54	1.98	2.7	2.6	0.03	2.3	0.03	2.3	2.6	2.2	81	70	45	30	24	0.56	0.37	0.29	0.43	0.34	2.23	70	24	0.34
T18-02D	T18-02D-A-028	TD4008	79.35	79.54	0.19	6	waste	MDST	9.2	345	5.5	2.6	9.6	13.1	0.26	0.01	0.15	0.01	0.15	0.25	0.14	8.1	4.4	219	87	164	27	11	20	20	37	0	4	164	37
T18-02D	T18-02D-A-029	TD4009	79.54	80.72	1.18	6	waste	MDST	6.3	1730	7.3	0.79	2.89	3.9	2.1	0.06	1.8	0.06	1.8	2.1	1.8	66	55	66	44	43	1.0	0.66	0.65	0.8	0.79	1.75	55	43	0.79
T18-03D	T18-03D-A-009	TD4055	17.5	18.6	1.1	6	waste	MDST	7.2	1370	5.0	0.55	2.03	2.8	1.3	0.05	1.1	0.05	1.1	1.3	1.0	42	33	46	37	34	1.1	0.89	0.81	1.1	1.0	1.0	33	34	1.0
T18-03D	T18-03D-A-012	TD4059	19.6	20.5	0.9	6	waste	MDST	8.8	590	2.1	0.29	1.06	1.4	0.1	0.01	0.07	0.01	0.07	0.09	0.06	3.1	1.9	24	16	16	7.7	5.0	5.0	8.3	8.3	0.1	2	16	8.3
T18-03D	T18-03D-A-013	TD4060	20.5	22.25	1.75	6	waste	MDST	8.7	630	3.3	0.96	3.53	4.8	0.09	0.01	0.06	0.01	0.06	0.08	0.05	2.8	1.6	80	51	37	29	18	13	32	24	0	2	37	24
T18-03D	T18-03D-A-014	TD4061	22.25	23.16	0.91	6	waste	MDST	9.6	623	5.1	3.6	13.4	18	0.04	0.01	<0.05	0.01	0.025	0.03	0.015	1.3	0.47	304	64	55	243	51	44	136	116	0	0	55	116
T18-03D	T18-03D-A-015	TD4062	23.16	23.56	0.4	6	waste	MDST	9.4	802	5.1	1.5	5.5	7.4	0.08	0.01	<0.05	0.01	0.025	0.07	0.015	2.5	0.47	124	57	51	50	23	20	122	108	0	0	51	108
T18-03D	T18-03D-A-016	TD4063	23.56	25	1.44	6	waste	MDST	9.6	897	5.1	2.6	9.4	12.8	0.07	0.02	<0.05	0.02	0.025	0.05	0.005	2.2	0.16	214	79	94	98	36	43	508	598	0	0	94	598
T18-03D	T18-03D-A-017	TD4064	25	26.12	1.12	6	waste	MDST	9.6	701	4.6	1.6	5.9	8.0	0.08	0.01	<0.05	0.01	0.025	0.07	0.015	2.5	0.47	134	68	77	54	27	31	145	164	0	0	77	164
T18-03D	T18-03D-A-018	TD4065	26.12	28	1.88	6	waste	MDST	7.4	1900	3.0	0.54	1.99	2.7	0.45	0.05	0.45	0.05	0.45	0.4	0.4	14	13	45	32	28	3.2	2.3	2.0	2.5	2.2	0.4	13	28	2.2
T18-03D	T18-03D-A-019	TD4066	28	29.06	1.06	6	waste	MDST	7.8	2350	2.8	1.6	5.8	7.9	0.47	0.07	0.49	0.07	0.49	0.4	0.42	15	13	133	63	70	9.0	4.3	4.8	4.8	5.4	0.4	13	70	5.4
T18-03D	T18-03D-A-020	TD4067	29.06	30	0.94	6	waste	MDST	8.5	1120	3.5	0.81	2.97	4.0	0.26	0.02	0.29	0.02	0.29	0.24	0.27	8.1	8.4	68	45	34	8.3	5.5	4.2	5.3	4.1	0.3	8	34	4.1
T18-03D	T18-03D-A-021	TD4069	30	32.25	2.25	6	waste	MDST	8.7	1100	3.8	0.56	2.06	2.8	0.29	0.02	0.35	0.02	0.35	0.27	0.33	9.1	10	47	26	19	5.2	2.8	2.1	2.5	1.8	0.3	10	19	1.8
T18-05D	28688	TH0828	126.6	126.8	0.2	6	waste	MDST	8.0	583	6.0	0.22	0.8	1.09	0.29	0.02	0.28	0.02	0.28	0.27	0.26	9.1	8.1	18	14	11	2.0	1.5	1.2	1.7	1.4	0.3	8	11	1.4
T18-05D	28689	TH0829	126.8	128.8	2	6	waste	MDST	8.1	729	2.1	0.55	2.01	2.7	0.4	0.03	0.41	0.03	0.41	0.37	0.38	13	12	46	33	29	3.7	2.6	2.3	2.7	2.5	0.4	12	29	2.5

Drill Hole	Sample Number	Maxxam Sample ID	Sample Depth (m)			ABA Zone	Class	Lithology	Paste pH (su)	Paste EC (µs/cm)	Carbon Species (w.t.%)				Sulphur Species (w.t.%)							Potentials (kg CaCO3/tonne)					Neutralization Potential Ratios					Mine Plan Inputs			
			From	To	Thickness						Total-C	Total Inorganic Carbon	CO2	CO3	Total-S	Sulphate	SICP	Sulphate (DL)	SICP (DL)	Sulphide (Total - SO4)	Sulphide (SICP - SO4)	AP (Total Sulphur)	AP (Sulphide)	CO3-NP	Sobek-NP	Modified Sobek-NP	CO3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)	Sulphide-S	AP	NP	NPR
T18-05D	28690	TH0830	128.8	131.6	2.8	6	waste	MDST	6.7	1300	8.0	0.62	2.27	3.1	2.5	0.04	2.5	0.04	2.5	2.5	2.5	79	77	52	37	34	0.65	0.46	0.43	0.47	0.44	2.46	77	34	0.44
T18-05D	28691	TH0832	131.6	131.9	0.3	6	waste	MDST	3.0	1400	59	0.17	0.62	0.85	2.6	0.13	2.4	0.13	2.4	2.5	2.2	82	70	14	13	8	0.17	0.15	0.1	0.18	0.11	2.24	70	8	0.11
T18-05D	28704	TH0843	131.9	132.2	0.3	6	waste	C	6.0	1170	42	0.78	2.84	3.9	2.3	0.07	2.2	0.07	2.2	2.3	2.1	73	66	65	58	58	0.89	0.79	0.8	0.87	0.88	2.12	66	58	0.88
T18-05D	28692	TH0833	132.2	132.5	0.3	6	waste	P	3.0	3320	4.3	0.14	0.51	0.7	2.5	0.25	2.5	0.25	2.5	2.2	2.2	78	69	12	51	-2	0.15	0.66	0	0.74	0	2	69	-2	0
T18-05D	28693	TH0834	132.5	132.85	0.35	6	waste	C	5.7	365	75	0.26	0.97	1.32	1.5	0.06	1.1	0.06	1.1	1.4	1.1	47	33	22	20	21	0.47	0.42	0.44	0.59	0.63	1.06	33	21	0.63
T18-05D	28694	TH0835	132.85	133.6	0.75	6	waste	MDST	9.1	483	5.1	1.8	6.6	9.1	0.18	0.02	0.17	0.02	0.17	0.16	0.15	5.6	4.7	151	86	127	27	15	23	18	27	0	5	127	27
T18-05D	28695	TH0836	133.6	134.4	0.8	6	waste	MDST	8.7	776	5.2	3.2	11.9	16	0.37	0.02	0.36	0.02	0.36	0.35	0.34	12	11	270	74	80	23	6.4	6.9	7.0	7.5	0.3	11	80	7.5
T18-05D	28696	TH0837	134.4	135	0.6	6	waste	MDST	6.6	2610	11	1.1	4.0	5.5	5.9	0.17	5.6	0.17	5.6	5.8	5.4	186	170	91	79	88	0.49	0.42	0.47	0.46	0.52	5.43	170	88	0.52
T18-05D	28697	TH0838	135	135.8	0.8	6	waste	C	5.6	1030	61	0.28	1.01	1.4	3.2	0.11	3.1	0.11	3.1	3.1	3.0	101	95	23	24	24	0.23	0.23	0.24	0.25	0.25	3.03	95	24	0.25
T18-07D	29516	TH0888	123.8	127.5	3.7	6	waste	MDST	8.2	1720	9.0	0.34	1.24	1.7	2.0	0.04	2.0	0.04	2.0	2.0	2.0	63	62	28	26	17	0.44	0.41	0.27	0.42	0.28	1.99	62	17	0.28
T18-07D	29517	TH0889	127.5	129.3	1.8	6	waste	SLST	8.6	1280	3.0	1.2	4.3	5.8	0.19	0.03	0.17	0.03	0.17	0.16	0.14	5.9	4.4	97	49	26	16	8.2	4.4	11	6.0	0.1	4	26	6.0
T18-07D	29518	TH0890	129.3	132.4	3.1	6	waste	SST	8.3	1550	3.3	0.49	1.8	2.5	1.1	0.04	1.1	0.04	1.1	1.1	1.1	35	34	41	26	17	1.2	0.74	0.47	0.77	0.48	1.09	34	17	0.48
T18-07D	29519	TH0891	132.4	133.8	1.4	6	waste	MDST	8.2	1290	2.9	0.11	0.4	0.55	1.1	0.02	1.2	0.02	1.2	1.1	1.2	36	38	9.1	8.5	7.3	0.26	0.24	0.2	0.23	0.19	1.2	38	7	0.19
T18-07D	29520	TH0892	133.8	134	0.2	6	waste	C	8.4	1130	3.2	0.09	0.33	0.45	0.83	0.02	0.84	0.02	0.84	0.81	0.82	26	26	7.5	9.5	7.0	0.29	0.37	0.27	0.37	0.27	0.82	26	7	0.27
T18-07D	29521	TH0893	134	134.6	0.6	6	waste	C	7.3	790	48	0.022	0.08	0.109	2.6	0.03	2.3	0.03	2.3	2.6	2.3	82	72	1.8	8.0	7.3	0.022	0.097	0.089	0.11	0.1	2.29	72	7	0.1
T18-03D	T18-03D-A-028	TD4076	37.8	38.1	0.3	7	8	MDST	9.0	552	4.1	0.27	1.0	1.4	0.02	0.01	<0.05	0.01	0.025	0.01	0.015	0.63	0.47	23	12	10	36	19	16	26	21	0	0	10	21
T18-01D	T18-01D-A-015	TD3965	44.75	47.2	2.45	7	waste	MDST	8.8	428	6.8	2.1	7.8	10.6	0.11	0.01	<0.05	0.01	0.025	0.1	0.015	3.4	0.47	176	56	30	51	16	8.6	120	63	0	0	30	63
T18-02D	T18-02D-A-030	TD4010	80.72	84.3	3.58	7	waste	MDST	7.3	1240	4.3	0.46	1.67	2.3	0.85	0.04	0.7	0.04	0.7	0.81	0.66	27	21	38	26	24	1.4	0.98	0.91	1.3	1.2	0.7	21	24	1.2
T18-02D	T18-02D-A-031	TD4011	84.3	84.53	0.23	7	waste	MDST	7.8	1090	9.3	0.99	3.63	4.9	2.0	0.03	1.7	0.03	1.7	1.9	1.6	61	51	83	61	58	1.3	0.99	0.94	1.2	1.1	1.6	51	58	1.1
T18-02D	T18-02D-A-032	TD4012	84.53	86.64	2.11	7	waste	MDST	8.2	669	2.5	0.68	2.49	3.4	1.2	0.01	1.0	0.01	1.0	1.2	1.0	38	31	57	38	34	1.5	1.0	0.91	1.2	1.1	1.0	31	34	1.1
T18-02D	T18-02D-A-033	TD4013	86.64	87.48	0.84	7	waste	MDST	7.1	1220	5.0	2.4	9.0	12.2	2.3	0.03	1.9	0.03	1.9	2.3	1.9	72	59	204	58	64	2.9	0.81	0.89	0.99	1.1	1.9	59	64	1.1
T18-02D	T18-02D-A-034	TD4014	87.48	89	1.52	7	waste	MDST	6.5	913	27	0.18	0.66	0.9	1.9	0.03	1.5	0.03	1.5	1.9	1.4	60	45	15	13	15	0.25	0.21	0.25	0.28	0.34	1.43	45	15	0.34
T18-03D	T18-03D-A-023	TD4071	32.65	32.9	0.25	7	waste	MDST	6.7	1750	2.0	0.85	3.1	4.2	5.2	0.05	5.1	0.05	5.1	5.2	5.1	163	158	70	43	36	0.43	0.26	0.22	0.27	0.22	5.06	158	36	0.22
T18-03D	T18-03D-A-024	TD4072	32.9	34.53	1.63	7	waste	MDST	8.6	550	17	0.3	1.1	1.5	0.62	0.03	0.61	0.03	0.61	0.59	0.58	19	18	25	13	15	1.3	0.66	0.75	0.71	0.8	0.58	18	15	0.8
T18-03D	T18-03D-A-025	TD4073	34.53	35.5	0.97	7	waste	MDST	9.4	447	6.7	3.4	12.4	17	0.06	0.01	0.07	0.01	0.07	0.05	0.06	1.9	1.9	283	45	49	151	24	26	24	26	0	2	49	26
T18-03D	T18-03D-A-026	TD4074	35.5	36.26	0.76	7	waste	MDST	8.8	676	7.3	0.42	1.53	2.1	0.18	0.02	0.25	0.02	0.25	0.16	0.23	5.6	7.2	35	36	26	6.2	6.5	4.5	5.1	3.5	0.2	7	26	3.5
T18-03D	T18-03D-A-027	TD4075	36.26	37.8	1.54	7	waste	MDST	9.1	430	13	0.9	3.31	4.5	0.07	0.01	0.06	0.01	0.06	0.06	0.05	2.2	1.6	75	28	23	34	13	11	18	15	0	2	23	15
T18-05D	28698	TH0839	135.8	139.1	3.3	7	waste	SLST	6.7	1610	4.2	0.34	1.23	1.7	1.4	0.04	1.5	0.04	1.5	1.4	1.4	45	45	28	15	13	0.63	0.34	0.29	0.34	0.29	1.43	45	13	0.29
T18-05D	28699	TH0840	139.1	139.9	0.8	7	waste	SLST	5.3	1830	4.3	0.21	0.78	1.06	2.1	0.06	2.1	0.06	2.1	2.0	2.0	65	62	18	9.3	7.3	0.27	0.14	0.11	0.15	0.12	1.99	62	7	0.12
T18-05D	28700	TH0842	139.9	140.9	1	7	waste	C	3.8	1500	51	0.22	0.8	1.09	4.1	0.12	3.9	0.12	3.9	4.0	3.7	128	117	18	17	17	0.14	0.13	0.13	0.14	0.15	3.74	117	17	0.15
T18-05D	28705	TH0844	140.9	141.2	0.3	7	waste	MDST	8.8	392	12	3.3	12.1	16	0.19	0.02	0.1	0.02	0.1	0.17	0.08	5.9	2.5	274	73	87	46	12	15	29	35	0	3	87	35
T18-05D	28706	TH0845	141.2	142.1	0.9	7	waste	MDST	8.0	341	21	0.11	0.39	0.53	0.24	0.01	0.08	0.01	0.08	0.23	0.07	7.5	2.2	8.9	6.8	5.8	1.2	0.91	0.77	3.1	2.7	0.1	2	6	2.7
T18-02D	T18-02D-A-035	TD4016	89	90.3	1.3	8	waste	MDST	8.6	581	4.0	0.31	1.15	1.6	0.08	0.01	<0.05	0.01	0.025	0.07	0.015	2.5	0.47	26	17	15	10	6.6	6.1	35	33	0	0	15	33
T18-02D	T18-02D-A-036	TD4017	90.3	90.93	0.63	8	waste	MDST	8.8	417	3.9	0.33	1.22	1.7	0.11	0.01	0.08	0.01	0.08	0.1	0.07	3.4	2.2	28	16	15	8.1	4.7	4.2	7.5	6.6	0.1	2	15	6.6
T18-02D	T18-02D-A-037	TD4018	90.93	92.52	1.59	8	waste	MDST	9.0	532	8.7	0.44	1.61	2.2	0.12	<0.01	<0.05	0.005	0.025	0.12	0.02	3.8	0.63	37	19	16	9.8	5.1	4.3	30	26	0	1	16	26
T18-05D	28708	TH0847	142.6	143	0.4	8	waste	MDST	7.9	661	2.3	0.37	1.36	1.9	0.09	0.01	0.07	0.01	0.07	0.08	0.06	2.8	1.9	31	11	6.5	11	3.9	2.3	5.9	3.5	0.1	2	7	3.5
T18-05D	28709	TH0848	143	143.9	0.9	8	waste	MDST	8.5	724	3.0	0.49	1.79	2.4	0.05	0.02	<0.05	0.02	0.025	0.03	0.005	1.6	0.16	41	26	21	26	17	13	168	131	0	0	21	131
T18-05D	28710	TH0849	143.9	144.1	0.2	8	waste	MDST	7.6	496	2.7	0.13	0.47	0.64	0.08	0.03	0.08	0.03	0.08	0.05	0.05	2.5	1.6	11	36	27	4.3	14	11	23	17	0	2	27	17
T18-05D	28711	TH0850	144.1	144.4	0.3	8	waste	MDST	7.6	538	23	0.43	1.59	2.2	0.39	0.01	0.24	0.01	0.24	0.38	0.23	12	7.2	36	33	32	3.0	2.7	2.6	4.5	4.4	0.2	7	32	4.4
T18-05D	28712	TH0851	144.4	148	3.6	8	waste	MDST	8.1	464	2.6	1.4	5.2	7.1	0.06	0.02	<0.05	0.02	0.025	0.04	0.005	1.9	0.16	118	49	10	63	26	5.3	316	64	0	0	10	64
T18-05D	28713	TH0852	148	148.2	0.2	8	waste	C	8.7	329	43	0.88	3.24	4.4	0.36	0.01	0.09	0.01	0.09	0.35	0.08	11	2.5	74	68	74	6.5	6.0	6.6	27	30	0	3	74	30
T18-03D	T18-03D-A-006	TD4052	12.57	12.82	0.25	55	waste	MDST	7.7	694	14	0.1	0.37	0.5	0.33	0.02	0.2	0.02	0.2	0.31	0.18	10	5.6	8.4	7.5	9.3	0.82	0.73	0.9	1.3	1.7	0.2	6	9	1.7
T18-03D	T18-03D-A-007	TD4053	12.82	13.44	0.62	55	waste	MDST	8.6	479	3.1	0.5	1.84	2.5	0.07	0.01	<0.05	0.01	0.025	0.06	0.015	2.2	0.47	42	33	30	19	15	14	70	65	0	0	30	65
T18-03D	T18-03D-A-008	TD4054	13.44	14.9	1.46	55	waste	MDST	8.2	381	14	0.31	1.14	1.6	0.22	0.01	0.12	0.01	0.12	0.21	0.11	6.9	3.4	26	19	22	3.8	2.8	3.1	5.6	6.3	0.1	3	22	6.3
T18-02D	T18-02D-A-007	TD3985	27.3	28.8	1.5	1a	waste	MDST	8.8	2170	2.2	0.88	3.21	4.4	1.3	0.02	1.2	0.02	1.2	1.2	1.1	39	36	73	58	40	1.9	1.5	1.0	1.6	1.1	1.1	36	40	1.1
T18-02D	T18-02D-A-008	TD3986	28.8	30.3	1.5	1a	waste	MDST	8.8	2150	2.0	0.82	3.02	4.1	1.2	0.03	1.1	0.03	1.1	1.2	1.0	39	32	69	50	42	1.8	1.3	1.1	1.6	1.3	1.0	32	42	1.3
T18-02D	T18-02D-A-009	TD3987	30.3	32.88	2.58	1a	waste	MDST	8.5	2810	2.5	1.3	4.7	6.5	1.6	0.05	1.3	0.05	1.3	1.5	1.2	49	38	108	65	49	2.2	1.3	1.0	1.7	1.3	1.2	38	49	1.3
T18-02D	T18-02D-A-010	TD3988	32.88	33.94	1.06	1a	waste	MDST	8.9	1980	2.8	1.5	5.6	7.7	1.1	0.02	0.95	0.02	0.95	1.1	0.93	36	29	128	69	53	3.6	1.9	1.5	2.4	1.8	0.9	29	53	1.8
T18-02D	T18-02D-A-011	TD3989	33.94	36.86	2.92	1a	waste	MDST	8.2	1670	7.0	0.99	3.62	4.9	2.6	0.03	2.3	0.03	2.3	2.6	2.3	81	71	82	64	24	1.0	0.78	0.29	0.9	0.34	2.26	71	24	0.34
T18-05D	28671	TH0810	85.6	88.3	2.7	1a	waste	SLST	8.3	2350	4.6	1.8	6.7	9.1	1.3	0.05	1.2	0.05	1.2	1.3	1.2	41	37	151	75	68	3.7	1.8	1.6	2.0	1.8	1.2	37	68	1.8
T18-05D	28672	TH0811	88.3	91.4	3.1	1a	waste	SLST	5.3	2460	12	0.49	1.79	2.4	2.2	0.08	2.2	0.08	2.2	2.1	2.2	69	67	41	26	23	0.59	0.38	0.33	0.39	0.33	2.15	67	23	0.33
T18-07D	28837	TH0855	10.4	14.8	4.4	1a	waste	MDST	8.7	2100	2.7	0.49	1.8	2.5	1.6	0.04	1.7	0.04	1.7	1.6	1.6	51	51	41	59	54	0.8	1.1	1.1	1.1	1.1	1.6	51	54	1.1
T18-07D	28838	TH0856	14.8	18.3	3.5	1a	waste	SLST	8.5	2440	1.8	0.13	0.48	0.65	1.8	0.05	1.7	0.05	1.7	1.8	1.7	57	53	11	32	25	0.19	0.57	0.43	0.62	0.47	1.68	53	25	0.47
T18-07D	28839	TH0857	18.3	22.2	3.9	1a	waste	SLST	8.8	1300	1.2	0.38	1.4	1.9	1.3	0.03	1.3	0.03	1.3	1.2	1.3	40	39	32	37	26	0.8	0.93	0.66	0.94	0.67	1.25	39	26	0.67
T18-07D	28840	TH0858	22.2	26.1	3.9	1a	waste	SLST	8.6	1550	1.1	0.28	1.01	1.4	0.74	0.03	0.74	0.03	0.74	0.71	0.71	23	22	23	30	21	0.99	1.3	0.89	1.3	0.92	0.71	22	21	0.92
T18-07D	28841	TH0859	26.1	30	3.9	1a	waste	SLST	8.4	1160	1.4	0.22	0.82	1.12	1.0	0.03	0.98	0.03	0.98	1.0	0.95	32	30	19	26	17	0.58	0.81	0.51	0.88	0.56	0.95	30	17	0.56
T18-07D	28842	TH0860	30	33.9	3.9	1a	waste	SLST	9.0	1810	1.2	0.19	0.71	0.97	1.2	0.04	1.2	0.04	1.2	1.1	1.1	37	35	16	31	20	0.44	0.83	0.53	0.87	0.56	1.12	35	20	0.56
T18-07D	28843	TH0861	33.9	38.2	4.3	1a	waste	SLST	8.3	1920	1.2	0.071	0.26	0.35	1.5	0.02	1.5	0.02	1.5	1.5	1.5	46	46	5.9	13	9.5	0.13	0.29	0.21	0.29	0.21	1.48	46	10	0.21
T18-07D	28844	TH0862	38.2	42.3	4.1	1a	waste	FLT	8.4	1120	1.3	0.24	0.87	1.19	1.0	0.03	1.1	0.03	1.1	0.99	1.0	32	32	20	28	21	0.62	0.88	0.67	0.87	0.66	1.03	32	21	0.66
T18-07D	28845	TH0863	42.3	44.2	1.9	1a	waste	SLST	9.0	1370	1.1	0.14	0.52	0.71	0.86	0.02	0.92	0.02	0.92	0.84	0.9	27	28	12	26	12	0.44	0.97	0.46	0.92	0.44	0.9	28	12	0.44
T18-07D	28846	TH0865	44.2	49.8	5.6	1a	waste	SST	9.0	1530	1.1	0.35	1.28	1.7	0.68	0.03	0.68	0.03	0.68	0.65	0.65	21	20	29	37	28	1.4	1.7	1.3	1.8	1.4	0.7	20	28	1.4
T18-07D	28847	TH0866	49.8	52.8	3	1a	waste	SLST	8.4	1740	1.3	0.31	1.15	1.6	0.65	0.02	0.64	0.02	0.64	0.63	0.62	20	19	26	36	27	1.3	1.8	1.3	1.9	1.4	0.6	19	27	1.4
T18-07D	28848	TH0867	52.8	57.15	4.35	1a	waste	SLST	9.2	1760	1.3	0.068	0.25	0.34	0.52	0.02	0.51	0.02	0.51	0.5	0.49	16	15	5.7	26	10	0.35	1.6	0.63	1.7	0.67	0.49	15	10	0.67
T18-07D	28849	TH0868	57.15	61.5	4.35	1a	waste	SLST	9.2	1550	1.4	0.12	0.45	0.61	0.8	0.02	0.82	0.02	0.82	0.78	0.8	25	25	10	25	15	0.41	0.98	0.6	0.98	0.6	0.8	25	15	0.6
T18-07D	28850	TH0869	61.5	63.4	1.9	1a	waste	FLT	8.5	2180	3.1	1.9	6.9	9.5	0.91	0.04	0.86	0.04	0.86	0.87	0.82	28	26	158	174	152	5.6	6.1	5.3	6.8	5.9	0.8	26	152	5.9
T18-07D	29501	TH0870	63.4	66.8	3.4	1a	waste	MDST	8.7	1660	1.8	0.34	1.24	1.7	0.77	0.03	0.78	0.03	0.78	0.74	0.75	24	23	28	39	19	1.2	1.6	0.79	1.7	0.81	0.75	23	19	0.81
T18-07D	29502	TH0871	66.8	69.6	2.8	1a	waste	SLST	8.8	1330	2.8	1.3	4.7	6.4	1.6	0.02	1.6	0.02	1.6	1.5	1.5	48	48	107	90	101	2.2	1.8	2.1	1.9	2.1	1.5	48	101	2.1
T18-07D	29503	TH0872	69.6	72.4	2.8	1a	waste	SLST	8.6	1290	1.9	0.23	0.86	1.17	1.7	0.02	1.8	0.02	1.8	1.7	1.8	54	56	20	42	26	0.36	0.78	0.48	0.76	0.46	1.79	56	26	0.46
T18-07D	29504	TH0873	72.4	75.6	3.2	1a	waste	SST	8.7	1270	2.8	1.2	4.3	5.8	1.8	0.02	1.8	0.02	1.8	1.8	1.8	56	57	98	133	104	1.7	2.4	1.9	2.3	1.8	1.8	57	104	1.8
T18-07D	28786	TH0874	75.6	78.8	3.2	1a	waste	SST	8.2	980	3.6	2.1	7.6	10.4	1.1	0.01	1.1	0.01	1.1	1.1	1.1	33	33	173	203	175	5.2	6.1	5.2	6.1	5.2	1.1	33	175	5.2
T18-07D	29505	TH0876	78.8	84	5.2	1a	waste	SLST	8.6	1110	1.9	0.45	1.66	2.3	0.54	0.02	0.54	0.02	0.54	0.52	0.52	17	16	38	44	28	2.2	2.6	1.6	2.7	1.7	0.5	16	28	1.7
T18-07D	29506	TH0877	84	86.9	2.9	1a	waste	SLST	8.7	1160	3.4	2.0	7.2	9.8	1.0	0.02	1.0	0.02	1.0	1.0	1.0	32	32	164	250	187	5.1	7.8	5.8	7.9	5.9	1.0	32	187	5.9
T18-07D	29507	TH0878	86.9	92.2	5.3	1a	waste	SLST	8.9	800	4.1	2.8	10.2	14	0.6	0.02	0.59	0.02	0.59	0.58	0.57	19	18	231	248	205	12	13	11	14	12	1	18	205	12
T18-07D	29508	TH0879	92.2	96.3	4.1	1a	waste	SLST	8.6	975	1.8	0.42	1.53	2.1	0.55	0.02	0.54	0.02	0.54	0.53	0.52	17	16	35	51	32	2.0	3.0	1.8	3.2	1.9	0.5	16	32	1.9
T18-07D	29509	TH0880	96.3	104.7	8.4	1a	waste	SLST	8.4	977	2.2	0.47	1.72	2.3	0.27	0.02	0.26	0.02	0.26	0.25	0.24	8.4	7.5	39	39	21	4.6	4.7	2.4	5.2	2.7	0.2	8	21	2.7
T18-07D	29510	TH0881	104.7	107.8	3.1	1a	waste	MDST	8.5	1160	2.7	0.63	2.3	3.1	0.63	0.02	0.64	0.02	0.64	0.61	0.62	20	19	52	51	35	2.7	2.6	1.8	2.6	1.8	0.6	19	35	1.8
T18-07D	29511	TH0882	107.8	111.1	3.3	1a	waste	MDST	8.5	1080	2.9	0.98	3.59	4.9	0.18	0.01	0.18	0.01	0.18	0.17	0.17	5.6	5.3	82	59	44	15	10	7.9	11	8.3	0.2	5	44	8.3
T18-07D	29512	TH0883	111.1	114.2	3.1	1a	waste	MDST	8.4	1160	2.5	0.47	1.72	2.3	0.34	0.02	0.35	0.02	0.35	0.32	0.33	11	10	39	43	21	3.7	4.1	2.0	4.2	2.0	0.3	10	21	2.0
T18-07D	29513	TH0884	114.2	117.4	3.2	1a	waste	MDST	8.4	1210	2.4	0.8	2.92	4.0	0.4	0.02	0.42	0.02	0.42	0.38	0.4	13	13	66	54	41	5.3	4.3	3.3	4.3	3.3	0.4	13	41	3.3
T18-07D	29514	TH0885	117.4	120.6	3.2	1a	waste	MDST	8.3	1630	2.3	1.0	3.8	5.2	1.2	0.02	1.2	0.02	1.2	1.1	1.2	36	37	87	54	33	2.4	1.5	0.91	1.5	0.9	1.17	37	33	0.9
T18-07D	29515	TH0887	120.6	123.8	3.2	1a	waste	MDST	8.3	1250	2.0	0.86	3.14	4.3	1.2	0.02	1.2	0.02	1.2	1.2	1.2	37	37	71	41	31	1.9	1.1	0.84	1.1	0.86	1.17	37	31	0.86
2019 Sampling Programme																																			
19-09D	1146024	BAJ890	4.45	5.90	1.45	4	waste		8.03	---	6.6	3.7	13	18	0.36	0.04	0.36	0.04	0.36	0.32	0.32	11	10	306	---	116	27	---	10	---	12	0.32	10	116	12
19-09D	1146025	BAJ891	5.90	8.00	2.1	4	waste	MDST	7.62	---	3.5	1.1	4.0	5.4	0.81	0.05	0.87	0.05	0.87	0.76	0.82	25	26	90	---	48	3.5	---	1.9	---	1.9	0.82	26	48	1.9
19-09D	1146026	BAJ892	8.00	10.75	2.75	5	waste	SLST	7.36	---	4.7	0.81	3.0	4.1	1.5	0.06	1.5	0.06	1.45	1.42	1.39	46	43	68	---	34	1.5	---	0.73	---	0.78	1.4	43	34	0.78
19-09D	1146030	BAJ893	13.25	14.75	1.5	55	waste	MDST	7.54	---	5.9	0.78	2.9	3.9	0.38	0.02	0.33	0.02	0.33	0.36	0.31	12	10	65	---	39	5.5	---	3.3	---	4.0	0.31	10	39	4.01
19-09D	1146034	BAJ894	18.85	20.20	1.35	6	waste	MDST	7.43	---	29	0.63	2.3	3.1	1.5	0.08	1.4	0.08	1.36	1.41	1.28	47	40	53	---	50	1.1	---	1.1	---	1.3	1.3	40	50	1.3
19-09D	1146035	BAJ895	20.20	21.90	1.7	6	waste	SLST	8.29	---	4.9	2.2	8.1	11	0.41	0.01	0.39	0.01	0.39	0.40	0.38	13	12	185	---	110	14	---	8.6	---	9.3	0.38	12	110	9.3
19-09D	1146036	BAJ896	21.90	23.40	1.5	6	waste	SLST	7.72	---	4.9	2.8	10	14	0.45	0.04	0.43	0.04	0.43	0.41	0.39	14	12	230	---	64	16	---	4.5	---	5.2	0.39	12	64	5.2
19-09D	1146037	BAJ897	23.40	24.90	1.5	6	waste	SLST	7.07	---	3.8	0.46	1.7	2.3	0.90	0.01	0.93	0.01	0.93	0.89	0.92	28	29	38	---	19	1.4	---	0.69	---	0.67	0.92	29	19	0.67
19-09D	1146038	BAJ898	24.90	26.40	1.5	6	waste	SLST	8.17	---	4.4	2.2	8.1	11	0.48	0.03	0.47	0.03	0.47	0.45	0.44	15	14	184	---	60	12	---	4.0	---	4.3	0.44	14	60	4.3
19-09D	1146039	BAJ899	26.80	27.75	0.95	6	waste	SLST	8.15	---	6.6	0.76	2.8	3.8	0.23	0.07	0.17	0.07	0.17	0.16	0.10	7.2	3.1	64	---	44	8.9	---	6.1	---	14	0.10	3.1	44	14

Drill Hole	Sample Number	Maxxam Sample ID	Sample Depth (m)			ABA Zone	Class	Lithology	Paste pH (su)	Paste EC (µs/cm)	Carbon Species (w.t.%)				Sulphur Species (w.t.%)							Potentials (kg CaCO3/tonne)					Neutralization Potential Ratios					Mine Plan Inputs			
			From	To	Thickness						Total-C	Total Inorganic Carbon	CO2	CO3	Total-S	Sulphate	SICP	Sulphate (DL)	SICP (DL)	Sulphide (Total - SO4)	Sulphide (SICP - SO4)	AP (Total Sulphur)	AP (Sulphide)	CO3-NP	Sobek-NP	Modified Sobek-NP	CO3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)	Sulphide-S	AP	NP	NPR
19-09D	1146040	BAJ900	27.90	28.70	0.8	6	Coal	C	8.25	---	16	0.86	3.1	4.3	0.60	0.01	0.50	0.01	0.50	0.59	0.49	19	15	71	---	33	3.8	---	1.8	---	2.2	0.49	15	33	2.2
19-09D	1146041	BAJ901	28.85	30.70	1.85	7	waste	SST	8.6	---	7.2	4.0	15	20	0.23	0.01	0.21	0.01	0.21	0.22	0.20	7.2	6.3	336	---	394	47	---	55	---	63	0.20	6.3	394	63
19-09D	1146042	BAJ902	30.70	32.70	2	7	waste	SLST	8.15	---	3.3	0.79	2.9	3.9	0.09	<0.01	0.06	0.01	0.06	0.09	0.06	2.8	1.7	65	---	20	23	---	7.0	---	12	0.06	1.7	20	12
19-09D	1146043	BAJ903	32.70	34.00	1.3	7	waste	SST	8.95	---	6.8	1.6	5.9	8.0	0.06	<0.01	<0.02	0.01	0.01	0.06	0.01	1.9	0.16	133	---	44	71	---	23	---	278	0.01	0.16	44	278
19-09D	1146044	BAJ904	34.00	35.40	1.4	8	waste	SST	8.22	---	2.6	0.92	3.4	4.6	0.04	<0.01	0.03	0.01	0.03	0.04	0.03	1.3	0.78	77	---	18	61	---	15	---	23	0.03	0.78	18	23
19-09D	1146045	BAJ905	35.40	35.90	0.5	8	waste	SHC	8.74	---	18	0.62	2.3	3.1	0.20	<0.01	0.06	0.01	0.06	0.20	0.06	6.3	1.7	51	---	27	8.2	---	4.3	---	16	0.06	1.7	27	16
19-16D	1146051	BAJ906	6.40	8.00	1.6	1	waste	SLST	8.3	---	3.2	1.8	6.5	8.9	0.23	0.01	0.23	0.01	0.23	0.22	0.22	7.2	6.9	148	---	79	21	---	11	---	11	0.22	6.9	79	11
19-16D	1146052	BAJ907	8.00	9.40	1.4	1	waste	SLST	8.18	---	3.0	1.4	5.3	7.2	0.19	0.01	0.17	0.01	0.17	0.18	0.16	5.9	5.0	121	---	53	20	---	8.9	---	11	0.16	5.0	53	11
19-16D	1146053	BAJ908	9.40	11.70	2.3	1	waste	MDST	8.2	---	3.3	1.5	5.5	7.5	0.18	0.01	0.17	0.01	0.17	0.17	0.16	5.6	5.0	124	---	45	22	---	8.0	---	9.0	0.16	5.0	45	9.0
19-16D	1146054	BAJ909	11.70	14.70	3	1	waste	MDST	8.13	---	3.2	1.4	5.2	7.0	0.27	0.01	0.25	0.01	0.25	0.26	0.24	8.4	7.5	117	---	35	14	---	4.2	---	4.7	0.24	7.5	35	4.7
19-16D	1146055	BAJ910	14.70	17.70	3	1	waste	MDST	8.21	---	3.5	1.6	5.8	7.9	0.32	0.01	0.32	0.01	0.32	0.31	0.31	10	10	131	---	38	13	---	3.8	---	3.9	0.31	10	38	3.9
19-16D	1146056	BAJ911	17.70	20.90	3.2	1	waste	MDST	8.4	---	3.2	1.4	5.2	7.1	0.45	0.01	0.43	0.01	0.43	0.44	0.42	14	13	119	---	42	8.5	---	3.0	---	3.2	0.42	13	42	3.2
19-16D	1146057	BAJ912	20.90	22.10	1.2	1	waste	SST	8.33	---	2.8	1.7	6.1	8.3	0.71	0.02	0.79	0.02	0.79	0.69	0.77	22	24	138	---	51	6.2	---	2.3	---	2.1	0.77	24	51	2.1
19-16D	1146058	BAJ913	22.10	24.70	2.6	1	waste	MDST	8.41	---	2.8	1.7	6.1	8.3	1.0	0.02	1.09	0.02	1.1	1.0	1.1	32	33	139	---	44	4.4	---	1.4	---	1.3	1.1	33	44	1.3
19-16D	1146059	BAJ914	24.70	26.30	1.6	1	waste	SST	8.2	---	2.3	1.5	5.4	7.3	1.0	0.04	1.1	0.04	1.1	1.0	1.1	33	33	122	---	44	3.8	---	1.4	---	1.3	1.1	33	44	1.3
19-16D	1146060	BAJ915	26.30	28.30	2	1	waste	SLST	7.31	---	4.9	0.86	3.1	4.3	3.1	0.09	3.2	0.09	3.2	3.0	3.1	97	96	71	---	40	0.74	---	0.41	---	0.41	3.1	96	40	0.41
19-16D	1146061	BAJ916	28.30	30.20	1.9	2	waste	SST	6.55	---	8.9	0.55	2.0	2.7	2.9	0.09	3.0	0.09	3.0	2.8	2.9	90	92	45	---	21	0.50	---	0.23	---	0.23	2.9	92	21	0.23
19-16D	1146062	BAJ917	30.20	32.20	2	2	waste	SST	7.75	---	4.0	1.2	4.3	5.9	1.7	0.02	1.7	0.02	1.7	1.6	1.7	52	53	98	---	52	1.9	---	1.0	---	0.98	1.7	53	52	0.98
19-16D	1146063	BAJ918	32.20	34.00	1.8	3	waste	SLST	5.7	---	16	0.52	1.9	2.6	2.4	0.16	2.5	0.16	2.5	2.3	2.3	76	72	43	---	20	0.57	---	0.27	---	0.29	2.3	72	20	0.29
19-16D	1146064	BAJ919	34.00	34.45	0.45	3	waste	MDST	3.49	---	44	0.32	1.2	1.6	3.6	0.29	3.3	0.29	3.3	3.3	3.0	113	93	27	---	22	0.24	---	0.20	---	0.24	3.0	93	22	0.24
19-16D	1146069	BAJ920	38.70	40.40	1.7	4	waste	SST	8.33	---	3.2	1.6	6.0	8.1	0.56	<0.01	0.55	0.01	0.55	0.56	0.55	18	17	136	---	123	7.8	---	7.0	---	7.2	0.55	17	123	7.2
19-16D	1146070	BAJ921	40.40	43.20	2.8	4	waste	SLST	7.49	---	3.3	1.4	5.2	7.1	0.85	0.04	0.78	0.04	0.78	0.81	0.74	27	23	119	---	42	4.5	---	1.6	---	1.8	0.74	23	42	1.8
19-16D	1146071	BAJ922	43.20	45.60	2.4	4	waste	SLST	7.5	---	4.1	1.7	6.2	8.5	0.45	0.04	0.43	0.04	0.43	0.41	0.39	14	12	141	---	42	10	---	3.0	---	3.5	0.39	12	42	3.5
19-16D	1146072	BAJ923	45.60	49.20	3.6	5	waste	SLST	6.63	---	5.0	1.1	4.2	5.7	1.5	0.08	1.5	0.08	1.5	1.5	1.4	48	44	95	---	37	2.0	---	0.78	---	0.84	1.4	44	37	0.84
19-16D	1146073	BAJ924	49.20	50.05	0.85	5	waste	SLST	7.15	---	4.3	0.58	2.1	2.9	2.0	0.07	2.0	0.07	2.0	1.9	2.0	63	61	48	---	22	0.77	---	0.34	---	0.35	2.0	61	22	0.35
19-16D	1146079	BAJ925	56.55	58.75	2.2	55	waste	SLST	7.16	---	2.1	0.64	2.3	3.2	0.87	0.02	0.88	0.02	0.88	0.85	0.86	27	27	53	---	22	1.9	---	0.81	---	0.82	0.86	27	22	0.82
19-16D	1146080	BAJ926	58.90	61.00	2.1	6	Coal	C	4.66	---	35	0.36	1.3	2	2.9	0.40	2.8	0.40	2.8	2.5	2.4	90	76	30	---	13	0.33	---	0.14	---	0.17	2.4	76	13	0.17
19-16D	1146081	BAJ927	61.15	61.85	0.7	7	waste	SLST	7.71	---	4.8	1.7	6.4	8.7	1.3	0.02	1.3	0.02	1.3	1.2	1.3	39	39	146	---	62	3.7	---	1.59	---	1.6	1.3	39	62	1.6
19-16D	1146082	BAJ928	62.00	63.90	1.9	7	Coal	C	5.91	---	24	0.52	1.9	2.62	2.3	0.14	2.0	0.14	2.0	2.1	1.9	71	59	44	---	27	0.62	---	0.38	---	0.46	1.9	59	27	0.46
19-16D	1146083	BAJ929	64.05	67.60	3.55	7	waste	SLST	7.52	---	5.9	1.8	6.5	8.8	0.70	0.02	0.61	0.02	0.61	0.68	0.59	22	18	147	---	51	6.7	---	2.3	---	2.7	0.59	18	51	2.7
19-16D	1146084	BAJ930	67.60	70.00	2.4	8	waste	SLST	7.96	---	18	2.0	7.4	10	0.27	0.01	0.13	0.01	0.13	0.26	0.12	8.4	3.8	168	---	36	20	---	4.2	---	9.5	0.12	3.8	36	9.5
19-17D	1146085	BAJ931	8.40	8.70	0.3	1	Coal	C	3.1	---	46	0.49	1.8	2.4	5.1	0.70	4.5	0.70	4.5	4.4	3.8	159	118	40	---	26	0.25	---	0.16	---	0.22	3.8	118	26	0.22
19-17D	1146086	BAJ932	8.85	11.45	2.6	2	waste	MDST	4.85	---	4.5	0.46	1.7	2.3	2.7	0.28	2.7	0.28	2.7	2.4	2.4	85	75	38	---	10	0.45	---	0.12	---	0.14	2.4	75	10	0.14
19-17D	1146087	BAJ933	11.60	12.00	0.4	2	Coal	C	3.16	---	41	0.11	0.41	0.56	2.6	0.41	2.1	0.41	2.1	2.2	1.7	81	53	9	---	-3	0.12	---	-0.04	---	-0.06	1.7	53	-3.0	-0.06
19-17D	1146088	BAJ934	12.15	14.50	2.35	3	waste	MDST	7.07	---	2.7	0.75	2.7	3.7	1.2	0.06	1.3	0.06	1.3	1.1	1.2	37	38	62	---	23	1.7	---	0.62	---	0.60	1.2	38	23	0.60
19-17D	1146089	BAJ935	14.50	17.45	2.95	3	waste	MDST	5.6	---	6.4	0.89	3.3	4.4	1.1	0.06	1.1	0.06	1.1	1.1	0.99	35	31	74	---	19	2.1	---	0.55	---	0.62	0.99	31	19	0.62
19-17D	1146090	BAJ936	19.60	22.00	2.4	4	waste	MDST	8.58	---	3.6	1.9	7.1	9.7	0.30	0.01	0.26	0.01	0.26	0.29	0.25	9.4	7.8	162	---	55	17	---	5.8	---	7.0	0.25	7.8	55	7.0
19-17D	1146091	BAJ937	22.00	25.00	3	4	waste	MDST	8.58	---	3.3	1.8	6.7	9.1	0.33	0.02	0.33	0.02	0.33	0.31	0.31	10	10	153	---	54	15	---	5.3	---	5.6	0.31	10	54	5.6
19-17D	1146092	BAJ938	25.00	26.40	1.4	4	waste	MDST	6.61	---	8.5	0.81	3.0	4.0	0.64	0.08	0.59	0.08	0.59	0.56	0.51	20	16	67	---	29	3.4	---	1.4	---	1.8	0.51	16	29	1.8
19-17D	1146093	BAJ939	26.40	29.50	3.1	5	waste	MDST	7.49	---	4.4	1.6	5.9	8.0	1.3	0.10	1.3	0.10	1.3	1.2	1.2	39	37	134	---	54	3.4	---	1.4	---	1.5	1.2	37	54	1.5
19-17D	1146095	BAJ940	29.50	31.05	1.55	5	waste	MDST	7.37	---	3.8	0.73	2.7	3.7	1.3	0.07	1.2	0.07	1.2	1.2	1.2	39	37	61	---	34	1.5	---	0.87	---	0.94	1.2	37	34	0.94
19-17D	1146098	BAJ941	37.05	38.80	1.75	6	waste	MDST	7.56	---	3.6	1.4	5.3	7.2	0.76	0.08	0.72	0.08	0.72	0.68	0.64	24	20	121	---	55	5.1	---	2.3	---	2.8	0.64	20	55	2.8
19-17D	1146099	BAJ942	38.80	41.50	2.7		waste		6.93	---	9.2	1.0	3.8	5.2	0.72	0.12	0.67	0.12	0.67	0.60	0.55	23	17	87	---	38	3.9	---	1.7	---	2.2	0.55	17	38	2.2
19-17D	1146100	BAJ943	41.50	42.75	1.25	6	waste	SLST	7.99	---	2.1	0.44	1.6	2.2	0.13	0.02	0.090	0.02	0.09	0.11	0.07	4.1	2.2	37	---	17	9.1	---	4.2	---	7.8	0.070	2.2	17	7.8
19-17D	1146401	BAJ944	42.75	45.75	3	6	waste	SLST	8.94	---	4.9	3.1	11	15	0.060	<0.01	0.040	0.01	0.04	0.06	0.04	1.9	1.1	258	---	137	137	---	73	---	125	0.035	1.1	137	125
19-17D	1146402	BAJ945	45.75	47.50	1.75	7	waste	MDST	7.72	---	5.6	0.95	3.5	4.8	0.86	0.15	0.83	0.15	0.83	0.71	0.68	27	21	79	---	79	3.0	---	2.9	---	3.7	0.68	21	79	3.7
19-17D	1146403	BAJ946	47.50	48.70	1.2	7	waste	MDST	4.45	---	9.3	0.57	2.1	2.8	2.2	<0.01	2.1	0.01	2.1	2.2	2.1	68	66	47	---	16	0.70	---	0.23	---	0.24	2.1	66	16	0.24
19-17D	1146404	BAJ947	48.70	50.50	1.8	7	waste	MDST	5.54	---	14	0.42	1.5	2.1	2.6	0.06	2.5	0.06	2.5	2.6	2.4	82	76	35	---	14	0.43	---	0.18	---	0.19	2.4	76	14	0.19
19-17D	1146405	BAJ948	50.50	53.50	3	7	waste	MDST	7.13	---	4.3	0.65	2.4	3.2	0.86	0.12	0.86	0.12	0.86	0.74	0.74	27	23	54	---	19	2.0	---	0.71	---	0.83	0.74	23	19	0.83
19-17D	1146406	BAJ949	53.50	54.95	1.45	7	waste	SLST	8.96	---	3.4	1.9	7.0	9.5	0.080	0.11	0.05	0.11	0.05	-0.03	-0.06	2.5	-1.9	159	---	49	64	---	20	---	-26	-0.06	-2	49	-26
19-17D	1146407	BAJ950	55.10	55.60	0.5	7	Coal	C	4.17	---	50	0.14	0.50	0.68	1.0	<0.01	0.67	0.01	0.67	1.02	0.67	32	21	11	---	13	0.36	---	0.40	---	0.61	0.67	21	13	0.61
19-17D	1146408	BAJ951	55.75	56.75	1	8	waste	MDST	8.26	---	3.1	1.5	5.6	7.6	0.08	0.03	0.05	0.03	0.05	0.05	0.02	2.5	0.6	127	---	27	51	---	11	---	42.4	0.020	0.6	27	42
19-17D	1146409	BAJ952	56.75	58.25	1.5	8	waste	MDST	7.38	---	8.1	0.59	2.2	2.9	0.17	0.07	0.11	0.07	0.11	0.10	0.04	5.3	1.3	49	---	13	9.2	---	2.4	---	10.4	0.040	1.3	13	10
19-17D	1146410	BAJ953	58.25	59.20	0.95	8	waste	MDST	7.63	---	7.9	0.47	1.7	2.4	0.15	0.01	0.09	0.01	0.09	0.14	0.08	4.7	2.5	39	---	5	8.4	---	1.07	---	2.0	0.080	2.5	5.0	2.0
19-18D	1146416	BAJ954	10.00	13.00	3	4	waste	MDST	7.59	---	2.8	1.1	4.1	5.5	0.68	0.03	0.71	0.03	0.71	0.65	0.68	21	21	92	---	52	4.3	---	2.4	---	2.4	0.68	21	52	2.4
19-18D	1146417	BAJ955	13.00	15.20	2.2	4	waste	MDST	7.44	---	3.2	1.5	5.6	7.6	0.30	0.03	0.29	0.03	0.29	0.27	0.26	9.4	8.1	127	---	44	14	---	4.7	---	5.5	0.26	8.1	44	5.5
19-18D	1146418	BAJ956	15.20	17.75	2.55	5	waste	MDST	6.59	---	6.8	0.78	2.9	3.9	1.5	0.12	1.5	0.12	1.5	1.4	1.4	48	42	65	---	40	1.4	---	0.83	---	0.94	1.4	42	40	0.94
19-18D	1146421	BAJ957	19.85	20.15	0.3	55	waste	SLST	7.78	---	4.9	0.57	2.1	2.8	0.12	0.01	0.06	0.01	0.06	0.11	0.05	3.8	1.6	48	---	37	13	---	9.7	---	23	0.050	1.6	37	23
19-18D	1146422	BAJ958	23.55	23.50	0.05	6	waste	MDST	7.08	---	12	0.46	1.7	2.3	0.29	0.04	0.19	0.04	0.19	0.25	0.15	9.1	4.7	38	---	25	4.2	---	2.7	---	5.3	0.15	4.7	25	5.3
19-18D	1146423	BAJ959	23.50	25.80	2.3	6	waste	MDST	6.77	---	13	1.2	4.3	5.9	1.6	0.09	1.6	0.09	1.59	1.54	1.50	51	47	99	---	73	1.9	---	1.4	---	1.6	1.5	47	73	1.6
19-18D	1146424	BAJ960	25.80	28.70	2.9	6	waste	MDST	7.34	---	3.8	1.2	4.4	6.0	0.33	0.03	0.29	0.03	0.29	0.30	0.26	10	8.1	99	---	40	10	---	3.8	---	4.9	0.26	8.1	40	4.9
19-18D	1146425	BAJ961	28.70	31.30	2.6	6	waste	SST	8.35	---	3.8	2.3	8.4	11.5	0.06	0.01	0.04	0.01	0.04	0.05	0.03	1.9	0.9	191	---	102	102	---	54	---	109	0.030	0.94	102	109
19-18D	1146426	BAJ962	31.30	33.30	2	6	waste	MDST	8.15	---	4.9	1.8	6.5	8.8	0.22	0.01	0.19	0.01	0.19	0.21	0.18	6.9	5.6	147	---	68	21	---	9.8	---	12	0.18	5.6	68	12
19-18D	1146427	BAJ963	33.30	35.50	2.2	6	waste	MDST	7.57	---	4.6	1.3	4.8	6.5	0.48	0.03	0.47	0.03	0.47	0.45	0.44	15	14	108	---	39	7.2	---	2.6	---	2.9	0.44	14	39	2.9

Appendix D – Mine Rock Elemental Analysis Results

Mine Rock Samples: Elemental Analysis Results

Hole-ID	Sample ID	Maxxam Sample ID	Sample Depth (m)		ABA Zone	Sample Type	Lithology	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
			From	To				%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
T18-01D	T18-01D-A-001	TD3950	12.38	13.6	2	waste	MDST	0.48	12.3	1.5	<20	158	0.37	0.76	0.71	23.9	18.2	45.7	3.39	1.3	0.27	0.14	1.4	0.6	403	1.14	0.051	52.7	0.016	89.8	2.15	0.38	11.1	<0.1	74.5	0.12	1.5	<0.001	0.08	0.3	24	<0.05	166
T18-01D	T18-01D-A-002	TD3951	13.6	14	2	coal	C	0.07	6.9	0.5	<20	36.5	0.13	2.23	0.38	14.4	5.6	16.6	2.97	1.5	0.18	0.02	<0.5	1	168	0.5	0.014	19.6	0.001	42.9	3.12	0.86	6	0.2	204	0.12	0.2	0.006	0.02	0.2	66	<0.05	44.3
T18-01D	T18-01D-A-003	TD3952	14	15.8	3	waste	MDST	0.58	5.3	0.3	<20	285	0.21	0.26	0.13	11.5	20.4	30.7	3.45	1.4	0.07	0.17	1.4	0.5	278	0.57	0.111	23.2	0.012	22	1.11	0.06	10.5	<0.1	59.9	0.09	0.8	<0.001	0.03	0.4	25	<0.05	89
T18-01D	T18-01D-A-004	TD3953	15.8	17.2	3	waste	MDST	0.54	11.7	0.5	<20	268	0.19	0.87	0.08	17.3	24.4	32.8	6.53	1.5	0.078	0.15	2.7	0.95	941	0.91	0.101	38.9	0.017	14.7	1.24	0.03	12.7	0.2	89.2	0.07	0.9	<0.001	0.03	0.3	36	<0.05	107
T18-01D	T18-01D-A-005	TD3954	17.2	18.7	3	waste	MDST	0.51	13.1	<0.2	<20	299	0.2	0.91	0.09	20	18.7	35.9	5.25	1.4	0.064	0.14	1.9	0.8	1700	1.36	0.093	37.4	0.027	15.5	0.87	0.07	11.8	0.1	94.1	0.13	0.6	<0.001	0.03	0.4	34	<0.05	111
T18-01D	T18-01D-A-006	TD3955	18.7	19	3	coal	C	0.54	9	1.1	<20	324	0.23	0.81	0.09	19.7	11.7	45.2	2.87	1.3	0.017	0.15	2.7	0.45	3110	0.48	0.129	28	0.021	14	0.2	0.05	14.2	0.2	88.3	0.08	1.5	<0.001	0.03	0.2	31	<0.05	98.8
T18-01D	T18-01D-A-007	TD3956	19	21.31	3	waste	MDST	0.67	8	2	<20	287	0.19	1.38	0.06	35.7	15.8	40.6	9.1	1.7	0.031	0.16	3.3	0.85	2900	1.51	0.118	51.8	0.053	15.2	0.57	0.06	20.6	0.4	112	0.05	1.3	<0.001	0.02	0.3	62	<0.05	130
T18-01D	T18-01D-A-008	TD3957	22.89	27.7	4	waste	MDST	0.7	10.2	0.5	<20	274	0.16	2.61	0.04	20.3	17.7	33.8	6.73	1.6	0.034	0.15	2.8	0.97	2130	0.61	0.109	36.9	0.042	11.3	0.64	0.04	14.6	0.2	122	0.02	2	<0.001	0.03	0.3	49	<0.05	95.8
T18-01D	T18-01D-A-009	TD3958	27.7	30	4	waste	MDST	0.55	19	0.3	<20	220	0.18	1.12	0.09	36.6	15.9	35	7.3	1.6	0.111	0.13	2	0.89	1290	3.23	0.103	64	0.036	20.5	1.28	0.11	14.9	0.6	95.6	0.03	0.7	<0.001	0.06	0.4	51	<0.05	109
T18-01D	T18-01D-A-010	TD3959	30	33.7	5	waste	SLST	0.53	11.9	1.5	<20	200	0.21	0.84	0.06	23.4	18	33.3	2.2	1.5	0.059	0.14	1.3	0.45	395	1.29	0.082	45.2	0.016	14.4	0.61	0.04	11.2	0.2	80.9	0.07	1.1	<0.001	0.03	0.3	30	<0.05	117
T18-01D	T18-01D-A-011	TD3961	33.7	36.39	5	waste	SLST	0.5	13.5	0.2	<20	177	0.2	0.7	0.04	18.8	17.8	33.4	1.89	1.6	0.075	0.14	1.1	0.37	499	0.91	0.067	31.5	0.016	11.1	0.75	0.04	10.9	0.1	73.4	0.05	0.7	<0.001	0.03	0.4	28	<0.05	112
T18-01D	T18-01D-A-012	TD3962	38.52	40.71	6	waste	FLT	0.4	22.7	0.7	<20	98.9	0.22	3.66	0.12	20.3	19.3	42.6	5.73	1.3	0.247	0.12	2.4	0.69	275	7.09	0.04	54.1	0.012	15.5	4.45	0.23	10.4	0.5	140	0.13	0.8	<0.001	0.2	0.3	32	<0.05	104
T18-01D	T18-01D-A-013	TD3963	40.71	43.93	6	waste	MDST	0.49	8.3	<0.2	<20	198	0.18	2.69	0.06	18	13.4	34.7	4.9	1.3	0.067	0.12	1.9	0.72	735	0.39	0.059	24.5	0.038	12.2	0.96	0.04	12.2	0.2	118	0.05	0.6	<0.001	0.04	0.3	29	<0.05	93.8
T18-01D	T18-01D-A-014	TD3964	43.93	44.75	6	waste	MDST	0.53	2.2	<0.2	<20	148	0.1	1.33	0.14	9.8	18.2	29.3	14.2	1.3	0.024	0.09	2.9	1.23	3160	1.23	0.06	13.4	0.062	17.9	0.23	0.05	10.6	0.2	88	<0.02	0.6	<0.001	0.1	0.3	42	<0.05	90.1
T18-01D	T18-01D-A-015	TD3965	44.75	47.2	7	waste	MDST	1.82	2.5	<0.2	<20	440	0.08	2.38	0.28	32	31.4	64.8	8.15	4.2	0.026	0.08	14.1	0.59	1250	1.85	0.068	36.7	0.76	12.3	0.04	0.15	16.8	0.2	470	0.04	1.2	0.006	0.05	0.5	79	<0.05	137
T18-02D	T18-02D-A-001	TD3978	8.35	12.03	1	waste	MDST	0.47	11.1	0.5	<20	131	0.21	1.09	0.1	20.2	22.4	47.8	3.52	1.4	0.088	0.15	2.9	0.8	645	0.66	0.096	54.3	0.051	13.2	0.2	0.1	10	0.2	72.9	0.1	4	<0.001	0.05	0.4	30	<0.05	110
T18-02D	T18-02D-A-002	TD3979	12.03	15.3	1	waste	MDST	0.51	11.8	<0.2	<20	162	0.24	1.05	0.09	24.8	26.1	53.5	3.82	1.4	0.071	0.17	2.7	0.82	849	0.9	0.197	74.7	0.046	14.4	0.17	0.09	10.6	0.1	71	0.07	4.1	<0.001	<0.02	0.4	35	<0.05	113
T18-02D	T18-02D-A-003	TD3980	15.3	18.58	1	waste	MDST	0.55	10.6	0.4	<20	164	0.2	2.53	0.08	19.4	28.1	44.6	4.29	1.4	0.041	0.16	3.8	1.21	963	0.57	0.194	58.3	0.082	12.9	0.16	0.09	10.9	<0.1	132	0.07	3.9	<0.001	<0.02	0.4	36	<0.05	104
T18-02D	T18-02D-A-004	TD3981	18.58	21.3	1	waste	MDST	0.57	14	0.2	<20	165	0.22	2.76	0.1	19.5	28.9	49.4	4.24	1.7	0.052	0.16	4.8	1.3	869	0.68	0.205	58.2	0.081	13.4	0.22	0.09	11.2	0.1	162	0.06	4.3	<0.001	0.02	0.5	39	<0.05	108
T18-02D	T18-02D-A-005	TD3983	21.3	24.3	1	waste	MDST	0.52	12.7	0.6	<20	167	0.29	0.84	0.09	31.5	25.6	58.4	4.4	1.4	0.081	0.16	2.4	0.96	626	1.84	0.226	92.6	0.039	17.1	0.37	0.12	12.6	0.3	77.5	0.11	4	<0.001	0.04	0.4	45	<0.05	137
T18-02D	T18-02D-A-006	TD3984	24.3	27.3	1	waste	MDST	0.5	10.1	0.8	<20	191	0.14	0.91	0.1	12	15.1	33	5.07	1	0.053	0.16	1.4	1	440	0.18	0.324	23.5	0.017	6.87	0.49	0.03	13.8	0.3	85.8	0.08	1.2	<0.001	0.02	0.4	33	<0.05	98.9
T18-02D	T18-02D-A-007	TD3985	27.3	28.8	1	waste	MDST	0.54	18.5	1.2	<20	213	0.12	0.81	0.08	14.9	10.9	36.2	3.52	1.2	0.091	0.15	0.8	0.59	194	0.4	0.34	22.6	0.019	12.3	1.16	0.04	14.3	0.6	89	0.05	0.6	<0.001	0.04	0.3	31	<0.05	96
T18-02D	T18-02D-A-008	TD3986	28.8	30.3	1	waste	MDST	0.66	14.9	0.3	<20	216	0.14	1.04	0.06	11.3	12	36.6	2.99	1.6	0.049	0.18	0.5	0.6	177	0.26	0.359	15.2	0.008	9	1.12	0.02	13.2	0.4	98.7	0.08	0.7	<0.001	0.05	0.2	27	<0.05	92.3
T18-02D	T18-02D-A-009	TD3987	30.3	32.88	1	waste	MDST	0.49	21.3	0.5	<20	184	0.09	0.98	0.14	11.8	17.8	23.7	4.86	1	0.201	0.18	1.3	0.84	291	1.55	0.325	30.8	0.025	9.53	1.32	0.06	12.5	0.3	118	0.03	0.4	<0.001	0.13	0.4	30	<0.05	91.9
T18-02D	T18-02D-A-010	TD3988	32.88	33.94	1	waste	MDST	0.52	16	<0.2	<20	153	0.08	0.96	0.07	15.4	30.9	18.6	5.9	1.3	0.05	0.19	1.3	0.98	383	0.82	0.272	21.6	0.004	7.88	1.04	0.03	11.8	0.4	86.1	<0.02	0.4	<0.001	0.05	0.2	32	<0.05	84.3
T18-02D	T18-02D-A-011	TD3989	33.94	36.86	1	waste	MDST	0.43	14.1	0.5	<20	107	0.12	0.96	0.16	25.5	24.4	26.4	4.51	1.3	0.159	0.13	0.8	0.7	584	1.49	0.203	37.3	0.003	14.5	2.29	0.07	11.2	0.3	78.6	0.04	0.3	<0.001	0.08	0.2	31	<0.05	127
T18-02D	T18-02D-A-012	TD3990	36.86	39.3	2	waste	SLST	0.43	12.4	<0.2	<20	119	0.22	0.24	0.03	19.5	17.7	39.3	3.5	1.2	0.144	0.14	0.6	0.55	317	1.69	0.202	41.9	0.002	13.5	2.13	0.06	10.4	0.3	43.8	0.08	0.4	<0.001	0.05	0.4	24	<0.05	102
T18-02D	T18-02D-A-013	TD3991	39.3	41.75	2	waste	SLST	0.32	5.3	<0.2	<20	103	0.22	0.27	0.14	15.2	12.6	36.4	2.25	1	0.121	0.11	0.7	0.35	144	1.12	0.159	31	0.003	16.6	1.63	0.07	7.8	<0.1	53.7	0.1	0.4	<0.001	0.03	0.3	23	<0.05	84.3
T18-02D	T18-02D-A-014	TD3992	41.75	45.18	3	waste	MDST	0.46	8.3	<0.2	<20	142	0.16	1.46	0.05	17.3	19.8	29.1	5	1.1	0.048	0.14	2.1	1.04	1020	0.41	0.212	35.9	0.015	11.8	0.43	0.04	10.9	<0.1	83.9	0.04	0.8	<0.001	0.02	0.2	31	<0.05	91.7
T18-02D	T18-02D-A-015	TD3994	45.18	48.3	3	waste	MDST	0.44	12.2	0.3	<20	133	0.17	0.99	0.05	21.7	22.6	32.1	3.07	1.2	0.061	0.14	1.3	0.66	1190	0.43	0.2	39.6	0.005	11.3	0.61	0.05	11	0.2	79.9	0.09	0.5	<0.001	<0.02	0.2	35	<0.05	111
T18-02D	T18-02D-A-016	TD3995	48.3	48.76	3	waste	MDST	0.56	27.8	1.1	<20	110	0.27	0.49	0.1	24.8	17.9	33	3.71	1.5	0.257	0.15	2.2	0.31	392	1.44	0.168	66	0.07	19.2	3.35	0.09	9.5	0.3	74.5	0.11	0.9	<0.001	0.05	0.5	29	<0.05	93.3
T18-02D	T18-02D-A-017	TD3996	50.44	50.5	4	waste	MDST	0.46	0.4	1.3	<20	154	0.17	0.53	0.03	0.9	8.7	38.9	0.48	0.9	<0.005	0.13	<0.5	0.2	128	0.08	0.23	2.6	0.006	5.42	0.32	<0.02	6.8	<0.1	46.9	0.11	0.2	<0.001	<0.02	0.1	18	<0.05	19
T18-02D	T18-02D-A-018	TD3997	50.5	52.8	4	waste	MDST	0.51	12.6	1.4	<20	166	0.17	1.15	0.05	20.1	14.8	35.7	6.28	1.1	0.037	0.14	2.4	0.79	2230	0.59	0.223	26.7	0.023	8.53	0.41	0.04	16	0.1	96.4	0.08	0.5	<0.001	<0.02	0.2	59	<0.05	85.9
T18-02D	T18-02D-A-019	TD3998	52.8	54.3	4	waste	MDST	0.49	8.7	1.2	<20	171	0.13	2.85	0.05	19.2	17.3	27	6.68	1.2	0.042	0.13	2.6	1.28	1740	0.68	0.189	36.4	0.029	10.3	0.66	0.05	14	<0.1	180	0.08	0.7	<0.001	0.02	0.2	52	<0.05	88.3
T18-02D	T18-02D-A-020	TD3999	54.3	58.08	4	waste	MDST	0.47	12.7	0.8	<20	146	0.16	1.82	0.06	17.7	13.3	32.9	2.54	1.2	0.181	0.14	0.7	0.49	401	1.13	0.188	36.9	0.004	12.8	1.63	0.07	10.4	0.3	164	0.07	0.4	<0.001	0.09	0.2	29	<0.05	95.9
T18-02D	T18-02D-A-021	TD4000	58.08	60.3	5	waste	SLST	0.39	9.9	0.5	<20	199	0.15	5.78	0.04	14.7	22.8	18.7	6.88	1	0.063	0.12	1.9	1.82	1470	0.44	0.1	30.8	0.016	9.36	0.99	0.06	9.5	<0.1	180	0.08	0.8	<0.001	0.03	0.3	46	<0.05	82.8
T18-02D	T18-02D-A-022	TD4001	60.3	63.3	5	waste	SLST	0.45	10.8	1.8	<20	154	0.23	0.75	0.05	20.6	14.3	34.6	1.62	1.4	0.035	0.15	0.7	0.31	211	1.09	0.119	40.9	0.003	12.4	0.57	0.06	10.2	0.2	65	0.07	0.5	<0.001	0.02	0.3	25	<0.05	121
T18-02D	T18-02D-A-023	TD4002	63.3	66.3	5	waste	SLST	0.39	9.9	0.5	<20	132	0.17	1.34	0.02	15.7	18.2	24.8	7.12	1.1	0.043	0.12	2	1.11	1460	1	0.09	31.6	0.019	10.5	0.38	0.06	11.5	0.3	84.4	0.09	0.6	<0.001	0.02	0.3	46	<0.05	93.4
T18-02D	T18-02D-A-024	TD4003	66.3	67.8	5	waste	SLST	0.38	10.6	1.1	<20	104	0.21	0.5	0.09	16.3	12.3	34	2.3	1.1	0.090	0.12	0.6	0.36	231	1.6	0.071	31.9	0.002	10.6	1.49	0.05	11.7	0.2	49.2	0.12	0.4	<0.001	0.02	0.4	27	<0.05	112
T18-02D	T18-02D-A-025	TD4005	67.8	68.56	5	waste	SLST	0.43	12.5	0.3	<20	94.7	0.19	0.36	0.07	19.2	17.7	28.8	2.65	1.3	0.17	0.12	0.5	0.25	232	0.86	0.054	40.5	0.002	12.2	2.18	0.05	9.8	0.2	38	0.02	0.4	<0.001	0.03	0.3	24	<0.05	115
T18-02D	T18-02D-A-026	TD4006	75.62	78.3	6	waste	SLST	0.48	13.2	1.4	<20	158	0.27	1	0.05	20.2	18.9	52.1	2.93	1.4	0.076	0.14	1.7	0.67	270	1.83	0.043	54.2	0.007	11.9	0.77	0.08	11.5	0.2	92.3	0.09	0.9	<0.001	0.03	0.5	35	<0.05	114
T18-02D	T18-02D-A-027	TD4007	78.3	79.35	6	waste	SLST	0.45	14.1	0.9	<20	130	0.28	0.52	0.09	21.8	16.2	53.4	3.26	1.2	0.16	0.14	1	0.49	198	1.51	0.043	76.4	0.002	16.9	2.31	0.1	10.4	0.2	61	0.11	0.6	<0.001	0.05	0.4	30	<0.05	111
T18-02D	T18-02D-A-028	TD4008	79.35	79.54	6	waste	MDST	0.44	1.6	<0.2	<20	99	0.22	4.82	0.11	2.1	2.8	10	2.09	1.2	0.017	0.04	8.6	1.66	155	1	0.032	1.8	0.002	13.1	0.16	0.04	5.6	<0.1	242	0.05	1.6	<0.001	0.04	1.1	4	<0.05	55.6
T18-02D	T18-02D-A-029	TD4009	79.54	80.72	6	waste	MDST	0.4	19.3	0.5	<20	116	0.16	1.13	0.09	18	12.2	32.9	3.15	1.2	0.11	0.12	1.3	0.5	268	0.85	0.045	26	0.002	11.5	1.85	0.07	13	0.3	79.4	0.06	0.3	<0.001	0.06	0.2	29	<0.05	114
T18-02D	T18-02D-A-030	TD4010	80.72	84.3	7	waste	MDST	0.45	7.5	<0.2	<20	135	0.15	0.65	0.05	14.5	10.2	29.9	1.63	1.4	0.047	0.12	0.7	0.34	84	1.38	0.056	17	0.001	9.96	0.73	0.06	12.7	0.1	84	0.06	0.3	<0.001	0.02	0.3	24	<0.05	111
T18-02D	T18-02D-A-031	TD4011	84.3	84.53	7	waste	MDST	0.41	5.1	<0.2	<20	109	0.15	1.51	0.06	13.8	11.3	27.5	3.19	1.2	0.10	0.11	1.3	0.67	132	1.01	0.052	22.8	<0.001	10.5	1.76	0.07	11.7	0.1	117	0.1	0.4	<0.001	0.04	0.2	30	<0.05	75.8
T18-02D	T18-02D-A-032	TD4012	84.53	86.64	7	waste	MDST	0.46	8.1	0.8	<20	119	0.2	0.69	0.03	15.5	12	38.2	2.75	1.3	0.069	0.13	0.9	0.47	134	0.53	0.062	28.2	0.001	10.9	1.13	0.03	14.3	0.3	77.6	0.06	0.3	<0.001	0.04	0.2	29	<0.05	114
T18-02D	T18-02D-A-033	TD4013	86.64	87.48	7	waste	MDST	0.44	21.9	0.4	<20	118	0.16	1.17	0.05	16	15.7	30	10.1	1.3	0.25	0.12	3	1.17	649	1.53	0.058	27.9	0.005	9.63	1.99	0.09	12.3	0.2	85.5	0.07	0.7	<0.001	0.11	0.3	41	<0.05	69.6
T18-02D	T18-02D-A-034	TD4014	87.48	89	7	waste	MDST	0.36	22.2	<0.2	<20	73	0.19	0.42	0.53	13	7.4	51.9	1.6	1.1	0.12	0.08	0.7	0.2	81	1.6	0.065	20.5	0.001	29.6	1.56	0.2	8.6	0.2	50.1	0.07	0.7	<0.001	0.05	0.7	27	<0.05	115
T18-02D	T18-02D-A-035	TD4016	89	90.3	8	waste	MDST	0.6	3.2	<0.2	<20	79.5	0.14	0.49	0.38	18.3	8.2	63.6	0.96	1.8	0.02	0.08	1	0.17	251	0.28	0.082	20.1	0.004	12.5	0.04	0.06	9.3	<0.1	62.5	0.1	0.2	<0.001	0.03	0.2	34	<0.05	142
T18-02D	T18-02D-A-036	TD4017	90.3	90.93	8	waste	MDST	0.49	12.8	<0.2	<20	78.4	0.25	0.42	0.08	22.9	9.8	39.7	1.06	1.6	0.032	0.1	0.7	0.23	343	0.24	0.078	33.6	0.002	13.1	0.08	0.06	10.5	0.1	50.5	0.03	0.4	<0.001	<0.02	0.2	31	<0.05	94.4
T18-02D	T18-02D-A-037	TD4018	90.93	92.52	8	waste	MDST	0.49	2	0.2	<20	78.8	0.15	0.48	0.49	17.1	6.7	52.3	1.46	1.5	0.043	0.08	0.7	0.18	549	0.28	0.084	12.5	0.002	13.3	0.04	0.07	9.2	<0.1	50.1	0.02	0.2	<0.001	<0.02	0.2	40	<0.05	157
T18-03D	T18-03D-A-005	TD4051	10.5	10.8	5	waste	MDST	0.47	13.8	<0.2	<20	121	0.23	0.76	0.07	22.2	27.7	36.3	3.06	1.4	0.20	0.12	0.8	0.48	290	0.6	0.036	46.9	0.006	15.7	2.02	0.08	13.4	0.3	65.1	0.06	0.7	<0.001	0.2	0.3	53	<0.05	137
T18-03D	T18-03D-A-006	TD4052	12.57	12.82	55	waste	MDST	0.36	1.3	<0.2	<20	99.8	0.21	0.21	1.32	10	7.6	64.6	0.43	0.8	0.022	0.08	0.5	0.14	52	0.31	0.037	9.8	<0.001	30.6	0.19	0.1	8.5	<0.1	42.5	0.12	0.6	<0.001	0.06	0.3	30	<0.05	197
T18-03D	T18-03D-A-007	TD4053	12.82	13.44	55	waste	MDST	0.54	0.6	<0.2	<20	127	0.16	0.9	0.62	16.5	23.6	58.8	1.09	1.4	0.026	0.1	2.3	0.39	131	0.96	0.044	21.5	0.001	29.7	0.05	0.05	13.7	0.3	88.4	0.04	0.9	<0.001	0.03	0.2	50	<0.05	189
T18-03D	T18-03D-A-008	TD4054	13.44	14.9	55	waste	MDST	0.41	2	<0.2	<20	98.1	0.26	0.49	0.15	9.4	13.8	28.3	0.78	1.2	0.054	0.1	0.9	0.29	41	0.2	0.034	13.6	0.001	12.1	0.12	0.05	8.9	0.2	57.4	0.03	0.6	<0.001	<0.02	0.2	35	<0.05	89
T18-03D	T18-03D-A-009	TD4055	17.5	18.6	6	waste	MDST	0.51	18.8	1.5	<20	155	0.31	0.85	0.08	24.7	29.7	56.1	2.38	1.5	0.31	0.15	1.3	0.5	94	2.63	0.059	94.9	0.004	18.1	1.18	0.15	13.2	0.4	76.1	0.04	0.9	<0.001	0.17	0.4	48	<0.05	126
T18-03D	T18-03D-A-010	TD4056	18.6	19.4	6	coal	C	0.53	0.5	0.8	<20	90.2	0.3	0.36	0.12	1.6	2.1	11.7	0.33	1.3	0.039	0.03	2.2	0.13	16	1.18	0.058	2.6	0.001	26.8	0.14	0.05	2.9	0.1	41.9	<0.02	1.9	<0.001	0.06	0.8	3	<0.05	38.7
T18-03D	T18-03D-A-011	TD4058	19.4	19.6	6	coal	C	0.3	3.1	<0.2	<20	100	0.12	0.69	0.11	12.6	5.2	37.9	0.62	1	0.061	0.06	<0.5	0.29	58	1.09	0.078	9.4	<0.001	14	0.42	0.22	10.9	<0.1	58.1	0.09	0.3	0.001	0.05	0.2	25	<0.05	58.5
T18-03D	T18-03D-A-012	TD4059	19.6	20.5	6	waste	MDST	0.45	2.9	<0.2	<20	162	0.15	0.36	0.12	17.4	12.1	57.7	0.82	1.2	0.028	0.11	0.6	0.22	162	0.32	0.13	21.9	<0.001	25.3	0.08	0.07	14.5	<0.1	87.2	0.1	0.4	<0.001	0.03	0.2	37	<0.05	136
T18-03D	T18-03D-A-013	TD4060	20.5	22.25	6	waste	MDST	0.49	2.3	<0.2	<20	177	0.12	0.89	0.22	19.1	21.9	40.9	2.79	1.3	0.023	0.12	1.2	0.45	845	0.36	0.125	20.2	0.01	13.8	0.06	0.03	13.7	<0.1	111	0.03	0.8	<0.001	<0.02	0.2	53	<0.05	141
T18-03D	T18-03D-A-014	TD4061	22.25	23.16	6	waste	MDST	0.56	1.8	<0.2	<20	152	0.07	1.7	0.1	18	24.2	23.5	13	1.4	0.008	0.1	3.6	0.88	4230	0.33	0.108	13.9	0.132	10.7	0.03	0.03	12.9	<0.1	115	0.05	0.8	0.001	<0.02	0.3	74	<0.05	103
T18-03D	T18-03D-A-015	TD4062	23.16	23.56	6	waste	MDST	0.49	3.7	0.2	<20	170	0.13	1.29	0.19	21.2	25.7	33.3	4.55	1.2	0.025	0.1	2.2	0.53	4270	0.4	0.127	15.2	0.045	13.8	0.06	0.06	11.7	<0.1	112	<0.02	0.8	<0.001	0.02	0.4	63	<0.05	130
T18-03D	T18-03D-A-016	TD4063	23.56	25	6	waste	MDST	0.72	4.1	1.9	<20	188	0.12	3.14	0.16	24	28	26	6.98	1.6	0.027	0.13	3.2	0.97	2970	0.59	0.129	22	0.201	14.2	0.06	0.07	10.1	<0.1	174	0.04	0.8	0.002	0.03	0.3	53	<0.05	134
T18-03D	T18-03D-A-017	TD4064	25	26.12	6	waste	MDST	0.4	2.2	1.1	<20	148	0.12	1.93	0.11	12.9	38.5	20.7	4.32	0.9	0.023	0.11	2.6	0.8	1480	0.2	0.11	12.7	0.021	14.1	0.06	0.05	11	<0.1	142	0.05	0.7	<0.001	0.02	0.3	48	<0.05	118
T18-03D	T18-03D-A-018	TD4065	26.12	28	6	waste	MDST	0.53	11.1	1.1	<20	256	0.17	0.62	0.08	22	19.8	35.1	2.11	1.4	0.057	0.15	1	0.38	441	0.36	0.204	24.5	0.011	13	0.49	0.04	12.5	0.1	123	0.08	0.6	<0.001	0.04	0.2	40	<0.05	118
T18-03D	T18-03D-A-019	TD4066	28	29.06	6	waste	MDST	0.49	9.6	1.7	<20	187	0.08	1.87	0.06	16	34.9	22.7	4.71	1	0.053	0.12	3.2	0.74	1070	0.31	0.158	18.9	0.04	13.7	0.53	0.04	10	<0.1	171	0.07	1.1	<0.001	0.09	0.4	50	<0.05	101
T18-03D	T18-03D-A-020	TD4067	29.06	30	6	waste	MDST	0.5	6.1	<0.2	<20	256	0.15	0.6	0.11	18.2	16.1	36.4	2.91	1.2	0.049	0.15	1.2	0.47	864	0.39	0.22	19.1	0.013	10.6	0.3	<0.02	12.9	0.2	119	0.04	0.5	<0.001	0.02	0.2	40	<0.05	103
T18-03D	T18-03D-A-021	TD4069	30	32.25	6	waste	MDST	0.47	6.5	0.5	<20	273	0.26	0.27	0.29	16.4	10.8	42	2.18	1.1	0.043	0.16	1.1	0.36	774	0.43	0.223	20	0.006	13.9	0.36	0.03	12.6	0.6	110	0.16	0.6	<0.001	0.05	0.3	32	<0.05	134
T18-03D	T18-03D-A-022	TD4070	32.25	32.65	6	8	SHC	0.36	7.7	1.3	<20	153	0.21	0.24	0.6	18.1	8.2	69.5	1.53	1.7	0.13	0.11	<0.5	0.2	115	2.02	0.136	25.9	<0.001	32.8	1.5	0.16	10.8	0.4	79.4	0.08	0.3	0.001	0.08	0.2	68	<0.05	123
T18-03D	T18-03D-A-023	TD4071	32.65	32.9	7	waste	MDST	0.42	215	0.8	<20	74.8	0.09	0.75	0.39	32.8	43.8	41.9	6.32	1.3	0.081	0.11	1.9	0.75	507	18.6	0.098	50.6	0.006	54	5.13	0.48	11.7	0.9	115	0.05	0.4	<0.001	0.34	0.2	40	<0.05	178
T18-03D	T18-03D-A-024	TD4072	32.9	34.53	7	waste	MDST	0.39	3.9	0.4	<20	153	0.17	0.26	0.66	17	12.8	61.5	1.31	1.2	0.058	0.11	<0.5	0.29	252	0.98	0.136	25.4	0.001	34.4	0.64	0.1	10.1	0.5	77.6	0.06	0.3	<0.001	0.06	0.3	59	<0.05	168
T18-03D	T18-03D-A-025	TD4073	34.53	35.5	7	waste	MDST	0.43	3.9	0.7	<20	146	0.13	1.1	0.32	17.3	21.1	43.9	13.2	1.1	0.027	0.11	3.6	0.63	2630	0.54	0.109	18.3	0.054	24.2	0.08	0.06	13.8	0.2	84.7	0.1	0.4	0.001	0.04	0.2	92	<0.05	137
T18-03D	T18-03D-A-026	TD4074	35.5	36.26	7	waste	MDST	1.51	6.9	<0.2	<20	252	0.11	1.57	0.42	27.8	26.3	70.8	1.51	3.3	0.054	0.13	6.3	0.22	457	1.25	0.173	38.7	0.503	18	0.24	0.1	16.5	0.4	185	0.09	1	0.004	0.1	0.3	84	<0.05	163
T18-03D	T18-03D-A-027	TD4075	36.26	37.8	7	waste	MDST	0.44	1	<0.2	<20	149	0.13	0.53	0.55	14.6	12.1	67.2	3.22	1.4	0.039	0.1	2.4	0.32	685	0.42	0.144	14.5	0.013	17.5	0.06	0.06	14.2	0.4	82.8	0.08	0.4	<0.001	0.02	0.2	51	<0.05	129
T18-03D	T18-03D-A-028	TD4076	37.8	38.1	7	8	MDST	0.47	1.7	0.7	<20	166	0.14	0.21	0.65	12.1	8.1	63.1	0.94	1.1	0.022	0.13	0.8	0.18	206	0.21	0.163	10.8	0.002	23.6	0.03	0.07	11.4	0.3	80.6	0.11	0.2	<0.001	0.04	0.1	37	<0.05	163
T18-05D	28651	TH0788	13.5	22.5	1	waste	SLST	0.98	6	0.6	<20	201	0.36	0.8	0.08	16.3	26.2	44.4	3.31	3.1	0.068	0.23	3.3	0.91	417	0.51	0.27	48.9	0.035	13.3	0.41	<0.02	9.3	<0.1	66	0.07	3.9	<0.001	0.03	0.4	33	<0.05	120
T18-05D	28652	TH0789	22.5	23.2	1	waste	SLST	0.75	19.3	0.4	<20	220	0.1	0.99	0.2	12.9	23.9	18.3	3.9	1.8	0.37	0.28	3.3	0.8	366	0.95	0.411	36.2	0.028	6.87	1.45	0.03	8.4	0.3	66.2	0.05	1.8	<0.001	0.25	0.5	26	<0.05	93.7
T18-05D	28653	TH0790	23.2	30.6	1	waste	SLST	0.64	12.8	<0.2	<20	170	0.27	1.72	0.07	19.4	32.3	45.3	4.26	2.3	0.12	0.22	2.6	1.13	1250	0.84	0.232	57.1	0.044	13.7	0.86	0.05	9.2	<0.1	71.4	0.06	4.2	<0.001	0.04	0.4	41	<0.05	112
T18-05D	28654	TH0791	30.6	33.5	1	waste	SLST	0.54	10.6	<0.2	<20	169	0.26	1.16	0.08	20.3	32.3	47.8	4.23	2.1	0.052	0.2	3.2	0.98	897	0.59	0.213	59.9	0.049	13.7	0.18	0.03	9.4	<0.1	57	0.08	4.7	<0.001	0.02	0.5	44	<0.05	99.5
T18-05D	28655	TH0792	33.5	37.4	1	waste	SLST	0.56	9.9	<0.2	<20	184	0.29	0.8	0.08	22.3	29.7	54.9	3.78	1.9	0.083	0.21	3.1	0.78	530	0.66	0.231	58.7	0.042	16.4	0.43	0.04	9.1	<0.1	57.4	0.05	4.7	<0.001	0.03	0.5	42	<0.05	121
T18-05D	28656	TH0793	37.4	38.9	1	waste	SLST	0.49	7.4	<0.2	<20	175	0.23	1.09	0.06	19	34	33.8	3.93	1.8	0.065	0.19	3.8	0.94	502	0.43	0.215	47.6	0.038	11.5	0.34	0.04	9.7	<0.1	60.6	0.04	3.5	<0.001	0.03	0.5	41	<0.05	94.5
T18-05D	28657	TH0794	38.9	42.4	1	waste	SLST	0.49	8.4	<0.2	<20	164	0.2	1.28	0.07	19.2	34.7	29.6	3.95	1.7	0.081	0.19	3.6	0.94	516	0.47	0.207	47.8	0.038	12.8	0.51	0.05	9.8	<0.1	64.8	0.04	3.6	<0.001	0.04	0.5	40	<0.05	94.8
T18-05D	28658	TH0795	42.4	46	1	waste	SLST	0.52	8.5	0.6	<20	169	0.22	1.22	0.05	18.3	32.8	37.2	4.07	1.8	0.10	0.2	3.2	0.91	513	0.54	0.216	52.6	0.043	11.6	0.63	0.04	10.3	<0.1	65	0.06	3.9	<0.001	0.04	0.5	40	<0.05	100
T18-05D	28659	TH0796	46	49.6	1	waste	SLST	0.51	9.9	<0.2	<20	158	0.17	2.09	0.06	18.9	31.3	26.8	3.62	1.6	0.14	0.17	3.6	1.02	518	0.5	0.195	53	0.052	12.6	0.88	0.08	10.5	<0.1	94.4	0.05	4	<0.001	0.05	0.4	35	<0.05	96.7
T18-05D	28660	TH0797	49.6	53.2	1	waste	SLST	0.46	9.8	<0.2	<20	160	0.21	1.09	0.07	21	30.1	40.7	4.09	1.5	0.11	0.18	3.1	0.92	533	0.6	0.21	61.8	0.052	12.2	0.45	0.08	10.8	<0.1	63.7	0.07	4.3	<0.001	0.04	0.5	39	<0.05	105
*Screening Criteria								800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000	20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

Notes:

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Hole-ID	Sample ID	Maxxam Sample ID	Sample Depth (m) From	Sample Depth (m) To	ABA Zone	Sample Type	Lithology	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
								%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
T18-05D	28661	TH0799	53.2	56.8	1	waste	SLST	0.61	10.4	<0.2	<20	171	0.14	4.36	0.05	15.2	42.1	28.4	5.17	1.7	0.045	0.18	3.3	1.78	872	0.49	0.177	46	0.074	9.16	0.19	0.03	10.3	<0.1	155	0.04	3.3	<0.001	0.02	0.4	43	<0.05	85.9
T18-05D	28662	TH0800	56.8	59.6	1	waste	SLST	0.51	9.2	<0.2	<20	177	0.18	1.28	0.05	16.4	29.9	36.3	4.56	1.6	0.054	0.18	3	1.06	717	0.47	0.204	51.1	0.047	11.6	0.17	0.05	12.1	<0.1	76.7	0.04	3.5	<0.001	0.03	0.4	41	<0.05	101
T18-05D	28663	TH0801	59.6	62.3	1	waste	SLST	0.53	10	<0.2	<20	180	0.22	1.17	0.07	19.4	25.4	46.7	3.74	1.7	0.082	0.18	2.8	0.83	783	0.61	0.215	57.1	0.038	14.7	0.25	0.03	10.7	<0.1	78.2	0.05	3.4	<0.001	0.03	0.4	36	<0.05	107
T18-05D	28664	TH0802	62.3	65.3	1	waste	SLST	0.51	10	<0.2	<20	166	0.22	1.39	0.08	23	28.3	42.8	4.03	1.6	0.059	0.17	3	0.91	872	0.7	0.201	61.5	0.047	12.8	0.12	0.04	11.3	<0.1	86.7	0.04	3.9	<0.001	0.02	0.4	38	<0.05	107
T18-05D	28665	TH0803	65.3	68.4	1	waste	SLST	0.51	11.3	<0.2	<20	163	0.23	1.29	0.06	19.1	26.8	46.9	3.84	1.5	0.082	0.17	2.7	0.84	789	0.55	0.199	55.7	0.041	11.4	0.27	0.07	10.4	<0.1	82.4	0.05	3.3	<0.001	0.03	0.4	35	<0.05	106
T18-05D	28666	TH0804	68.4	71.4	1	waste	SLST	0.55	13.3	<0.2	<20	160	0.24	3.08	0.06	20.9	29.5	40.2	4.46	1.4	0.094	0.16	3.7	1.4	951	0.78	0.181	68.2	0.053	12	0.25	0.07	10.9	<0.1	162	0.03	3.9	<0.001	0.04	0.5	41	<0.05	101
T18-05D	28667	TH0805	71.4	75.1	1	waste	SLST	0.49	13.2	<0.2	<20	159	0.26	1.63	0.05	19.8	26.9	48.4	5.98	1.5	0.07	0.15	2.9	1.35	982	0.81	0.189	62.8	0.064	12.2	0.24	0.1	14.3	<0.1	122	0.08	3.4	<0.001	0.03	0.4	55	<0.05	108
T18-05D	28668	TH0806	75.1	78.6	1	waste	SLST	0.61	9.6	<0.2	<20	190	0.21	1.77	0.08	14.4	17.8	42.7	4.86	1.4	0.054	0.17	2.7	1.17	570	0.46	0.244	36.4	0.033	9.42	0.42	0.04	11.7	<0.1	158	0.05	1.6	<0.001	0.02	0.4	38	<0.05	101
T18-05D	28669	TH0807	78.6	82.1	1	waste	SLST	0.6	10.8	<0.2	<20	190	0.1	0.94	0.04	10.8	14.3	26.6	4.51	1.3	0.055	0.17	0.7	0.88	318	0.22	0.32	17.1	0.005	7.27	0.8	<0.02	14.1	<0.1	87.6	0.03	0.4	<0.001	0.03	0.2	40	<0.05	91.4
T18-05D	28670	TH0808	82.1	85.6	1	waste	SLST	0.7	15.3	<0.2	<20	212	0.11	3.23	0.07	9.2	14.2	25.1	4	1.6	0.048	0.16	1	1.25	333	0.41	0.238	16.4	0.034	7.82	0.84	<0.02	12	<0.1	190	0.05	0.6	<0.001	0.03	0.5	37	<0.05	79.3
T18-05D	28671	TH0810	85.6	88.3	1	waste	SLST	0.49	14.1	<0.2	<20	163	0.08	1.29	0.09	12.5	25.2	13.2	5.97	1.3	0.054	0.18	1.4	1.03	387	1.87	0.254	18.1	0.007	6.72	1.32	<0.02	11.7	<0.1	118	0.03	0.5	<0.001	0.06	0.3	37	<0.05	91.3
T18-05D	28672	TH0811	88.3	91.4	1	waste	SLST	0.44	17.4	<0.2	<20	117	0.21	0.5	0.08	16	16.2	28.3	2.89	1.4	0.135	0.13	<0.5	0.39	202	5.36	0.165	31.1	0.001	12.7	2.21	0.06	10.5	<0.1	57.6	<0.02	0.3	<0.001	0.09	0.8	27	<0.05	91.7
T18-05D	28673	TH0812	91.4	93.97	2	waste	MDST	0.44	21.3	<0.2	<20	129	0.21	0.54	0.02	19.5	18.9	33.4	3	1.4	0.114	0.14	0.6	0.48	272	0.68	0.16	43.2	0.002	13.9	2.11	0.04	10.3	<0.1	68.2	0.03	0.4	<0.001	0.04	0.3	24	<0.05	112
T18-05D	28674	TH0813	93.97	94.61	2	coal	C	0.18	58.8	<0.2	<20	58.6	0.12	0.63	0.02	2.8	3.8	10.4	2.09	1.3	0.116	0.02	3	0.19	40	0.9	0.027	4.8	0.075	9.41	2.75	0.17	3	<0.1	117	0.06	1.4	0.004	0.05	0.7	13	<0.05	10.3
T18-05D	28675	TH0814	94.61	96.9	3	waste	MDST	0.51	38.7	<0.2	<20	157	0.17	0.61	0.04	20.6	16.7	31.8	2.78	1.4	0.085	0.15	0.7	0.42	224	0.69	0.192	36.4	0.004	11.4	1.99	<0.02	10.1	<0.1	60.9	0.06	0.3	<0.001	0.05	0.2	22	<0.05	109
T18-05D	28676	TH0815	97.45	97.61	3	coal	SLST	0.5	50	<0.2	<20	151	0.2	0.66	0.05	20.9	21.8	28	4.32	1.5	0.09	0.15	0.8	0.73	514	0.7	0.144	43.7	0.007	11.7	2.08	<0.02	11.8	0.3	63	0.05	0.3	<0.001	0.03	0.3	35	<0.05	106
T18-05D	28677	TH0816	97.61	99.97	3	waste	SLST	0.46	99.7	<0.2	<20	102	0.27	0.11	0.07	22.1	14.1	31	3.92	1.6	0.194	0.15	0.5	0.29	323	1.81	0.154	57.7	0.002	16	3.54	0.04	7.5	0.5	38.4	0.06	0.3	<0.001	0.05	0.3	24	<0.05	93.8
T18-05D	28678	TH0817	101.97	102.17	4	waste	SLST	0.6	49.3	<0.2	<20	289	0.22	0.26	0.05	36.2	9.1	50.6	1.3	1.5	0.026	0.17	2	0.18	1920	2.1	0.249	50.3	0.007	11.4	0.09	<0.02	9.8	<0.1	58.2	0.07	0.3	<0.001	<0.02	0.3	28	<0.05	226
T18-05D	28679	TH0818	102.17	106.3	4	waste	SLST	0.62	35.8	<0.2	<20	263	0.18	1.47	0.03	20.1	14.9	41.1	3.95	1.5	0.027	0.17	2.2	0.61	2650	0.47	0.215	30.2	0.021	11.5	0.33	<0.02	14.3	<0.1	94	0.04	0.9	<0.001	<0.02	0.3	42	<0.05	96.9
T18-05D	28680	TH0819	106.3	108.7	4	waste	SLST	0.61	29.7	<0.2	<20	227	0.16	1.21	0.02	14.6	18.1	30.5	7.91	1.6	0.028	0.16	2.4	1.13	1520	0.32	0.169	21.8	0.026	9.1	0.3	0.03	15.8	<0.1	106	0.04	0.8	<0.001	<0.02	0.3	58	<0.05	83.5
T18-05D	28681	TH0821	108.7	111.1	4	waste	SLST	0.49	78.9	<0.2	<20	190	0.16	1.04	0.05	17	14.9	29.6	7.14	1.3	0.062	0.13	1.6	0.93	1280	1.39	0.149	26.9	0.013	9.93	1.62	0.06	13.9	<0.1	71.8	0.05	0.4	<0.001	0.04	0.3	48	<0.05	87
T18-05D	28682	TH0822	111.1	111.9	4	waste	MDST	0.45	30.8	<0.2	<20	179	0.19	0.69	0.08	15	12	29.5	2.29	1.2	0.109	0.12	0.6	0.32	344	1.62	0.145	27.2	0.009	13.1	1.73	0.05	11.6	<0.1	60.9	0.06	0.3	<0.001	0.06	0.4	32	<0.05	121
T18-05D	28683	TH0823	111.9	112.1	4	coal	C	0.14	89.4	<0.2	<20	46.4	0.08	1.47	0.12	5.1	18.4	8.58	3.58	0.8	0.226	0.02	1.7	0.47	352	4.4	0.02	17.2	0.083	4.15	3.52	0.43	3.9	0.4	127	0.02	0.4	0.003	0.08	0.4	27	<0.05	25
T18-05D	28684	TH0824	112.1	112.6	5	waste	SLST	0.44	45.6	0.6	<20	164	0.27	0.49	0.03	21.6	16.4	31.5	2.53	1.3	0.118	0.14	0.5	0.32	228	0.67	0.123	43.9	0.005	14.4	1.92	0.04	10.9	0.3	49.7	0.06	0.4	<0.001	0.06	0.2	24	<0.05	115
T18-05D	28685	TH0825	112.6	115.5	5	waste	SLST	0.43	35.3	0.9	<20	162	0.16	3	0.02	12.2	18.8	19.7	12	1.1	0.033	0.1	2.6	1.61	4530	0.47	0.09	26.8	0.06	8.45	0.41	0.09	12.1	<0.1	139	0.06	0.9	0.001	0.02	0.3	52	<0.05	72.2
T18-05D	28686	TH0826	115.5	119.3	5	waste	SLST	0.4	42.6	0.8	<20	147	0.23	1.12	0.04	20.2	15.6	29.7	3.88	1.3	0.119	0.11	1.4	0.61	851	0.5	0.083	43.3	0.01	14.4	1.25	0.05	12.9	0.4	67.2	0.04	0.6	<0.001	0.03	0.3	38	<0.05	118
T18-05D	28687	TH0827	119.3	119.5	5	waste	SLST	0.41	61.4	0.5	<20	144	0.25	0.22	0.05	22.7	12.1	35.3	1.84	1.2	0.116	0.11	0.6	0.17	194	0.75	0.075	40.4	0.01	13.2	1.42	0.08	9.6	0.4	38	0.05	0.4	<0.001	0.04	0.3	23	<0.05	137
T18-05D	28688	TH0828	126.6	126.8	6	waste	MDST	0.4	26.7	<0.2	<20	227	0.31	0.37	<0.01	6.6	8.9	42.3	0.59	1	0.031	0.13	<0.5	0.15	42	0.87	0.055	13.9	0.001	4.42	0.26	0.06	6.1	0.2	43.6	0.08	0.6	<0.001	0.03	0.3	23	<0.05	32.7
T18-05D	28689	TH0829	126.8	128.8	6	waste	MDST	0.47	82.3	1.2	<20	229	0.32	0.87	0.06	16.4	17	58	1.24	1.4	0.057	0.14	1.2	0.31	155	1.11	0.051	55.6	0.012	11.3	0.4	0.13	11.3	0.4	64	0.09	0.9	<0.001	0.05	0.3	26	<0.05	135
T18-05D	28690	TH0830	128.8	131.6	6	waste	MDST	0.38	66.9	0.5	<20	164	0.25	0.97	0.16	15.5	15	50.7	2.93	1.1	0.133	0.11	1	0.42	223	1.38	0.055	39.6	0.006	23.6	2.48	0.17	11.2	0.3	67	0.07	0.6	<0.001	0.12	0.3	25	<0.05	123
T18-05D	28691	TH0832	131.6	131.9	6	coal	MDST	0.16	64.9	<0.2	<20	61.5	0.16	0.43	0.14	8	3.4	15.4	1.89	0.8	0.12	0.02	<0.5	0.16	46	2.21	0.021	8.2	<0.001	15.7	2.47	0.22	7.6	<0.1	40.6	0.06	0.8	0.001	0.03	0.2	13	<0.05	22.5
T18-05D	28704	TH0843	131.9	132.2	6	waste	C	0.23	53	0.8	<20	62	0.14	1.87	0.1	5.3	5.8	11.4	2.14	1.1	0.121	0.02	2.3	0.43	51	1.23	0.02	3	0.002	12	2.12	0.15	3.9	0.4	57	<0.02	1	0.002	0.06	0.5	11	<0.05	36.4
T18-05D	28692	TH0833	132.2	132.5	6	coal	P	0.56	79.6	<0.2	<20	124	0.17	0.25	0.04	19.5	10.5	37.8	2.7	2	0.105	0.14	<0.5	0.14	80	2.25	0.075	21.7	0.016	12.2	2.53	0.04	9	0.4	50.4	0.04	0.7	<0.001	0.11	0.2	19	<0.05	82.2
T18-05D	28693	TH0834	132.5	132.85	6	waste	C	0.08	18.4	<0.2	<20	13	0.05	0.83	<0.01	1.7	2.2	5.79	0.88	0.3	0.057	<0.01	0.8	0.17	34	0.36	0.008	2.1	0.074	2.28	1.17	0.04	3	0.1	44.4	<0.02	0.5	0.002	<0.02	0.2	8	<0.05	7.4
T18-05D	28694	TH0835	132.85	133.6	6	coal	MDST	0.44	12.6	0.2	<20	193	0.14	3.59	0.02	5.4	14.1	20.5	1.85	1.4	0.013	0.1	0.8	1.02	245	0.36	0.067	7.2	0.011	7.09	0.18	0.02	10.9	0.2	129	0.03	1.8	<0.001	<0.02	0.3	32	<0.05	88.1
T18-05D	28695	TH0836	133.6	134.4	6	waste	MDST	0.61	19.3	<0.2	<20	192	0.12	2.44	<0.01	12.3	12.2	19.8	8.96	1.5	0.02	0.12	1.6	1.15	2720	1.07	0.073	11.8	0.069	6.46	0.37	0.04	10.8	0.4	96.9	0.02	0.7	<0.001	<0.02	0.4	35	<0.05	58.6
T18-05D	28696	TH0837	134.4	135	6	waste	MDST	0.44	79.8	0.6	<20	57.3	0.12	2.56	0.1	19.3	10.7	25	5.97	1.2	0.383	0.1	<0.5	0.84	216	6.45	0.065	30.3	0.001	16.9	5.75	0.12	10.2	0.7	92.2	0.03	0.1	<0.001	0.19	0.4	33	<0.05	54.2
T18-05D	28697	TH0838	135	135.8	6	coal	C	0.09	49.6	<0.2	<20	25.6	0.13	1.02	0.03	1.4	4.4	8.83	2.32	0.7	0.136	0.02	<0.5	0.1	23	2.98	0.014	2.8	<0.001	8.56	3.08	0.13	1.8	<0.1	26.4	<0.02	0.2	0.002	0.04	0.1	6	<0.05	5.8
T18-05D	28698	TH0839	135.8	139.1	7	waste	SLST	0.52	17.7	0.4	<20	142	0.23	0.37	0.08	20.5	13.9	37.4	2.14	1.7	0.107	0.13	<0.5	0.24	129	1.37	0.094	26	0.001	13.9	1.48	0.05	12.5	0.4	53.9	0.07	0.2	<0.001	0.06	0.5	25	<0.05	108
T18-05D	28699	TH0840	139.1	139.9	7	waste	SLST	0.49	28.9	<0.2	<20	129	0.24	0.23	0.11	23.6	10.5	38.9	2.39	1.6	0.106	0.12	<0.5	0.19	118	4.44	0.099	31.6	0.001	14.6	2.11	0.06	10.4	0.3	53.2	0.04	0.3	<0.001	0.08	1.5	24	<0.05	117
T18-05D	28700	TH0842	139.9	140.9	7	coal	C	0.2	68.8	<0.2	<20	40.4	0.17	0.6	0.29	9.6	3.3	33.4	3.01	1.1	0.29	0.04	<0.5	0.18	57	5	0.038	16.3	<0.001	20.4	3.73	0.3	6.1	0.3	31.4	0.06	0.4	0.002	0.2	0.4	40	<0.05	59.1
T18-05D	28705	TH0844	140.9	141.2	7	waste	MDST	0.59	8.6	<0.2	<20	84.1	0.09	2.27	0.51	8.5	31.5	43.8	9.05	1.6	0.006	0.08	2.2	1.57	1290	0.43	0.049	11.9	0.086	25.3	0.11	0.1	11.9	0.4	80.3	0.02	0.7	0.002	<0.02	0.3	88	<0.05	141
T18-05D	28706	TH0845	141.2	142.1	7	waste	MDST	0.62	3.1	<0.2	<20	86.5	0.18	0.16	0.1	10	2.9	46.4	0.29	1.9	0.029	0.05	1.1	0.08	30	1.06	0.076	9.6	0.002	12.2	0.08	0.08	5.7	0.3	39.2	0.02	0.5	0.002	<0.02	0.5	27	<0.05	60.5
T18-05D	28707	TH0846	142.1	142.6	7	coal	C	0.23	1	<0.2	<20	35.6	0.1	0.74	0.06	3.4	5.2	22.9	0.09	1	0.025	0.03	<0.5	0.09	25	0.84	0.039	3.3	<0.001	10.7	0.09	0.05	4	0.3	24.4	<0.02	<0.1	0.003	<0.02	0.1	76	<0.05	27.4
T18-05D	28708	TH0847	142.6	143	8	waste	MDST	0.54	16.7	0.3	<20	116	0.15	0.26	0.26	13.5	14.8	48.9	1.57	1.7	0.026	0.09	1.2	0.09	360	1.2	0.111	23.4	0.003	21.4	0.07	0.12	8.8	0.3	42.8	0.04	0.2	<0.001	0.06	0.2	47	<0.05	132
T18-05D	28709	TH0848	143	143.9	8	waste	MDST	1.36	13.6	0.6	<20	138	0.15	1.1	0.46	30.9	19.4	83.2	1.58	3.5	0.025	0.1	5.1	0.17	382	2.67	0.099	39.5	0.267	21.2	0.05	0.14	12.4	0.5	99.1	0.12	1.2	0.003	0.06	0.5	49	<0.05	158
T18-05D	28710	TH0849	143.9	144.1	8	waste	MDST	3.97	21.2	1	<20	297	0.07	5.27	0.33	66.4	49	91.4	0.18	7.6	0.027	0.05	16.8	0.05	30	5.87	0.095	83.3	1.94	14.5	0.08	0.31	24.5	0.3	719	0.11	2	0.013	0.15	1.4	71	<0.05	136
T18-05D	28711	TH0850	144.1	144.4	8	waste	MDST	0.51	26.5	<0.2	<20	84.6	0.14	1.05	0.5	9.5	5.5	49.8	0.53	1.6	0.063	0.09	<0.5	0.26	78	0.67	0.095	16.4	0.021	25.3	0.24	0.22	6.9	0.4	52.2	0.06	0.2	0.001	0.1	0.2	81	<0.05	150
T18-05D	28712	TH0851	144.4	148	8	waste	MDST	0.68	6.1	<0.2	<20	105	0.13	0.27	0.15	19.1	13.8	52	6.12	1.6	0.014	0.1	3.5	0.19	1060	0.13	0.094	19.4	0.027	19.8	0.05	0.07	13.1	0.2	50.6	0.06	0.5	<0.001	0.05	0.1	54	<0.05	111
T18-05D	28713	TH0852	148	148.2	8	coal	C	0.32	3.5	<0.2	<20	49.2	0.12	2.35	0.35	10.9	4.6	50.4	0.52	1	0.02	0.05	0.6	0.51	138	0.66	0.055	10	0.003	12.1	0.1	0.13	10.9	0.1	61.8	0.05	0.1	0.003	<0.02	0.2	75	<0.05	96.3
T18-07D	28836	TH0854	6.9	10.4	1	waste	MDST	2.12	8.3	<0.2	<20	315	0.15	1.77	0.1	13.7	28.4	47.6	3.61	5.5	0.043	0.24	4.4	0.86	346	0.21	0.254	35.5	0.039	9.23	0.76	0.02	10.4	0.4	140	0.04	2.2	<0.001	0.04	0.5	49	<0.05	114
T18-07D	28837	TH0855	10.4	14.8	1	waste	MDST	2.02	13.2	<0.2	<20	273	0.15	2.14	0.28	12.7	36.2	46.8	3.51	4.8	0.095	0.24	5.7	0.75	294	2.11	0.371	46.8	0.046	11.6	1.72	0.07	10.6	1.9	166	0.06	2.5	<0.001	0.08	1	43	<0.05	156
T18-07D	28838	TH0856	14.8	18.3	1	waste	SLST	1.97	18.9	<0.2	<20	254	0.13	0.92	0.42	13.1	37.2	27.2	3.89	4.1	0.086	0.29	8.3	0.72	228	1.91	0.477	29.4	0.068	9.57	1.74	0.06	8.8	1	154	<0.02	3.4	<0.001	0.17	0.8	34	<0.05	130
T18-07D	28839	TH0857	18.3	22.2	1	waste	SLST	2.06	12.7	<0.2	<20	261	0.08	0.9	0.07	15.2	53.5	17.1	4.49	4.7	0.12	0.27	6.3	0.93	308	1.17	0.319	39.7	0.047	9.68	1.34	0.06	8	0.3	109	0.02	2.1	0.002	0.14	0.4	42	<0.05	94.4
T18-07D	28840	TH0858	22.2	26.1	1	waste	SLST	2.22	7.8	1.3	<20	285	0.19	0.71	0.06	17.3	53.5	27.6	4.06	6.1	0.07	0.28	5.9	1.02	319	0.27	0.312	48.8	0.037	9.6	0.76	0.03	8.3	<0.1	94.8	0.03	3.1	0.003	0.05	0.3	50	<0.05	102
T18-07D	28841	TH0859	26.1	30	1	waste	SLST	2.36	8.1	0.7	<20	278	0.26	0.59	0.11	19.8	60.9	39.7	4.44	6.8	0.111	0.27	6.9	1.12	356	0.6	0.281	66.1	0.039	12.6	1.08	0.05	8.2	<0.1	84.6	<0.02	4.3	0.004	0.06	0.4	54	<0.05	115
T18-07D	28842	TH0860	30	33.9	1	waste	SLST	2.39	8.4	0.7	<20	287	0.26	0.82	0.1	21	61	37	4.21	7.1	0.122	0.29	7.9	1.07	345	0.43	0.279	70.5	0.09	13.8	1.24	0.07	8.3	<0.1	99.8	0.06	4.2	0.005	0.07	0.4	53	<0.05	118
T18-07D	28843	TH0861	33.9	38.2	1	waste	SLST	2.29	11.3	0.5	<20	256	0.33	0.34	0.07	23	62.7	51.5	4.21	7.1	0.147	0.29	5.5	1.03	390	1.43	0.296	79.1	0.053	17.6	1.62	0.07	8.2	0.1	87.5	0.07	5.5	0.003	0.07	0.4	54	<0.05	128
T18-07D	28844	TH0862	38.2	42.3	1	waste	FLT	2.25	8.7	1.7	<20	320	0.3	0.84	0.09	18.8	56.8	43.3	3.95	6.7	0.104	0.3	5.8	1.02	389	0.71	0.303	64.4	0.045	13.6	1.17	0.04	8.4	<0.1	106	0.05	5.1	0.003	0.06	0.4	50	<0.05	119
T18-07D	28845	TH0863	42.3	44.2	1	waste	SLST	2.28	6.8	1.2	<20	286	0.3	0.38	0.07	19.4	52.6	43.8	3.99	6.8	0.061	0.28	6.2	1.05	317	0.67	0.302	67.5	0.039	13.7	0.94	0.04	7.9	<0.1	86.2	0.04	4.6	0.003	0.06	0.4	49	<0.05	118
T18-07D	28846	TH0865	44.2	49.8	1	waste	SST	1.97	6	0.2	<20	295	0.18	1.09	0.07	16.7	57.3	20	3.6	5.3	0.091	0.25	7	0.97	379	0.29	0.28	51.7	0.045	11.6	0.7	0.08	8	<0.1	105	<0.02	3.8	0.003	0.08	0.4	43	<0.05	109
T18-07D	28847	TH0866	49.8	52.8	1	waste	SLST	2.13	5.8	<0.2	<20	302	0.23	1.06	0.09	16.8	54.9	27.2	3.69	5.8	0.08	0.26	7.3	1.02	346	0.27	0.309	54.2	0.062	12.2	0.68	0.06	8.1	<0.1	112	<0.02	4	0.003	0.05	0.4	45	<0.05	112
T18-07D	28848	TH0867	52.8	57.15	1	waste	SLST	2.34	7.5	0.5	<20	310	0.32	0.35	0.11	20.9	55	44.4	3.6	6.4	0.087	0.27	6.3	1.05	297	0.43	0.335	68.2	0.039	15.8	0.55	0.05	8.8	<0.1	95.9	0.03	4.4	0.002	0.06	0.4	50	<0.05	133
T18-07D	28849	TH0868	57.15	61.5	1	waste	SLST	2.27	8.7	0.9	<20	282	0.35	0.5	0.09	19.9	48.3	47.4	3.85	5.9	0.081	0.26	5.2	1.03	340	0.6	0.32	65	0.049	15.2	0.87	0.06	8.5	0.1	94.6	0.07	4.6	0.002	0.07	0.3	49	<0.05	122
T18-07D	28850	TH0869	61.5	63.4	1	waste	FLT	1.66	14.2	0.3	<20	345	0.12	7.02	0.14	14.4	35.8	25.7	3.12	3.6	0.106	0.32	10.8	0.7	879	1.19	0.378	42.1	0.033	13.7	1.01	0.03	8.3	0.2	190	<0.02	2.3	<0.001	0.11	0.4	31	<0.05	103
T18-07D	29501	TH0870	63.4	66.8	1	waste	MDST	1.98	8.6	1.3	<20	307	0.21	0.67	0.1	15.1	46.3	37.5	3.81	5.4	0.084	0.28	4.9	0.92	392	0.64	0.327	42.4	0.04	9.98	0.83	0.03	9.3	0.2	110	<0.02	3.5	0.002	0.07	0.5	43	<0.05	119
T18-07D	29502	TH0871	66.8	69.6	1	waste	SLST	2	13.1	0.3	<20	193	0.19	3.89	0.11	18.5	60.4	41.1	4.78	6.3	0.1	0.21	5.6	1.12	1070	0.99	0.197	61.4	0.068	13.5	1.6	0.09	9.5	<0.1	141	0.07	4.7	0.004	0.04	0.4	58	<0.05	89.1
T18-07D	29503	TH0872	69.6	72.4	1	waste	SLST	2	14.3	1.1	<20	210	0.27	1.03	0.09	21.6	63.6	54.3	4.34	7	0.154	0.23	4.8	0.94	703	1.03	0.219	75.5	0.06	16.1	1.83	0.14	9.2	0.1	85.2	0.06	5.3	0.005	0.07	0.4	58	<0.05	113
T18-07D	29504	TH0873	72.4	75.6	1	waste	SST	1.69	14.8	<0.2	<20	200	0.29	3.92	0.12	19.8	54.7	45	4.04	5.9	0.138	0.21	5.3	0.93	985	1.23	0.199	66.3	0.069	15.2	1.85	0.16	8.3	<0.1	144	0.05	4.7	0.004	0.06	0.4	50	<0.05	94.9
T18-07D	28786	TH0874	75.6	78.8	1	waste	SST	1.61	9.7	0.5	<20	213	0.18	6.77	0.08	17	51.5	35.2	4.17	5.7	0.071	0.2	5.2	0.99	829	0.54	0.172	55.1	0.054	10.6	1.12	0.08	8.2	0.2	129	0.09	3.8	0.004	0.06	0.4	49	<0.05	89.1
T18-07D	29505	TH0876	78.8	84	1	waste	SLST	2.06	9.4	1.2	<20	254	0.25	0.77	0.1	23.6	62.6	50.6	4.43	7.1	0.111	0.24	5	1.09	554	0.55	0.213	75.8	0.043	19.4	0.57	0.05	9.8	<0.1	82.5	0.04	4.2	0.004	0.05	0.4	60	<0.05	119
T18-07D	29506	TH0877	84	86.9	1	waste	SLST	1.59	9.5	0.8	<20	219	0.19	6.61	0.08	20.1	52.9	36	3.82	5.5	0.143	0.22	4.6	0.95	640	0.61	0.183	68.1	0.054	13.5	1.12	0.1	8.4	<0.1	151	<0.02	3.5	0.004	0.07	0.4	48	<0.05	93.6
T18-07D	29507	TH0878	86.9	92.2	1	waste	SLST	1.47	8.7	<0.2	<20	206	0.18	9.35	0.06	19.3	45.8	34	3.69	5.3	0.108	0.19	5.6	0.87	714	0.59	0.177	62.5	0.053	11.8	0.67	0.08	8.2	<0.1	153	0.05	3.6	0.003	0.05	0.4	47	<0.05	86.4
T18-07D	29508	TH0879	92.2	96.3	1	waste	SLST	1.76	10.3	0.2	<20	235	0.21	1.07	0.06	22	61.4	41.8	3.7	6.5	0.105	0.23	4.8	0.88	438	0.72	0.193	70.5	0.056	12.8	0.58	0.09	9.6	<0.1	85.7	<0.02	4.6	0.004	0.06	0.4	57	<0.05	123
T18-07D	29509	TH0880	96.3	104.7	1	waste	SLST	1.76	12.3	0.4	<20	221	0.24	0.71	0.1	21.7	58.2	52.8	3.83	6.3	0.095	0.21	4.7	0.89	634	0.68	0.203	75.3	0.05	14	0.27	0.09	10.1	0.2	80.5	0.1	4.2	0.003	0.05	0.4	56	<0.05	122
T18-07D	29510	TH0881	104.7	107.8	1	waste	MDST	1.65	16.8	<0.2	<20	222	0.26	1.12	0.11	25.4	56.1	59.4	3.94	5.8	0.239	0.21	4.7	0.87	1010	0.89	0.194	92.9	0.053	16.8	0.65	0.19	10.2	<0.1	89.7	0.04	4.4	0.004	0.15	0.3	54	<0.05	126
T18-07D	29511	TH0882	107.8	111.1	1	waste	MDST	1.66	12.1	0.7	<20	221	0.25	1.37	0.1	22	56.4	56.1	4.8	6	0.084	0.2	5.9	0.98	822	0.7	0.19	79.7	0.059	14.3	0.19	0.08	11.5	<0.1	93.6	0.03	4.5	0.004	0.03	0.4	63	<0.05	121
T18-07D	29512	TH0883	111.1	114.2	1	waste	MDST	1.73	13.5	1	<20	250	0.3	0.74	0.11	23.1	55.3	61.7	3.89	6	0.087	0.21	5.8	0.81	593	0.81	0.202	78.4	0.057	15.2	0.35	0.11	10.5	<0.1	88	0.08	5.3	0.003	0.04	0.4	59	<0.05	128
T18-07D	29513	TH0884	114.2	117.4	1	waste	MDST	1.64	12	0.4	<20	243	0.26	1.46	0.09	20.1	45.3	53.8	4.08	5.3	0.064	0.22	5.3	0.8	618	0.67	0.235	59.5	0.049	13.3	0.43	0.05	11	<0.1	107	0.05	3.8	0.002	0.04	0.4	56	<0.05	117
T18-07D	29514	TH0885	117.4	120.6	1	waste	MDST	1.26	13	<0.2	<20	305	0.1	0.87	0.08	11.3	21.2	28.7	5.08	2.8	0.07	0.24	3.1	0.73	390	0.78	0.345	23.7	0.023	9.08	1.29	<0.02	11.1	<0.1	129	0.03	1.4	<0.001	0.06	0.4	41	<0.05	92.9
T18-07D	29515	TH0887	120.6	123.8	1	waste	MDST	1.32	15.6	0.3	<20	310	0.14	0.78	0.08	12.9	17.3	37.4	4.73	3.4	0.061	0.22	2.9	0.63	307	0.3	0.343	19.4	0.026	10.1	1.33	<0.02	13.3	<0.1	133	0.09	1.5	<0.001	0.05	0.3	47	<0.05	92.3
T18-07D	29516	TH0888	123.8	127.5	6	waste	MDST	1.15	12.8	0.2	<20	199	0.12	0.7	0.08	16.5	25.2	28	3.42	2.8	0.217	0.21	2.6	0.38	242	0.97	0.274	25.1	0.017	12	2.15	0.02	9.4	<0.1	111	<0.02	1.4	<0.001	0.09	0.3	29	<0.05	78.9
T18-07D	29517	TH0889	127.5	129.3	6	waste	SLST	1.02	5	<0.2	<20	319	0.11	0.64	0.06	14.4	20.5	22.3	4.65	2.3	0.035	0.21	2.6	0.71	572	0.29	0.324	16.3	0.019	7.68	0.18	<0.02	9.5	<0.1	128	0.02	1	<0.001	<0.02	0.1	26	<0.05	92.4
T18-07D	29518	TH0890	129.3	132.4	6	waste	SST	1.13	12.6	0.6	<20	296	0.09	0.59	0.07	21.7	29.5	21.6	3.07	2.5	0.153	0.18	1.7	0.4	600	0.41	0.315	29.5	0.018	14.8	1.16	0.02	8.7	<0.1	122	0.03	0.8	<0.001	0.1	0.2	25	<0.05	108
T18-07D	29519	TH0891	132.4	133.8	6	waste	MDST	1.23	11.3	<0.2	<20	288	0.18	0.25	0.07	19	24.5	38.7	2.29	3.2	0.088	0.21	1.9	0.33	228	0.6	0.287	28.6	0.018	12.8	1.25	<0.02	9	<0.1	109	0.02	1.5	<0.001	0.05	0.2	27	<0.05	100
T18-07D	29520	TH0892	133.8	134	6	coal	C	1.21	7.3	0.7	<20	298	0.19	0.23	0.06	17.9	22.6	40.3	1.97	3.1	0.06	0.21	2.3	0.32	115	0.21	0.29	25.7	0.017	9.25	0.88	<0.02	9.3	<0.1	114	0.04	1.5	<0.001	0.05	0.2	27	<0.05	138
T18-07D	29521	TH0893	134	134.6	6	coal	C	0.53	5	1.6	<20	117	0.27	0.28	0.52	14.7	13.4	51	1.98	1.8	0.18	0.08	4.1	0.13	44	1.91	0.108	17.5	0.003	22.6	2.2	0.19	6.3	0.3	47.5	0.07	1.6	0.003	0.05	0.4	71	<0.05	120
*Screening Criteria								800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000	20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

Notes:

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Hole-ID	Sample ID	Maxxam Sample ID	Sample Depth (m)		ABA Zone	Sample Type	Lithology	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
			From	To				%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
19-09D	1146024	BAJ890	4.45	5.9	4	waste		1.2	8.5	3	<20	189	0.12	4.06	0.06	12.4	49	49.7	10.7	3.5	0.031	0.18	4	1.06	5270	2.85	0.026	24.3	0.083	11.1	0.36	0.15	13.6	<0.1	94.8	0.06	1	0.003	0.03	0.4	56	9.3	75
19-09D	1146025	BAJ891	5.9	8	4	waste	MDST	1.33	12.7	1.9	<20	254	0.18	1.31	0.06	20.5	47.5	36.6	3.43	3.4	0.056	0.21	2.4	0.69	814	1.15	0.01	37.1	0.012	13	0.87	0.18	16	<0.1	90.4	0.06	0.8	0.001	0.06	0.4	65	<0.1	112
19-09D	1146026	BAJ892	8	10.75	5	waste	SLST	1.51	16.7	0.7	<20	214	0.19	0.9	0.06	19.3	57.6	32.5	3.01	4	0.094	0.24	1.8	0.62	230	1.64	0.007	38.4	0.003	12.6	1.45	0.12	13.7	0.2	56.6	0.05	0.8	0.001	0.05	0.6	57	<0.1	108
19-09D	1146030	BAJ893	13.25	14.75	55	waste	MDST	1.25	12.9	0.4	<20	217	0.2	1.1	0.28	20	37.7	37.5	1.84	3.4	0.048	0.15	1.8	0.55	92	1.09	0.006	35.9	0.001	22	0.33	0.12	15.5	<0.1	77.5	0.07	1.4	<0.001	0.09	0.4	52	<0.1	146
19-09D	1146034	BAJ894	18.85	20.2	6	waste	MDST	0.59	23.1	<0.2	<20	91.2	0.11	1.26	0.11	9.8	30.7	23.4	1.95	2	0.088	0.08	2.2	0.4	47	1.62	0.004	14.3	<0.001	12.3	1.36	0.14	12.2	<0.1	87.2	0.04	1.6	0.002	0.09	0.4	31	<0.1	61.3
19-09D	1146035	BAJ895	20.2	21.9	6	waste	SLST	1.05	9.7	0.3	<20	163	0.09	3.84	0.04	14.6	37.2	25.2	4.6	2.8	0.038	0.16	2.3	0.85	821	0.5	0.02	19	0.039	9.44	0.39	0.07	14.7	0.2	149	0.02	1.1	0.001	0.05	0.3	56	<0.1	90.3
19-09D	1146036	BAJ896	21.9	23.4	6	waste	SLST	1.14	15	<0.2	<20	197	0.09	1.42	0.09	18	42	30.3	9.65	3.2	0.035	0.16	2.8	0.92	2930	0.65	0.038	20.8	0.053	11.1	0.43	0.11	16	<0.1	128	0.04	0.7	0.001	0.07	0.3	68	<0.1	107
19-09D	1146037	BAJ897	23.4	24.9	6	waste	SLST	1.26	14.7	0.9	<20	197	0.16	0.64	0.37	18.5	50.6	47.2	2.04	3.4	0.081	0.23	1.2	0.36	278	1	0.067	34.7	0.002	28.4	0.93	0.16	16.2	0.3	96.6	0.1	0.5	<0.001	0.13	0.3	52	<0.1	152
19-09D	1146038	BAJ898	24.9	26.4	6	waste	SLST	1.09	11.9	<0.2	<20	214	0.13	1.72	0.06	19.2	40.9	30	6.69	3	0.049	0.22	2.5	1.02	1510	0.69	0.086	31.6	0.047	12.6	0.47	0.13	15.8	0.1	148	0.05	0.8	<0.001	0.08	0.3	53	<0.1	111
19-09D	1146039	BAJ899	26.8	27.75	6	waste	SLST	1.16	2.6	<0.2	<20	155	0.13	0.43	0.54	14.8	60.2	68.4	2.4	2.5	0.027	0.19	1.8	0.48	450	0.55	0.099	23.9	0.007	45.4	0.17	0.17	16.2	<0.1	73.8	0.05	0.4	<0.001	0.07	0.2	63	<0.1	200
19-09D	1146040	BAJ900	27.9	28.7	6	Coal	C	0.7	4.9	<0.2	<20	130	0.15	0.78	0.52	23.7	34.5	51.1	2.47	2	0.084	0.12	1.8	0.57	795	1.52	0.084	27.8	0.006	29.7	0.5	0.26	13.7	<0.1	88.9	0.06	0.5	0.001	0.18	0.4	59	<0.1	154
19-09D	1146041	BAJ901	28.85	30.7	7	waste	SST	1.34	10.1	<0.2	<20	196	0.05	7.69	0.36	22.9	43.4	48.3	7.57	3.1	0.032	0.14	4.6	0.87	1700	0.97	0.082	34.3	0.181	20.7	0.21	0.16	15.9	<0.1	207	0.05	0.7	0.003	0.18	0.4	97	<0.1	99.2
19-09D	1146042	BAJ902	30.7	32.7	7	waste	SLST	1.13	2.6	<0.2	<20	153	0.12	0.28	0.28	16.8	24.1	52.6	3.46	2.6	0.022	0.14	3.1	0.17	479	0.32	0.136	23.1	0.021	18.3	0.06	0.19	11.4	<0.1	88.3	0.04	0.5	0.001	0.07	0.2	50	<0.1	102
19-09D	1146043	BAJ903	32.7	34	7	waste	SST	0.89	2	<0.2	<20	106	0.1	1.26	0.38	14.7	48.8	47.6	4.99	1.9	0.007	0.14	3.3	0.65	1090	0.62	0.096	16.3	0.026	19.4	<0.02	0.09	13.4	<0.1	82.3	0.05	0.4	0.001	0.04	0.2	53	<0.1	110
19-09D	1146044	BAJ904	34	35.4	8	waste	SST	1.67	2	<0.2	<20	132	0.09	0.48	0.39	18.4	53.2	57.1	3.43	3.7	0.008	0.22	2.2	0.31	1130	0.38	0.129	20.4	0.013	17.5	0.03	0.11	17.1	<0.1	75.2	0.06	0.4	0.001	0.06	0.2	57	<0.1	159
19-09D	1146045	BAJ905	35.4	35.9	8	waste	SHC	1.36	1.6	<0.2	<20	108	0.09	0.88	0.34	17.1	66.1	50.6	1.33	3.3	0.017	0.18	1.2	0.38	481	0.56	0.11	20.9	0.003	14.9	0.06	0.1	13.9	<0.1	71.8	0.03	0.3	0.002	0.02	0.2	51	<0.1	119
19-16D	1146051	BAJ906	6.4	8	1	waste	SLST	1.49	11.3	<0.2	<20	144	0.15	2.26	0.09	19.6	75.6	38.4	4.82	4.5	0.077	0.29	5.3	1.32	1030	0.74	0.023	65.3	0.07	12.3	0.23	0.16	12.7	<0.1	81.5	0.06	4.2	0.001	0.09	0.4	48	<0.1	106
19-16D	1146052	BAJ907	8	9.4	1	waste	SLST	1.43	10.3	<0.2	<20	144	0.18	1.7	0.09	21.7	70.4	42.4	4.15	4.2	0.072	0.3	4.7	1.11	992	0.79	0.02	72.5	0.057	12.4	0.17	0.15	12.4	0.2	77.8	0.05	4.3	0.001	0.05	0.4	44	<0.1	115
19-16D	1146053	BAJ908	9.4	11.7	1	waste	MDST	1.35	13.3	0.3	<20	156	0.2	1.44	0.09	21.4	62.2	48.5	4.64	3.9	0.061	0.3	4.4	1.1	1100	0.83	0.019	68.3	0.059	13.4	0.17	0.16	13.2	0.2	81.1	0.06	4.5	0.001	0.05	0.4	46	<0.1	111
19-16D	1146054	BAJ909	11.7	14.7	1	waste	MDST	1.26	14.1	0.6	<20	163	0.24	1.09	0.09	22.9	53.6	51.7	4.28	3.3	0.066	0.28	3.9	0.94	894	0.8	0.022	72.2	0.063	13.5	0.25	0.16	13.1	0.3	74.6	0.05	4.9	<0.001	0.05	0.4	47	<0.1	124
19-16D	1146055	BAJ910	14.7	17.7	1	waste	MDST	1.28	14.4	<0.2	<20	157	0.26	1.38	0.09	23	53.6	55.6	4.72	3.4	0.08	0.29	5	1.04	874	1.09	0.047	73	0.076	15.1	0.32	0.19	13.9	0.1	87.4	0.07	5.5	<0.001	0.06	0.5	52	<0.1	121
19-16D	1146056	BAJ911	17.7	20.9	1	waste	MDST	1.15	12	<0.2	<20	195	0.2	1.22	0.11	18.8	47.7	43.2	4.37	2.9	0.067	0.27	3.6	0.89	531	0.96	0.133	55.9	0.056	12.5	0.43	0.18	13.7	0.4	78.3	0.05	4	<0.001	0.06	0.4	47	<0.1	110
19-16D	1146057	BAJ912	20.9	22.1	1	waste	SST	1.41	12.1	<0.2	<20	249	0.07	1.59	0.08	11	44.4	25.5	5.1	3.6	0.053	0.31	3.4	1.03	392	0.34	0.195	19.7	0.032	7.95	0.79	0.08	15.4	0.3	102	0.04	1.9	<0.001	0.05	0.4	51	<0.1	92
19-16D	1146058	BAJ913	22.1	24.7	1	waste	MDST	1.57	18.8	<0.2	<20	394	0.1	1.66	0.07	12.8	34.4	31.6	5.38	3.9	0.06	0.27	2.7	0.97	403	0.92	0.159	23.3	0.071	9.07	1.09	0.08	17.4	0.3	113	0.05	1.6	<0.001	0.08	0.4	61	<0.1	89.5
19-16D	1146059	BAJ914	24.7	26.3	1	waste	SST	1.43	17.6	<0.2	<20	206	0.06	1.47	0.09	11.8	81.8	17.5	5.13	3.8	0.058	0.48	2.9	0.94	336	1.07	0.152	19.5	0.026	6.22	1.11	0.06	14.7	0.3	104	0.03	1.4	0.001	0.11	0.4	50	<0.1	61.1
19-16D	1146060	BAJ915	26.3	28.3	1	waste	SLST	1.21	19.8	<0.2	<20	139	0.11	1.34	0.12	22.9	69.3	24.7	4.47	3.3	0.221	0.24	1.7	0.64	541	2.26	0.061	36.5	0.014	11.9	3.17	0.12	13.3	0.1	78.9	0.03	1.1	0.001	0.22	0.3	43	<0.1	111
19-16D	1146061	BAJ916	28.3	30.2	2	waste	SST	1.08	11.4	<0.2	<20	143	0.19	0.64	0.07	22.2	60.4	33.4	3.98	3.3	0.214	0.22	1.3	0.53	252	1.28	0.018	51.1	0.01	15.3	3.03	0.11	13.5	<0.1	68.1	0.05	0.8	0.001	0.11	0.3	33	<0.1	96
19-16D	1146062	BAJ917	30.2	32.2	2	waste	SST	1.32	10.7	<0.2	<20	157	0.18	1.52	0.07	20.7	61.7	33.7	3.82	3.6	0.09	0.23	2.3	0.91	352	1.93	0.013	39.5	0.012	13.9	1.7	0.09	14.7	<0.1	108	0.05	0.9	0.001	0.07	0.6	44	<0.1	102
19-16D	1146063	BAJ918	32.2	34	3	waste	SLST	1	11.4	<0.2	<20	133	0.18	0.78	0.05	15.9	42.3	32.4	3.1	2.7	0.184	0.18	1.4	0.53	142	2.12	0.008	33.5	0.029	14.5	2.45	0.12	12.5	0.2	93.1	0.05	0.9	0.001	0.1	0.5	36	<0.1	81.4
19-16D	1146064	BAJ919	34	34.45	3	waste	MDST	0.23	6.1	<0.2	<20	68.8	0.11	0.83	0.07	8.2	18.2	26.2	2.59	1.2	0.205	0.07	0.7	0.34	80	2.61	0.003	21.4	0.005	7.76	3.26	0.09	7	0.3	70.3	0.04	0.4	0.003	0.11	0.6	32	<0.1	34.7
19-16D	1146069	BAJ920	38.7	40.4	4	waste	SST	0.65	9.2	<0.2	<20	192	0.17	2.96	0.06	17.8	28.4	28.9	3.45	1.5	0.037	0.16	1.9	0.67	1160	0.51	0.017	31.1	0.034	9.02	0.55	0.05	12.9	0.2	260	0.05	1.5	<0.001	<0.02	0.3	40	<0.1	91.6
19-16D	1146070	BAJ921	40.4	43.2	4	waste	SLST	0.66	10.2	<0.2	<20	226	0.19	1.26	0.03	21.9	25	35.7	4.52	1.6	0.053	0.15	2.1	0.73	1600	0.68	0.024	32.1	0.032	10.4	0.78	0.05	14.2	0.3	109	0.04	1.3	<0.001	0.03	0.3	47	<0.1	101
19-16D	1146071	BAJ922	43.2	45.6	4	waste	SLST	0.62	9.7	<0.2	<20	237	0.19	1.22	0.04	18.8	27.4	33.3	5.38	1.4	0.046	0.14	2.7	0.8	1760	0.65	0.023	31.1	0.024	10.7	0.43	0.06	15.1	0.3	107	0.05	1.1	<0.001	0.02	0.3	56	<0.1	97.5
19-16D	1146072	BAJ923	45.6	49.2	5	waste	SLST	0.61	13	0.3	<20	234	0.19	1.06	0.07	19.7	32.4	27.5	4.26	1.6	0.117	0.16	1.5	0.66	838	0.68	0.019	42.7	0.016	12.3	1.5	0.07	12.6	0.4	84.5	0.04	0.8	<0.001	0.03	0.2	43	<0.1	114
19-16D	1146073	BAJ924	49.2	50.05	5	waste	SLST	0.61	13.5	<0.2	<20	115	0.19	0.65	0.08	22.4	26.2	33.5	3.03	1.7	0.181	0.15	0.7	0.5	287	1.9	0.01	54	0.003	15.3	2.02	0.07	12.7	0.7	63	0.08	0.4	<0.001	0.05	0.3	38	<0.1	122
19-16D	1146079	BAJ925	56.55	58.75	55	waste	SLST	0.83	12.3	<0.2	<20	250	0.27	0.54	0.1	25.8	33	54.6	2.4	2.6	0.11	0.21	1	0.59	179	1.69	0.007	71.9	0.006	16	0.88	0.11	13	0.5	61.4	0.09	0.6	<0.001	0.04	0.4	43	<0.1	128
19-16D	1146080	BAJ926	58.9	61	6	Coal	C	0.52	9.3	<0.2	<20	75.2	0.12	1.06	0.1	10.7	31.9	23.4	2.91	1.8	0.274	0.09	1.3	0.37	59	1.97	0.005	20.9	0.017	10.9	2.84	0.1	8.7	0.5	69.4	0.05	0.7	0.001	0.02	0.3	23	<0.1	64.4
19-16D	1146081	BAJ927	61.15	61.85	7	waste	SLST	0.81	8	<0.2	<20	187	0.12	1.9	0.07	16.8	30.6	28.5	5.12	2.2	0.08	0.15	2.3	1.02	278	0.63	0.008	22.9	0.005	10	1.27	0.04	15.7	0.6	140	0.06	0.8	<0.001	<0.02	0.3	51	<0.1	95.9
19-16D	1146082	BAJ928	62	63.9	7	Coal	C	0.73	6.4	<0.2	<20	156	0.14	0.84	0.11	13.1	29.8	28.5	2.72	1.9	0.142	0.13	0.6	0.43	76	1.55	0.008	17.3	0.001	11.8	2.03	0.04	11.5	0.4	75.7	0.06	0.6	<0.001	<0.02	0.4	38	<0.1	72.2
19-16D	1146083	BAJ929	64.05	67.6	7	waste	SLST	0.67	7.1	<0.2	<20	156	0.13	1.34	0.06	16.1	25.4	28.6	5.07	1.8	0.045	0.14	1.7	0.81	1230	0.58	0.021	25.8	0.023	9.49	0.61	0.04	13.7	0.3	105	0.04	0.7	<0.001	0.02	0.2	43	<0.1	93.9
19-16D	1146084	BAJ930	67.6	70	8	waste	SLST	0.71	3.6	<0.2	<20	123	0.1	1.27	0.34	15	33.1	43.5	6.77	1.8	0.027	0.1	2	0.72	1830	1.01	0.027	17.7	0.054	26.2	0.13	0.11	11.3	0.4	81.5	0.03	1	0.001	<0.02	0.5	62	<0.1	130
19-17D	1146085	BAJ931	8.4	8.7	1	Coal	C	0.22	46.3	<0.2	<20	31.9	0.06	1.28	0.25	7.6	17.5	12.9	3.98	0.9	0.307	0.07	0.6	0.46	154	17.4	0.007	15.6	<0.001	5.6	4.47	0.19	5.6	0.5	47.2	0.02	0.4	0.002	0.06	0.9	20	<0.1	33.3
19-17D	1146086	BAJ932	8.85	11.45	2	waste	MDST	0.7	9.8	<0.2	<20	116	0.19	0.4	0.06	20.3	34.8	33.5	3.71	1.8	0.211	0.16	0.6	0.53	334	1.32	0.046	46.1	0.002	16	2.67	0.04	10.4	0.3	48.3	0.05	0.4	<0.001	0.09	0.3	34	<0.1	101
19-17D	1146087	BAJ933	11.6	12	2	Coal	C	0.34	4.2	<0.2	<20	83	0.16	0.17	0.07	7.5	16.1	24.1	1.94	1.4	0.15	0.09	1.3	0.16	64	0.94	0.045	20.9	0.015	13.8	2.12	0.07	5.2	0.2	49.5	0.04	1	0.002	0.02	0.4	22	<0.1	47.6
19-17D	1146088	BAJ934	12.15	14.5	3	waste	MDST	0.66	8.7	<0.2	<20	174	0.19	0.41	0.03	17.5	36.3	31.3	3.33	1.8	0.087	0.19	1.1	0.55	521	1.09	0.153	35.1	0.002	11.2	1.28	0.03	12.8	0.3	50.8	0.05	0.5	<0.001	0.03	0.3	38	<0.1	102
19-17D	1146089	BAJ935	14.5	17.45	3	waste	MDST	0.57	11.7	<0.2	<20	152	0.18	0.85	0.05	18.2	32.4	30.9	3.16	1.6	0.09	0.15	1.4	0.63	719	1.49	0.126	38.1	0.008	11.8	1.05	0.04	12.9	0.5	66.2	0.07	0.5	<0.001	0.03	0.4	45	<0.1	90.7
19-17D	1146090	BAJ936	19.6	22	4	waste	MDST	0.76	9	<0.2	<20	217	0.15	1.61	0.04	18	24.6	39.8	5.53	1.9	0.025	0.17	2.7	0.76	3450	0.57	0.14	28.8	0.034	9.73	0.26	0.03	17.2	0.2	83.4	0.04	1	<0.001	<0.02	0.3	53	<0.1	96.3
19-17D	1146091	BAJ937	22	25	4	waste	MDST	1.01	10.5	<0.2	<20	207	0.15	1.71	0.03	20.1	38.5	33.1	5.52	2.8	0.034	0.22	2.8	0.83	1910	0.9	0.127	34.3	0.034	9.51	0.33	0.03	16.4	0.2	104	0.04	1.2	<0.001	0.02	0.3	61	<0.1	99
19-17D	1146092	BAJ938	25	26.4	4	waste	MDST	0.71	8.8	<0.2	<20	168	0.15	0.79	0.04	17	29.4	32.3	2.87	2	0.055	0.16	1.9	0.49	901	1.6	0.12	25	0.022	7.39	0.59	<0.02	13.1	0.2	87.8	0.04	0.6	<0.001	<0.02	0.4	48	<0.1	95.6
19-17D	1146093	BAJ939	26.4	29.5	5	waste	MDST	0.76	10.9	<0.2	<20	159	0.17	1.47	0.05	19.9	39.1	28	5.5	2.2	0.098	0.16	2.2	0.86	1160	0.74	0.077	42.6	0.034	11.4	1.28	0.03	13.2	0.4	68.9	0.04	1	<0.001	0.02	0.3	49	<0.1	121
19-17D	1146095	BAJ940	29.5	31.05	5	waste	MDST	0.69	9.4	<0.2	<20	133	0.18	0.83	0.06	20.3	35.3	29.8	2.68	1.9	0.097	0.15	1.2	0.56	231	1.15	0.069	40.1	0.002	12	1.24	0.03	13.6	0.3	59.9	0.05	0.5	<0.001	<0.02	0.4	49	<0.1	104
19-17D	1146098	BAJ941	37.05	38.8	6	waste	MDST	0.93	11.8	<0.2	<20	183	0.23	1.54	0.05	24.7	41.2	42.1	3.95	2.8	0.056	0.19	3.2	0.73	1400	2.03	0.05	72.3	0.01	14.2	0.72	0.12	13.1	0.4	125	0.07	1.3	<0.001	0.04	0.6	58	<0.1	96.3
19-17D	1146099	BAJ942	38.8	41.5		waste		0.72	6.7	<0.2	<20	164	0.11	1	0.04	17.8	23.7	28	3.41	2	0.051	0.14	1.8	0.6	1060	0.68	0.08	19.1	0.005	10.3	0.67	0.03	15.4	0.3	119	0.04	0.9	<0.001	0.03	0.2	49	<0.1	80.2
19-17D	1146100	BAJ943	41.5	42.75	6	waste	SLST	0.69	3.8	<0.2	<20	189	0.11	0.38	0.06	17.8	21.1	33.5	1.07	1.9	0.014	0.16	0.7	0.25	186	0.24	0.095	22.9	0.001	8.87	0.09	0.03	14.3	0.2	82.8	0.03	0.5	<0.001	<0.02	0.1	38	<0.1	95.6
19-17D	1146401	BAJ944	42.75	45.75	6	waste	SLST	1.29	2	<0.2	<20	214	0.06	5	0.15	18.5	59.1	29.9	6.79	3.5	<0.005	0.21	3	0.85	2410	0.42	0.091	17.7	0.061	11.5	0.04	<0.02	14.2	<0.1	217	0.03	0.9	0.001	<0.02	0.3	66	<0.1	111
19-17D	1146402	BAJ945	45.75	47.5	7	waste	MDST	2.02	7.6	<0.2	<20	206	0.11	0.91	0.06	16.7	77.8	27.8	3.46	4.7	0.053	0.34	1.2	0.61	989	0.42	0.122	22.3	0.006	9.07	0.83	<0.02	14.9	0.2	129	<0.02	0.4	<0.001	<0.02	0.2	48	<0.1	97.3
19-17D	1146403	BAJ946	47.5	48.7	7	waste	MDST	0.55	8.6	<0.2	<20	150	0.12	0.39	0.08	14.8	19.7	36.3	3.66	1.4	0.076	0.15	0.6	0.48	291	1.22	0.124	17.9	0.001	8.96	2.11	<0.02	11.7	0.4	84	0.05	0.3	<0.001	0.05	0.2	33	<0.1	116
19-17D	1146404	BAJ947	48.7	50.5	7	waste	MDST	1.43	4.8	<0.2	<20	159	0.14	0.66	0.09	15.5	57.8	30.9	3.17	3.5	0.158	0.25	0.6	0.45	121	1.18	0.107	26.4	<0.001	10.8	2.49	<0.02	13.8	0.3	96.9	0.04	0.4	0.001	0.03	0.3	42	<0.1	81.3
19-17D	1146405	BAJ948	50.5	53.5	7	waste	MDST	0.7	5.9	<0.2	<20	169	0.17	0.51	0.22	18.9	23	44.7	2.56	1.9	0.078	0.18	0.8	0.47	304	0.55	0.134	33.2	0.002	18.6	0.86	0.05	13.7	0.2	90.3	0.07	0.3	<0.001	0.04	0.2	39	<0.1	128
19-17D	1146406	BAJ949	53.5	54.95	7	waste	SLST	0.59	1.8	<0.2	<20	114	0.05	1.27	0.31	13.7	36.8	38.6	4.68	1.5	0.02	0.12	2.3	0.72	1130	0.56	0.087	16.1	0.038	20.5	0.05	0.03	11.6	0.1	99	0.03	0.7	<0.001	0.03	0.2	49	<0.1	150
19-17D	1146407	BAJ950	55.1	55.6	7	Coal	C	0.54	7.7	<0.2	<20	80.9	0.16	0.63	0.31	16.5	8.7	33	0.68	1.3	0.155	0.06	4.1	0.14	51	1.47	0.052	19.5	0.085	18.9	0.67	0.16	5.7	0.4	134	0.05	2.3	0.003	0.03	1.2	84	<0.1	61.3
19-17D	1146408	BAJ951	55.75	56.75	8	waste	MDST	0.69	5	0.4	<20	143	0.11	0.6	0.35	23.6	31.5	59.6	5.64	1.6	0.026	0.14	2.8	0.45	1860	0.58	0.108	32.1	0.013	24.3	0.05	0.04	14.3	0.2	70.8	0.05	0.5	<0.001	0.04	0.2	58	<0.1	147
19-17D	1146409	BAJ952	56.75	58.25	8	waste	MDST	1.54	7	<0.2	<20	340	0.12	0.75	0.36	28.9	23.8	65.8	2.36	3.6	0.033	0.14	5.7	0.2	502	0.78	0.127	40.2	0.216	14.1	0.11	0.06	14.5	0.3	228	0.04	0.9	0.002	0.03	0.3	58	<0.1	130
19-17D	1146410	BAJ953	58.25	59.2	8	waste	MDST	0.81	3	<0.2	<20	153	0.14	0.19	0.37	21.1	11.4	61	2.18	2.1	0.026	0.11	1.1	0.13	398	0.29	0.135	23.6	0.006	28	0.09	0.05	9.3	0.6	69.5	0.04	0.4	<0.001	0.02	0.2	32	<0.1	137
19-18D	1146416	BAJ954	10	13	4	waste	MDST	1.01	10.4	<0.2	<20	262	0.17	1.44	0.04	18.4	30.8	37.9	3.2	2.9	0.047	0.19	1.9	0.69	994	0.68	0.012	35.3	0.016	10	0.71	<0.02	15.6	0.2	104	0.06	0.9	<0.001	0.03	0.3	49	<0.1	114
19-18D	1146417	BAJ955	13	15.2	4	waste	MDST	1.07	12.5	<0.2	<20	290	0.16	1.16	0.03	19	34.1	34	4.9	3.2	0.033	0.18	2.9	0.74	1850	1.08	0.015	29.3	0.024	10.4	0.29	0.04	15.9	0.3	109	0.04	0.9	<0.001	<0.02	0.4	56	<0.1	90.4
19-18D	1146418	BAJ956	15.2	17.75	5	waste	MDST	0.83	12.2	1.2	<20	193	0.33	1.02	0.07	17.5	34.4	26.4	2.82	2.6	0.093	0.15	1.8	0.62	254	1.44	0.007	40.1	0.005	11.6	1.47	0.11	14	0.4	81.1	0.06	1.2	<0.001	0.07	0.4	43	<0.1	109
19-18D	1146421	BAJ957	19.85	20.15	55	waste	SLST	1.9	0.3	1.6	<20	115	0.36	1.14	0.52	5.6	74.5	48	0.95	4	0.016	0.19	2.2	0.45	120	0.41	0.01	7.5	0.002	28.8	0.06	<0.02	10.3	0.2	51.7	0.1	0.8	0.001	0.06	0.4	41	<0.1	157
19-18D	1146422	BAJ958	23.55	23.5	6	waste	MDST	0.74	2.8	0.4	<20	153	0.27	0.7	0.08	17.4	29.8	41.4	1.08	2.4	0.047	0.14	1.6	0.38	58	1.45	0.006	35.8	0.001	5.75	0.19	0.05	10.6	0.1	41	0.04	0.8	0.001	<0.02	0.3	40	<0.1	106
19-18D	1146423	BAJ959	23.5	25.8	6	waste	MDST	0.92	16.3	0.3	<20	187	0.27	1.97	0.13	20.5	41.7	43.8	3.06	2.7	0.224	0.15	3.3	0.89	204	1.34	0.009	63	0.003	16.4	1.59	0.13	13.6	0.6	112	0.05	1.5	0.001	0.12	0.4	51	<0.1	111
19-18D	1146424	BAJ960	25.8	28.7	6	waste	MDST	0.84	4.6	0.9	<20	211	0.15	0.9	0.1	16.4	22.4	28.9	3.79	2.2	0.022	0.13	2.2	0.58	1000	0.32	0.018	18.1	0.005	13.5	0.29	0.08	16	0.2	67	<0.02	1	<0.001	0.05	0.2	51	<0.1	94.2
19-18D	1146425	BAJ961	28.7	31.3	6	waste	SST	1.37	3	1.4	<20	160	0.14	2.99	0.15	16.7	103	23.8	5.13	3.1	<0.005	0.17	2.9	0.98	2000	0.64	0.022	16.6	0.046	18	0.04	<0.02	10.7	<0.1	139	<0.02	1.5	0.001	0.03	0.3	51	<0.1	133
19-18D	1146426	BAJ962	31.3	33.3	6	waste	MDST	0.93	8.9	0.3	<20	279	0.15	1.85	0.1	19	28.6	26	4.59	2.6	0.016	0.2	2.2	0.9	1300	0.41	0.05	23.2	0.027	9.72	0.19	0.05	15	0.2	143	0.05	0.8	<0.001	0.03	0.2	41	<0.1	99
19-18D	1146427	BAJ963	33.3	35.5	6	waste	MDST	1.04	9.8	1.1	<20	315	0.18	0.92	0.08	18.4	33.5	31.5	4.27	2.8	0.082	0.22	1.8	0.61	988	0.89	0.065	25.3	0.015	12.7	0.47	0.06	15.9	0.3	99.8	0.05	0.8	<0.001	0.09	0.4	45	<0.1	105
*Screening Criteria								800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000	20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

Notes:

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Appendix E – Field Barrel Test Work Memo

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FINAL

Memo

To	Dan Farmer, Project and Development Manager	**Client**	Telkwa Mining Ltd.
From	Carlos Paulo, Laura Volden, Michael Herrell	**Project**	CAPR002933
		Date	April 22, 2024

Subject Geochemical Field Barrel Results Interpretation – Tenas Project

File name: TCL Task 100 Field barrels analysis MEMO CAPR002933 FINAL 20240422.docx

1 Introduction

Telkwa Mining Ltd (TCL) submitted an Environmental Assessment Certificate (EAC), application for the Tenas Project, located at the Telkwa Property, near the town of Telkwa, British Columbia in May of 2022. In support of the EA application, SRK Consulting (Canada) Inc. (SRK) conducted a comprehensive geochemical program to evaluate the risk of ML/ARD from mine materials that will be produced by the Project. The program included static geochemical characterization, kinetic testing through humidity cell tests (HCTs) and the development of source terms (SRK 2022a, SRK 2022b).

The kinetic testing program was expanded in 2019 to include field barrel tests and is currently on-going. The barrel tests were initiated to advance the understanding of ML/ARD rates from select stratigraphic zones under field conditions and to modify scaling factors used to adjust release rates based on laboratory testing (HCTs) to the field scale, which were used in the development of geochemical source terms. This memo provides a review and interpretation of existing field barrel data.

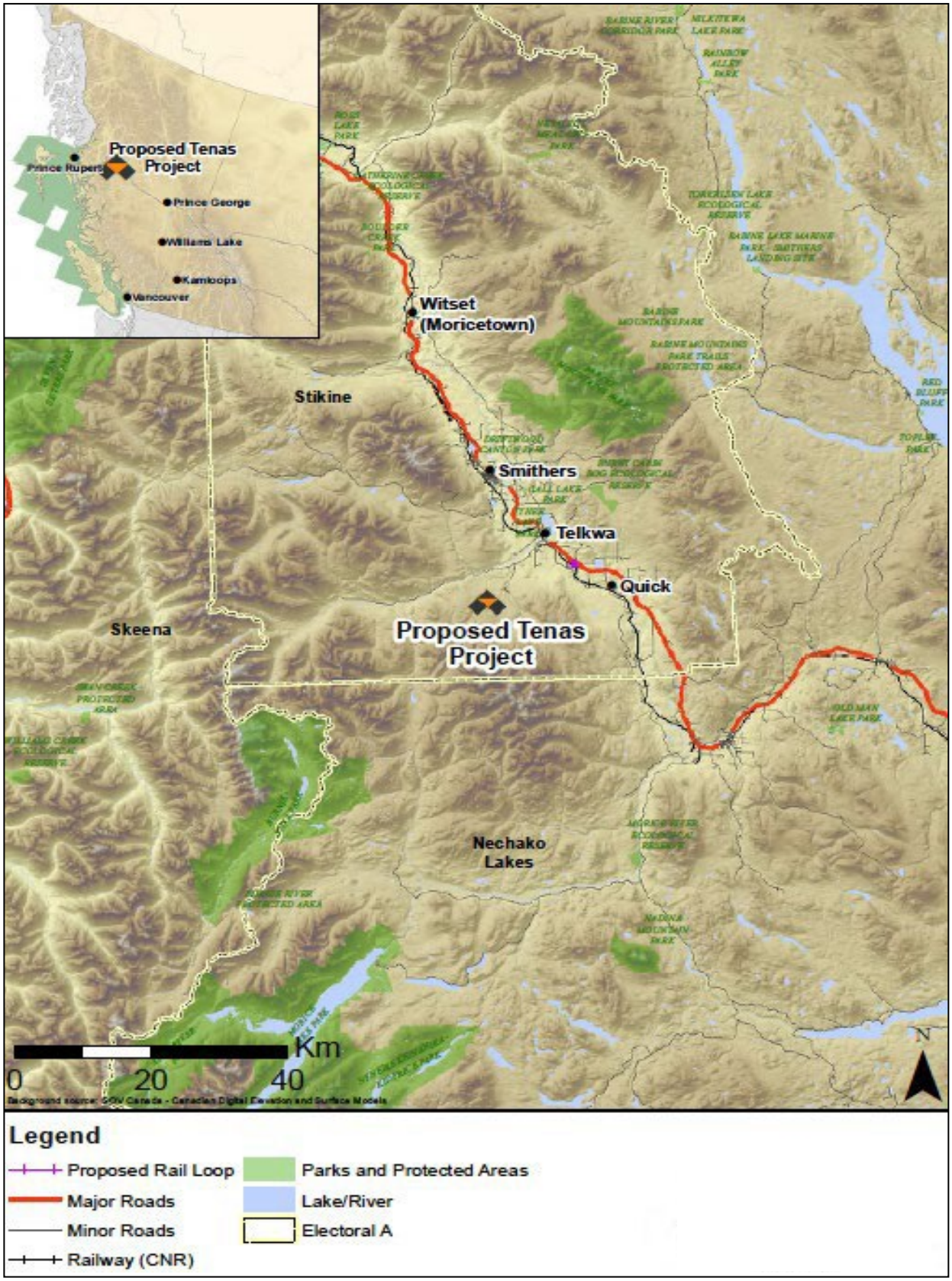
2 Background

2.1 Site Overview

The Tenas Project is in the Regional District of Bulkley-Nechako in northwestern British Columbia (BC), approximately 25 kilometers (km) south of Smithers and 7 km southwest of Telkwa, within the Wet'suwet'en's traditional territory, which includes the majority of the Bulkley River drainage Figure 2-1). Coal was reportedly discovered in the Telkwa area around 1900. Small-scale underground and surface mining began in 1918 and continued sporadically until 1985, resulting in the recovery of over 400,000 tonnes of coal. Modern exploration of the Project to delineate further exploitable coal reserves started in 1978, and with recent exploration programs, over 800 exploration drillholes, three bulk samples, trenching, geological mapping, and surface geophysics are available. The Project will extract run-of-mine (ROM) coal from a surface open pit through conventional shovel and truck methods (TCL 2018). Mining and processing of ROM coal will produce overburden, mine rock and processed rock that will need to be managed as appropriately to minimize long term environmental effects and geotechnical risks.

2.2 Bedrock Geology

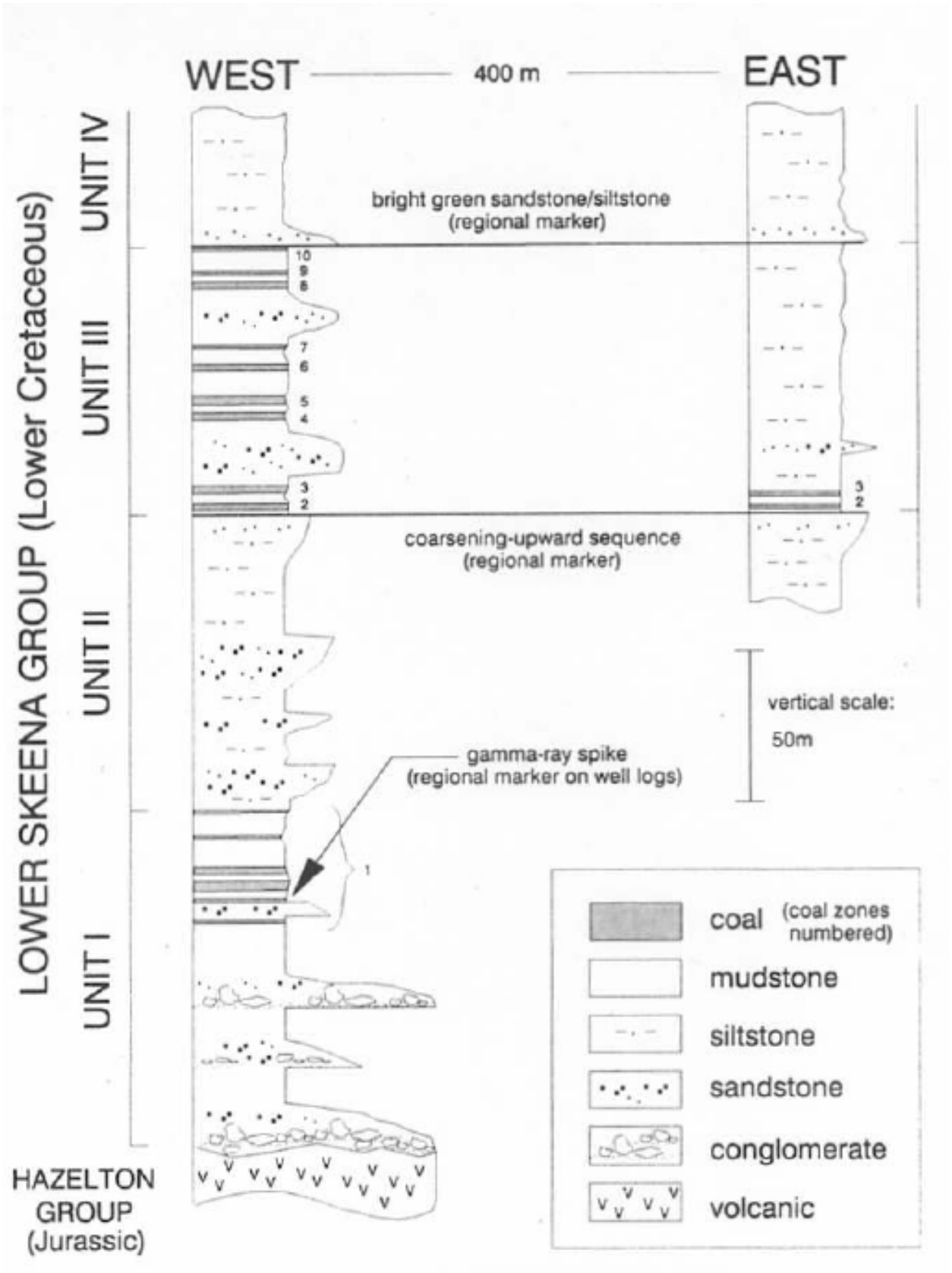
The Tenas Project is located within the northeast/southwest trending Skeena Arch, which separates Jurassic-age sedimentary rocks of the Bowser Basin in the north from the Jurassic to Cretaceous-age sedimentary rocks of the Nechako Basin to the south. The coal-bearing sedimentary rock sequence of the Project is associated with the Lower Cretaceous age Skeena Group, and unconformably overlies the Jurassic-age Hazelton volcanic group. A simplified stratigraphic column of the Tenas deposit is presented in Figure 2-2.



Adapted from Telkwa Mining Ltd.

Source: C:\Users\lvolden\SRK Consulting\NA CAPR002933 Telkwa Mining Project 2023 Geochemistry Support - Figures

srk consulting	TELKWA MINING LIMITED	Geochemical Field Barrel Testing
		Project Location
Job No: CAPR2933 Filename: CAPR002933_TelkwaFieldBarrel_Figures_Portrat_rev00_lv.pptx	Tenas Project	Date: March 2024 / Approved: LV / Figure: **2.1**



Adapted from Telkwa Mining Ltd.

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srk consulting	TELKWA MINING LIMITED	Geochemical Field Barrel Testing
		Stratigraphic Sequence
Job No: CAPR2933 Filename: CAPR002933_TelkwaFieldBarrel_Figures_Portrat_rev00_lv.pptx	Tenas Project	Date: March 2024 / Approved: LV / Figure: **2.2**

2.2.1 Jurassic Hazelton Volcanic Group

The volcanic rocks include andesite, trachyte, and basalt with associated tuffs and breccias.

2.2.2 Lower Cretaceous Skeena Group

The Lower Cretaceous Skeena Group includes marine and continental sediments interbedded with coal seams, often correlated over long lateral distances. It is subdivided into four units (Units I through IV) and a unit of undivided sediments overlying the four units.

The economic coal seams in the Tenas Deposit are located in Coal Zone 1 of Unit I and includes two seams: C seam and 1 seam (upper and lower). Coal Zones 2 through 10, located in Unit III are absent from the Tenas area. Units I through IV are summarized below.

Unit I (modified after Ledda, 1998)

The basal unit, Unit I, was deposited in a fluvial environment and, in the Telkwa Property, rests unconformably over the eroded Hazelton volcanic basement of Jurassic age. Because it was deposited over an undulating surface, the Unit l stratigraphy has been observed to display variability in thickness, often over short lateral distances. This variability is most evident in the lower sedimentary assemblage, between the basement contact and the lowermost Unit l coals. As such, Unit l can be more than 100 m in thickness and consists mainly of conglomerate, sandstone, mudstone, and coal.

Coals within this unit, collectively referred to as Coal Zone 1, formed in poorly drained backswamps and are characterized by lateral variation throughout the study area. The Unit l coals can consist of up to 12 individual coal seams that collectively contribute up to 11.9 m of coal to the unit's overall thickness. Sands and gravels were typically deposited in braided channels and bars while mudstones accumulated in floodplains. Indications are that there was periodic marine influence during deposition of the unit. Deposition of Unit I ended with a marine transgression and deposition of Unit II.

Unit II (Ledda, 1998)

Unit II was deposited within a deltaic / shallow marine environment and consists of up to 140 m of sandstone, silty mudstone and occasional thin coaly mudstone. Sands were deposited in distributary channels and mouth-bars while mudstones and silty mudstones accumulated in interdistributary bays. Thin discontinuous peat beds, none of which are of economic significance, accumulated in local salt marshes.

Unit III (modified after Ledda, 1998)

Unit III is indicative of the second regressive episode for the area and represents the deposition of the second main coal-bearing stratigraphic sequence. The unit averages 85 m in thickness and is comprised of sandstone, siltstone, carbonaceous mudstone, and thick, laterally extensive coal seams. Restricted nearshore marine, tidal flat and coastal swamp environments persisted throughout much of the deposition of Unit III. Sandstone units were deposited within tidal channels while interbedded sandstones and siltstones were deposited nearshore within intertidal environments. Mudstones are representative of tidal flat deposits. Significant marine influence during deposition of the entire unit is indicated.

Coal Zones 2 through 11 are represented in Unit III, collectively contributing to up to 17 coal seams of economic significance. The coal zones were likely formed in freshwater peat swamps, located landward of the tidal flat, somewhat isolated from influxes of brackish water. The presence of sulphur in some of the coal seams suggests, however, that the peat was infiltrated periodically by marine water. Thus, the major coal seams are interpreted to have formed from peat accumulated in a freshwater marsh that was proximal to a brackish environment. The Snuggedy Swamp of South Carolina is considered a modern analogue for the paleoenvironment in which Unit III was deposited.

2.2.3 Intrusions

Tertiary and Cretaceous-age porphyritic dykes and sills commonly intrude this sequence, the most notable of which includes a Tertiary granodiorite intrusion located on the north side of the Telkwa River. These intrusions are not present in the Tenas area.

2.2.4 Geological Structures

The sedimentary sequence in the Tenas area is folded into a syncline in which the gently (typically 10 to 20°) northeast-dipping western limb of the syncline subcrops on the western side of the pit area, while the moderately (40 to 45°) southwest-dipping eastern limb subcrops on the eastern side of the pit. Faulting is generally near-vertical, and can be subdivided into two main groups, one which strikes approximately northwest/southeast and the other which strikes approximately northeast/southwest.

2.3 Surficial Geology

The surficial geology in the Project area consists primarily of two types of deposits, glacial clay- or silt-rich till, and sand and glaciofluvial sand and gravel outwash. At upper elevations and south of the proposed pit, the terrain is mapped as having bedrock outcrops to a limited extent or thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick. North of the proposed pit and towards Tenas Creek and Goathorn Creek, drillholes report thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick underlain by a thick sand and gravel outwash deposit that can exceed 100 m.

Other types of deposits are present locally. Patches of glaciolacustrine deposits are scattered throughout the morainal landscape in low ridges and in depressions; the sediments comprise bedded and laminated mud, and minor sand and gravel (Clague 1984). Recent fluvial deposits form the narrow floodplains of Goathorn Creek and Tenas Creek, which are 40 m to 80 m deep incised into the subdued morainal landscape, and the wide floodplains of the Telkwa and Bulkley Rivers. The fluvial deposits range from extremely coarse, poorly sorted gravel on steep alluvial fans to moderately to well-sorted sand and mud on low-gradient floodplains (Clague 1984).

2.4 Material Zone Designations

Geochemical properties are stratigraphically constrained in coal deposits versus lithologically constrained. For example, the deposition environment of the Tenas Deposit includes marine and deltaic sedimentary sequences and rocks formed in these two different environments will be compositionally different. The deposit was demarcated into stratigraphic zones of sedimentary sequences between the mineable coal seams. The stratigraphic zones were further divided into additional zones if they had different distinct geochemical properties (e.g., Zone 1 and Zone 1a) or grouped if geochemical properties were similar between zones identified between coal seams (e.g., Zone 2 and Zone 3). The stratigraphic zones and classification of PAG and non-PAG based on an NPR of 2.0 identified for the Project are presented in Figure 2-3.

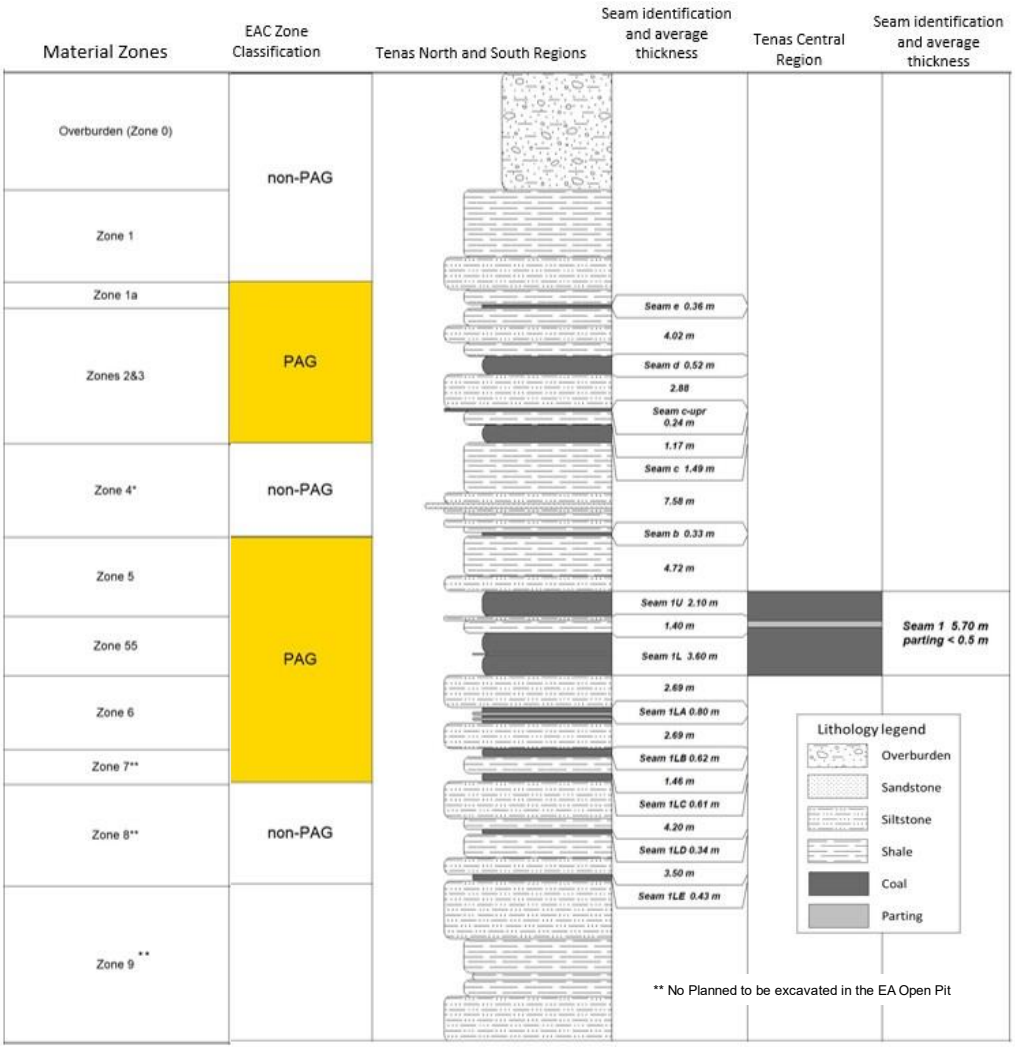


Figure 2-3. Tenas Deposit Stratigraphic Zones

2.5 Summary of Previous Geochemical Characterization Studies

Two geochemical studies have been completed to characterize the acid generating and metal leaching potential of the Tenas deposit:

- Norecol Dames and Moore (1999). Draft Report. Assessment of ARD Potential and Water Quality Predictions. Telkwa Coal Project.
- SRK (2022a). Telkwa Coal – Tenas Project Supplemental Geochemical Characterization.

The Norecol Dames and Moore (1999) study included the collection and analysis of over 700 samples. An additional 173 samples were collected as part of the supplemental geochemical characterization study (SRK 2022a). The supplemental samples were used to confirm the results of the 1999 study and calibrate the test results to more up-to-date testing methods. For example, samples collected as part of the Norecol Dames and Moore (1999) study were analyzed for total sulfur only and neutralization potential was determined using the Sobek-NP (1978) method. Results from both studies were combined to form a robust geochemical characterization that is documented in SRK (2022a). The reader is referred to SRK (2022a) for additional detail on the geochemical characterization program including sample selection, collection, geochemical testing methods and results.

The outcomes of these studies indicated that a large volume of the mine rock to be mined from the Tenas deposit is potentially acid generating (PAG) and that acid generating potential is stratigraphically constrained in zones generally separated by the coal seams (Figure 2-3). The geochemical testing results indicate that all zones contain some PAG rock; however, there are units that are predominantly PAG versus non-PAG. Based on a neutralization potential ratio (NPR) (SRK 2022a) of 2, the following zones were characterized as PAG and non- PAG based on their average bulk properties:

- Non-PAG: Zone 1, portions of Zone 4, overburden, construction materials, and topsoil;
- PAG: Zone 1a, Zone 2/3, portions of Zone 4, Zone 5, Zone 55, Zone 6, processed rock, processed coal and ROM coal

All zones contain both PAG and non-PAG materials with the exception of overburden, construction materials, and topsoil. The above zones were classified as non-PAG or PAG were based on an neutralization potential ratio (NPR) cutoff of 2. This cutoff was used to initially classify zones as non-PAG or PAG. PAG and non-PAG rock volume estimates based on this criterion were used to inform the waste management strategy (e.g., sizing of the management ponds).

SRK subsequently developed a site-specific NPR of 1.2 for mine rock based on carbonate molar ratios (CMRs) observed in humidity cell tests. Application of the site-specific NPR results in the following zones being classified as non-PAG and PAG based on their average bulk properties:

- Non-PAG: Zone 1, portions of Zone 4, Zone 5, Zone 55 and Zone 6;
- PAG: Zone 1a, Zone 2/3 and portions of Zone 4

The site-specific NPR of 1.2 is specific to mine rock does not apply to other mine materials (i.e., overburden, construction materials, topsoil, processed rock, processed coal and ROM coal). An NPR of 2 is used to characterize these materials as PAG or non-PAG and their classification (see above) does not change. The NPR of 2 is used for planning purposes and TML is proposing the site-specific

NPR of 1.2 be used as an operational segregation criterion, pending approval by the British Columbia Ministry of Energy Mines and Lower Carbon Innovation.

2.6 Overview of Field Barrel Testing Program

Nine field barrels were constructed at the Project site and have been monitored intermittently since October 2019. Details of each barrel, including material zone, ARD classification, and data availability are summarized by Table 2-1.

Composite samples for each barrel were prepared from sample rejects stored at Bureau Veritas Laboratories in Burnaby, British Columbia. Sample rejects, varying in mass from one to 110 kg were selected for use in the barrels until a minimum mass of 200 kg was achieved. Zones with insufficient mass (e.g., Zone 4 PAG and Zone 4 non-PAG) were supplemented with sample rejects from other zones with similar geochemical properties (Table 2-1). Individual waste rock samples were homogenized using cone and quartering methods prior to placing the samples in the barrels. A barrel consisting of overburden collected at site was also constructed. As part of the QA/QC program, a duplicate barrel was constructed from Zone 1 rock and a blank barrel, containing no materials, was also constructed at site to identify any systematic laboratory testing errors.

The PAG management strategy for the Project is to place PAG rock underwater in the management ponds prior to the rock becoming acidic. A key objective of the barrel testing program was to confirm the lag time to onset of acid generation estimates derived using lab based kinetic tests (SRK 2022a) that have been used to inform the PAG management strategy. With this objective in mind, conservatism was included in the evaluation by selecting sample rejects for some barrels which resulted in weighted sulfide concentrations greater than the bulk sulfide content of the zone and a weighted NPR lower than the bulk properties of each zone (Table 2-1). Samples used in the construction of each barrel are provided in Appendix A.

Leachate sampling has been conducted intermittently from October 2019 until November 2023. Seven to nine samples have been collected from each barrel during this period. The volume of leachate collected in each barrel between sampling periods was calculated from the water column height at the time of collection. Table 2-2 presents the calculated volume of each barrel for the sampling date, as well as the dates when volumes were not recorded but leachate samples were collected for analytical chemistry.

During sample collection the following field parameters were measured and recorded: pH, temperature, oxidation reduction potential (ORP), dissolved oxygen and electrical conductivity (EC). Olfactory and other visual (e.g., colour) observations were made during sampling. Laboratory analysis was conducted at Bureau Veritas Laboratories in Richmond, BC, using standard analytical methodologies. The following parameters were measured:

- General parameters: electrical conductivity (EC), pH, hardness, acidity, alkalinity
- major anions (chloride, fluoride, sulfate, phosphate) and nitrogen species (nitrate, nitrite, ammonia),
- total and dissolved major and trace elements concentrations.

Before data analysis and interpretation, SRK screened the analytical results against internal QA/QC procedures to validate that data quality is acceptable for the purpose of the Project.

Table 2-1. Field Barrel Attributes

Barrel	Description	ID	Mass (kg)	Zone Classification	Starting Date	Weeks of Data	No. Leachate Samples	Barrel Geochemical Attributes		Zone Average Geochemical Properties	
								S^{2-} (w.t.%)	NPR	S^{2-} (w.t.%)	NPR
Barrel 1	Zone 1	B1	193.5	Non-PAG	8/7/2019	158	9	0.55	2.7	0.43	3.2
Barrel 2	Zone 1 (duplicate)	B2	193.5	Non-PAG	8/7/2019	158	8	0.55	2.7	0.43	3.2
Barrel 30.32	Zone 1a	B3	234.3	PAG	8/7/2019	158	8	1.46	0.47	1.6	0.7
Barrel 4	Zone 2/3	B4	190.7	PAG	8/7/2019	158	9	1.40	0.82	0.88	0.80
Barrel 5	Zone 4 PAG + Zone 5	B5	146.1	PAG/ Non-PAG	8/20/2019	156	8	1.23	1.01	1.75 (Zone 4 PAG) 1.13 (Zone 5)	0.6 (Zone 4 PAG) 1.5 (Zone 5)
Barrel 6	Zone 6 + Zone 7	B6	138.7	Non-PAG	8/20/2019	156	8	1.66	0.51	0.97 (Zone 6) 0.86 (Zone 7)	1.6 (Zone 6) 1.4 (Zone 7)
Barrel 7	Zone 4 non-PAG + Zone 8	B7	183.8	Non-PAG	8/20/2019	156	9	0.32	5.6	0.5 (Zone 4 non-PAG) 0.3 (Zone 8)	3.5 (Zone 4 non-PAG) 4.7 (Zone 8)
Barrel 8	Overburden	B8	167	Non-PAG	10/18/2019	147	9	N/A	N/A	N/A	N/A
Barrel 9	Blank	B9	0		8/20/2019	156	7	N/A	N/A	N/A	N/A

Source**:** compiled in the text.

Table 2-2. Sampling Events and Leachate Volumes

Volume (L)	Barrel 1: Zone 1	Barrel 2: Zone 1 (duplicate)	Barrel 3: Zone 1a	Barrel 4: Zone 2-3	Barrel 5: Zone 4PAG + Zone 5	Barrel 6: Zone 6 + Zone 7	Barrel 7: Zone 4 NPAG + Zone 8	Barrel 8: Overburden	Barrel 9: Blank
12/31/2019	10.7	10.9	20.4	6.4	5.1	6.9	6.4	n.r.	n.r.
4/29/2020	13.4	8.1	11.5	7.8	10.9	6.4	4.7	16.8	n.r.
9/23/2020	13.4	8.1	11.5	7.8	10.9	6.4	4.7	16.8	n.r.
11/29/2020	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
4/5/2021	12.8	11.3	11.8	10.4	9.3	10.2	6.9	15.7	n.r.
7/15/2021	21.2	9.9	17.1	15.7	14.5	18.5	18.2	9.0	n.r.
12/20/2021	3.9	n. r.	15.1	18.1	17.5	6.3	19.3	8.1	n.r.
5/24/2022	4.0	5.5	n.r.	2.5	n.r.	2.5	7.0	8.5	n.r.
8/15/2022	n.r.	12.5	5.1	8.1	14.5	9.2	n.r.	n.r.	n.r.
8/16/2022	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	19.8	6.9	n.r.

n.r. - volume not recorded during sampling,

Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx

3 Field Barrel Results

Barrel release rates for select parameters are presented on Figure 3-1 and a complete summary of results is provided in Appendix B. Select parameters are defined as those that provide insight to acid generation potential (pH, alkalinity, acidity and sulfate), were screened to be greater than 10 times the average crustal abundances during static geochemical characterization (arsenic, phosphorus and selenium) or had increasing concentrations during the testing period in at least one barrel (cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, nickel, tin, thallium, uranium, vanadium and zinc).

Release rates were calculated using the following formula:

$$L_j = C_j * \frac{V}{m} / t$$

Where: L_j is the load of parameter j expressed in mg/kg/week

C_j is the concentration of parameter j in the leachate sample in mg/L

V is the volume of the sample in L

m is the total mass in the barrel in kg

t is the time between sample events in weeks

Trends in release rates were relatively consistent, or decreasing, in all barrels until the most recent sampling event (October 2023), where acidity increased in B4 (Zone 2/3) and B6 (Zone 6/7) along with several other parameters (Figure 3-1). Sulfate, as well as calcium and magnesium loadings were higher in barrels containing PAG rock (i.e., B3, B4, B5 and B6) in comparison to non-PAG barrels (i.e., B1, B2 and B7). Higher sulfate production rates are expected in the PAG barrels because they have higher sulfide concentrations (Table 2-1). The higher calcium and magnesium loading rates are indicative of carbonate mineral dissolution in response to acid production from sulfide oxidation.

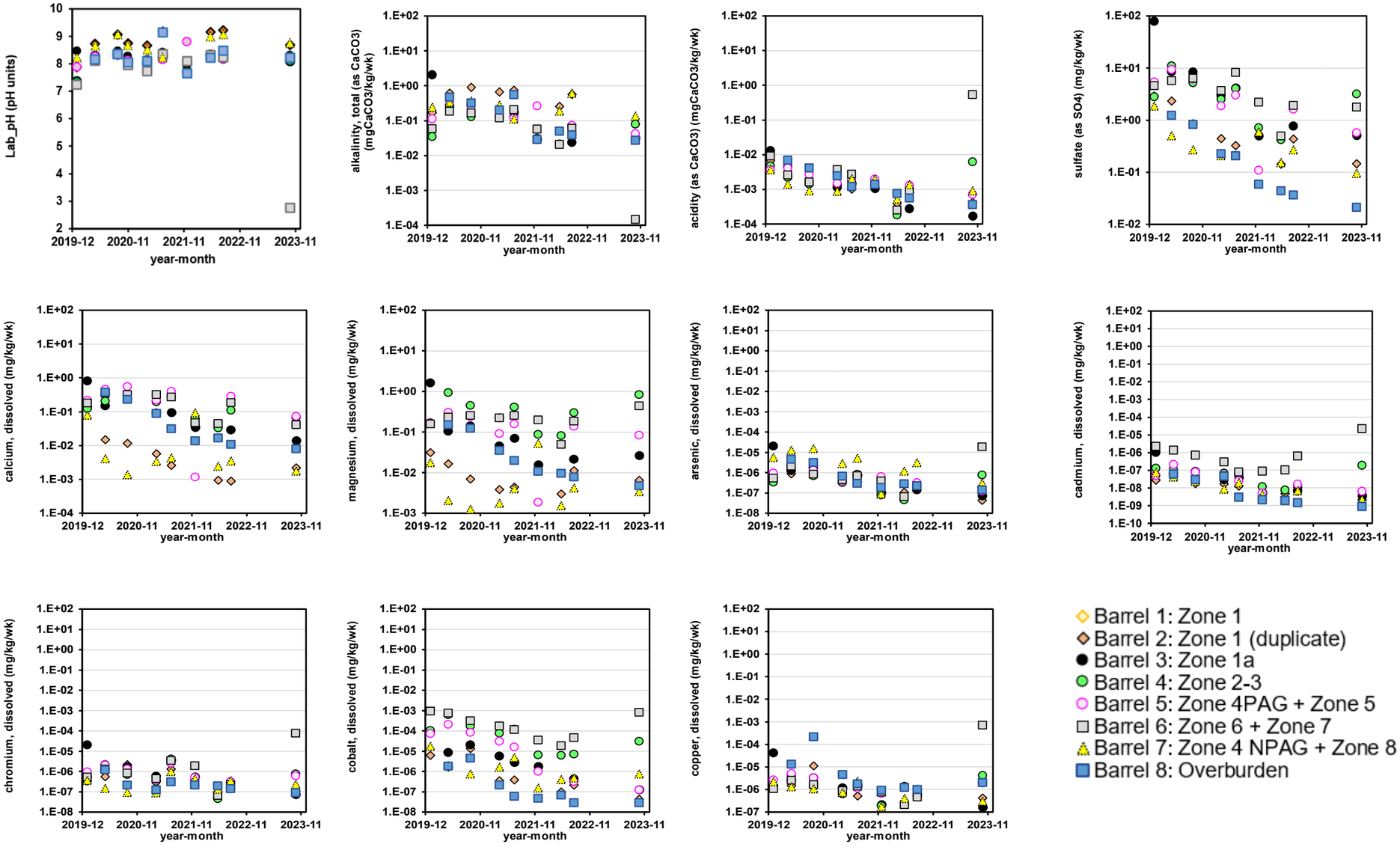
The pH in B6 decreased from 8.2 in August 2022 to 2.8 in October 2023. B6 represents a composite of waste rock Zones 6 and 7, which were classified as non-PAG based on static data and is currently the only barrel with an acidic pH. The NPR of the barrel containing waste rock reject samples from these zones was 0.5 (Table 2-1), which is lower than the bulk average NPR for Zone 6 (1.6) and Zone 7 (1.4). Although the Zone 6 and 7 composite barrel went acidic this does not change the overall PAG classification for Zone 6 and Zone 7 since the barrel NPR is closer to the 5th percentile NPRs in these two zones based on static properties (SRK 2022a).

Decreasing pH in B6 coincided with an increase in several constituent loadings including cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, phosphorus, nickel, tin, thallium, uranium, vanadium and zinc (Figure 3-1). Increases in some of these parameters were also observed at lower magnitudes in B4. The results suggest that if acidic drainage occurs from mine rock prior to placement in the management ponds, concentrations of these parameters will increase. The current interpretation is only based on one monitoring point with an acidic pH, and continued monitoring is required to confirm the trends.

Increasing acidity and sulfate loads in B4, along with several other parameters indicates B4 may go acidic in the near future. B4 represents waste Zone 2/3 which is classified as PAG based on static data. In all other barrels, alkalinity loadings remained generally consistent during the testing period with a slight decrease over time. Loadings of other constituents have generally maintained a slight decreasing trend throughout the testing period. This generally occurs when the pH remains stable and the mass inventory is depleted through time.

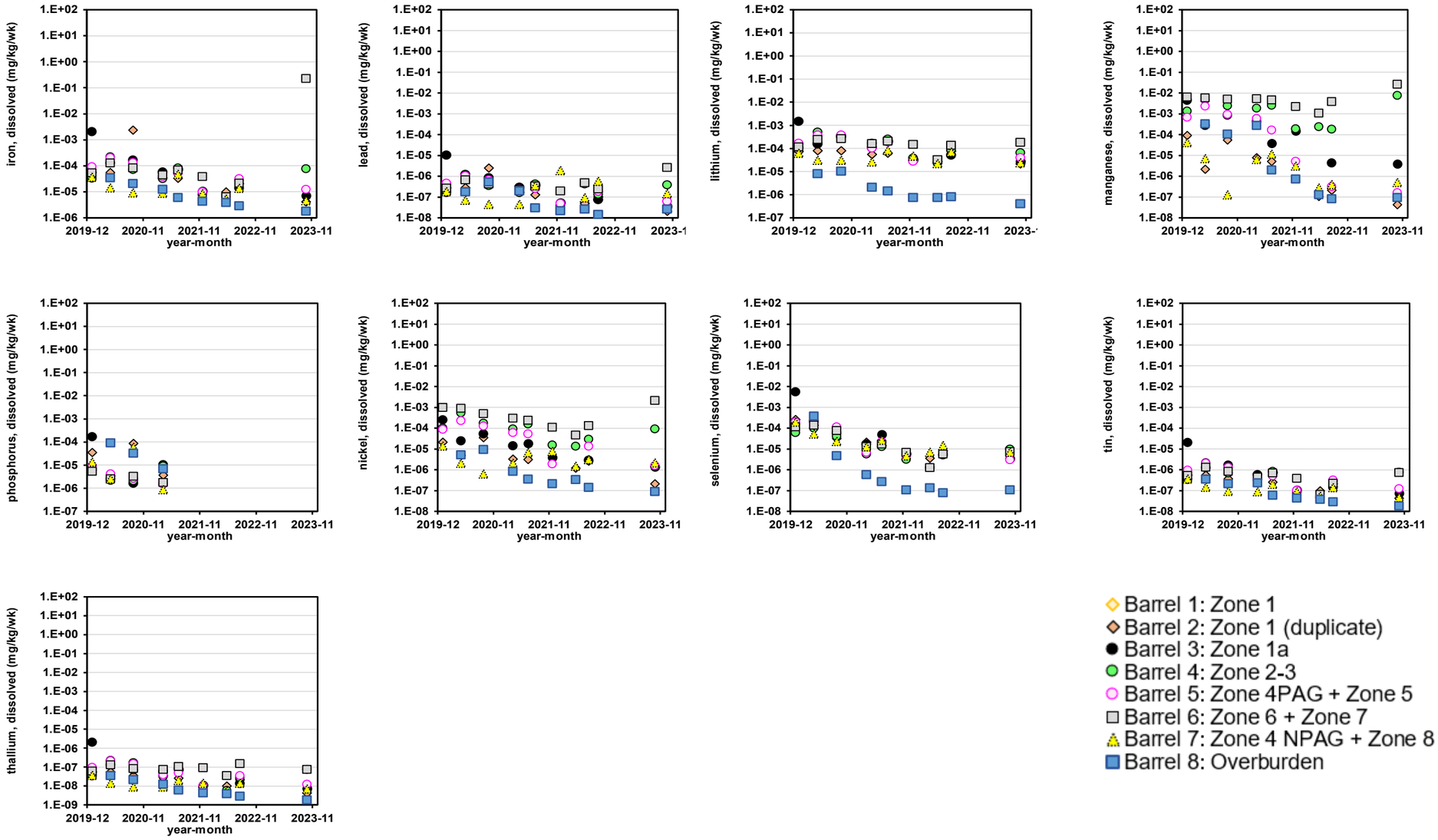
As discussed in Section 2.5, SRK (2022a) developed a site-specific NPR criterion based on kinetic testing results. CMRs calculated using the methods described in SRK (2022a) are presented in Figure 0-1. The HCT CMRs are also presented.

The field barrels had low sulfate production rates in comparison to the HCTs (Figure 0-1). The non-PAG barrels (1, 2 and 7) had sulfate release rates less than 1 mg/kg/week and PAG barrels (3, 4, 5 and 6) had sulfate release rates ranging from 3.5 to 13 mg/kg/week. The lower barrel production rates occur because of much lower water to rock ratios and water yields in the barrel tests compared to the HCTs. The CMRs of the PAG barrels were approximately 1.0 mol/mol for all barrels. The non-PAG CMRs were higher as a result of the lower sulfate production rates. The empirical sulfate production and carbonate dissolution rates converge on a CMR of 1.0 indicating the site-specific NPR of 1.2 estimated based on the HCTs is reasonable.



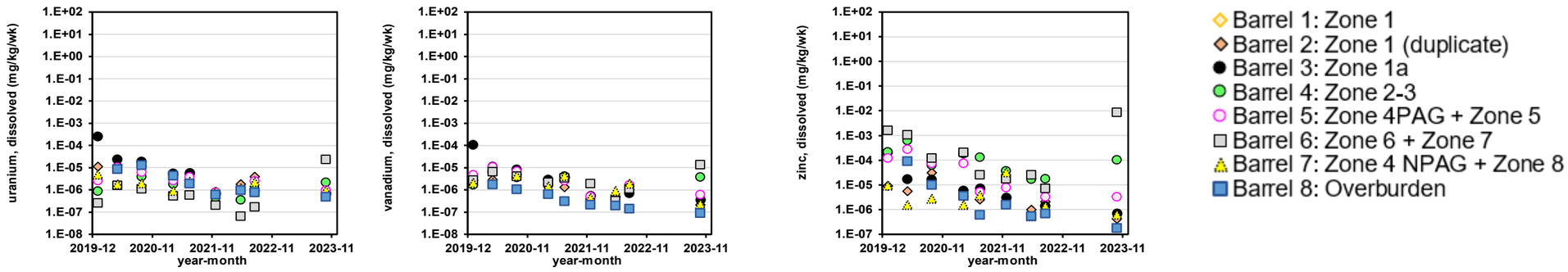
Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx]Load_S

Figure 3-1. Loading Results from Barrel Tests for Select Parameters



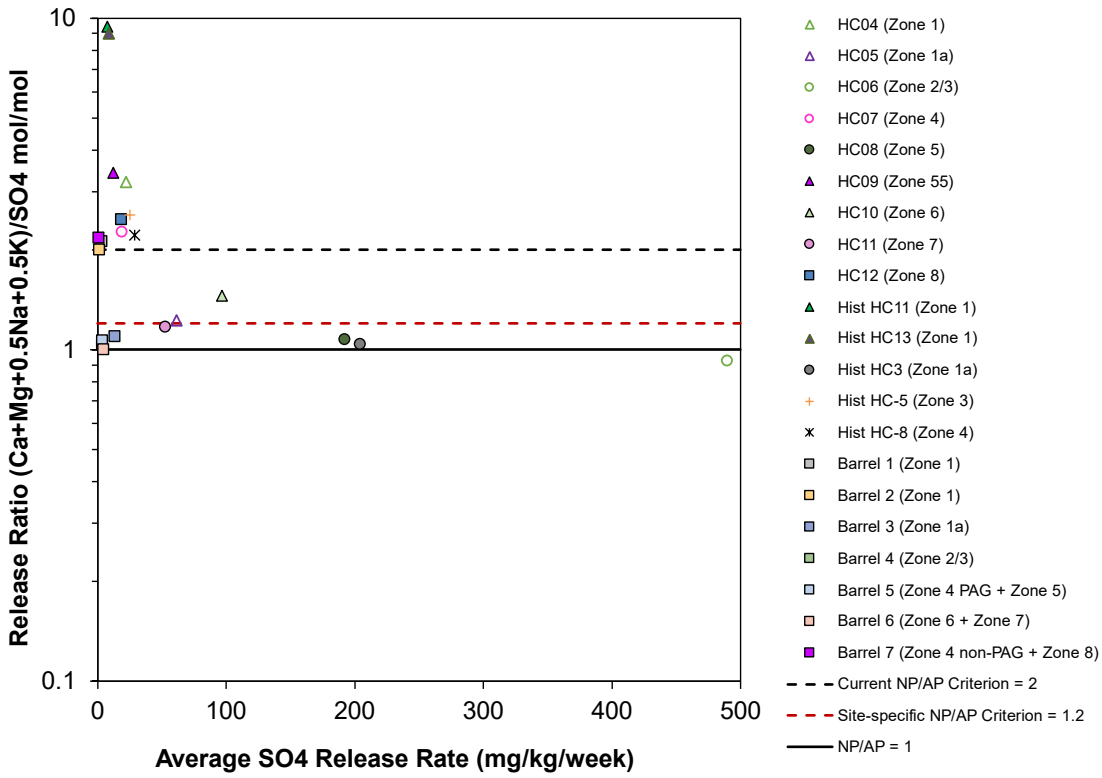
Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx]Load_S

Figure 3-1 (cont.) Loading Results from Barrel Tests for Select Parameters



Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx]Load_S

Figure 3-1 (cont.) Loading Results from Barrel Tests for Select Parameters



Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[NPR_Crit_1CT027.002_JED_MKH_r01.xlsx]

Figure 0-1. Comparison of CMR Estimates from HCTs and Field Barrels

4 Comparison to Source Term Loadings

SRK (2022b) developed geochemical source terms using humidity cell testing (HCT) results that were scaled to account for the differences between lab and site conditions (e.g., temperature and grain size). The reader is referred to SRK (2022b) for additional details on the source term derivation methods, including the scaling approach that was used. The barrel release rates provide insight into parameter release rates under ambient conditions. These were compared to the scaled HCT results to determine if the scaling approach used in the source term derivation was accurate. Prior to the comparison, a grain size scaling factor (0.2) was applied to the barrel release rates since the barrels were constructed using HCT rock rejects (i.e., <1/4”). The barrels are much smaller than a full scale rock pile and will not exhibit the same internal heating that occurs in full scale piles containing pyritic rock. The field temperature of the barrels was approximately 10ºC and the release rates were not adjusted for temperature differences since this is the expected temperature of the full scale pile.

Figures comparing the scaled barrel and HCT release rates for non-PAG zones (Zones 1 and 4) is included in Appendix C. A release rate higher in the barrel in comparison to the HCT indicates the lab rates were over scaled. The following list the parameters that were similar, lower or higher in the barrels compared to the HCT.

- Higher: sulfate, arsenic, cobalt, lead, molybdenum, nickel, selenium and uranium,
- Lower: calcium, magnesium, potassium, barium, boron, cadmium, iron, lithium, manganese, mercury, phosphorus, silicon, strontium, tin and thallium.
- Similar: sodium, chloride, antimony, chromium, copper, silver, vanadium and zinc.

The comparison indicated several constituents were either over or under scaled in the HCTs. SRK has updated the geochemical source terms using the barrel release rates to be used in the Project water quality model to evaluate changes to water quality (SRK 2022c).

5 Summary

A field barrel testing program was initiated to evaluate release rates and acidic lag times from Project Materials under ambient conditions. The results were used for several purposes, including:

- Advance the understanding of ML/ARD from stratigraphic zones under field conditions.
- Provide additional empirical evidence to support lag times lag times to the onset of acid generation.
- Constrain scaling factors that were used in the geochemical source terms that were used as the basis of the EA water quality predictions.

With the exception of barrel 6 (Zone 6/7), all barrels remained alkaline during the four-year data collection period. Sulfate loadings were higher in barrels that are characterized as PAG based on the weighted NPRs (Table 2-1) in comparison to non-PAG barrels. In addition, the calcium and magnesium release rates were also higher in PAG barrels relative to non-PAG barrels. Release rates of these constituents as well as the alkaline pH of the leachates and alkalinity production rates indicate carbonate mineral dissolution is buffering acid production from sulfide oxidation. Acidity and sulfate release rates increased during the last sampling round (October 2023) in barrel 4 (Zone 2/3) indicating this barrel may go acidic in the near future.

The PAG management strategy for the project is to place all PAG rock underwater in the management ponds within a period of 12 months. Barrel 6 became acid generating in October 2023, four years after the barrel testing program was constructed and all other barrels maintained alkaline pH values. The barrel results support the proposed period for inundation of PAG rock is reasonable.

SRK (2022a) developed a site-specific NPR of 1.2 based on HCT results. CMRs on the steady state rates in the barrel tests converged on a value of 1. The similarities between the barrel and the HCT CMRs support that the site-specific NPR estimated based on the HCT results of 1.2 is reasonable.

A comparison of the scaled barrel and HCT release rates indicate the scaling factors applied in the source terms (SRK 2022b) were too high for some constituents and too low for others. SRK has updated the geochemical source terms and site-wide water quality predictions using the scaled barrel release rates. The results of these updates will be reported under separate cover.

6 Closing

We trust this memo satisfies your current requirements. Should you have any questions or require any additional information please do not hesitate to contact the undersigned.

Regards,
SRK Consulting (Canada) Inc.

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Attachments:

Appendix A	Barrel Attribute Data
Appendix B	Summary of Barrel release rates
Appendix C	Comparison of Scaled HCT Loads to Barrel Load Figures

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References

Norecol Dames and Moore, 1999. Draft Report. Assessment of ARD Potential and Water Quality Predictions. Telkwa Coal Project. Prepared for Luscar Coal Ltd. Project No. 25373-004-310. March 19, 1999.

SRK 2022a. Telkwa Coal – Tenas Project Supplemental Geochemical Characterization. Prepared for Telkwa Coal Ltd. By SRK Consulting (Canada) Inc. February 2022.

SRK 2022b. Telkwa Coal – Tenas Project Water Quality Model Source Term Derivation Methods. Prepared for Telkwa Coal Ltd. By SRK Consulting (Canada) Inc. February 2022.

SRK 2023c. Tenas Project – Water and Load Balance Modeling Report. FINAL. Prepared for Telkwa Coal Limited: Vancouver BC. Project Number 1CT027.003. Issued July 29, 2022.

Appendix A Barrel Attribute Data

Barrel #	Description	Sample IDs	Sample Mass (kg)	Total Mass (kg)
1 and 2	Zone 1 and duplicate	T18-02D-A-005	34.0	633.96725 (2 barrels for 316.983625 kg each) *247kg total or 123.5kg each barrel was disposed of and did not fit into barrels. ***28657 + 28669 samples were not on pallet*.**
		T18-02D-A-006	37.1	
		28651	97.6	
		28653	82.5	
		28655	49.8	
		28657	40.0	
		28658	47.7	
		28659	41.2	
		28660	17.9	
		28669	40.9	
		29502	33.8	
		29509	111.6	
3	Zone 1a	28841	51.6	332.2785 *98.0kgs total was disposed of and did not fit into barrel.
		28842	43.3	
		28843	52.3	
		28844	40.7	
		T18-02D-A-011	33.7	
		28672	35.4	
		29514	41.8	
		29515	33.6	
4	Zone 2-3	T18-01D-A-001	11.1	282.249875 *91.5kgs total was disposed of and did not fit into barrel.
		T18-01D-A-002	0.9	
		T18-02D-A-012	29.5	
		T18-02D-A-013	14.9	
		28673	26.6	
		28674	4.9	
		T18-01D-A-003	5.1	
		T18-01D-A-004	14.0	
		T18-01D-A-005	23.4	
		T18-01D-A-006	10.6	
		T18-01D-A-007	1.2	
		T18-02D-A-014	43.5	
		T18-02D-A-015	33.2	
		T18-02D-A-016	3.3	
		28675	30.1	
		28676	27.6	
		28677	2.3	
5	Zone 4PAG + Zone 5	T18-01D-A-009	24.9	282.11575 *136.0kgs total was disposed of and did not fit into barrel.
		T18-02D-A-020	47.2	
		28681	32.1	
		28682	2.7	
		28683	5.2	
		T18-01D-A-010	44.0	
		T18-01D-A-011	29.7	
		T18-02D-A-022	34.8	
		T18-02D-A-024	14.6	
		T18-02D-A-025	6.7	
		T18-03D-A-005	14.3	
		28684	6.3	
		28686	14.9	
		28687	4.8	
6	Zone 6 + Zone 7	T18-01D-A-012	7.1	335.677875 *197.0kgs was disposed of and did not fit into barrel.
		T18-02D-A-027	3.7	
		T18-02D-A-029	11.5	
		T18-03D-A-009	10.9	
		T18-03D-A-021	15.0	
		T18-03D-A-022	3.7	
		28688	2.2	
		28690	24.3	
		28691	1.8	
		28704	6.5	
		28692	2.8	
		28693	5.6	
		28696	1.9	
		28697	5.4	
		29516	41.3	
		29518	38.6	
		29519	15.2	
		29520	3.4	
		29521	4.9	
		T18-02D-A-030	13.4	
		T18-02D-A-031	18.9	
		T18-02D-A-032	16.3	
		T18-02D-A-033	11.3	
		T18-02D-A-034	9.4	
		T18-03D-A-023	2.1	
		T18-03D-A-024	11.6	
		28698	38.8	
		28699	2.4	
		28700	5.7	
7	Zone 4 NPAG + Zone 8	T18-01D-A-008	35.1	224.280125 *40.5kgs was disposed of and did not fit into the barrel.
		T18-02D-A-017	0.8	
		T18-02D-A-018	28.2	
		T18-02D-A-019	14.8	
		28678	3.0	
		28679	56.2	
		28680	30.9	
		T18-02D-A-035	17.8	
		T18-02D-A-036	5.6	
		T18-02D-A-037	12.0	
		28708	4.1	
		28709	15.7	
8	Overburden	B945450	167.4	167.367kgs- All overburden pail samples fit into barrel.
9	Blank	0	0.0	0

Appendix B Summary of Barrel release rates

Appendix B: Summary of Barrel release rates (mg/kg/week)

Table B1: Element release rates for non-PAG zones estimated from field kinetics testing

Parameter	Units	non-PAG Zones											
		Barrel 1: Zone 1			Barrel 2: Zone 1 (duplicate)			Barrel 6: Zone 6 + Zone 7			Barrel 7: Zone 4 NPAG + Zone 8		
		min	Average	Max	min	Average	Max	min	Average	Max	min	Average	Max
Conventional													
pH	s.u.	8.0	8.7	9.5	7.9	8.6	9.2	2.8	7.9	8.4	7.6	8.3	9.1
EC	mS/cm	2790	4706	6350	2160	3953	5190	1020	7893	11200	511	2095	3050
Alkalinity	mg$CaCO_3$/Kg/week	0.18	3.6	9.4	0.08	0.55	0.88	0.00014	0.11	0.20	0.032	0.27	0.61
Major Ions													
Calcium	mg/kg/week	0.0019	0.033	0.117	0.00089	0.025	0.14	0.041	0.21	0.34	0.0014	0.024	0.093
Magnesium	mg/kg/week	0.010	0.028	0.13	0.0029	0.011	0.031	0.049	0.19	0.44	0.0012	0.011	0.053
Potassium	mg/kg/week	0.008	0.023	0.043	0.0014	0.0051	0.0083	0.00052	0.010	0.016	0.0011	0.0028	0.0048
Sodium	mg/kg/week	1.1	3.1	5.3	0.11	0.72	1.3	0.06	1.1	2.4	0.11	0.37	0.81
Chloride	mg/kg/week	0.010	0.042	0.083	0.0019	0.0085	0.027	0.0031	0.018	0.034	0.00077	0.0044	0.0087
Sulfate	mg/kg/week	0.91	3.1	7.6	0.14	1.1	2.9	0.49	4.1	8.2	0.09	0.51	1.9
Nitrate	mg/kg/week	0.00024	0.015	0.046	0.000021	0.0075	0.024	0.000031	0.00018	0.00034	0.000024	0.0013	0.0031
Nitrite	mg/kg/week	0.000023	0.0014	0.0042	0.0000042	0.00023	0.00066	0.0000062	0.000039	0.000067	0.0000023	0.000076	0.00026
Ammonia	mg/kg/week	0.000007	0.0010	0.0035	0.0000010	0.00034	0.0011	0.0000019	0.00037	0.0014	0.0000013	0.000083	0.00044
Dissolved Elements													
Aluminum	mg/kg/week	0.0000053	0.00062	0.0041	0.00000048	0.00017	0.0011	0.00000062	0.0000063	0.022	0.00000045	0.000025	0.00011
Antimony	mg/kg/week	0.00000069	0.0000054	0.000011	0.000000042	0.0000014	0.0000029	0.0000001	0.0000005	0.0000013	0.000000086	0.00000091	0.0000018
Arsenic	mg/kg/week	0.00000074	0.0000054	0.000014	0.000000042	0.000001	0.000002	0.000000062	0.00000064	0.000018	0.000000086	0.0000057	0.000015
Barium	mg/kg/week	0.0000010	0.000065	0.00025	0.00000016	0.00001	0.00002	0.0000010	0.0000056	0.000010	0.0000010	0.000011	0.000025
Boron	mg/kg/week	0.00008	0.00085	0.0019	0.000011	0.000094	0.00018	0.0000116	0.0000738	0.00013	0.000022	0.00010	0.00026
Cadmium	mg/kg/week	0.000000025	0.00000015	0.00000030	0.0000000021	0.000000019	0.000000044	0.000000077	0.00000067	0.000022	0.0000000023	0.000000023	0.000000073
Chromium	mg/kg/week	0.0000005	0.0000034	0.000013	0.00000010	0.0000007	0.0000021	0.000000062	0.0000011	0.000074	0.00000009	0.00000032	0.0000010
Cobalt	mg/kg/week	0.0000012	0.000021	0.00012	0.000000042	0.0000032	0.000013	0.000018	0.00029	0.00093	0.00000015	0.00000342	0.000017
Copper	mg/kg/week	0.0000023	0.000015	0.00007	0.00000021	0.0000023	0.000011	0.00000021	0.0000011	0.00069	0.00000017	0.00000115	0.0000024
Iron	mg/kg/week	0.000049	0.00092	0.00577	0.0000042	0.00036	0.0023	0.0000062	0.000055	0.22354	0.00000454	0.00001802	0.000048
Lead	mg/kg/week	0.00000026	0.0000095	0.00005	0.000000021	0.00000049	0.0000024	0.00000019	0.00000035	0.0000025	0.00000004	0.00000040	0.0000019
Lithium	mg/kg/week	0.000078	0.00025	0.00053	0.000022	0.000064	0.000080	0.000031	0.00016	0.00026	0.000022	0.000046	0.000083
Manganese	mg/kg/week	0.0000012	0.000064	0.00031	0.000000042	0.000022	0.000089	0.0011	0.0042	0.025	0.00000013	0.0000089	0.000042
Mercury	mg/kg/week	0.0000000049	0.000000014	0.000000026	0.0000000010	0.0000000045	0.000000013	0.00000000062	0.0000000049	0.000000013	0.0000000013	0.0000000064	0.000000022
Phosphorus	mg/kg/week	0.0000066	0.0000	0.0000	0.0000034	0.000032	0.000087	0.0000017	0.0000032	0.0000052	0.00000088	0.000019	0.0001
Molybdenum	mg/kg/week	0.0000019	0.00031	0.00102	0.00000017	0.000040	0.00011	0.000000031	0.00000071	0.0000027	0.00000043	0.000059	0.00017
Nickel	mg/kg/week	0.0000059	0.00005	0.00023	0.00000021	0.000010	0.000034	0.000046	0.00040	0.0020	0.00000063	0.000005	0.00001
Selenium	mg/kg/week	0.0000005	0.00013	0.00039	0.0000034	0.000067	0.00025	0.0000012	0.000045	0.00013	0.0000047	0.000041	0.00019
Silicon	mg/kg/week	0.0012	0.0055	0.013	0.000094	0.0011	0.0026	0.00018	0.0012	0.0064	0.00026	0.00095	0.0018
Silver	mg/kg/week	0.000000049	0.00000014	0.00000026	0.0000000042	0.000000033	0.000000055	0.0000000062	0.000000055	0.00000013	0.0000000045	0.000000015	0.000000037
Strontium	mg/kg/week	0.00008	0.0011	0.0024	0.000017	0.00068	0.0031	0.00079	0.0032	0.0052	0.000049	0.00038	0.0015
Tin	mg/kg/week	0.00000049	0.0000014	0.0000026	0.000000042	0.00000033	0.00000055	0.000000062	0.00000055	0.0000013	0.000000045	0.00000015	0.00000037
Thallium	mg/kg/week	0.000000049	0.00000014	0.00000026	0.0000000042	0.000000033	0.000000055	0.000000034	0.000000090	0.00000015	0.0000000053	0.000000015	0.000000037
Uranium	mg/kg/week	0.000009	0.000035	0.000092	0.00000075	0.0000073	0.000013	0.000000064	0.00000055	0.000023	0.00000081	0.0000020	0.0000049
Vanadium	mg/kg/week	0.0000025	0.0000068	0.000013	0.00000021	0.0000021	0.0000047	0.00000031	0.0000027	0.000013	0.00000023	0.0000021	0.0000043
Zinc	mg/kg/week	0.0000049	0.000046	0.00025	0.00000042	0.000008	0.000030	0.0000071	0.00038	0.0085	0.00000053	0.0000066	0.000032

Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx

Appendix B: Summary of Barrel release rates (mg/kg/week)

Table B2: Element release rates for PAG zones estimated from field kinetics testing

Parameter	Units	PAG Zones								
		Barrel 3: Zone 1a			Barrel 4: Zone 2-3			Barrel 5: Zone 4PAG + Zone 5		
		min	Average	Max	min	Average	Max	min	Average	Max
Conventional										
pH	s.u.	7.9	8.2	8.5	7.4	7.9	8.3	7.9	8.1	8.8
EC	mS/cm	2000	13318	27200	1580	7857	19200	727	5471	8660
Alkalinity	mg $CaCO_3$/L	0.024	0.43	2.0	0.021	0.10	0.27	0.042	0.19	0.35
Major Ions										
Calcium	mg/kg/week	0.014	0.21	0.81	0.032	0.16	0.28	0.0011	0.30	0.55
Magnesium	mg/kg/week	0.016	0.29	1.61	0.081	0.33	0.93	0.0018	0.15	0.30
Potassium	mg/kg/week	0.0019	0.043	0.21	0.0015	0.010	0.025	0.0013	0.016	0.043
Sodium	mg/kg/week	0.140	7.1	38.3	0.017	1.1	4.4	0.034	1.4	3.9
Chloride	mg/kg/week	0.0018	0.049	0.23	0.0019	0.018	0.054	0.00049	0.018	0.051
Sulfate	mg/kg/week	0.49	15	79	0.41	3.5	11	0.11	3.9	9.3
Nitrate	mg/kg/week	0.00032	0.0028	0.0058	0.000057	0.0017	0.0079	0.000024	0.0065	0.023
Nitrite	mg/kg/week	0.0000035	0.0010	0.0059	0.0000038	0.000084	0.00031	0.0000020	0.00026	0.0011
Ammonia	mg/kg/week	0.00000042	0.0061	0.032	0.0000013	0.00039	0.0025	0.0000012	0.00040	0.0020
Dissolved Elements										
Aluminum	mg/kg/week	0.00000070	0.00004	0.00021	0.00000045	0.00001	0.000022	0.0000012	0.000010	0.000021
Antimony	mg/kg/week	0.000000070	0.0000036	0.000021	0.000000045	0.00000059	0.0000022	0.00000012	0.0000008	0.0000021
Arsenic	mg/kg/week	0.000000070	0.0000036	0.000021	0.000000045	0.00000059	0.0000022	0.00000012	0.00000087	0.0000021
Barium	mg/kg/week	0.00000023	0.0000074	0.000032	0.00000065	0.0000035	0.0000071	0.0000019	0.0000082	0.000015
Boron	mg/kg/week	0.000012	0.00042	0.0021	0.000014	0.00010	0.00022	0.000019	0.00013	0.00024
Cadmium	mg/kg/week	0.0000000035	0.00000018	0.0000010	0.0000000072	0.000000054	0.00000018	0.0000000049	0.000000062	0.00000021
Chromium	mg/kg/week	0.00000007	0.0000041	0.000021	0.000000045	0.0000010	0.0000041	0.00000032	0.0000011	0.0000025
Cobalt	mg/kg/week	0.00000012	0.000018	0.00009	0.0000062	0.00013	0.00060	0.00000012	0.000058	0.00021
Copper	mg/kg/week	0.00000016	0.0000073	0.000042	0.00000019	0.0000015	0.0000043	0.00000065	0.0000020	0.0000050
Iron	mg/kg/week	0.0000070	0.00036	0.00208	0.0000045	0.000059	0.00022	0.000010	0.000080	0.00021
Lead	mg/kg/week	0.000000035	0.0000019	0.000010	0.000000038	0.00000034	0.0000011	0.000000049	0.00000041	0.0000010
Lithium	mg/kg/week	0.000026	0.00034	0.00151	0.000023	0.00019	0.00051	0.000027	0.00019	0.00038
Manganese	mg/kg/week	0.0000037	0.0009	0.00433	0.00018	0.0017	0.0076	0.0000002	0.00066	0.00231
Mercury	mg/kg/week	0.000000000035	0.0000000059	0.000000021	0.00000000045	0.0000000037	0.0000000080	0.0000000012	0.000000006	0.000000010
Phosphorus	mg/kg/week	0.0000017	0.000045	0.00017	0.0000021	0.0000049	0.0000091	0.0000015	0.0000043	0.0000090
Molybdenum	mg/kg/week	0.000000055	0.000077	0.00046	0.000000061	0.0000023	0.000010	0.00000025	0.000011	0.000036
Nickel	mg/kg/week	0.0000013	0.000053	0.00025	0.000013	0.00014	0.00054	0.0000015	0.000080	0.00022
Selenium	mg/kg/week	0.0000033	0.00086	0.00566	0.0000013	0.000028	0.000099	0.0000029	0.000074	0.00020
Silicon	mg/kg/week	0.000090	0.0023	0.010	0.00016	0.00092	0.0017	0.00020	0.0012	0.0023
Silver	mg/kg/week	0.0000000070	0.00000036	0.0000021	0.0000000045	0.000000059	0.00000022	0.000000010	0.000000080	0.00000021
Strontium	mg/kg/week	0.00037	0.0068	0.032	0.00040	0.0021	0.0044	0.000031	0.0030	0.0052
Tin	mg/kg/week	0.000000070	0.0000036	0.000021	0.000000045	0.00000059	0.0000022	0.00000010	0.00000080	0.0000021
Thallium	mg/kg/week	0.0000000070	0.00000036	0.0000021	0.0000000057	0.000000059	0.00000022	0.000000010	0.000000082	0.00000021
Uranium	mg/kg/week	0.00000066	0.000043	0.00025	0.00000034	0.0000026	0.000010	0.0000008	0.0000041	0.000010
Vanadium	mg/kg/week	0.00000035	0.000018	0.00010	0.00000022	0.0000029	0.000011	0.00000049	0.0000040	0.000010
Zinc	mg/kg/week	0.00000070	0.000037	0.00021	0.000017	0.00016	0.00063	0.0000032	0.000078	0.00027

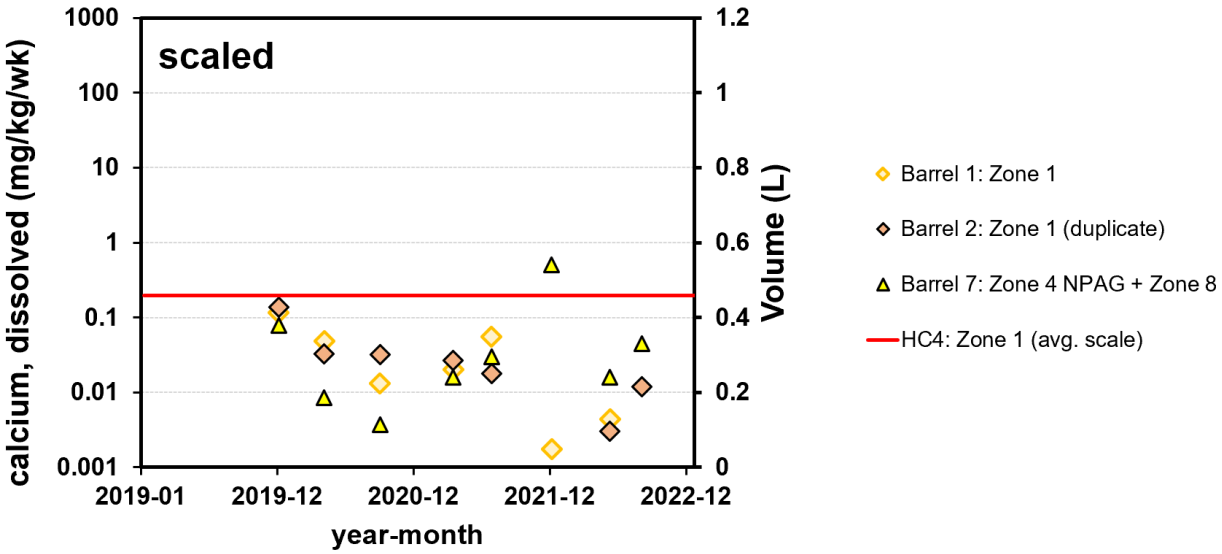
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Appendix B: Summary of Barrel release rates (mg/kg/week)

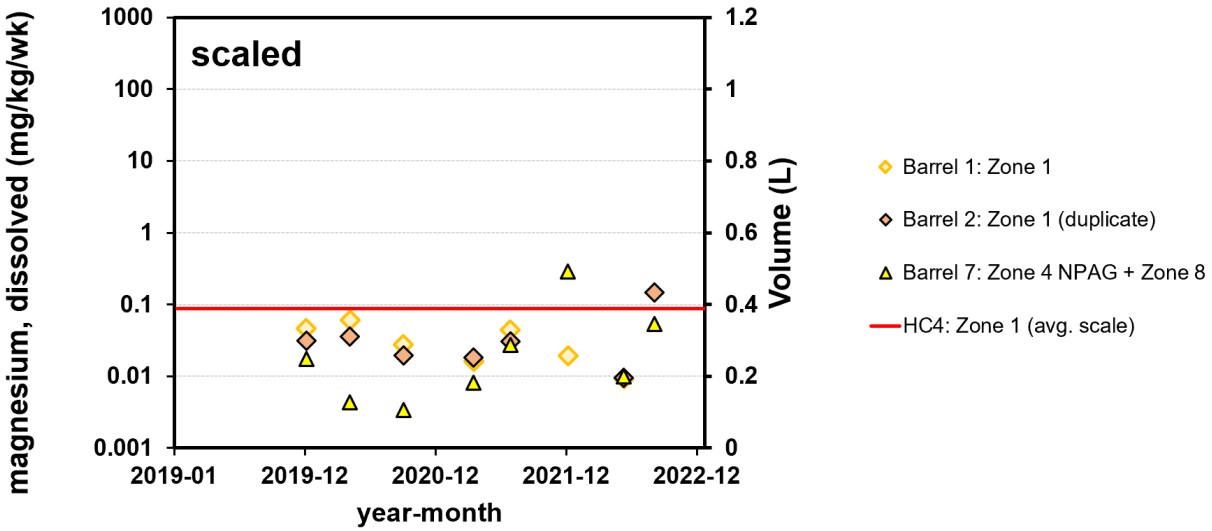
Table B3: Element release rates for overburden estimated from field kinetics testing

Parameter	Units	Overburden		
		Barrel 8: Overburden		
		min	Average	Max
Conventional				
pH	s.u.	7.7	8.1	9.1
EC	mS/cm	29	896	2320
Alkalinity	mg $CaCO_3$/L	0.027	0.23	0.55
Major Ions				
Calcium	mg/kg/week	0.0079	0.11	0.37
Magnesium	mg/kg/week	0.0046	0.051	0.15
Potassium	mg/kg/week	0.00028	0.0041	0.018
Sodium	mg/kg/week	0.0033	0.034	0.10
Chloride	mg/kg/week	0.000089	0.008	0.037
Sulfate	mg/kg/week	0.021	0.37	1.2
Nitrate	mg/kg/week	0.0000014	0.0025	0.012
Nitrite	mg/kg/week	0.00000028	0.00014	0.00061
Ammonia	mg/kg/week	0.0000014	0.000022	0.000080
Dissolved Elements				
Aluminum	mg/kg/week	0.00000018	0.0000023	0.0000059
Antimony	mg/kg/week	0.000000037	0.00000024	0.00000070
Arsenic	mg/kg/week	0.00000014	0.0000013	0.0000044
Barium	mg/kg/week	0.0000027	0.000039	0.00011
Boron	mg/kg/week	0.0000059	0.000034	0.00010
Cadmium	mg/kg/week	0.00000000089	0.000000020	0.000000060
Chromium	mg/kg/week	0.000000089	0.00000033	0.0000012
Cobalt	mg/kg/week	0.000000028	0.00000093	0.0000044
Copper	mg/kg/week	0.00000088	0.000033	0.00021
Iron	mg/kg/week	0.0000018	0.000012	0.000034
Lead	mg/kg/week	0.000000014	0.00000014	0.00000052
Lithium	mg/kg/week	0.00000039	0.0000034	0.000010
Manganese	mg/kg/week	0.000000081	0.00010	0.00032
Mercury	mg/kg/week	0.00000000089	0.0000000060	0.0000000172
Phosphorus	mg/kg/week	0.0000066	0.000042	0.000088
Molybdenum	mg/kg/week	0.00000029	0.0000031	0.0000084
Nickel	mg/kg/week	0.000000089	0.0000023	0.0000092
Selenium	mg/kg/week	0.000000075	0.0000525	0.00036
Silicon	mg/kg/week	0.0011	0.0064	0.016
Silver	mg/kg/week	0.0000000018	0.000000012	0.000000034
Strontium	mg/kg/week	0.000062	0.00055	0.0016
Tin	mg/kg/week	0.000000018	0.00000014	0.00000034
Thallium	mg/kg/week	0.0000000018	0.000000012	0.000000034
Uranium	mg/kg/week	0.00000048	0.0000042	0.000013
Vanadium	mg/kg/week	0.000000089	0.00000060	0.0000017
Zinc	mg/kg/week	0.00000018	0.000015	0.000090

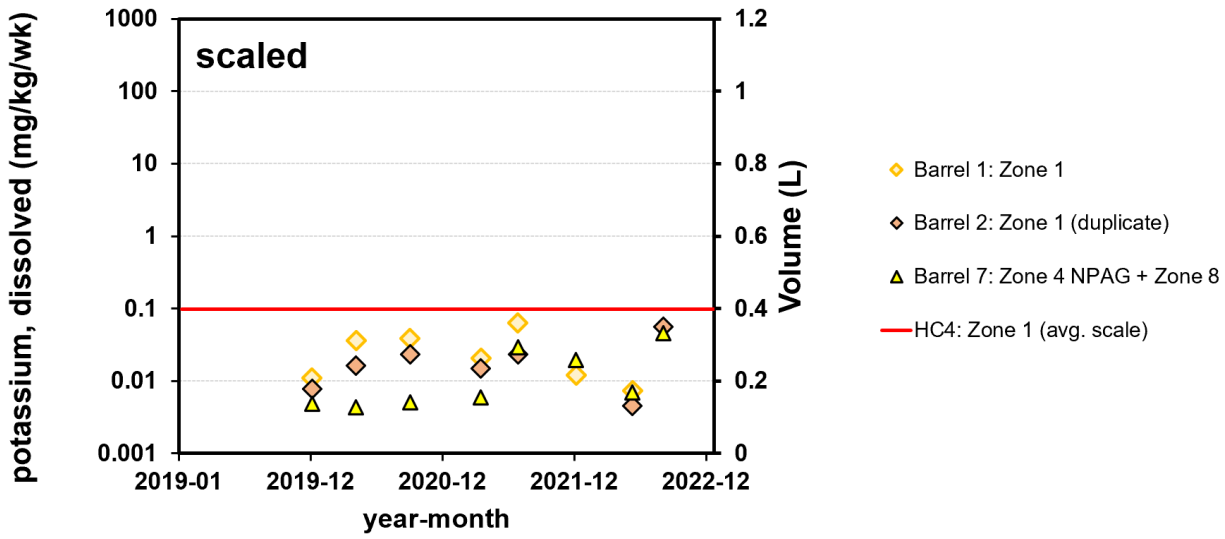
Appendix C Comparison of Scaled HCT Loads to Barrel Load Figures



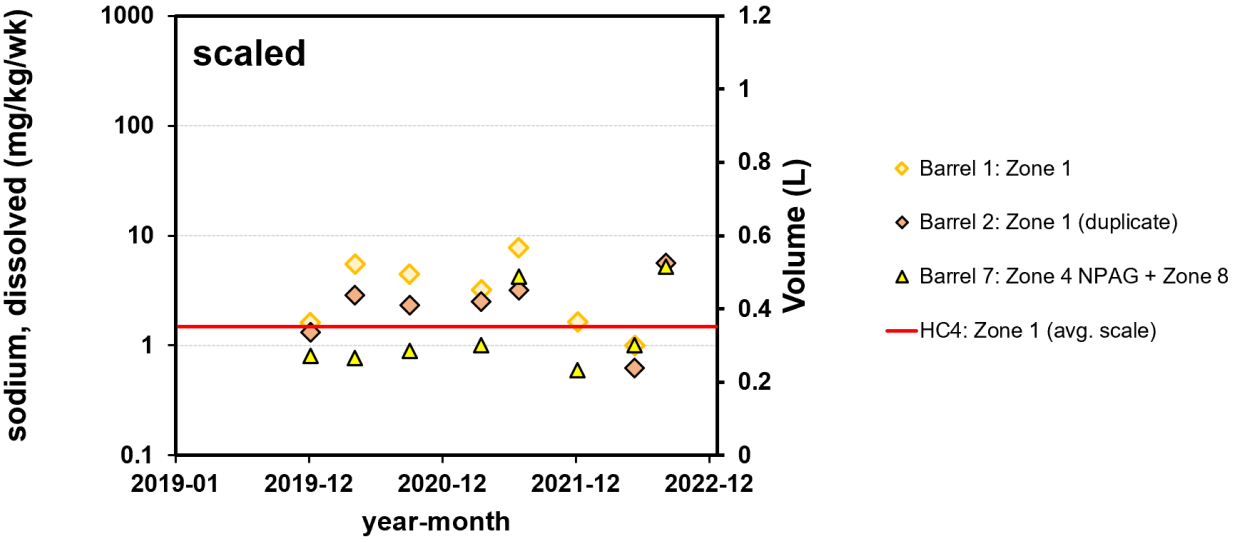
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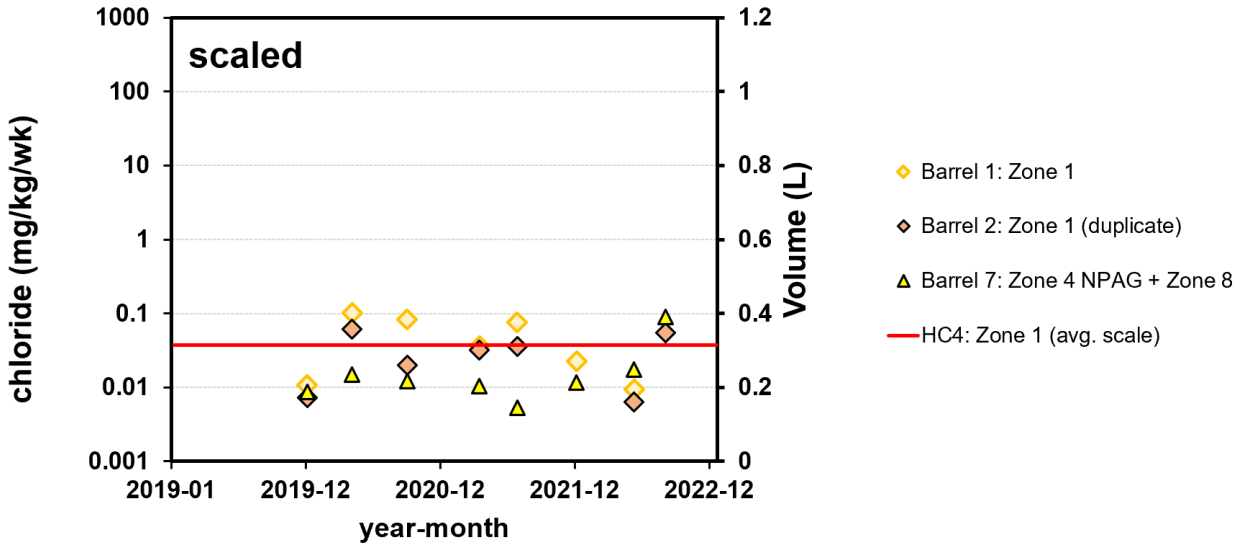
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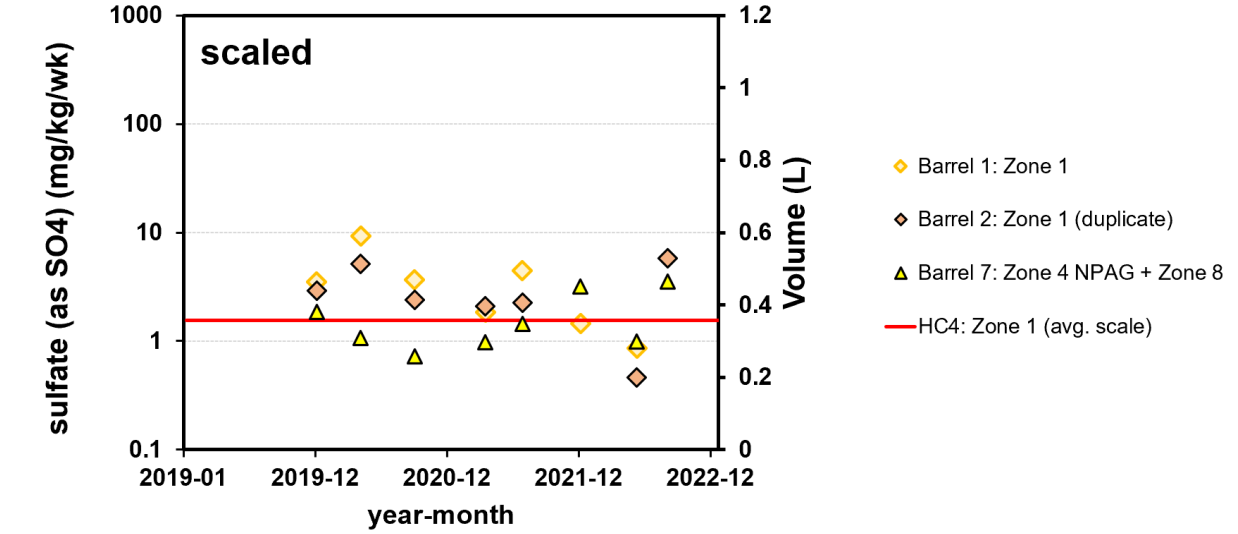
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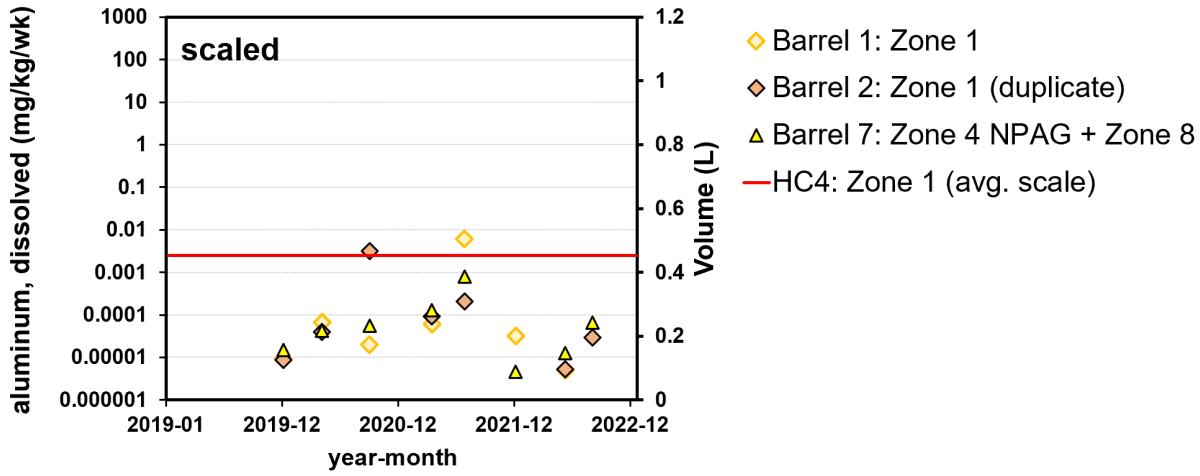


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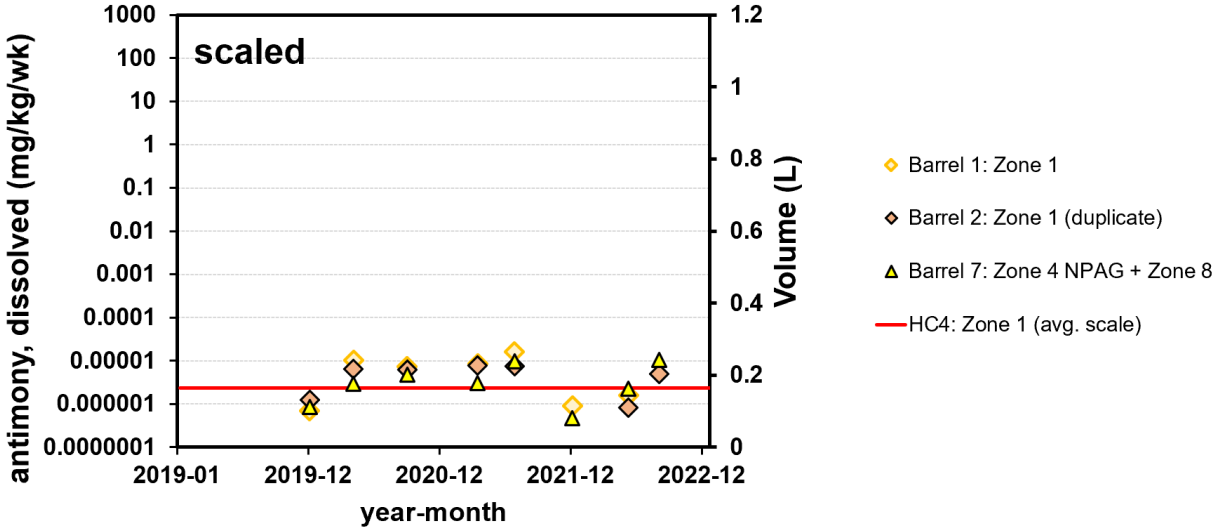


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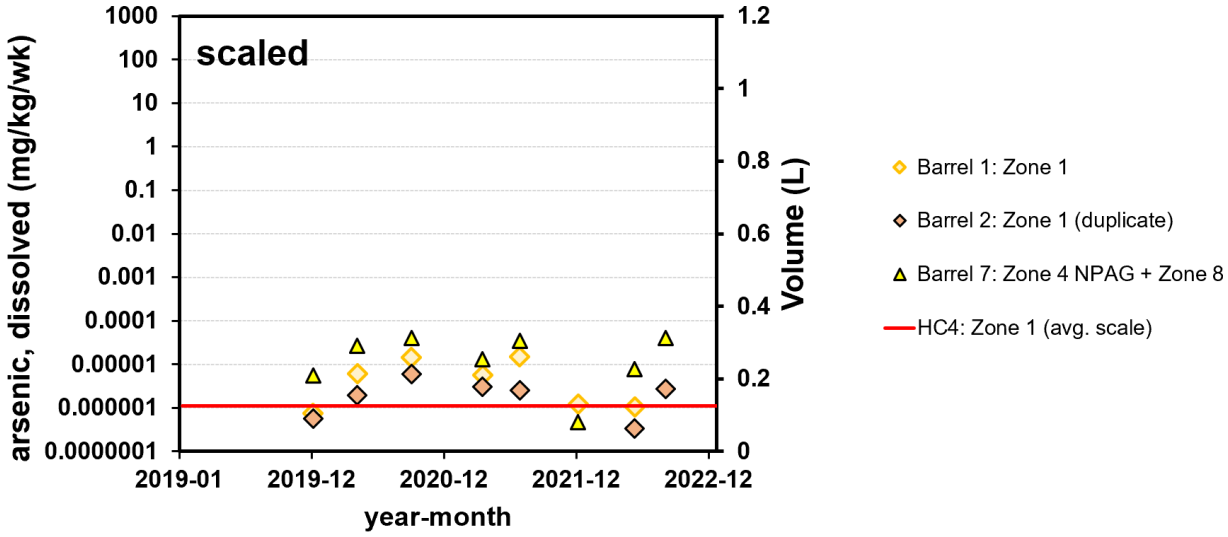
Appendix C Comparison of Scaled HCT Loads to Barrel Load Figures



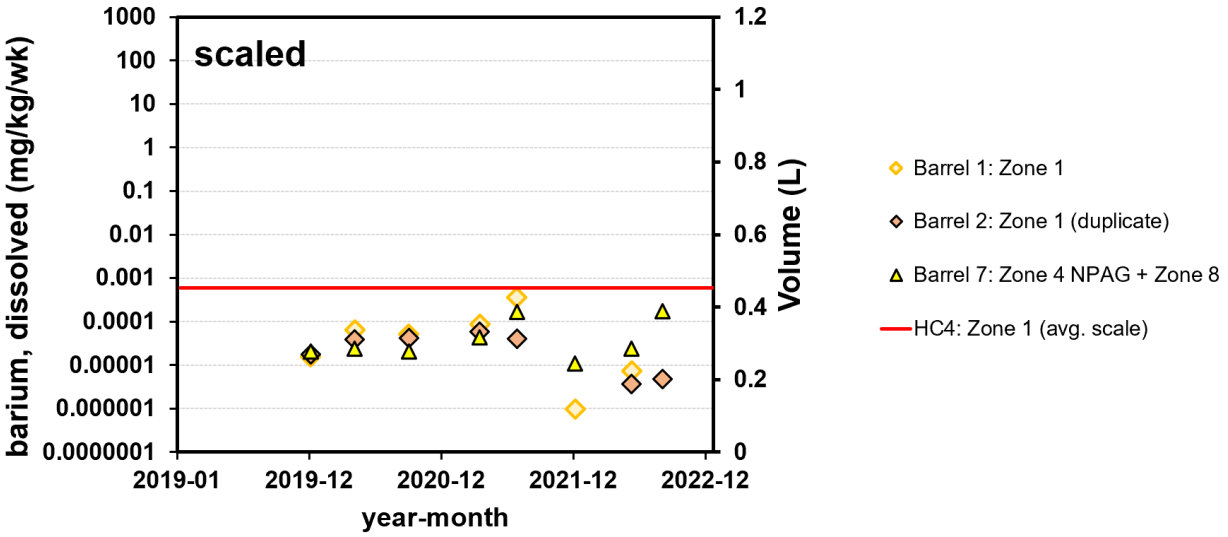
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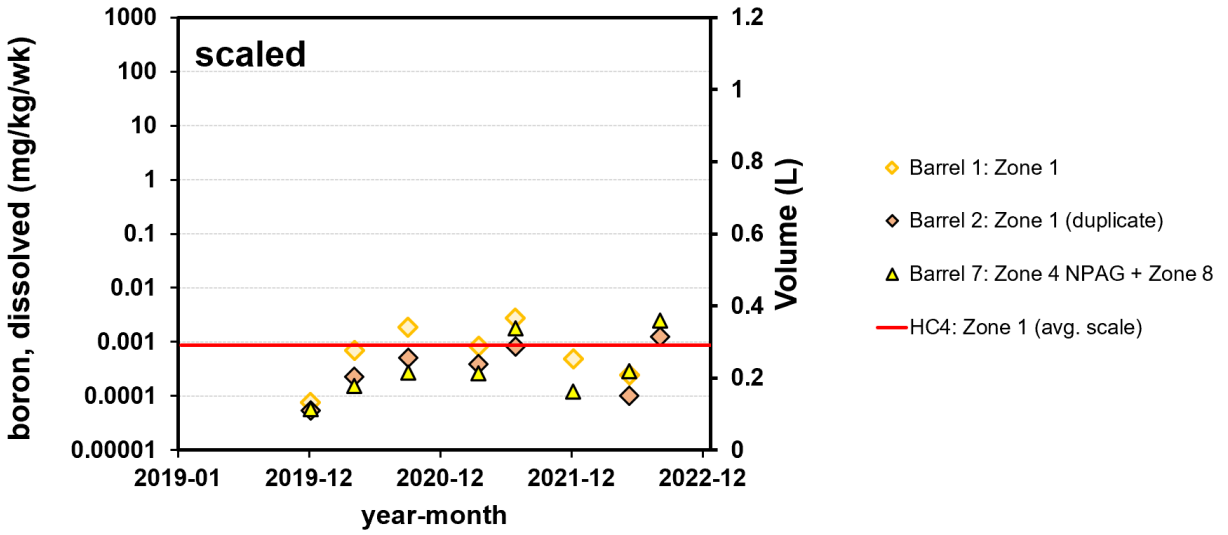
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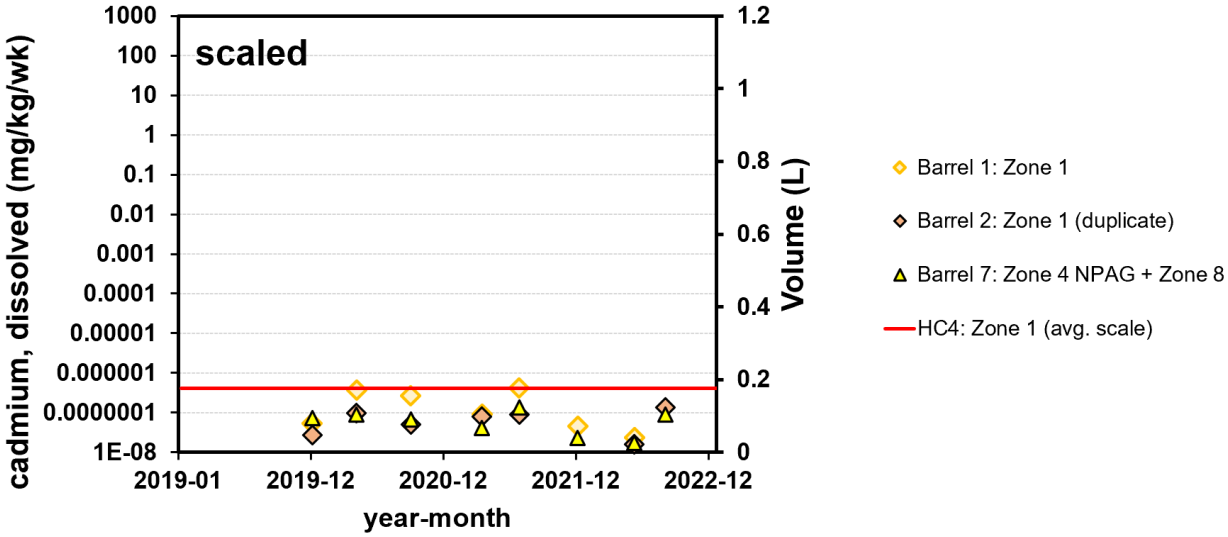
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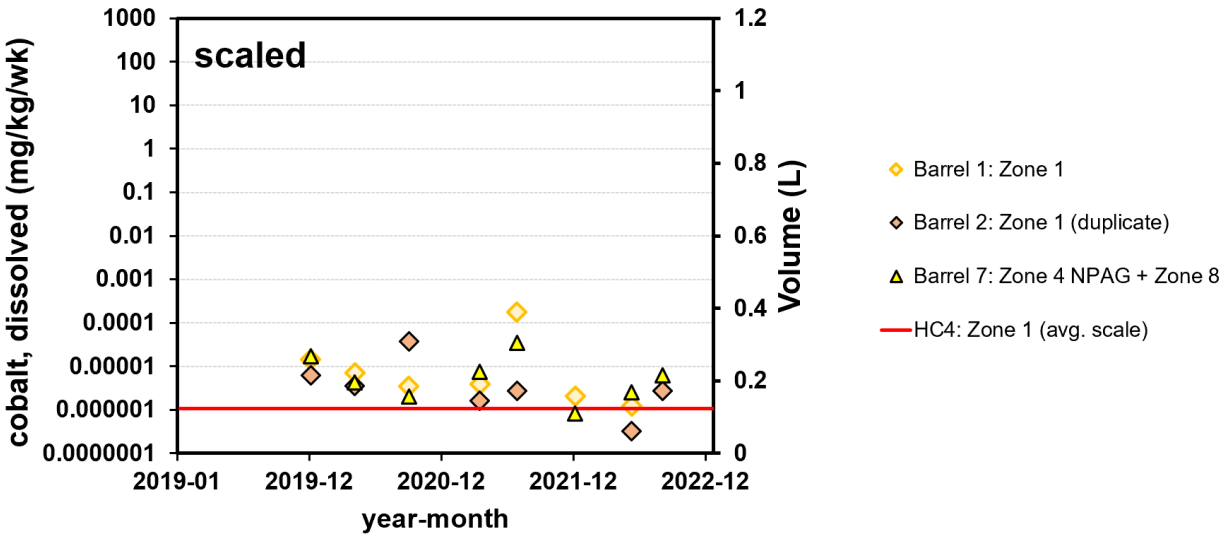
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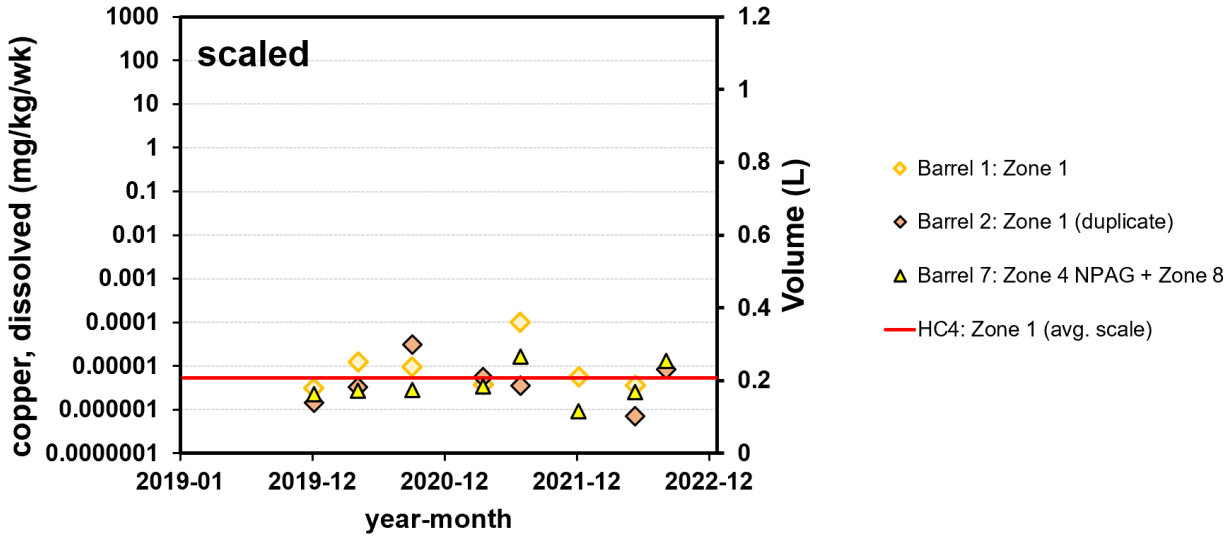
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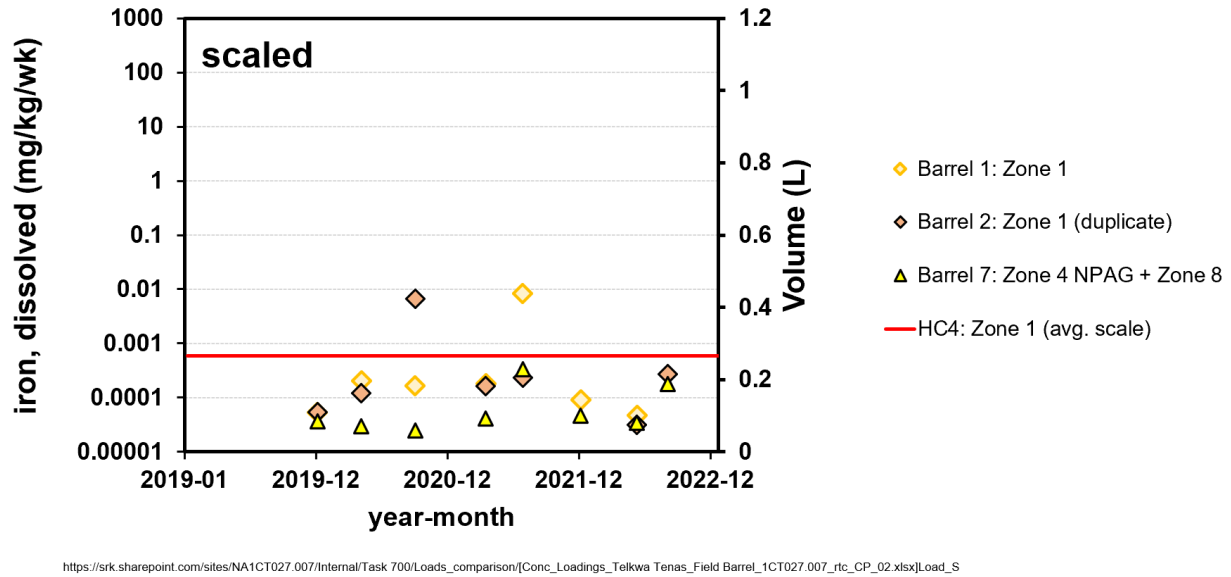
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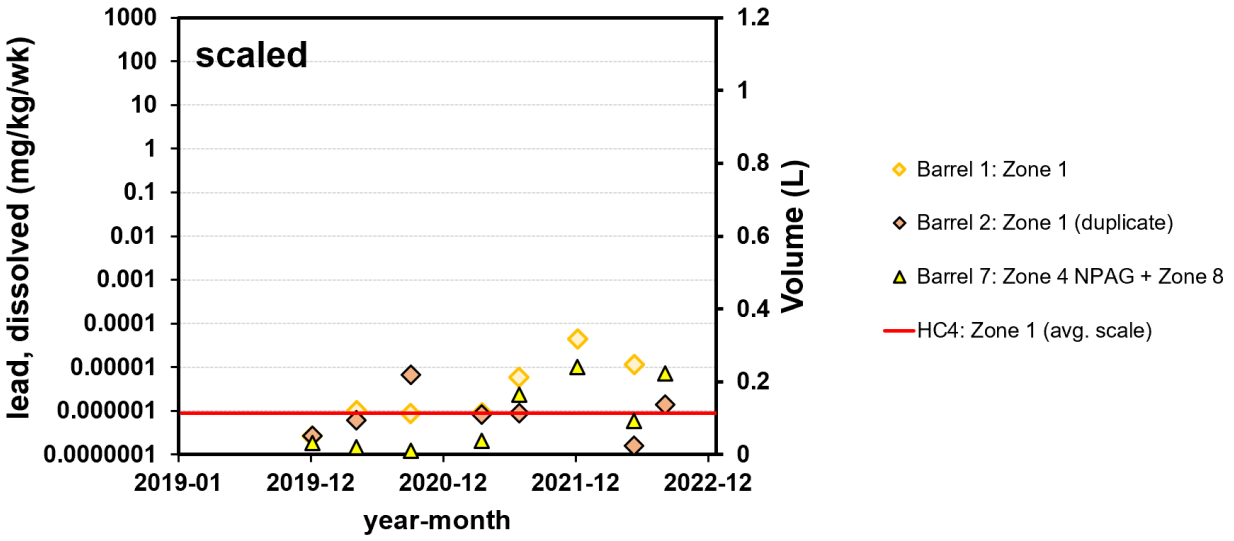
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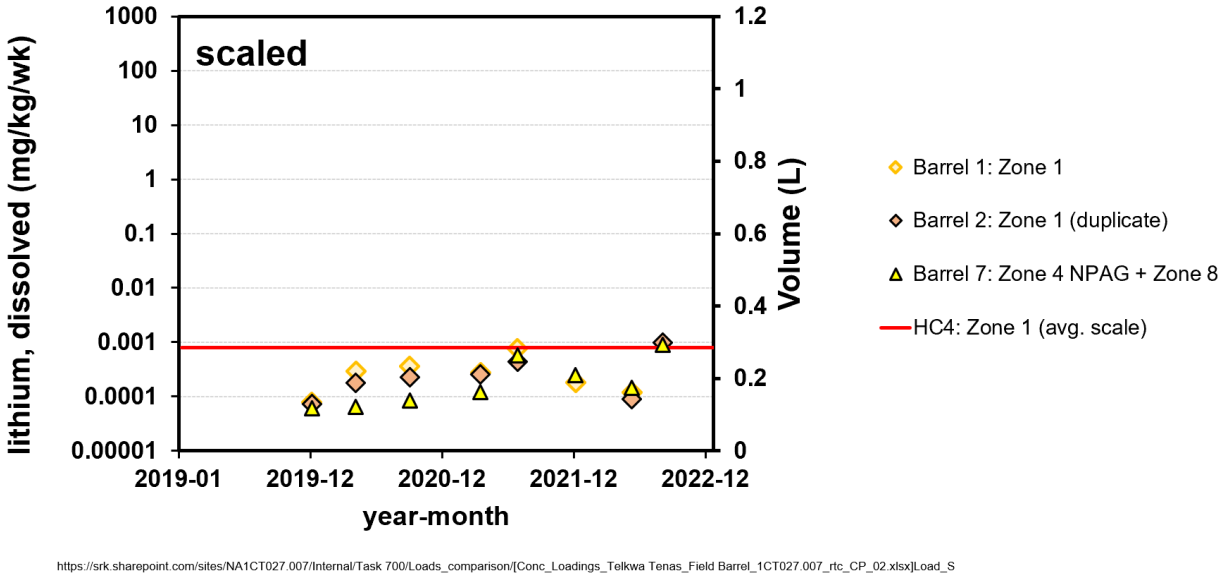
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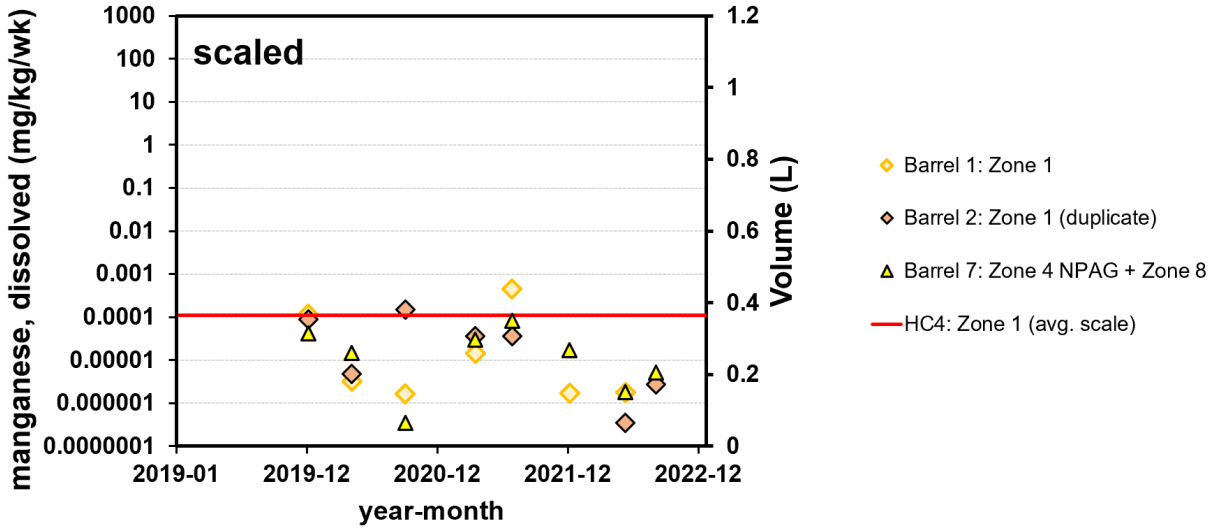
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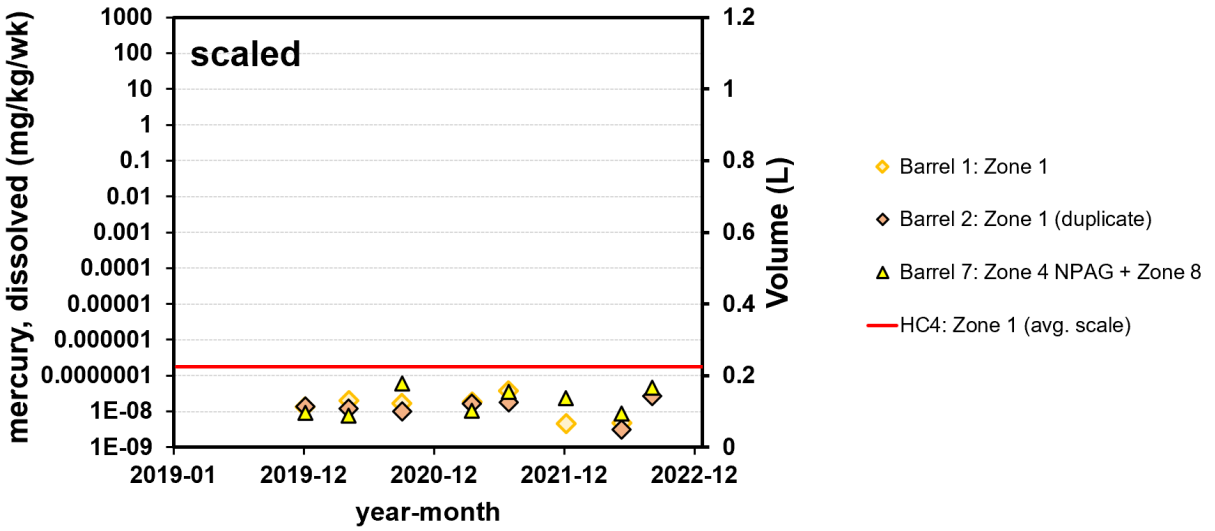


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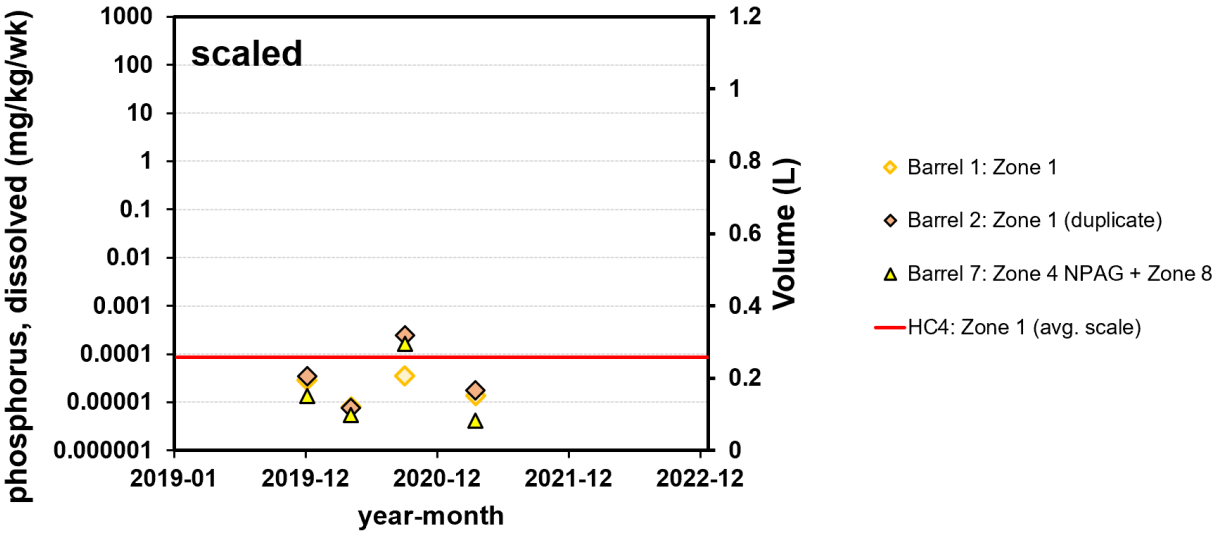


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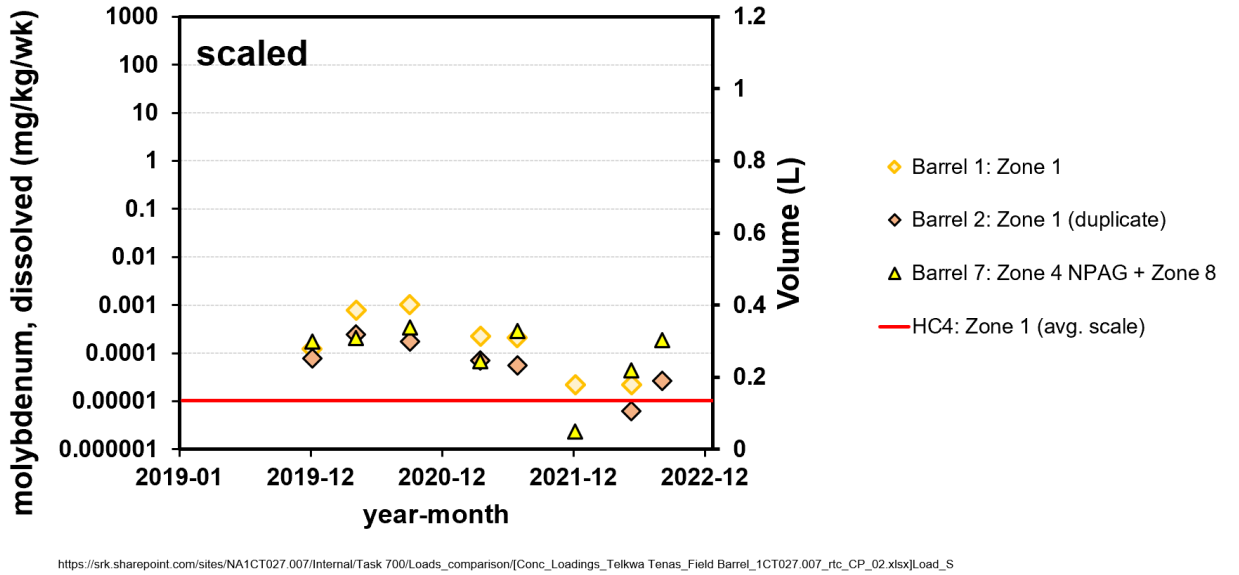
Appendix C Comparison of Scaled HCT Loads to Barrel Load Figures



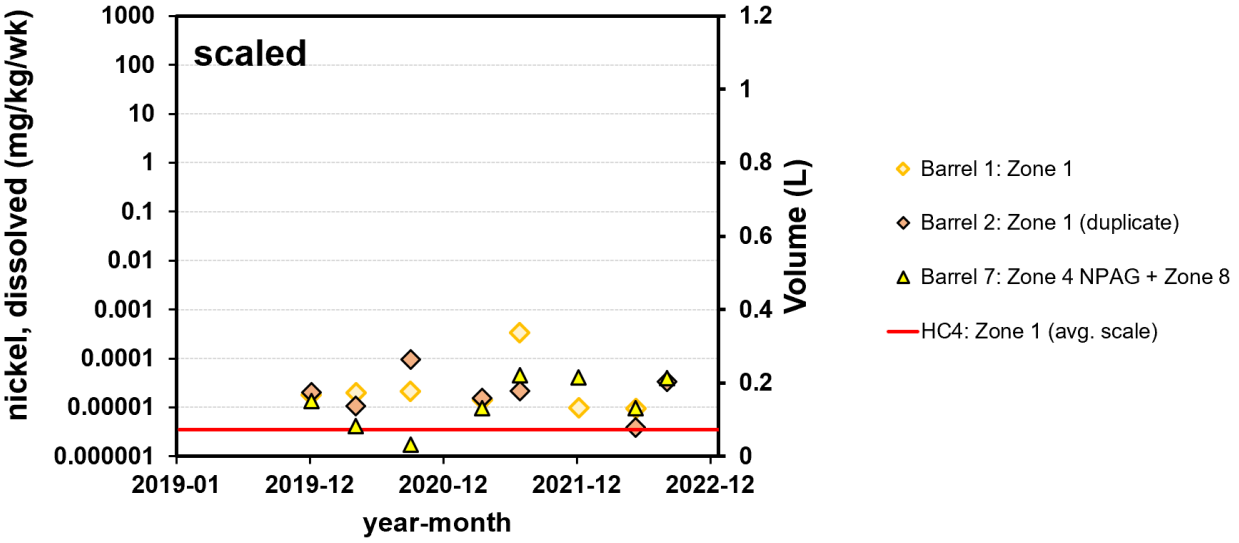
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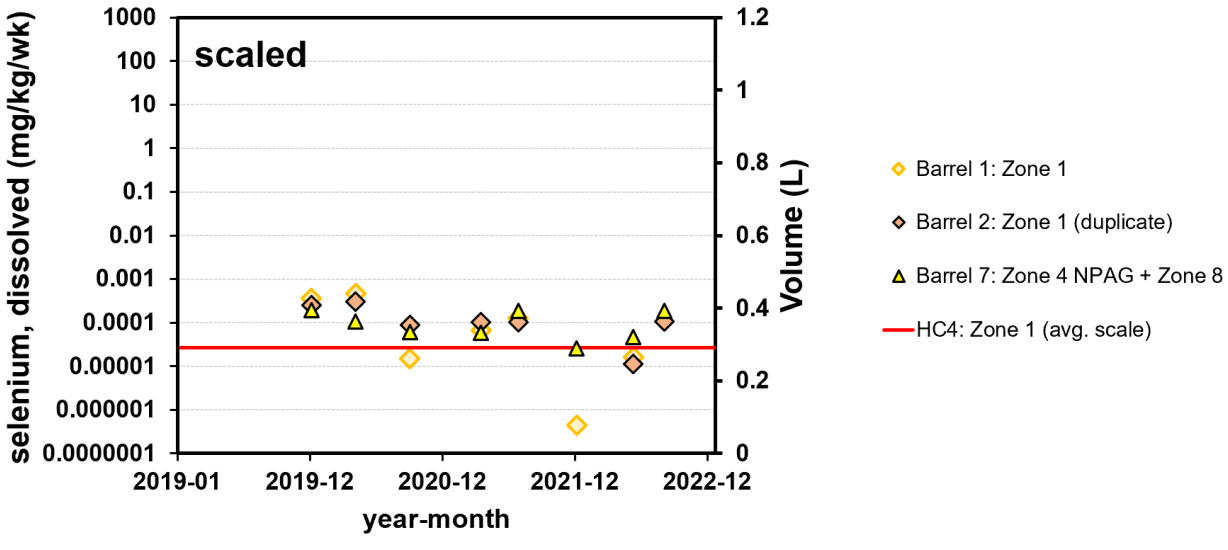
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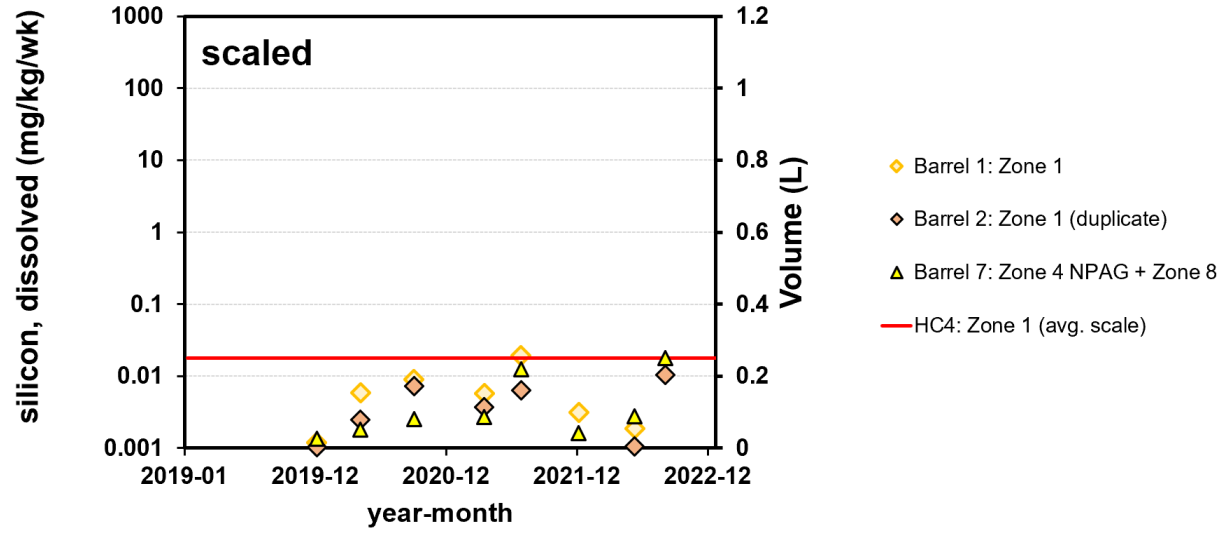
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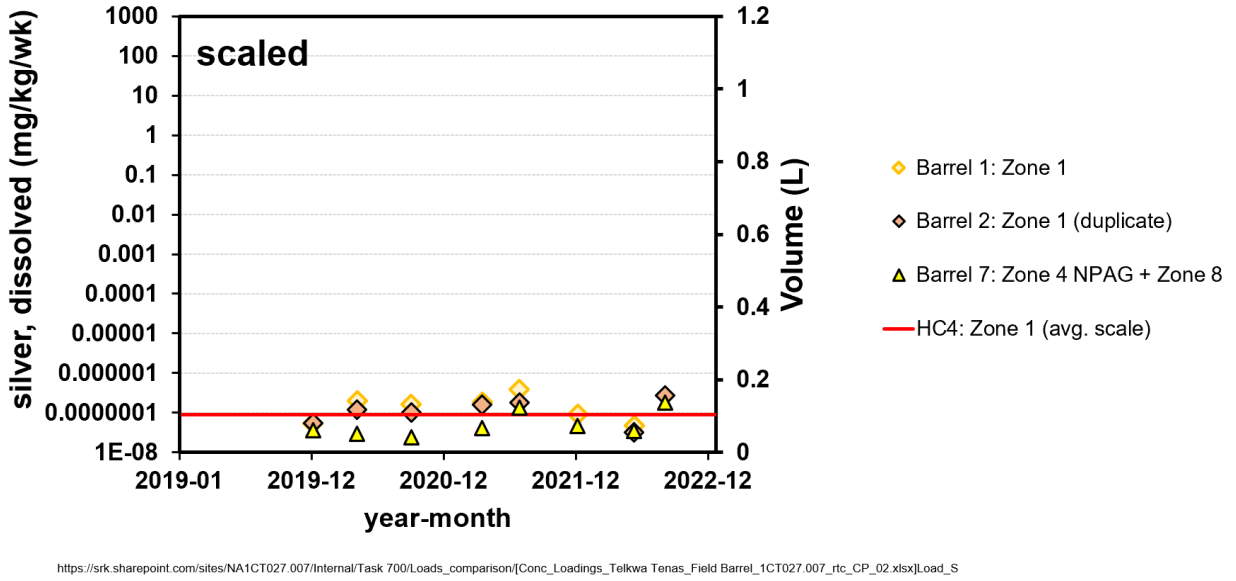
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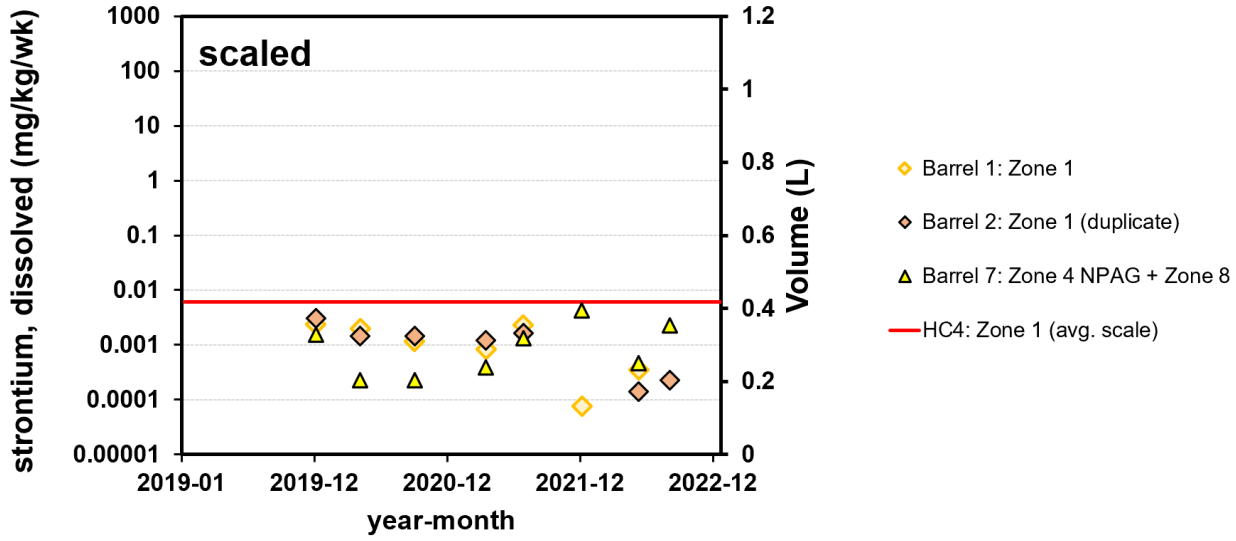
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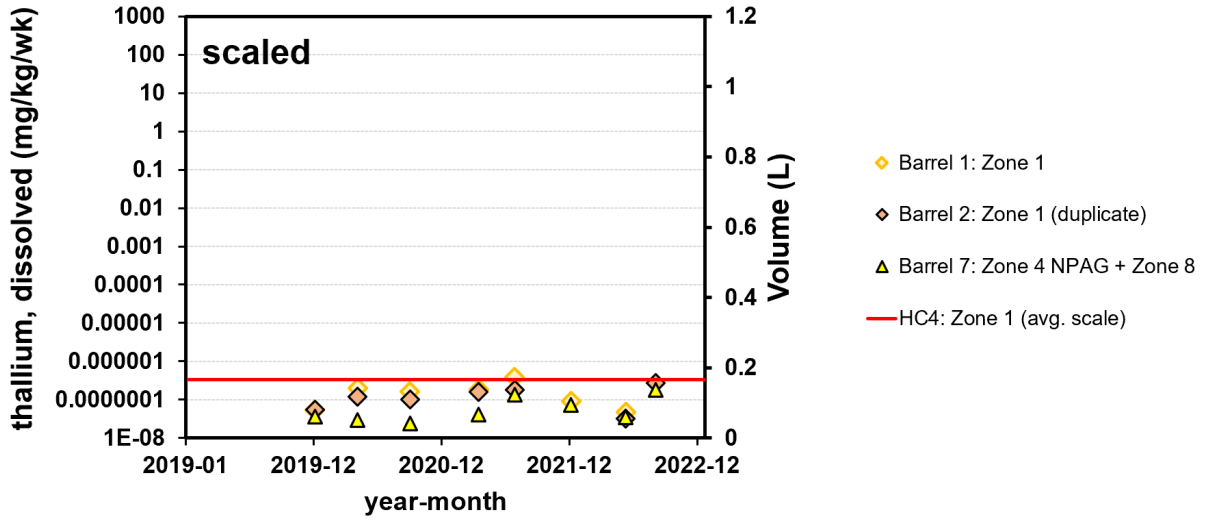
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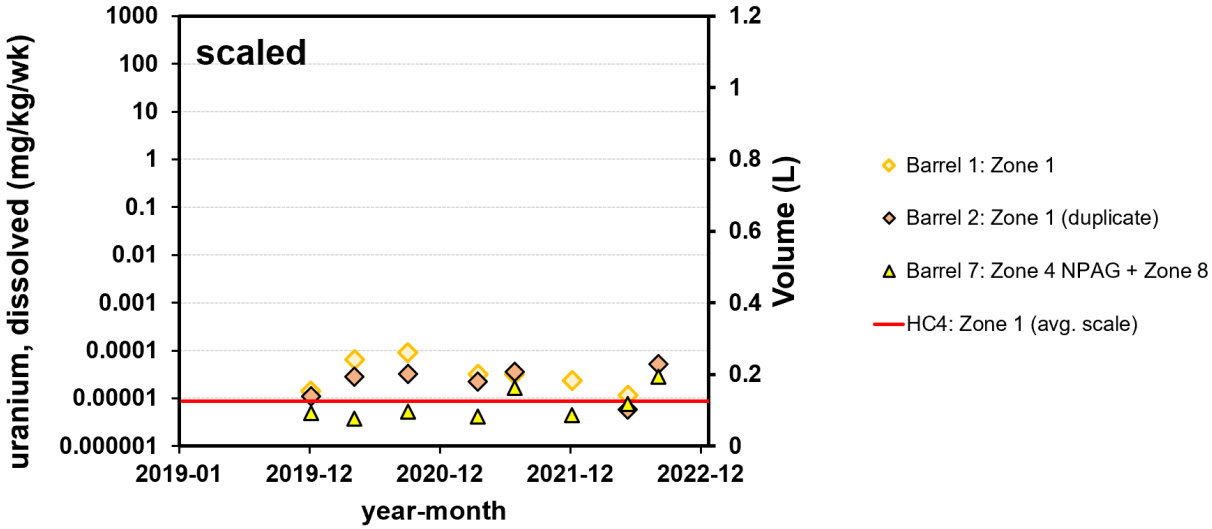
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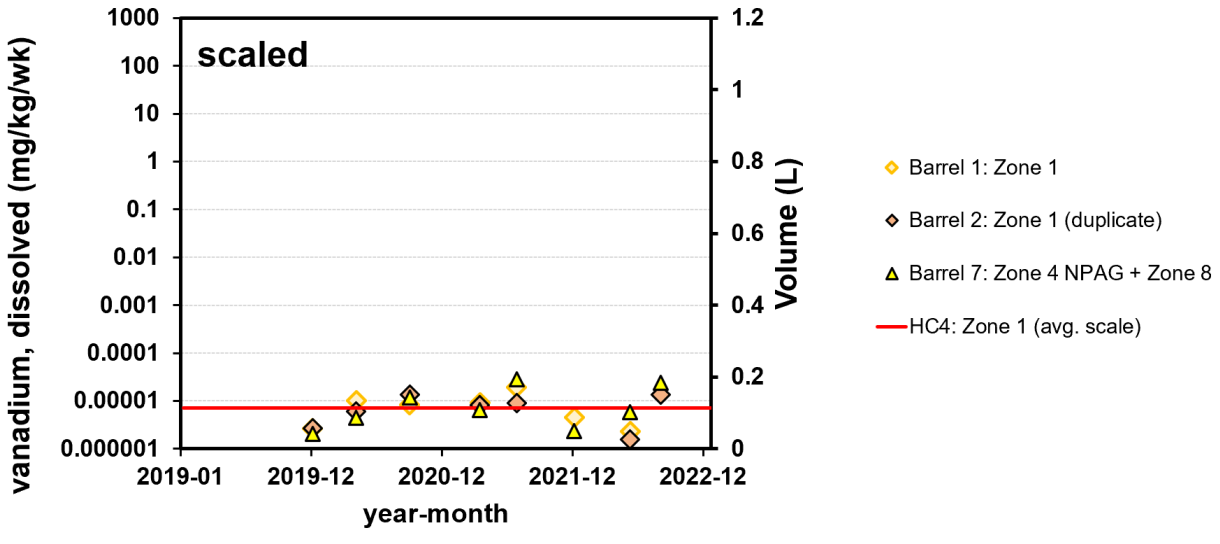
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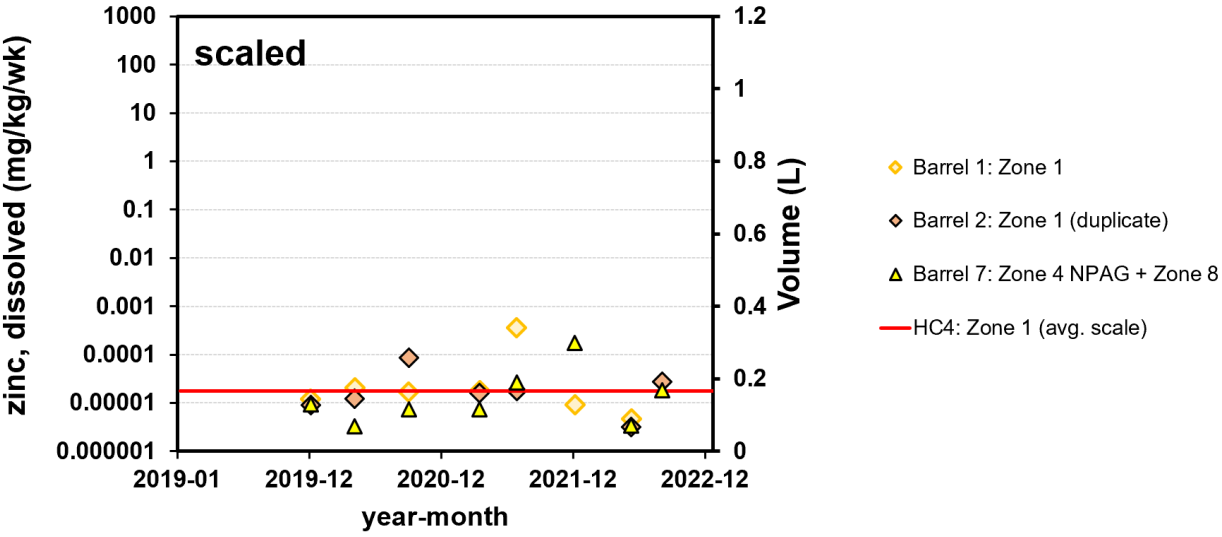
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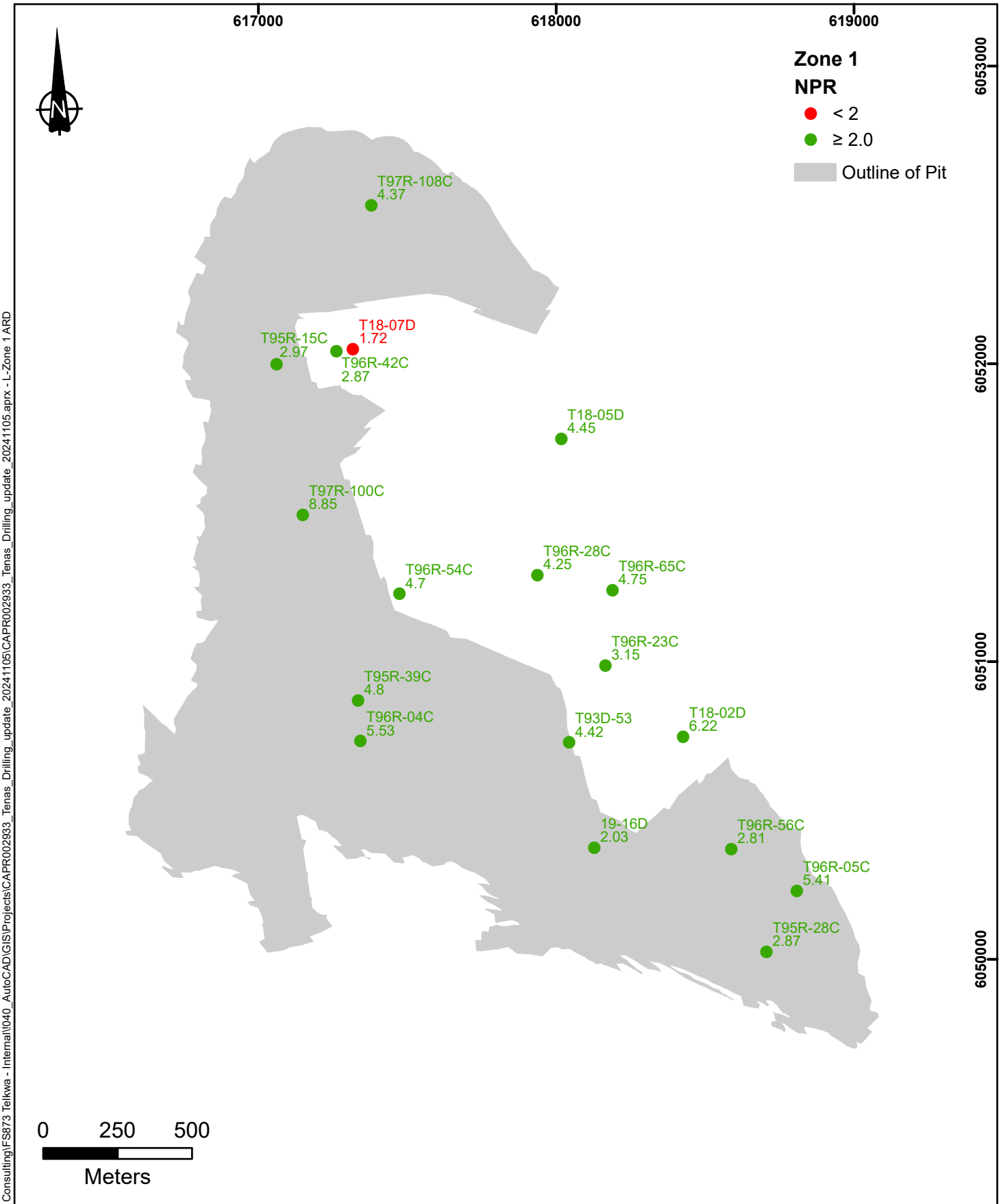


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Appendix F – Mine Rock ARD Maps



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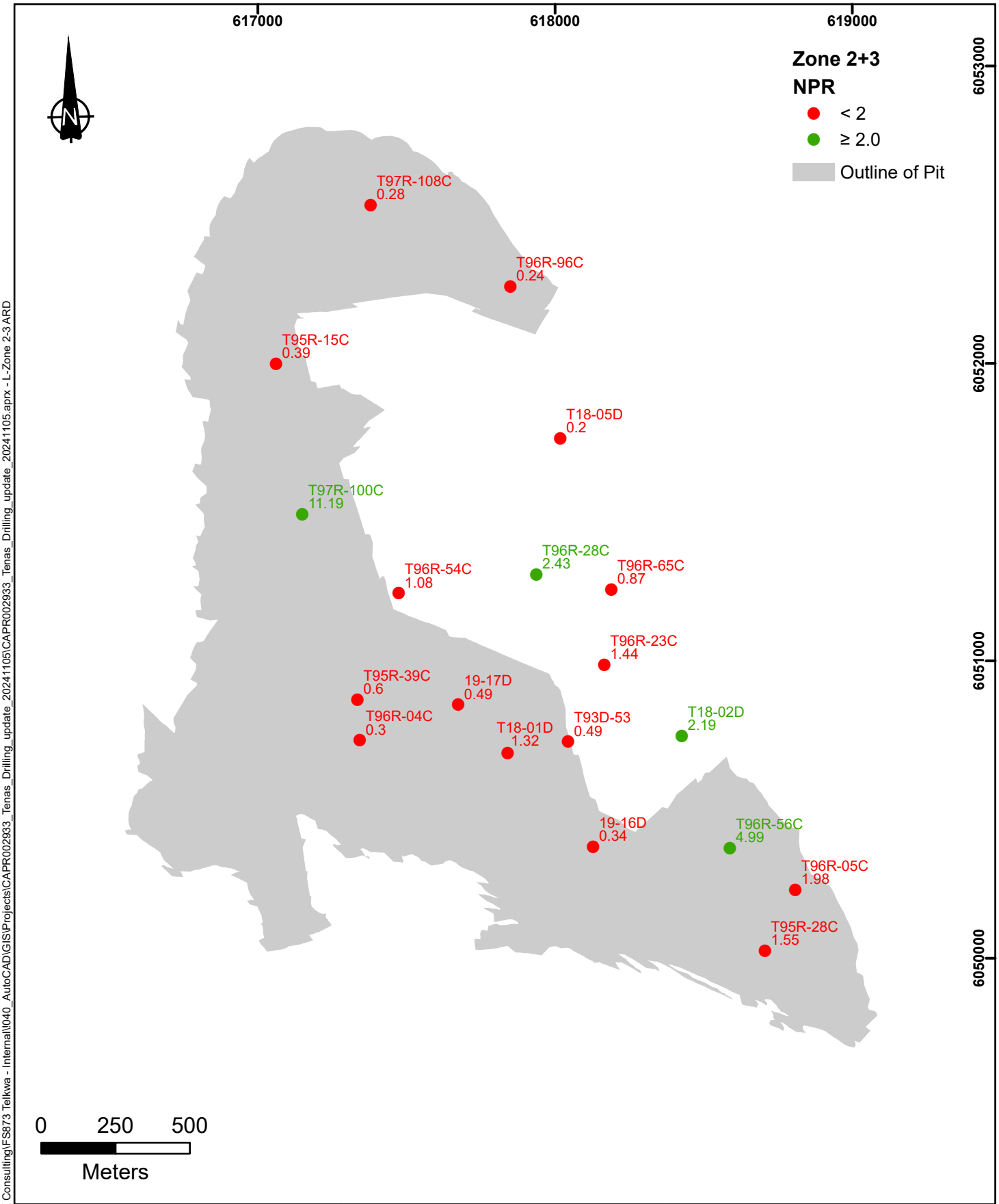
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Job No: CAPR002933

Filename: CAPR002933_Tenas_Drilling_update_20241105

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Date:	Approved:	Figure:
Nov 2024	MKH	F-1



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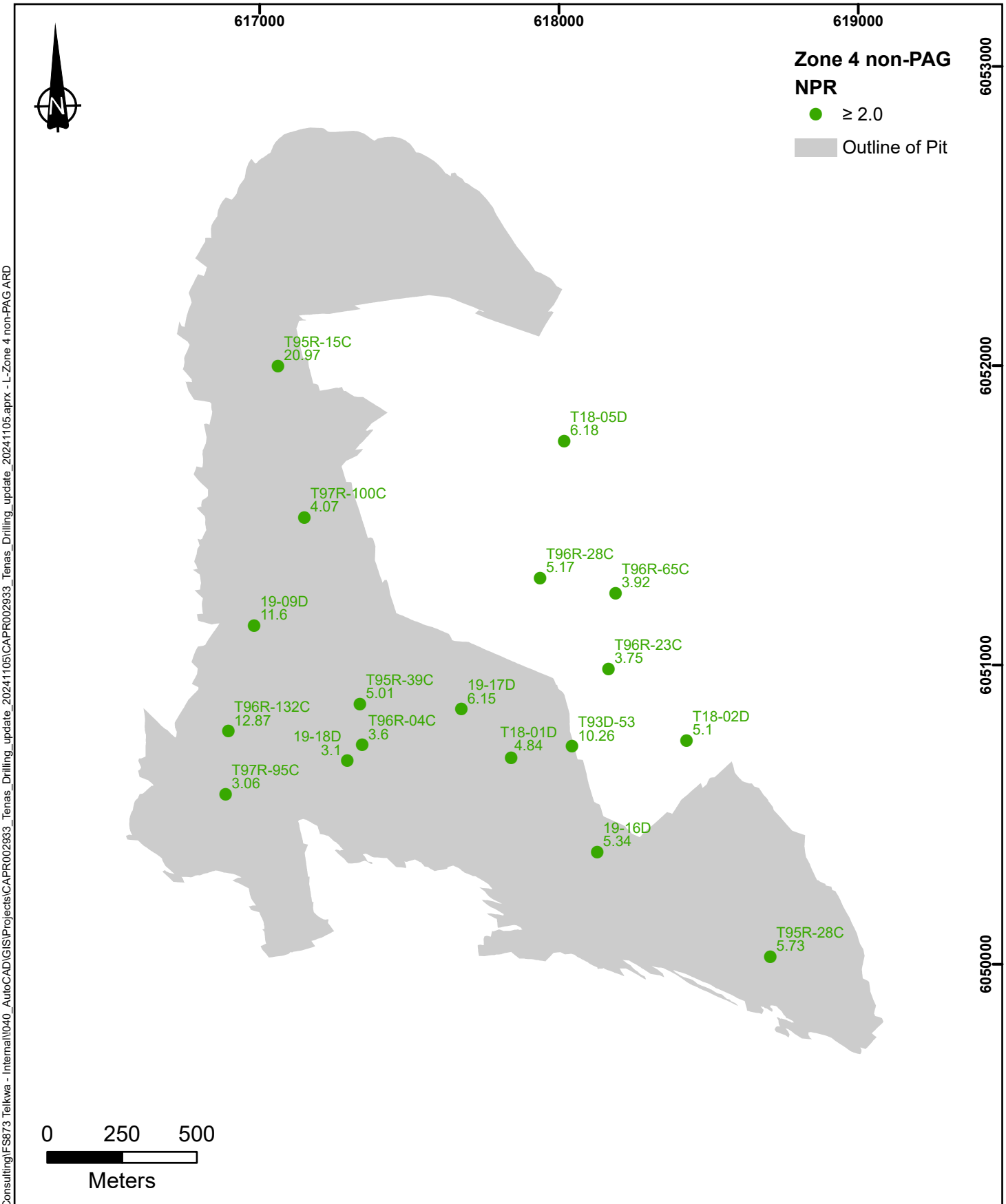
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Job No: CAPR002933

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Date:	Approved:	Figure:
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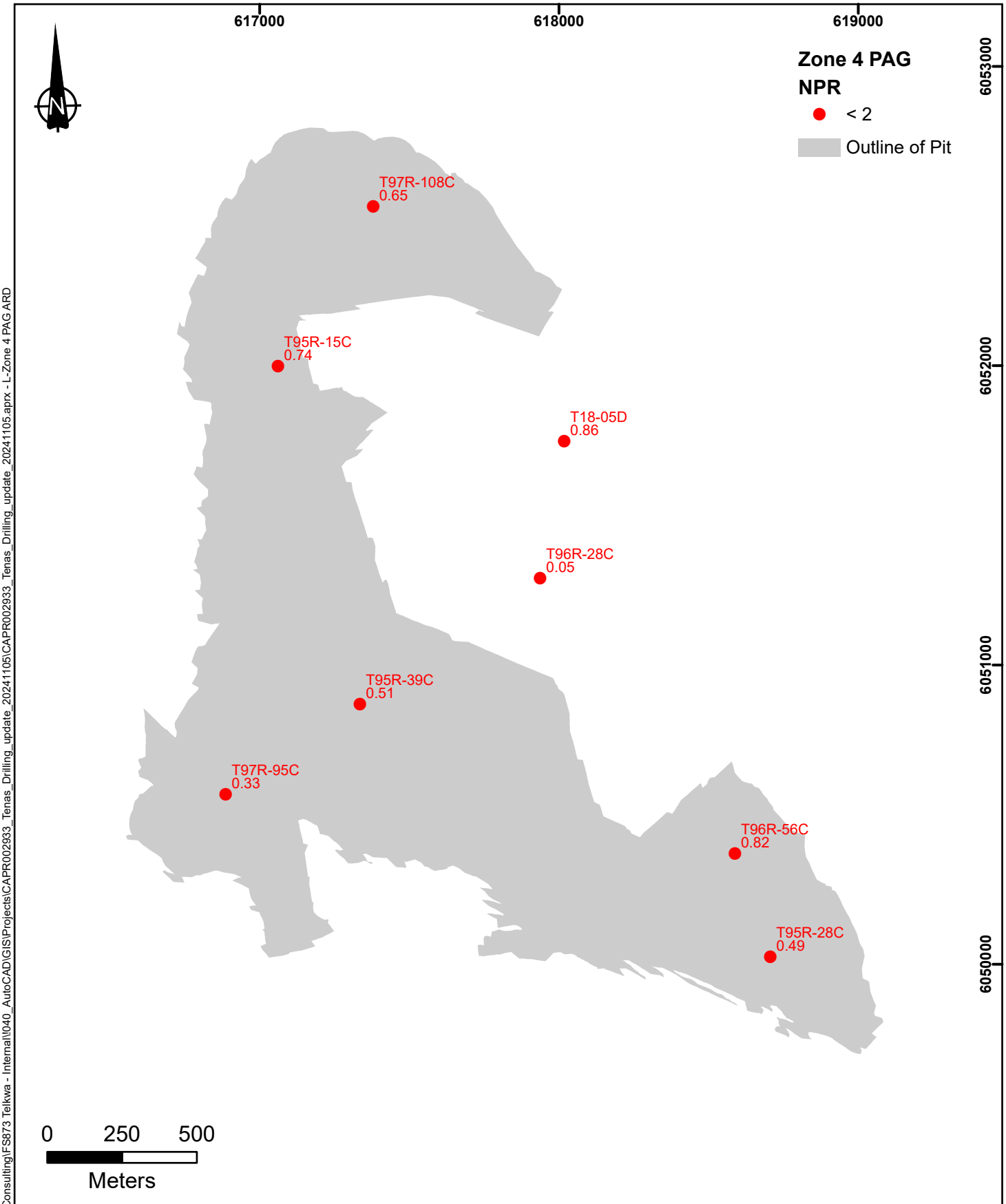
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Job No: CAPR002933

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Date:	Approved:	Figure:
Nov 2024	MKH	F-3



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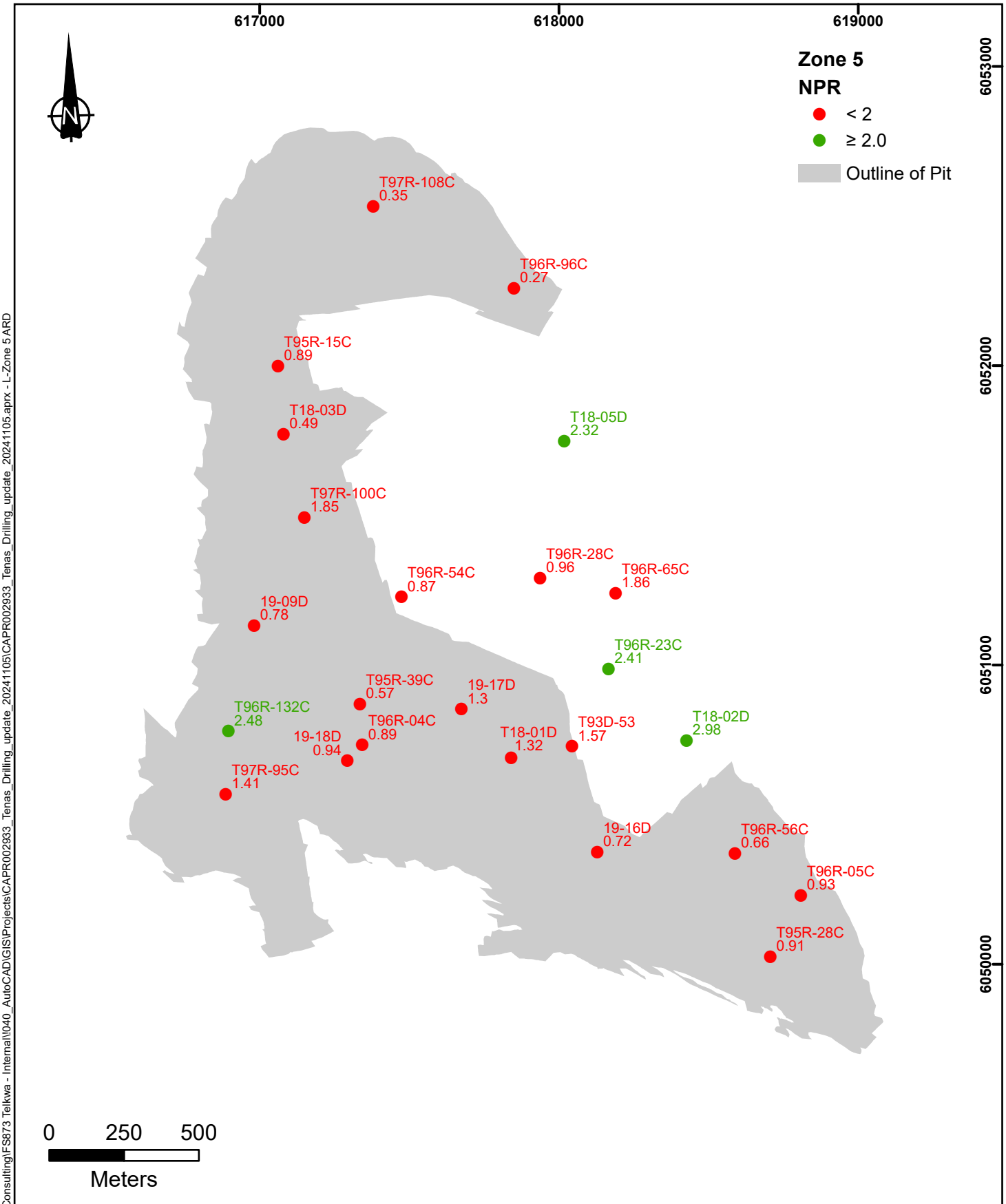
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Job No: CAPR002933

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Date:	Approved:	Figure:
Nov 2024	MKH	F-4



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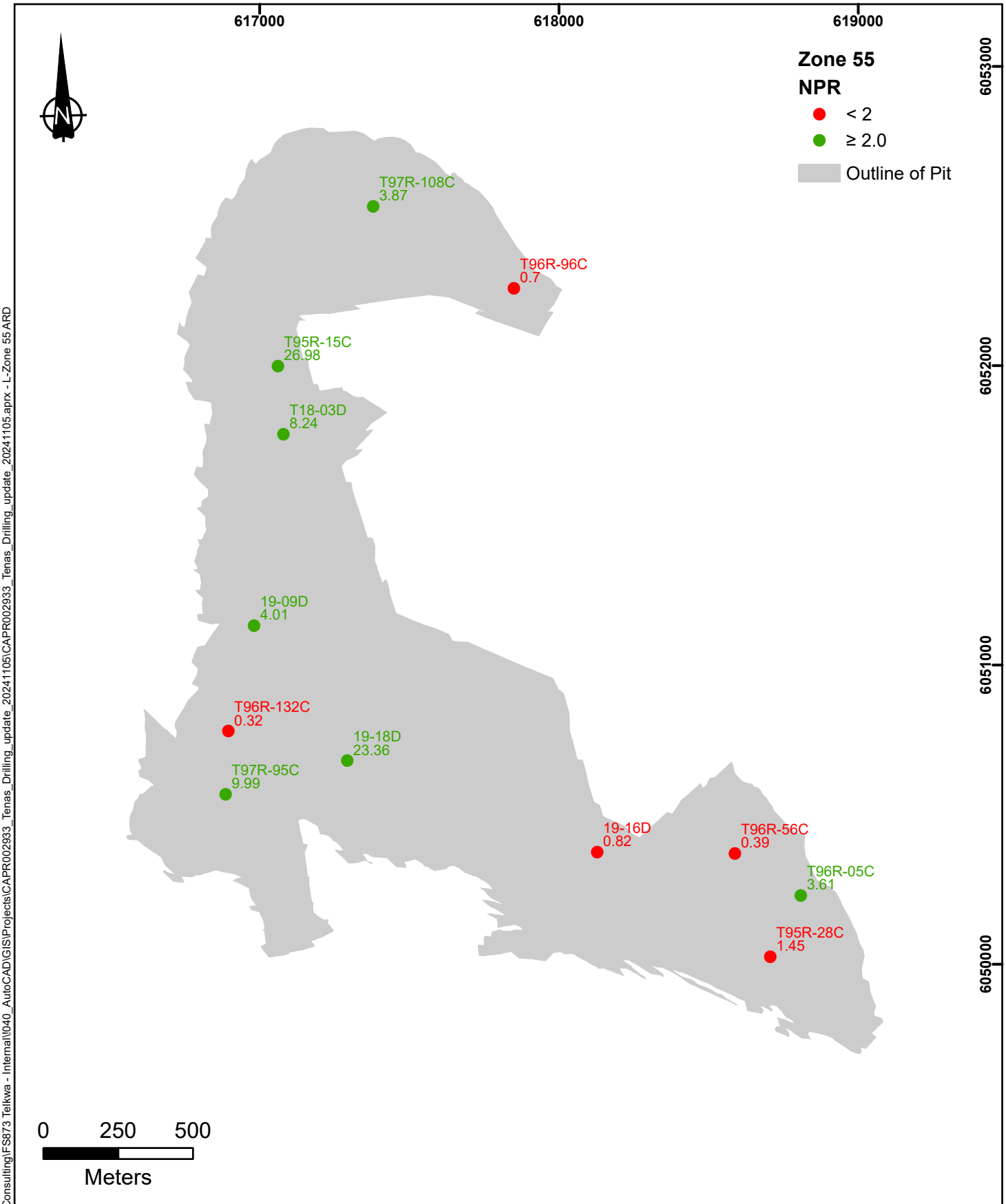
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Date:	Approved:	Figure:
Nov 2024	MKH	F-5



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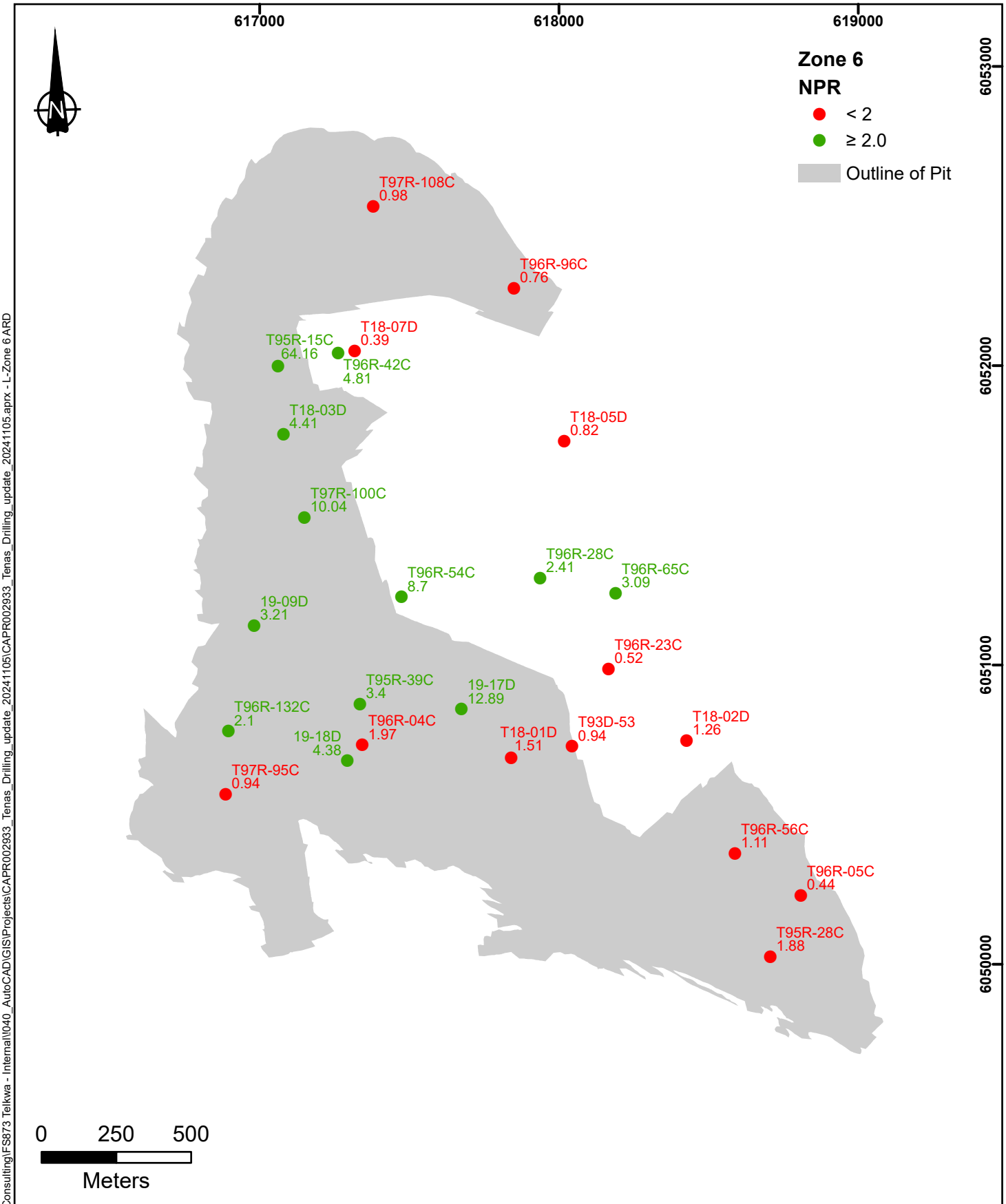
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Nov 2024	MKH	F-6



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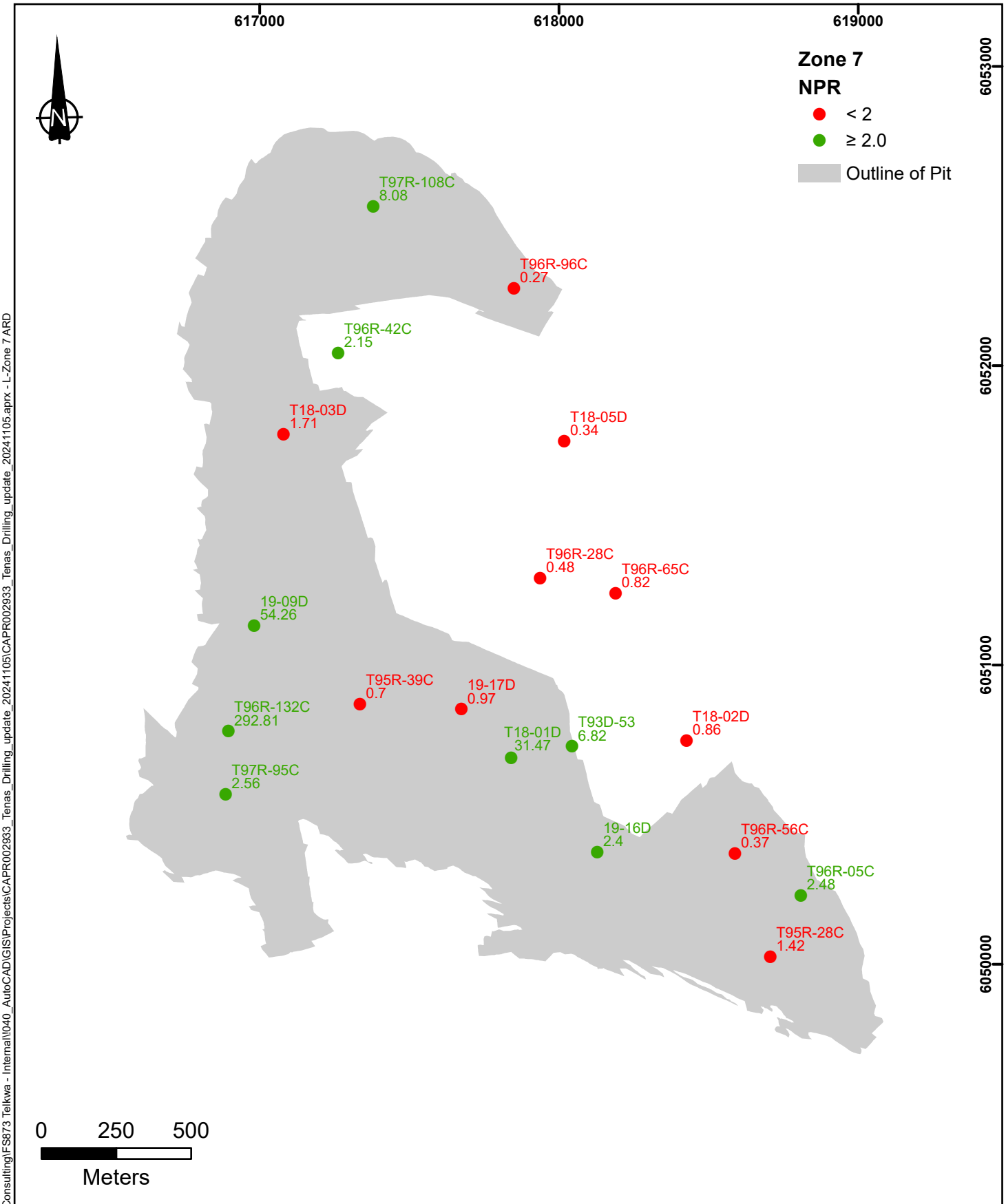
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Date:	Approved:	Figure:
Nov 2024	MKH	F-7



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Supplemental Geochemical Characterization

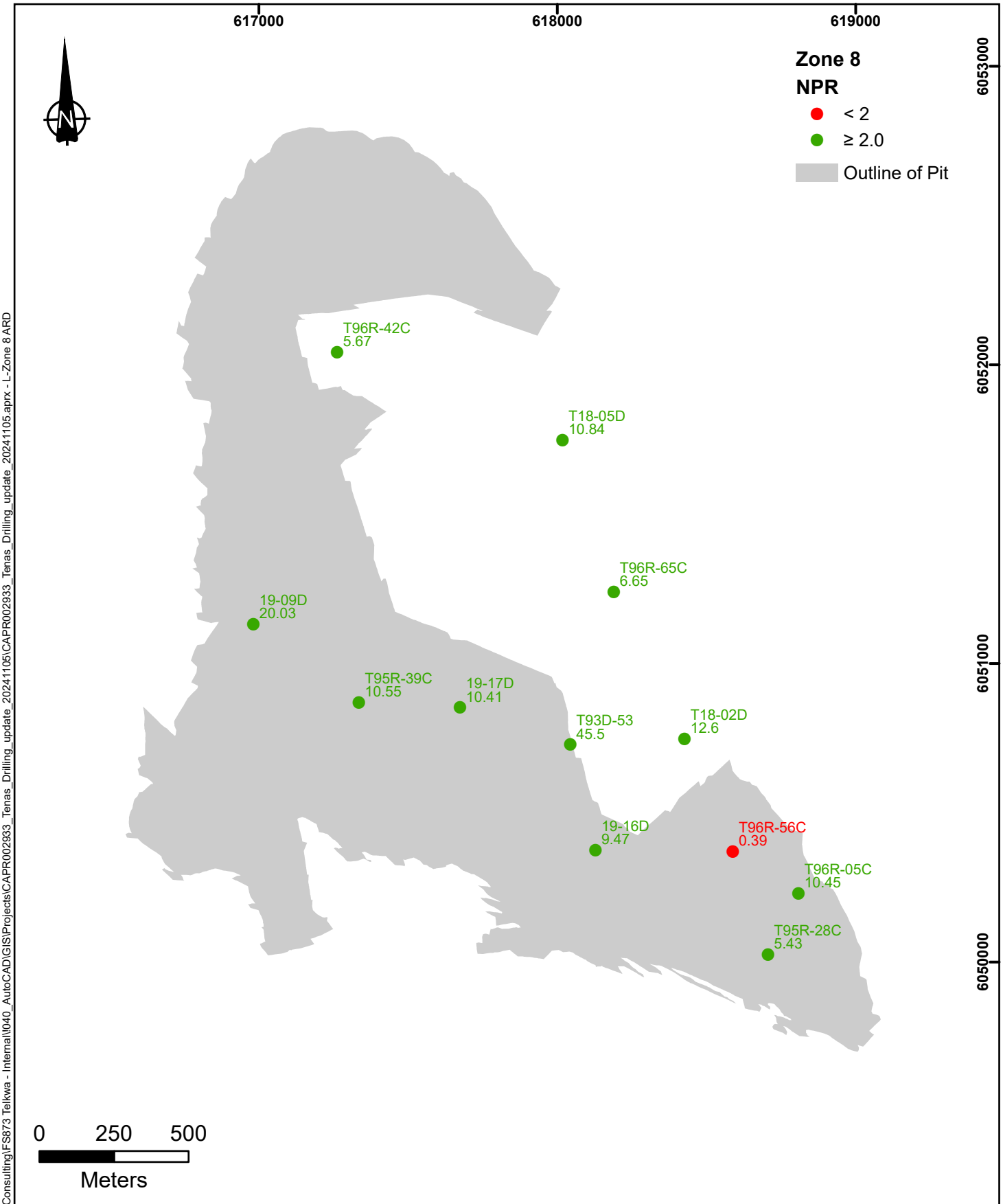
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Job No: CAPR002933

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Date:	Approved:	Figure:
Nov 2024	MKH	F-8



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Zone 8 ARD

Job No: CAPR002933

Filename: CAPR002933_Tenas_Drilling_update_20241105

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Date:	Approved:	Figure:
Nov 2024	MKH	F-9

Appendix G – Overburden and Construction Rock ABA Results

Overburden and Construction Material Samples: ABA Results

Sample ID	Maxxam Sample ID	Sample Depth (m)			Lithology	Paste pH (s.u.)	Paste EC (µS/cm)	Carbon Species (w.t.%)			Sulphur Species (w.t.%)								Potentials (kg $CaCO_3$/tonne)					Neutralization Potential Ratios				
		From	To	Thickness				Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulphate	S_{ICP}	Total-S (DL)	Sulphate (DL)	S_{ICP} (DL)	Sulphide (Total - SO_4)	Sulphide (S_{ICP} - SO_4)	AP (Total Sulphur)	AP (Sulphide)	CO_3-NP	Sobek-NP	Modified Sobek-NP	CO_3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)
2018 Overburden																												
+25mm fraction																												
+25MM - T18-10-S-BLK-02 9.5	UJ3985	9	9.5	0.50	Overburden	8.8	158	---	0.21	0.77	<0.02	0.010	<0.02	0.01	0.01	0.02	0.00	0.010	0.31	0.31	18	40	33	56	128.0	104.0	128.0	104
+2mm-25mm fraction																												
+2MM - T18-03-S-SPT4 6.0-6.45	UJ3987	6	6.45	0.45	Overburden	7.9	816	---	0.23	0.84	0.19	0.020	0.19	0.19	0.020	0.19	0.17	0.17	5.9	5.3	19	37	29	3.6	6.1	4.9	6.9	5.5
+2MM - T18-10-S-SPT2 3.0-3.45	UJ3988	3	3.45	0.45	Overburden	8.1	376	---	0.20	0.74	0.030	0.010	0.020	0.030	0.010	0.020	0.020	0.010	0.94	0.31	17	33	28	54	35	30	106	89
+2MM - T18-13-S-SPT2 4.5-4.95	UJ3989	4.5	4.95	0.45	Overburden	8.2	693	---	0.31	1.1	0.040	0.010	0.040	0.040	0.010	0.040	0.030	0.030	1.3	0.94	26	45	39	27	36	31	48	41
+2MM - T18-13-S-SPT5 12.0-12.45	UJ3990	12	12.45	0.45	Overburden	8.3	532	---	0.21	0.78	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.005	0.015	0.31	0.47	18	40	34	38	127	107	85	71
+2MM - T18-10-S-BLK-02 9.0-9.5	UJ3991	9	9.5	0.50	Overburden	8.5	398	---	0.13	0.49	0.04	<0.01	0.040	0.040	0.005	0.040	0.035	0.035	1.3	1.1	11	34	30	10	27	24	31	27
+2MM - T18-02-S SPT-14 6.0-6.45m	UJ3993	6	6.45	0.45	Overburden	8.3	437	---	0.52	1.9	0.05	<0.01	0.050	0.050	0.005	0.050	0.045	0.045	1.6	1.4	43	67	66	31	43	42	48	47
-2mm fraction																												
-2MM - T18-03-S-SPT4 6.0-6.45	TO9565	6	6.45	0.45	Overburden	8.0	747	0.75	0.26	0.95	0.070	0.020	0.070	0.070	0.020	0.07	0.050	0.050	2.2	1.6	22	39	28	14	18	13	25	18
-2MM - T18-10-S-SPT2 3.0-3.45	TO9566	3	3.45	0.45	Overburden	8.3	383	0.87	0.25	0.90	0.020	0.010	<0.02	0.020	0.010	0.020	0.010	0.010	0.6	0.31	20	36	26	65	58	42	115	83
-2MM - T18-13-S-SPT2 4.5-4.95	TO9567	4.5	4.95	0.45	Overburden	8.0	2010	0.62	0.32	1.2	0.080	0.050	0.10	0.080	0.050	0.10	0.030	0.050	2.5	1.6	26	43	32	17	17	13	27	21
-2MM - T18-13-S-SPT5 12.0-12.45	TO9568	12	12.45	0.45	Overburden	8.3	580	0.43	0.22	0.79	<0.02	0.010	<0.02	0.010	0.010	0.020	0	0.010	0.31	0.31	18	39	27	57	123	86	123	86
-2MM - T18-10-S-BLK-02 9.0-9.5	TO9570	9	9.5	0.50	Overburden	8.2	717	0.73	0.27	1.0	0.040	0.020	0.050	0.040	0.020	0.050	0.020	0.030	1.3	0.94	23	41	28	24	32	22	43	30
-2MM - T18-02-S SPT-14 6.0-6.45m	TO9571	6	6.45	0.45	Overburden	8.1	875	0.89	0.28	1.0	0.060	0.020	0.070	0.060	0.020	0.070	0.040	0.050	1.9	1.6	24	41	28	15	22	15	26	18
Bulk Samples																												
ORIGINAL - T18-03-5-SPT2	TV0022	3	3.45	0.45	Overburden	8.2	276	0.63	0.19	0.70	<0.02	0.010	<0.02	0.010	0.010	0.020	0	0.010	0.31	0.31	16	53	23	51	168	75	168	75
ORIGINAL - T18-03-5-SPT6	TV0175	10.5	10.95	0.45	Overburden	8.4	336	1.0	0.43	1.6	0.10	0.010	0.10	0.10	0.010	0.10	0.090	0.090	3.1	2.8	36	32	37	13	10	12	11	13
ORIGINAL - T18-03-5-SPT5	TV0176	7.5	7.95	0.45	Overburden	8.4	483	0.75	0.38	1.4	0.090	0.010	0.090	0.090	0.010	0.090	0.080	0.080	2.8	2.5	32	48	38	13	17	13	19	15
Duplicates																												
+25MM - T18-10-S-BLK-02 9.5 Split Dup	UJ3986	9	9.5	0.50	Overburden	8.9	161	---	0.19	0.70	<0.02	0.010	<0.02	0.010	0.010	0.020	0	0.010	0.31	0.31	16	38	33	51	121	105	121	105
+2MM - T18-10-S-BLK-02 9.0-9.5 Split Dup	UJ3992	9	9.5	0.50	Overburden	8.5	436	---	0.14	0.51	0.050	<0.01	0.050	0.050	0.0050	0.050	0.045	0.045	1.6	1.4	12	35	29	8.2	22	18	25	20
-2MM - T18-13-S-SPT5 12.0-12.45 SPLIT DUP	TO9569	12	12.45	0.45	Overburden	8.2	771	0.40	0.21	0.76	<0.02	0.010	<0.02	0.010	0.010	0.02	0	0.010	0.31	0.31	17	38	27	55	123	86	123	86
2019 Overburden																												
29632	VW1525	---	---	---	Overburden	7.9	---	0.49	0.0082	0.030	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	0.68	12	7.7	1.5	38	25	26	16
29633	VW1526	---	---	---	Overburden	8.4	---	0.48	0.13	0.46	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	10	27	19	22	87	59	58	39
29634	VW1527	---	---	---	Overburden	8.3	---	0.67	0.20	0.73	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	17	28	18	35	90	56	60	37
29635	VW1528	---	---	---	Overburden	8.4	---	0.50	0.15	0.54	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	12	30	21	26	95	68	63	45
29636	VW1529	---	---	---	Overburden	8.4	---	0.68	0.25	0.90	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	20	32	27	44	103	85	69	57
29637	VW1530	---	---	---	Overburden	8.5	---	0.72	0.23	0.86	0.040	<0.01	0.050	0.040	0.005	0.050	0.035	0.045	1.3	1.4	20	35	28	14	28	22	25	20
29638	VW1531	---	---	---	Overburden	8.4	---	0.77	0.29	1.1	0.040	<0.01	0.050	0.040	0.005	0.050	0.035	0.045	1.3	1.4	24	38	30	17	30	24	27	21
35029	VW1532	---	---	---	Overburden	8.2	---	0.47	0.08	0.28	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	6.4	20	14	14	65	45	44	30
35030	VW1533	---	---	---	Overburden	8.3	---	0.77	0.24	0.88	0.060	0.01	0.070	0.060	0.010	0.070	0.050	0.060	1.9	1.9	20	29	25	11	16	13	16	13
35031	VW1534	---	---	---	Overburden	8.4	---	0.74	0.27	0.98	0.070	0.01	0.070	0.070	0.010	0.070	0.060	0.060	2.2	1.9	22	36	28	12	16	13	19	15
29655	VW1535	---	---	---	Overburden	8.3	---	0.50	0.068	0.25	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	5.7	20	13	12	64	41	43	27
29656	VW1536	---	---	---	Overburden	8.4	---	0.78	0.20	0.72	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	16	31	29	35	100	91	67	61
29657	VW1537	---	---	---	Overburden	8.4	---	0.79	0.29	1.1	0.030	<0.01	0.040	0.030	0.005	0.040	0.025	0.035	0.94	1.1	25	37	30	22	39	32	34	28
29658	VW1538	---	---	---	Overburden	8.3	---	0.83	0.31	1.1	0.040	0.01	0.070	0.040	0.010	0.070	0.030	0.060	1.3	1.9	25	36	28	14	28	22	19	15
29659	VW1539	---	---	---	Overburden	8.3	---	0.82	0.27	0.98	0.040	<0.01	0.050	0.040	0.005	0.050	0.035	0.045	1.3	1.4	22	35	27	16	28	22	25	19
29660	VW1540	---	---	---	Overburden	8.4	---	0.73	0.26	0.96	0.040	<0.01	0.030	0.040	0.005	0.030	0.035	0.025	1.3	0.78	22	31	29	28	25	24	39	38
35021	VW1541	---	---	---	Overburden	8.0	---	0.52	0.035	0.13	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	3.0	17	12	6	54	37	36	25
35022	VW1542	---	---	---	Overburden	8.5	---	0.51	0.27	0.99	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	23	37	31	48	118	98	79	65
35024	VW1543	---	---	---	Overburden	8.6	---	0.59	0.30	1.1	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	25	41	35	53	131	111	87	74
2023 Overburden																												
Overburden Composite Sample from Sonic Drilling Program in 2021 for Management Ponds	BEF361	---	---	---	Overburden	8.4	---	0.94	0.24	0.88	0.060	<0.01	0.070	0.060	0.005	0.070	0.055	0.065	1.9	2.0	20	---	31	10	---	17	---	15
Construction Material																												
Quarry Sample																												
ROCK ROAD CONSTRUCTION	UU1350	---	---	---	Overburden	8.8	---	0.19	0.1	0.36	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.005	0.005	0.31	0.16	8	17	15	53	54	46	109	93
ROCK MATERIAL FOR ROADS	ZB0881	---	---	---	Overburden	8.7	---	0.78	0.6	2.3	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.005	0.005	0.31	0.16	50	---	45	320	---	145	---	289
Road Samples																												
T18-29	VH0513	---	---	---	Overburden	8.1	---	0.97	0.35	1.3	0.030	<0.01	0.020	0.030	0.005	0.010	0.0250	0.005	0.94	0.16	29	45	40	187	48	43	287	257
T18-32	VH0514	---	---	---	Overburden	7.9	---	1.0	0.30	1.2	0.040	0.01	0.040	0.040	0.010	0.020	0.0300	0.010	1.25	0.31	25	44	39	80	35	31	141	124
T18-35	VH0515	---	---	---	Overburden	7.5	---	0.66	0.01	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.83	11	8	5.3	34	25	67	49
T18-36	VH0516	---	---	---	Overburden	7.7	---	0.44	0.01	<0.08	0.020	<0.01	0.020	0.020	0.005	0.010	0.0150	0.005	0.63	0.16	0.83	11	6	5.3	17	10	67	38
T18-39	VH0517	---	---	---	Overburden	7.6	---	0.17	0.01	<0.08	0.040	<0.01	0.030	0.040	0.005	0.015	0.0350	0.010	1.25	0.31	0.83	9	7	2.7	7	6	30	23
Rail Loop Samples																												
TP18-23, 1.3-1.4	VH0584	1.3	1.4	0.10	Overburden	8.3	---	0.08	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	9.8	8.7	5.9	31	28	63	56
TP18-23, 2.6-2.7	VH0585	2.6	2.7	0.10	Overburden	8.3	---	0.07	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	10	6.2	5.9	32	20	65	40
TP18-24 1.9-2.1	VH0586	1.9	2.1	0.20	Overburden	8.5	---	0.07	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	11	7.0	5.9	34	22	67	45
TP18-24 1-1.2	VH0587	1	1.2	0.20	Overburden	8.5	---	0.06	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	10	6.7	5.9	32	21	64	43
T18-25, 2.1-2.3	VH0588	2.1	2.3	0.20	Overburden	8.5	---	0.06	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	12	8.9	5.9	38	28	76	57
T18-25 3.2-3.4	VH0589	3.2	3.4	0.20	Overburden	8.7	---	0.05	0.011	<0.08	0.050	<0.01	<0.02	0.050	0.005	0.010	0.0450	0.005	1.6	0.16	0.92	10	7.5	5.9	6	5	64	48
TP18-20 0.3-0.4	VH0590	0.3	0.4	0.10	Overburden	7.1	---	0.38	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	9.8	7.2	5.9	31	23	63	46
TP18-20 0.7-0.8	VH0591	0.7	0.8	0.10	Overburden	6.9	---	0.39	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	9.9	6.3	5.9	32	20	63	40
TP18-20 1.8-2.0	VH0592	1.8	2	0.20	Overburden	8.3	---	0.07	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	6.8	5.2	5.9	22	17	44	33

Appendix H – Overburden and Construction Rock Elemental Analysis Results

Overburden and Construction Material Samples: Elemental Analysis Results

Sample ID	Maxxam Sample ID	Sample Depth (m) From	To	Lithology	Al %	As ppm	Au ppb	B ppm	Ba ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P %	Pb ppm	S %	Sb ppm	Sc ppm	Se ppm	Sr ppm	Te ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
2018 Overburden																																								
+25mm fraction																																								
+25MM - T18-10-S-BLK-02 9.5	UJ3985	9	9.5	Overburden	2.62	15.3	0.3	<20	128	0.38	2.2	0.35	24.3	49	15.8	4.48	5.5	7	0.05	8.7	1.76	1470	0.39	0.166	48.1	0.074	10.2	<0.02	0.25	7	<0.1	79	<0.02	1.6	0.179	0.03	1	111	<0.1	78.7
+2mm-25mm fraction																																								
+2MM - T18-03-S-SPT4 6.0-6.45	UJ3987	6	6.45	Overburden	1.92	300	0.6	<20	245	6.15	1.42	3.05	14.5	41	73.5	3.89	5.3	38	0.12	8.4	0.95	971	0.87	0.054	28.3	0.076	16.2	0.19	1.11	8.1	0.4	90.7	0.04	1.8	0.061	0.06	0.5	71	<0.1	336
+2MM - T18-10-S-SPT2 3.0-3.45	UJ3988	3	3.45	Overburden	2.07	35.3	0.5	<20	270	0.9	1.34	0.65	16.6	52.4	46.4	4.32	6.1	52	0.13	9.5	1	1040	0.85	0.032	39.3	0.084	15.9	0.02	0.57	10.1	<0.1	83.5	<0.02	1.7	0.049	0.06	0.5	71	<0.1	143
+2MM - T18-13-S-SPT2 4.5-4.95	UJ3989	4.5	4.95	Overburden	1.92	22.1	<0.2	<20	253	0.46	1.85	0.38	15.4	42.2	41.9	3.72	5.6	49	0.11	9	1.03	966	0.59	0.052	29.1	0.078	13.2	0.04	0.51	9.3	<0.1	115	<0.02	1.5	0.078	0.06	0.5	75	<0.1	108
+2MM - T18-13-S-SPT5 12.0-12.45	UJ3990	12	12.45	Overburden	2.19	15.7	1.7	<20	241	0.37	1.79	0.37	16	37.7	43.6	3.94	6.1	30	0.14	9.3	1.01	965	0.44	0.054	28.3	0.07	11.8	<0.02	0.52	10.3	0.2	112	<0.02	1.8	0.067	0.06	0.5	77	<0.1	98.6
+2MM - T18-10-S-BLK-02 9.0-9.5	UJ3991	9	9.5	Overburden	1.81	12.6	0.3	<20	181	0.2	1.42	0.22	17	45.8	36.9	3.8	5.3	30	0.09	12.9	1.13	834	0.6	0.081	40.7	0.104	8.42	0.04	0.44	7.1	<0.1	86.4	<0.02	1.6	0.09	0.06	0.5	82	<0.1	82
+2MM - T18-02-S SPT-14 6.0-6.45m	UJ3993	6	6.45	Overburden	1.74	22.9	<0.2	<20	227	0.46	2.77	0.59	13.9	43.6	39.4	3.31	4.8	38	0.1	8	0.84	2490	0.65	0.055	27	0.064	14.4	0.05	0.5	8	<0.1	99.9	0.04	1.5	0.064	0.05	0.5	63	<0.1	96.1
-2mm fraction																																								
-2MM - T18-03-S-SPT4 6.0-6.45	TO9565	6	6.45	Overburden	1.88	13.4	<0.2	<20	193	0.29	1.5	0.3	14.5	48.4	44.2	3.61	4.9	52	0.13	8.2	0.86	865	0.7	0.048	30.2	0.072	31.8	0.07	0.39	8.5	<0.1	94.9	0.03	1.7	0.066	0.08	0.5	67	<0.05	105
-2MM - T18-10-S-SPT2 3.0-3.45	TO9566	3	3.45	Overburden	1.96	14	0.3	<20	225	0.17	1.31	0.27	14.9	48.1	43.7	3.79	5.2	55	0.16	8.3	0.9	843	0.89	0.04	32.3	0.074	15.8	<0.02	0.35	8.8	<0.1	79.2	0.04	1.8	0.053	0.06	0.5	68	<0.05	109
-2MM - T18-13-S-SPT2 4.5-4.95	TO9567	4.5	4.95	Overburden	2.06	14.3	0.6	<20	259	0.15	1.73	0.39	14.7	38.6	48.8	3.7	5.2	36	0.14	8.5	0.99	851	0.56	0.092	27.1	0.07	26	0.1	0.51	9.9	<0.1	109	0.04	1.6	0.084	0.06	0.5	75	<0.05	110
-2MM - T18-13-S-SPT5 12.0-12.45	TO9568	12	12.45	Overburden	2.32	13.2	0.6	<20	233	0.16	1.62	0.28	16.9	39.5	46.3	3.86	5.7	31	0.15	8.8	0.98	837	0.47	0.06	28.2	0.063	29.5	<0.02	0.44	10.7	<0.1	110	0.04	1.7	0.075	0.07	0.5	82	<0.05	103
-2MM - T18-10-S-BLK-02 9.0-9.5	TO9570	9	9.5	Overburden	2.02	10.2	<0.2	<20	193	0.14	1.5	0.23	15.1	36.1	43.2	3.66	5.3	41	0.14	8.7	0.94	1040	0.65	0.055	27.9	0.065	10.6	0.05	0.27	9.8	<0.1	96.7	<0.02	1.7	0.063	0.06	0.6	70	<0.05	88.9
-2MM - T18-02-S SPT-14 6.0-6.45m	TO9571	6	6.45	Overburden	1.98	41.4	273	<20	227	0.15	1.47	0.3	16.2	45.3	48.2	3.7	5.3	53	0.16	8.8	0.92	1020	0.71	0.048	33.5	0.069	12.7	0.07	0.31	10.2	<0.1	93.8	0.05	1.8	0.06	0.06	0.5	69	<0.05	100
Bulk Samples																																								
ORIGINAL - T18-03-5-SPT2	TV0022	3	3.45	Overburden	1.92	12.1	<0.2	<20	219	0.13	1.27	0.4	15.3	43.9	39.4	3.82	6	25	0.13	8.3	0.89	957	0.65	0.03	28.9	0.075	10.5	<0.02	0.3	9.6	<0.1	67.8	0.02	1.7	0.058	0.06	0.4	68	<0.05	110
ORIGINAL - T18-03-5-SPT6	TV0175	10.5	10.95	Overburden	1.61	12.2	1.2	<20	198	0.11	1.71	0.36	14.3	37.7	31.6	3.45	5.1	74	0.13	8.9	0.73	869	0.95	0.044	27.3	0.066	12	0.1	0.39	9.6	<0.1	89.4	0.02	1.9	0.027	0.07	0.7	54	<0.05	92.4
ORIGINAL - T18-03-5-SPT5	TV0176	7.5	7.95	Overburden	1.7	10.5	0.2	<20	234	0.11	1.94	0.22	13.9	35.3	38.2	3.38	5	42	0.13	10.4	0.79	889	0.76	0.061	19.4	0.067	9.3	0.09	0.31	9.7	<0.1	120	0.03	2.1	0.095	0.06	0.7	70	<0.05	88
Duplicates																																								
+25MM - T18-10-S-BLK-02 9.5 Split Dup	UJ3986	9	9.5	Overburden	2.67	17	1.1	<20	124	0.39	2.19	0.3	24.3	48.3	16	4.45	5.5	<5	0.05	8.9	1.79	1490	0.39	0.164	50.2	0.076	10.5	<0.02	0.28	7	<0.1	80.8	<0.02	1.6	0.18	0.03	0.9	112	<0.1	78.7
+2MM - T18-10-S-BLK-02 9.0-9.5 Split Dup	UJ3992	9	9.5	Overburden	1.94	15	<0.2	<20	216	0.26	1.48	0.29	15.9	48.5	44.8	3.84	5.7	52	0.13	8.7	1.02	1060	0.67	0.07	30.7	0.07	10	0.05	0.52	9.9	<0.1	101	0.03	1.6	0.078	0.06	0.5	76	<0.1	94.2
-2MM - T18-13-S-SPT5 12.0-12.45 SPLIT DUP	TO9569	12	12.45	Overburden	2.41	14.1	1.6	<20	228	0.15	1.65	0.26	16.4	43	48.1	3.97	6.1	38	0.17	8.9	1	858	0.43	0.068	29	0.063	25	<0.02	0.4	11.3	<0.1	109	0.03	1.7	0.077	0.07	0.5	82	<0.05	106
2019 Overburden																																								
29632	VW1525	---	---	Overburden	1.8	10.7	4	<20	219	0.12	0.64	0.21	11.7	37.8	32.3	3.26	4.8	35	0.13	8.4	0.67	852	0.58	0.042	25.3	0.062	7.5	<0.02	0.57	9	<0.1	59.8	0.03	2	0.061	0.07	0.4	70	<0.1	71.3
29633	VW1526	---	---	Overburden	1.98	13	5.1	<20	212	0.17	1.08	0.38	13.4	46.8	35.8	3.48	5.5	36	0.15	7.8	0.8	955	0.63	0.042	30.1	0.067	9.67	<0.02	0.57	8.9	<0.1	62.7	0.05	1.9	0.059	0.08	0.5	70	<0.1	91.5
29634	VW1527	---	---	Overburden	1.95	13.1	2.4	<20	225	0.13	1.26	0.29	13.5	39.8	33.5	3.7	5.3	42	0.15	8.3	0.81	890	0.64	0.04	28.7	0.066	8.67	<0.02	0.43	9.5	<0.1	66	0.03	1.7	0.055	0.08	0.4	72	<0.1	87.8
29635	VW1528	---	---	Overburden	2.21	12.3	1.9	<20	253	0.11	1.42	0.25	14.7	42.7	36.6	3.81	5.7	63	0.15	8.4	0.9	937	0.67	0.095	29.9	0.071	7.94	<0.02	0.55	9.8	<0.1	129	0.03	1.7	0.069	0.07	0.4	84	<0.1	85.2
29636	VW1529	---	---	Overburden	1.99	12.8	1	<20	224	0.12	1.48	0.26	13.9	38.9	35.5	3.72	5.6	43	0.17	8.6	0.89	1020	0.74	0.049	28.6	0.077	7.93	<0.02	0.54	9	<0.1	77.7	0.04	1.8	0.063	0.07	0.4	74	<0.1	87.4
29637	VW1530	---	---	Overburden	1.97	11.7	3.6	<20	198	0.11	1.38	0.25	13.7	40.6	35.1	3.64	5.5	39	0.15	8	0.92	1040	0.66	0.046	29	0.072	9.32	0.05	0.52	9	<0.1	82.1	0.04	1.6	0.066	0.07	0.4	74	<0.1	83.2
29638	VW1531	---	---	Overburden	1.99	12.3	0.9	<20	201	0.11	1.57	0.34	13.8	40.5	32.9	3.63	5.5	32	0.17	8.1	0.87	894	0.73	0.051	27.1	0.072	8.18	0.05	0.61	8.9	<0.1	85	0.04	1.6	0.056	0.07	0.5	73	<0.1	91.1
35029	VW1532	---	---	Overburden	1.65	12.4	1.6	<20	235	0.09	0.79	0.22	13.4	38.2	28.3	3.65	5.2	34	0.11	8	0.74	990	0.65	0.038	22.5	0.068	8.09	<0.02	0.52	9	<0.1	48.4	0.03	1.5	0.067	0.06	0.4	71	<0.1	93
35030	VW1533	---	---	Overburden	1.83	12.8	3.5	<20	186	0.14	1.19	0.24	13.7	39.2	35.5	3.44	5.7	37	0.15	7.6	0.88	868	0.85	0.037	31.3	0.071	7.81	0.07	0.59	7.9	<0.1	74.3	0.04	1.6	0.052	0.07	0.4	64	<0.1	81.8
35031	VW1534	---	---	Overburden	2.05	11.9	1.8	<20	300	0.12	1.39	0.23	13.9	38.2	34.1	3.59	5.6	34	0.16	7.7	0.99	875	0.69	0.058	28.8	0.079	7.19	0.07	0.74	8.1	<0.1	95.9	0.04	1.8	0.073	0.07	0.5	72	<0.1	77.4
29655	VW1535	---	---	Overburden	1.73	17.3	0.9	<20	320	0.09	0.78	0.27	14.4	35	31.2	3.93	5.6	38	0.15	7.5	0.78	1010	0.83	0.032	22	0.071	9.46	<0.02	0.63	9.1	<0.1	39.8	0.03	1.6	0.064	0.08	0.3	89	<0.1	121
29656	VW1536	---	---	Overburden	1.83	15.4	1.3	<20	270	0.1	1.18	0.28	15	46	31.7	3.76	5.6	32	0.15	7.5	0.87	964	0.7	0.034	28	0.069	8.97	<0.02	0.45	9.7	<0.1	56.3	0.03	1.7	0.039	0.08	0.4	77	<0.1	110
29657	VW1537	---	---	Overburden	2.02	13.9	1	<20	266	0.12	1.54	0.32	14.6	43.2	35.3	3.75	5.9	40	0.17	7.8	0.9	970	0.72	0.043	29	0.071	9.25	0.04	0.51	9.7	<0.1	74.3	0.03	1.7	0.051	0.09	0.4	74	<0.1	101
29658	VW1538	---	---	Overburden	2	16.7	1.6	<20	268	0.14	1.49	0.4	15.1	39	36.6	3.89	5.9	46	0.17	8.3	0.95	960	0.78	0.046	29.2	0.072	10.5	0.07	0.53	9.7	<0.1	92.8	0.04	1.7	0.055	0.08	0.5	79	<0.1	106
29659	VW1539	---	---	Overburden	1.98	14.8	2.5	<20	252	0.14	1.33	0.31	15	39	38.1	3.74	5.7	41	0.17	8.2	0.92	999	0.7	0.035	30	0.07	9.13	0.05	0.52	9.3	<0.1	74.7	0.04	1.8	0.055	0.08	0.4	74	<0.1	99.1
29660	VW1540	---	---	Overburden	1.96	12.2	1.5	<20	228	0.12	1.49	0.28	13.9	39.5	34.1	3.74	5.5	43	0.15	8.5	0.92	968	0.73	0.063	29.4	0.075	7.88	0.03	0.6	9.1	<0.1	84.7	0.04	1.7	0.064	0.07	0.4	73	<0.1	87.6
35021	VW1541	---	---	Overburden	2.17	12.6	0.9	<20	252	0.12	0.87	0.15	14.9	44.6	35.7	3.75	5.7	41	0.14	8.5	0.86	938	0.7	0.075	30.3	0.071	7.7	<0.02	0.52	10	<0.1	90.1	0.04	1.6	0.057	0.08	0.4	80	<0.1	80.1
35022	VW1542	---	---	Overburden	2.11	10.3	0.8	<20	198	0.12	1.65	0.23	13.8	38.7	37.7	3.62	5.6	31	0.15	7.7	0.93	844	0.59	0.051	28.8	0.072	7.12	<0.02	0.64	9.3	<0.1	94.7	0.05	1.5	0.071	0.06	0.4	74	<0.1	76.2
35024	VW1543	---	---	Overburden	2.15	11.4	0.3	<20	205	0.12	1.79	0.22	14.3	37.9	36.9	3.78	5.9	47	0.16	8.8	0.96	900	0.59	0.055	28.2	0.076	7.68	<0.02	0.52	9.8	<0.1	104	0.04	1.7	0.074	0.07	0.5	79	<0.1	81.2
2023 Overburden																																								
Overburden Composite Sample from Sonic Drilling Program in 2021 for Management Ponds	BEF361	-	-	Overburden	1.94	10.4	1.2	<20	189	0.12	1.43	0.24	13.6	75.6	34.1	3.55	5.4	40	0.18	7.6	0.86	930	0.89	0.061	28.8	0.069	7.44	0.07	0.47	9	0.3	89.3	0.04	1.5	0.066	0.07	0.4	72	<0.1	91.5
Construction Material																																								
Quarry Sample																																								
ROCK ROAD CONSTRUCTION	UU1350	---	---	Overburden	0.33	3.1	0.5	<20	129	0.04	0.54	0.09	5.6	85.8	13.6	1.65	1.4	111	0.17	15.5	0.1	486	0.93	0.035	10.6	0.044	3.33	<0.02	0.12	4.8	<0.1	21	<0.02	8	0.022	0.06	1	28	<0.1	49.7
ROCK MATERIAL FOR ROADS	ZB0881	---	---	Overburden	0.27	5.9	0.3	<20	219	<0.02	1.45	0.03	5.6	77.3	9.59	1.62	1.1	9	0.14	14.7	0.44	523	0.71	0.028	9.8	0.04	4.11	<0.02	0.12	5.1	<0.1	106	<0.02	7.1	0.017	0.05	1.3	27	0.2	33
Road Samples																																								
T18-29	VH0513	---	---	Overburden	1.72	10.2	1.6	<20	217	0.12	1.74	0.3	11.7	37.8	30.3	3.63	4.6	37	0.12	6.7	0.75	834	0.73	0.054	24.5	0.061	7.63	0.02	0.42	9.1	<0.1	106	0.02	2	0.041	0.07	0.4	66	<0.1	76.4
T18-32	VH0514	---	---	Overburden	2.45	9	0.8	<20	213	0.12	1.78	0.2	14.3	37.1	37.6	4.45	5.6	38	0.15	6.5	1.09	742	0.57	0.087	34.7	0.068	7.27	0.04	0.27	9.1	<0.1	128	0.02	1.7	0.032	0.06	0.4	74	<0.1	82.6
T18-35	VH0515	---	---	Overburden	1.78	8.7	0.3	<20	225	0.16	0.53	0.21	12	45.2	30.5	3.89	6.1	23	0.2	6	0.82	953	1.2	0.059	18.4	0.042	7.26	<0.02	0.52	8.5	0.1	36.6	0.04	1.4	0.069	0.19	0.3	71	0.2	81.6
T18-36	VH0516	---	---	Overburden	1.7	8.4	0.9	<20	248	0.19	0.52	0.35	15.1	45.3	32.5	4.78	5.6	16	0.16	5.6	1.01	1100	0.95	0.06	19.3	0.065	6.84	0.02	0.76	9.5	<0.1	29	<0.02	1.4	0.094	0.12	0.4	93	0.2	98.2
T18-39	VH0517	---	---	Overburden	1.74	9	1.2	<20	210	0.13	0.52	0.7	13.6	48.1	37.9	4.13	5.5	19	0.16	6.8	0.96	992	1.06	0.06	23	0.068	7.32	0.03	0.65	8.9	<0.1	27.9	<0.02	1.5	0.089	0.11	0.4	86	0.1	98.7
Rail Loop Samples																																								
TP18-23, 1.3-1.4	VH0584	1.3	1.4	Overburden	1.84	4.1	0.8	<20	110	0.05	0.8	0.13	13.8	56.5	31	3.98	6.5	9	0.08	5.2	1.23	944	0.43	0.06	15.9	0.073	3.83	<0.02	0.3	7	<0.1	23.6	<0.02	1	0.127	0.03	0.4	89	<0.1	101
TP18-23, 2.6-2.7	VH0585	2.6	2.7	Overburden	1.68	4.6	3.5	<20	85.8	0.04	0.55	0.1	9.6	53	23.9	3.91	5.6	9	0.08	5.2	0.95	874	0.43	0.049	12	0.063	4.38	<0.02	0.43	7.5	<0.1	24.3	<0.02	0.9	0.116	0.04	0.3	82	<0.1	91.7
TP18-24 1.9-2.1	VH0586	1.9	2.1	Overburden	1.39	5.9	2	<20	224	0.04	0.51	0.14	9.9	60.8	20	3.64	5.5	10	0.2	5.7	0.86	820	0.5	0.06	13.8	0.072	4.34	<0.02	0.36	7.4	<0.1	26.9	0.02	1.1	0.109	0.08	0.4	72	<0.1	100
TP18-24 1-1.2	VH0587	1	1.2	Overburden	1.47	5.2	2.1	<20	121	0.06	0.56	0.14	9.7	54.7	18.3	3.49	6.1	14	0.11	6.4	0.88	827	0.4	0.077	13	0.066	4.25	<0.02	0.31	7.3	<0.1	24.7	<0.02	1.2	0.099	0.04	0.4	74	<0.1	92.7
T18-25, 2.1-2.3	VH0588	2.1	2.3	Overburden	1.4	6.4	0.9	<20	151	0.06	0.68	0.13	11.8	66.3	21.9	3.85	6.2	7	0.12	6.8	0.88	904	0.62	0.071	13.3	0.122	4.89	<0.02	0.54	8.9	<0.1	26.8	0.05	1.3	0.121	0.05	0.4	86	<0.1	103
T18-25 3.2-3.4	VH0589	3.2	3.4	Overburden	1.4	5.9	0.5	<20	148	0.06	0.51	0.14	11.4	48.2	28.7	3.5	6.1	13	0.09	7.2	0.86	879	0.45	0.077	13.7	0.078	5.14	<0.02	0.36	7.1	<0.1	27.4	0.03	1.3	0.102	0.06	0.3	72	<0.1	92.5
TP18-20 0.3-0.4	VH0590	0.3	0.4	Overburden	1.55	8	0.3	<20	180	0.08	0.56	0.14	11.6	39.8	29.1	3.31	5	31	0.09	8.9	0.67	913	0.51	0.04	21.5	0.057	7.19	<0.02	0.37	7.8	<0.1	42.8	0.02	1.5	0.084	0.06	0.6	76	<0.1	67.6
TP18-20 0.7-0.8	VH0591	0.7	0.8	Overburden	1.58	7.5	1	<20	185	0.09	0.55	0.13	11.7	30.5	26	3.26	4.9	23	0.08	8.8	0.7	524	0.54	0.035	19.3	0.062	7.56	<0.02	0.38	7.4	<0.1	40.2	0.03	1.5	0.079	0.06	0.6	78	<0.1	67.9
TP18-20 1.8-2.0	VH0592	1.8	2	Overburden	1.15	5.5	0.8	<20	168	0.04	0.42	0.07	9.1	42	14.5	3.18	4.9	9	0.07	6.2	0.73	587	0.48	0.037	11.1	0.068	4.44	<0.02	0.4	6.3	<0.1	21	0.02	1.1	0.085	0.03	0.4	65	<0.1	78.1
***Screening Criteria**					**800**	**20**	**40**	**100**	**4300**	**2**	**300**	**1.8**	**250**	**2000**	**600**	**500**	**170**	**800**	**260**	**65**	**210**	**9000**	**20**	**240**	**800**	**1**	**160**	**0.5**	**1.5**	**50**	**0.9**	**3500**	**0.01**	**100**	**5**	**10**	**30**	**1500**	**10**	**700**

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Appendix I – Processed Rock ABA Analysis Results

Processed Rock and Processed Coal ABA Results

Sample ID	Maxxam /Bureau Veritas Sample ID	Description	Paste pH (s.u.)	Carbon Species (w.t.%)			Sulphur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios	
				Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulphate	S_{ICP}	Sulphide (S_{ICP} - SO_4)	AP (Sulphide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek NPR (Sulphide)
Fine Processed Rock															
183104	UI3972	Fine processed rock	7.8	26	2.3	8.6	1.9	0.02	1.8	1.8	57	196	192	3.4	3.4
182962	UI3973	Fine processed rock	7.6	16	1.8	6.7	2.7	0.02	2.7	2.7	84	151	157	1.8	1.9
TELKWA TAILINGS COMPOSITE	WT7431	Fine processed rock	7.6	22	2.3	8.6	3.9	0.07	3.5	3.4	109	194	158	1.8	1.4
TAILINGS	WP0672	Fine processed rock	6.2	43	0.8	3.1	3.0	0.05	3.1	3.0	95	71	61	0.74	0.64
Coarse Processed Rock															
183104	UI3970	Coarse processed rock	6.2	34	0.7	2.5	3.8	0.05	3.71	3.7	116	56	111	0.49	0.96
182962	UI3971	Coarse processed rock	6.8	33	0.4	1.4	2.8	0.03	3.1	3.0	96	32	36	0.34	0.37
JIG CCR	WP0671	Coarse processed rock	3.7	47	0.5	1.9	4.1	0.16	3.8	3.6	119	43	30	0.36	0.25

Appendix J – Processed Rock Elemental Analysis Results

Processed Rock and Processed Coal Elemental Analysis Results

Sample ID	Maxxam Sample	Description	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn
			%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm
Fine Processed Rock																				
183104	UI3972	Fine processed rock	0.47	39	1.1	<20	115	0.10	6.1	0.20	2.8	14	78	2.6	1.0	0.19	0.040	5.0	1.3	251
182962	UI3973	Fine processed rock	0.54	102	0.70	<20	119	0.20	5.6	0.30	2.7	16	96	3.0	1.0	0.41	0.030	3.0	0.65	205
TELKWA TAILINGS COMPOSITE	WT7431	Fine processed rock	0.52	22	<0.2	<20	183	0.21	7.1	0.29	7.9	21	75	4.3	1.3	0.26	0.060	3.6	0.84	257
TAILINGS	WP0672	Fine processed rock	0.32	12	<0.2	<20	70	0.16	2.4	0.30	6.7	13	44	3.2	1.1	0.21	0.040	2.5	0.63	231
Coarse Processed Rock																				
183104	UI3970	Coarse processed rock	0.39	71	0.90	<20	68	0.20	2.1	0.20	2.0	5.0	20	3.4	<1	0.37	0.040	3.0	0.48	139
182962	UI3971	Coarse processed rock	0.42	95	<0.5	<20	79	0.20	1.4	0.10	1.6	3.0	15	2.6	<1	0.19	0.030	2.0	0.18	56
JIG CCR	WP0671	Coarse processed rock	0.19	16	<0.2	<20	61	0.20	1.0	0.12	3.7	6.0	18	3.7	0.70	0.34	0.020	1.0	0.38	307
Processed Coal																				
TENAS PROCESSED COAL	CGF546	Processed Coal	0.050	2.4	<0.2	<20	13	0.050	0.10	0.020	3.5	2.1	4.7	0.25	0.70	0.084	<0.01	<0.5	0.030	5.0
****Screening Criteria***			800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000

Sample ID	Maxxam Sample	Description	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
			ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Fine Processed Rock																				
183104	UI3972	Fine processed rock	5.1	0.0080	10	0.17	21	1.8	0.30	17	1.7	176	<0.2	2.1	0.0010	<0.1	0.80	23	0.60	74
182962	UI3973	Fine processed rock	6.0	0.0060	10	0.17	14	2.7	0.50	19	1.7	198	<0.2	1.8	0.0010	0.10	0.70	20	2.3	71
TELKWA TAILINGS COMPOSITE	WT7431	Fine processed rock	4.8	0.011	22	0.12	18	3.5	0.37	26	1.2	270	0.090	2.3	<0.001	0.38	1.1	26	0.60	101
TAILINGS	WP0672	Fine processed rock	4.1	0.0090	13	0.093	22	3.1	0.34	20	1.1	86	0.080	1.5	<0.001	0.040	0.70	19	0.20	57
Coarse Processed Rock																				
183104	UI3970	Coarse processed rock	3.8	0.024	5.2	0.048	16	3.7	0.40	6.6	1.0	70	<0.2	4.5	<0.001	0.10	0.90	12	<0.1	31
182962	UI3971	Coarse processed rock	3.1	0.035	5.8	0.038	14	3.1	0.20	4.5	1.2	60	<0.2	2.4	<0.001	0.10	0.60	11	<0.1	26
JIG CCR	WP0671	Coarse processed rock	3.4	0.0040	7.1	0.0070	16	3.8	0.25	5.9	0.80	37	0.080	1.7	<0.001	0.060	0.40	9.0	<0.1	19
****Screening Criteria***			20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

APPENDIX 17: METAL LEACHING/ACID ROCK DRAINAGE MANAGEMENT PLAN, SRK

FINAL

Section 13.0 Management Plans

Chapter 12 Metal Leaching/Acid Rock Drainage Management Plan

Tenas Project, Telkwa B.C., Canada
Telkwa Mining Limited



SRK Consulting (Canada) Inc. ▪ CAPR002933 ▪ April 2025

srk consulting

FINAL

Chapter 12 Metal Leaching/Acid Rock Drainage Management Plan

Tenas Project, Telkwa B.C., Canada

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File Name:
App P 13.12_MLARDMP_CAPR002933_FINAL_20250414.docx

Suggested Citation:
SRK Consulting (Canada) Inc. 2025. Chapter 12 Metal Leaching/Acid Rock Drainage Management Plan. FINAL. Prepared for : Canada BC. Project number: CAPR002933. Issued April. 2025.

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The opinions expressed in this document have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. While SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

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Appendices

Appendix 13.12A Tenas Project Geochemical Characterization Update, SRK

Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

ABA	Acid Base Accounting
AP	Acid Potential
ARD	Acid Rock drainage
TIC	Total Inorganic Carbon
BC MMCM	British Columbia Ministry of Energy, Mines and Lower Carbon Innovation
BC MECCS	British Columbia Ministry of Environment and Climate Change Strategy
ML/ARD	metal leaching and acid rock drainage
non-PAG	non-potentially acid generating
NP	Neutralization Potential
NPR	Neutralization Potential Ratio
PAG	Potentially Acid Generating
POPC	parameters of potential concern
SRK	SRK Consulting (Canada) Inc.
TC	Total Carbon
TIC	Total Inorganic Carbonate
TML	Telkwa Mining Limited

UNITS OF MEASURE

km	Kilometre
m	Metre

Executive Summary

The focus of this Metal Leaching (ML)/Acid Rock Drainage (ARD) Management Plan (ML/ARDMP) is the identification and management of potentially acid generating (PAG) materials and the management of metal leaching under neutral conditions from non-PAG rock for elements such as selenium. Geochemical test results (SRK 2024a) were used to develop source terms for material handled by the Project which were carried forward into a site wide water quality and quantity model (SRK 2024b) to evaluate ML under neutral conditions as the current designed method of submerging PAG material underwater and covering of Environmental Assessment (EA) Open Pit Walls by non-PAG materials are expected to prevent ARD. Management of ML is addressed through the Minesite Water Management Plan (S13.0-C11) (MWMP). This ML/ARDMP and the Selenium Management Plan is in Appendix 13.5-I of the Discharge Management Plan (S13.0-C5) (DMP) and 1.9.4.2.5 Mining of the EA Certificate Application. The primary purpose of the ML/ARDMP is to outline an operational ML/ARD monitoring and identification program of mined material for geochemical inventory and identification of trending geochemical parameters which may require changes to handling and/or management strategies. Roles and responsibilities are outlined to undertake this monitoring and identification programs, enable correct timing and depth of water cover in management ponds and alleviate any improper placement of PAG rock within the Project footprint.

Telkwa Mining for mine planning, regulatory applications, and operational verification testing will use an NPR criterion cut-off of 2.0 where material having an NPR greater than or equal to 2.0 will be classified as non-PAG and material with an NPR less than 2.0 will be classified as PAG and submerged underwater for permanent storage. SRK (2024a) characterized the deposit based on stratigraphic zones and identified zones that are predominantly PAG or non-PAG based on their bulk geochemical properties (i.e., average weighted NPRs). Regardless of the weighted average NPR of zone, the geochemical testing results indicate that all rock zones contain some PAG and non-PAG rock and operational monitoring and verification testing must be done for all non-PAG materials. In zones where the rock is predominantly PAG, operational testing may not be completed. If testing is not completed a zone will be treated as PAG and managed appropriately.

Management of PAG materials at the Tenas Project will be critical to meet the Environmental Assessment Certificate (EAC) and Mines Act, RSBC 1996, c 293 and Environmental Management Act, SBC 2003, c 53 (MA/EMA) permit conditions and ensure environmental protection from both potential metal leaching and PAG materials. Through implementation of this ML/ARDMP and relevant Standard Policies and Procedures (SPPs), TML will ensure sampling and verification testing is completed to identify and manage PAG and non-PAG rock so that PAG rock is placed permanently underwater for storage with the goal of preventing potential future ARD.

1 Introduction

The Tenas Project (Project) is a proposed open pit mine that will excavate overburden, mine rock, and Run-of-Mine Coal from the EAC Open Pit. Based on the work conducted over the past twenty-five years (i.e., Norecol Dames & Moore (1999), SRK (2022), SRK (2024)), some of these materials are identified to be potentially acid generating (PAG). Telkwa Mining Limited (TML) has developed the following Metal Leaching/Acid Rock Drainage Management Plan (ML/ARDMP) to address the management of PAG materials to prevent potential Acid Rock Drainage. The focus of this ML/ARDMP is on the identification and management of PAG rock. Geochemical testing results (SRK 2024a) were used to develop source terms which were carried forward into a site wide water quality model (SRK 2024b) to evaluate metal leaching (ML). Management of ML is addressed through the Minesite Water Management Plan (S13.0-C11) (MWMP). The ML/ARDMP will form a key component of TML's Environmental Management System (S13.0-C1) (EMS) for operation of the Project, located approximately 25 kilometres (km) southwest of the Town of Smithers, British Columbia (BC).

2 Purpose and Objectives

The objectives of the ML/ARDMP are to:

- Provide a summary of geochemical characteristics of mined materials and identification of Parameters of Potential Concern (POPC) for water quality;
- Outline an ML/ARD monitoring program of mined material for geochemical inventory and identification of trending geochemical parameters which may require changes to handling and/or management strategies; and
- Provide operational handling and management strategies which will minimize the potential of ML/ARD during operations.

3 Scope and Scale

The scope of the ML/ARDMP is defined within Project Area. This ML/ARDMP will be implemented during the Construction, Operation, Decommissioning and Reclamation, and Post-closure phases of the Project and ceases to be in force at the final closure of the Minesite as approved by the regulatory authorities.

4 Compliance Obligations

4.1 Regulatory Requirements

Several legislative requirements are applicable to management of materials that are metal leaching and/or produce ARD. A list of these requirements and their major applicable components are provided in Table 4-1 below.

Table 4-1: Legislation and Guidelines Relevant to the Metal Leaching/Acid Rock Drainage Management Plan (ML/ARDMP)

Legislation, Regulations, and Guidelines	Applicable Information
Environmental Management Act, SBC 2003, c. 53 (Government of British Columbia [GovBC] 2003) (*EMA*)	The *EMA* sets out requirements for disposal of oil and hazardous materials, spill prevention and reporting, and pollution abatement. Authority for provincial spill cost recovery is additionally provided by the *EMA*. Regulations will be applied to a reportable hydraulic or chemical spill, any spill in water, industrial accident, or environmental emergency.
Fisheries Act, 1985, c F-14 (Government of Canada [GovCan] 1985)	Prohibits the release of a deleterious substance to fish habitat.
Health, Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] 2021) (Code)	Part 3, 3.7.1 Mine Emergency Response Plan details components and testing requirements
Mines Act, RSBC 1996, c 293 (GovBC1996)	Regulates mines through the Code and permitting of roads on mineral claims registered to a proponent
Waste Discharge Regulation, BC Reg 320/2004 (GovBC 2004)	"Prescribes" which industries and trades are regulated under the *EMA* and prescribes annual fees.
Water Sustainability Act, B.C. Reg. 36/2016 (GovBC 2016)	Provides guidance on protecting aquatic ecosystems and handling wells and groundwater protection.

Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (British Columbia Ministry of Mining and Critical Minerals [BC MMCM] and British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019) (JAIR) provides requirements for obtaining *Mines Act,* RSBC 1996, c 293, and *Environmental Management Act,* SBC 2003, c 53 (*MA/EMA)* permits. This ML/ARDMP is designed to fulfill the JAIR objectives as well as EAC Application requirements

4.2 Standard Practices and Procedures (SPP)

TML Standard Practices and Procedures (SPPs) will conform to the British Columbia Health, Safety and Reclamation Code for Mines in British Columbia (British Columbia Ministry of Mining and Low Critical Minerals [BC MMCM] 2021) (Code).

In addition to BC MMCM regulatory and Code requirements, if the Project implements SPPs they will meet other required laws and regulations.

5 Relationship to Other Management Plans

The Project is governed by an EMS, an overarching management plan strategy comprising a set of processes and practices which enable TML to manage its environmental and safety performance in a holistic way, within an integrated framework of management plans on specific topics. The ML/ARDMP is a component of the EMS.

In addition to the overall guidance of the EMS, this ML/ARDMP has a relationship with other management plans that also present mitigation measures. Those management plans and their relationship to this ML/ARDMP are listed in Table 5-1

Table 5-1: Management Plans with Relationship to the Metal Leaching/Acid Rock Drainage Management Plan (ML/ARDMP)

Management Plans	Nature of Relationship
Environmental Management System (S13.0-C1) (EMS)	Management plans are part of the EMS.
Construction Environmental Management Plan (S13.0-C4) (CEMP)	Any materials excavated as part of construction will need to follow this ML/ARD
Discharge Management Plan (S13.0-C5) (DMP)	ML/ARD is an input into the overall Discharge Management Plan.
Mine Emergency Response Plan (S13.0-C9) (MERP)	Response to emergencies from storage, and disposal of materials are addressed in the MERP.
Minesite Water Management Plan (S13.0-C11) (MWMP)	The adequate management of ML/ARD is key component in the development of the MSWMP especially the management ponds.

6 Details of Metal Leaching and Acid Rock Drainage Management Plan (ML/ARDMP)

6.1 Tenas Deposit Geochemistry and Potentially Acid Generating (PAG) Classification Criteria

The following two (2) principal geochemical studies have been completed to characterize the potential acid generating and ML potential of the Tenas Deposit:

- Norecol Dames and Moore (1999). Draft Report. Assessment of ARD Potential and Water Quality Predictions. Telkwa Coal Project; and
- SRK (2024a). Telkwa Coal – Tenas Project Geochemical Characterization Update.

The Norecol Dames and Moore (1999) study included the collection and analysis of over 700 samples. An additional 173 samples were collected as part of a supplemental geochemical characterization study (SRK 2024) in 2018 and 2019. The supplemental samples were used to confirm the results of the 1999 study and correlate the test results to more up-to-date testing methods. For example, analysis on samples collected as part of the Norecol Dames and Moore (1999) study was limited to total sulfur and neutralization potential using the Sobek-NP (1978) method. Furthermore, onsite barrel tests were initiated in late 2019 to provide additional information on the geochemical reactivity of PAG and non-PAG rock under ambient conditions. The testing results to the end of 2023 are provided in Appendix 13.12-A Tenas Project, Geochemical Characterization Update. Results from the two studies were combined to form a robust geochemical characterization for the Project that is reported in Appendix 13.12-A Tenas Project, Geochemical Characterization Update of this report. The reader is referred to Appendix 13.12-A for additional detail on the geochemical characterization program including sample selection, collection, testing, and results.

The outcomes of these studies indicated that a large volume of the material that will be excavated from the Tenas Deposit is PAG. Furthermore, ARD potential is stratigraphically constrained in zones that are generally separated by identifiable coal seams. The geochemical properties of the deposit were therefore described based on these mineable stratigraphical zones. The geochemical testing results indicate that all rock zones contain some PAG and *non-PAG* rock as illustrated by Figure 6.1 below; however, there are zones that are predominantly PAG versus *non-PAG.* Table 6-1 below summarizes the bulk weighted geochemical NPR results for the stratigraphical zones for the Tenas Deposit.

PAG material is identified as material that has an NPR less than a cut-off value of 2.0 for this management plan and the Tenas Project as a whole. The NPR is the ratio of the neutralization potential (NP) to the acid potential (AP). NP is measured in the lab through digestion of a small volume of sample in acid and titration of the sample to determine how much neutralizing mineral was consumed during the digestion. AP was estimated based on measured sulfide concentrations using a combination of Leco furnace and ICP-MS methods (SRK 2024a). Testing using these methods requires samples to be sent to offsite laboratories, which can have lengthy turn around times that are not amenable to making operational mine rock management decisions (i.e., the permanent storage location of blasted mine rock). To facilitate the shorter turnaround times that are required to make

operational decisions for the placement of blasted rock, processed rock, and other materials, the results of the geochemical characterization (Appendix 13.12-A) were used to develop operational proxies for determining NP and AP by an onsite laboratory that will be equipped with a Leco furnace. The following subsections provide the derivation details of the NP and AP proxies.

Table 6-1: Bulk Geochemical NPR for Material Zones for the Tenas Deposit

Material Zone Name	Stratigraphic Location	Material Designation	Bulk Weighted NPR
Zone 0	Till and overburden – topography to bedrock surface	*non-PAG*	**17.5**
Zone 1	Bedrock surface to top of Seam e (minus Zone 1a)	*non-PAG* with potential separable PAG portions	**3.1**
Zone 1a	Select area above Seam e to bottom of Seam e	PAG	**0.7**
Zone 2 & 3	Bottom of Seam e to bottom of Seam c	PAG	**0.8**
Zone 4	Bottom of Seam c to top of Seam b	*non-PAG* with potential separable PAG portions	**2.6**
Zone 5	Top of Seam b to top of Seam 1U	PAG	**1.2**
Zone 55	Top of Seam 1U to bottom of Seam 1L	PAG	**1.9**
Zone 6	Bottom of Seam 1L to bottom of Seam 1Lc	PAG	**1.8**
Zone 7**	Below Seam 1Lc to the bottom of Seam 1Ld	PAG	**1.7**
Zone 8**	Below Seam 1Ld	*non-PAG* with potential separable PAG portions	**5.0**

[1] Note: Zones 7 and 8 are not currently recovered within the EA Open Pit design

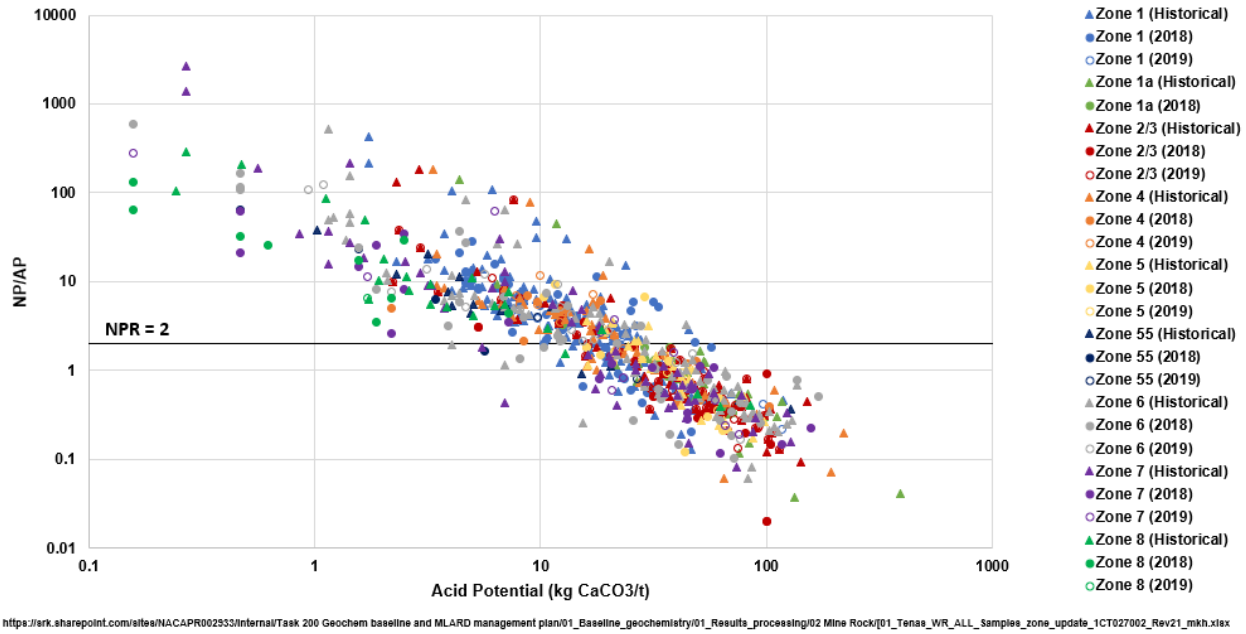


Figure 6-1: Neutralization Potential Ratio (NPR) versus Acid Potential for the Tenas Project

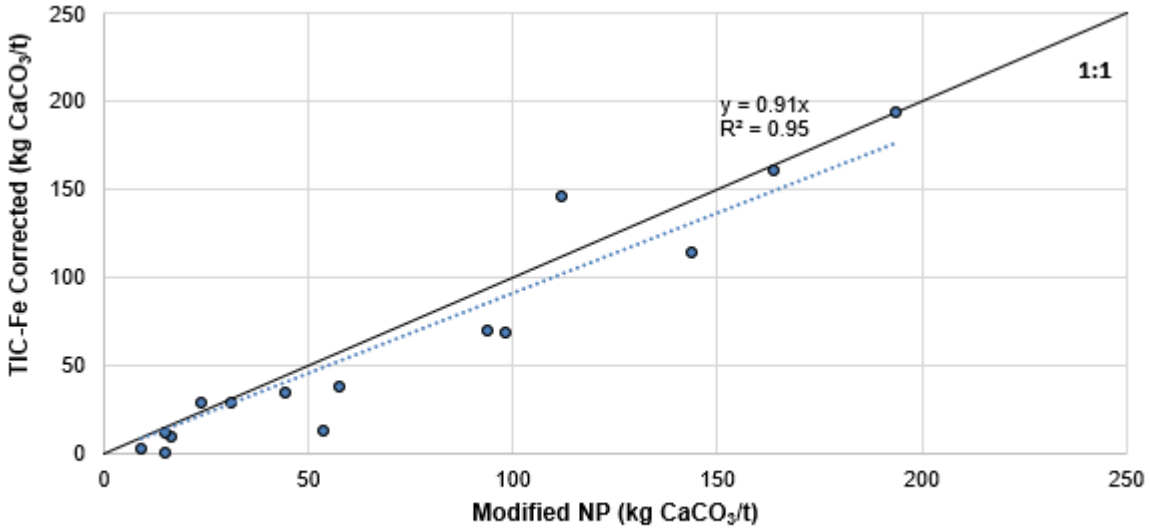
6.1.1 Neutralization Potential (NP)

Mineralogical testing of mine rock samples indicates that iron carbonates (e.g., siderite) are present in varying percentages in stratigraphic zones (SRK 2024a). As iron carbonates do not provide effective NP, a correction was developed to account for the effective NP available from Ca-Mg carbonates (e.g., calcite, dolomite) ($TIC_{XRD\text{-}corrected}$).

A strong positive correlation (r=0.95) exists between the modified-NP and total inorganic carbon (TIC), when corrected for iron carbonates ($TIC_{Fe\text{-}corrected}$) as illustrated by Figure 6-2below. The modified-NP results exceed the $TIC_{Fe\text{-}corrected}$ results indicating some silicate influence.

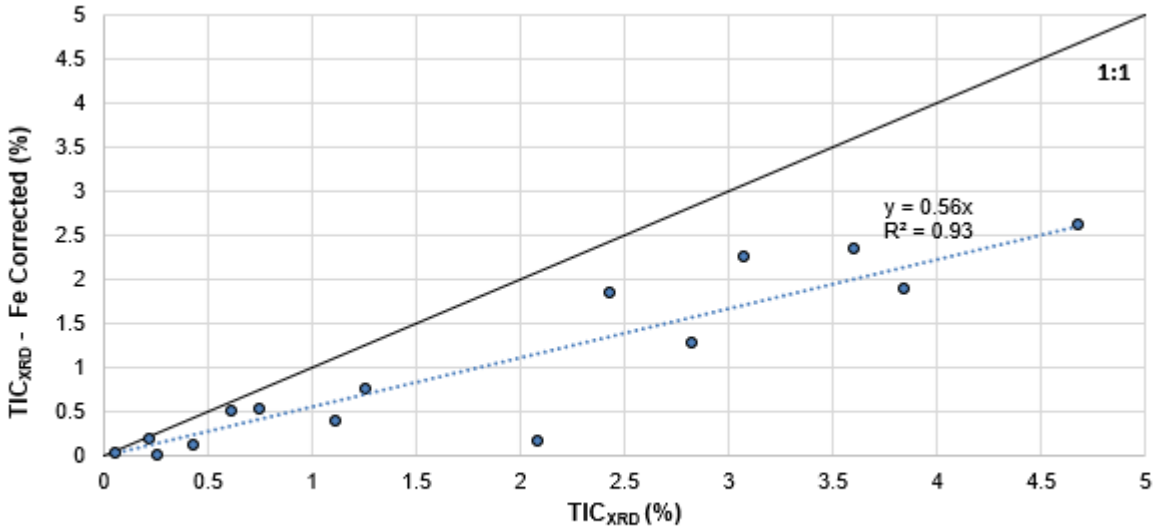
The relationship between TIC_{XRD}-Fe corrected and modified-NP can be used to correct total TIC concentrations measured by Leco. A strong correlation also exists between the TIC concentrations, estimated from XRD (TIC_{XRD}-total), to TIC_{XRD}-Fe corrected as illustrated by Figure 6 3 below. This relationship indicates the carbonate-NP, or the effective-NP ($NP_{effective}$) can be estimated using the following equation (EQ1):

$$NP_{effective}(kg\ CaCO_3/t) = 0.56 \times TIC_{Leco}(\%) \times 83.3 \quad \text{(EQ1)}$$



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Figure 6-2: Modified-NP versus TICXRD-Fe corrected



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Figure 6-3: TICXRD versus TICXRD-Fe corrected

6.1.2 Acid Potential (AP)

Sulfur in the mine rock for the Project occurs as mineralogical sulfur (sulfide and sulfate minerals) as well as organic sulfur which commonly occurs in coal deposits. The definition of sulfur species and sulfur analysis at the Project are as follows:

- S_{ICP} – sulfur from ICP-MS analysis representing mineralogical sulfur as sulfide and sulfate (also referred to as total inorganic sulfur);
- S_{HCl} – sulfur which occurs as sulfate as measured following HCl leach;
- S_{XRD} – sulfur as determine by mineralogy using XRD; and
- S_{Leco} – total sulfur (i.e., inorganic + organic) analyzed by Leco furnace.

Mineralogical sulfur was estimated using ICP-MS following an aqua regia digestion (S_{ICP}). The aqua regia digestion is used to estimate total inorganic sulfur in lieu of total sulphur by Leco due to the presence of organic sulfur species (SRK 2024a). To account for the presence of non-sulfide inorganic sulfur, sulfur as sulfate is measured by analysis of sulfur following an HCl digestion (S_{HCl}). Sulfide (S^{2-}) was calculated as the difference of total inorganic sulfur and sulfate according to the following equation (EQ2):

$$S^{2-}\ (\%) = S_{ICP}\ (\%) - S_{HCl}\ (\%) \qquad \text{(EQ2)}$$

Much of the total sulfur is present as sulfide in the material zones as illustrated by Figure 6-4 below. Highest total sulfur concentrations typically occur in Zone 2/3 and in the footwall Zones 6 and 7 as illustrated by Figure 6-4 below. Sulfate is generally low (average of 0.03%) in the samples as indicated by the difference of S_{ICP} (open symbols presented by Figure 6-4 below) and the calculated sulfide concentrations (solid symbols presented by Figure 6-4 below) using Equation 2. Sulfate concentrations

increase at higher total sulfur concentrations; however, sulfide is still the dominant sulfur species. At higher total sulfur concentrations, larger deviations from the 1:1 line occur indicating the presence of organic sulfur.

A regression analysis of samples indicates there is a strong positive correlation (i.e., r=0.99) between total sulfur and sulfide sulfur as illustrated in Figure 6-4. Total sulfur can therefore be used as a proxy for estimating sulfide using the following mathematical relationship:

$$S^{2-}\ (\%) = 0.93 \times \text{Total-}S_{Leco}\ (\%) \quad \text{(EQ3)}$$

Mineralogical analyses (SRK 2024a) indicate pyrite is the predominant sulfide mineral in the samples. Based on estimated pyrite content, total sulfur calculated using the XRD results generally corresponds to the total sulfur by Leco as demonstrated by Figure 6-5. Therefore, use of Equation 3 to estimate sulfide sulfur is considered reasonable.

S_{XRD} generally exceeds S_{Leco} as illustrated by Figure 6-5. This can occur because the XRD results are normalized to 100%. XRD does not detect amorphous phases and minerals at lower percentages and the normalization of detectable mineral species to 100% can result in an overestimation of the detectable species.

The calculated sulfide sulfur can subsequently be used to estimate AP by the following equation (EQ4):

$$AP\ (\frac{kgCaCO_3}{t}) = S^{2-}(\%) \times 31.25 \quad \text{(EQ 4)}$$

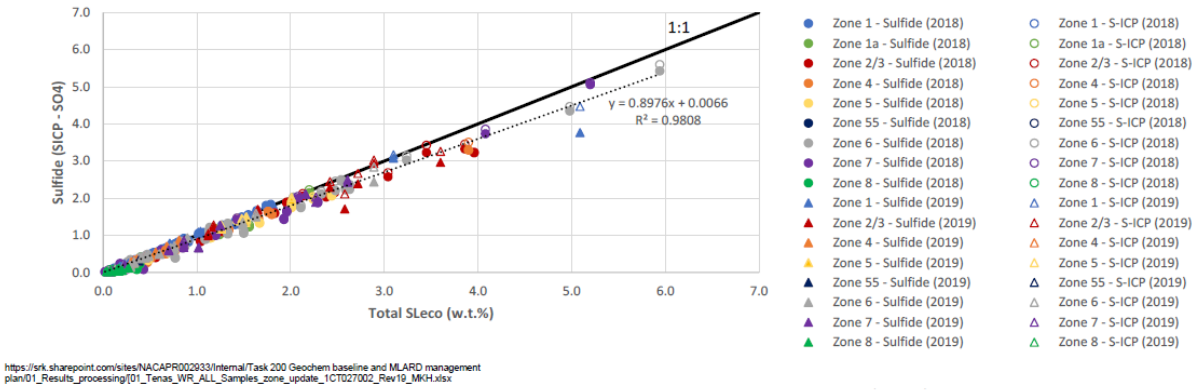


Figure 6-4: SLeco versus Total Inorganic Sulfur and S^{2-}

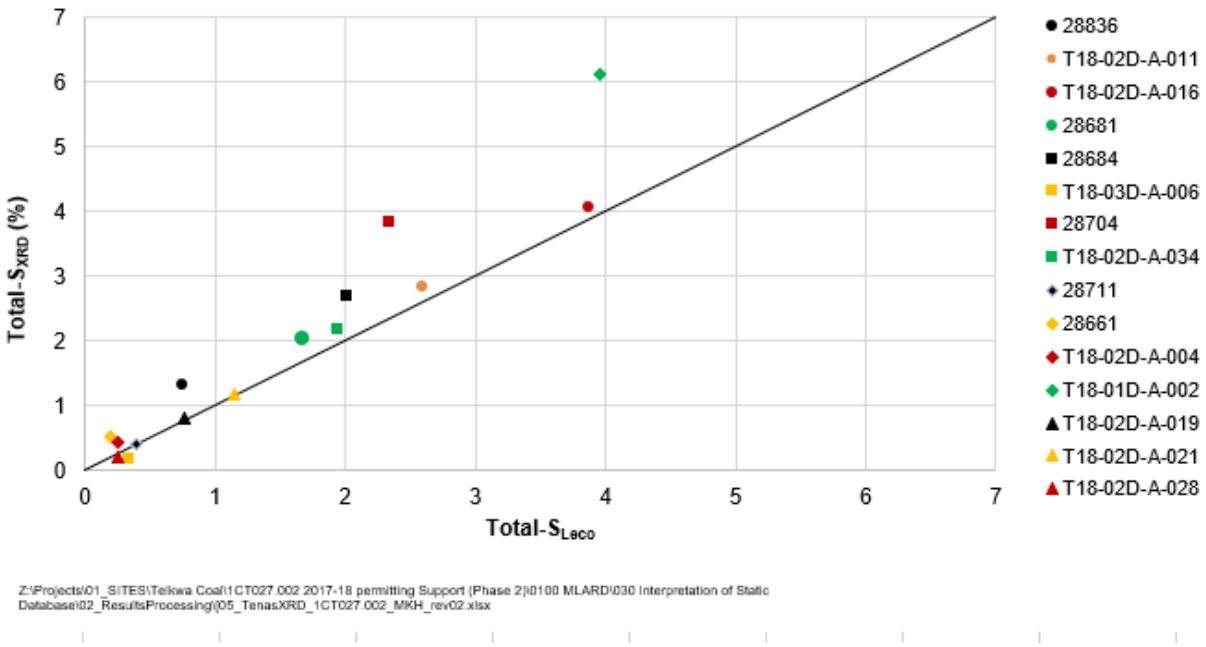


Figure 6-5: Leco Sulfur versus XRD Sulfur

6.1.3 Potentially Acid Generating (PAG) Classification Criterion

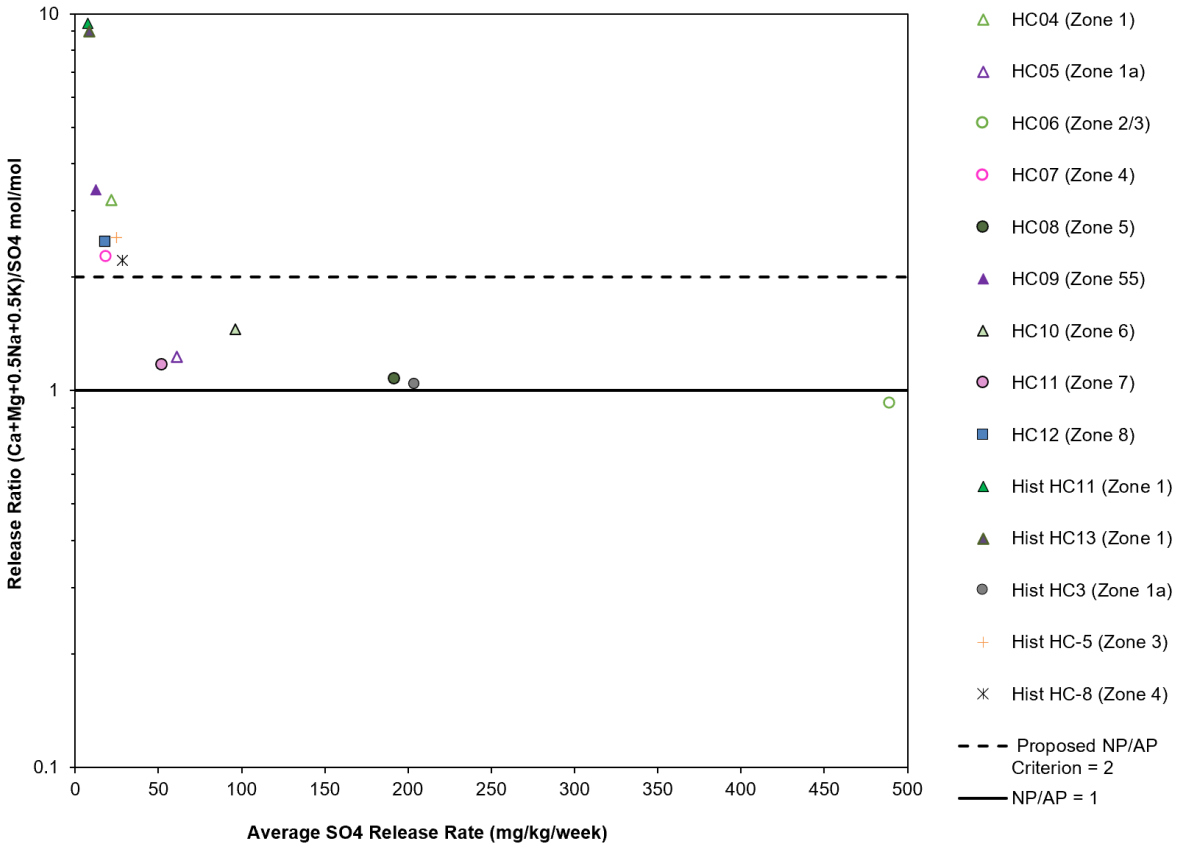
Humidity cell tests (HCTs) were initiated on representative mine rock material from the Project (SRK 2024a). The HCT results were used to calculate the carbonate molar ratio (CMR), which is the ratio of calcium and magnesium from carbonates to the sulphate production rates, expressed as follows:

$$(Ca+Mg)SO_4 \text{ mol/mol} (Ca+Mg)SO4 \text{ mol/mol}$$

The CMR is used to develop site-specific criteria for the classification of ARD potential for a particular deposit. If it is determined that the calcium and magnesium loads in the humidity cell tests are released from carbonate dissolution, the CMR represents the site-specific NPR when the pH in the test is neutral. SRK (2024a) demonstrated that a strong positive correlation exists between NP_{XRD}, following correction for iron carbonates, and modified-NP and a strong positive correlation exists between modified-NP and calcium plus magnesium. These lines of evidence provide confidence that the modified-NP is a measure of calcium and magnesium carbonate dissolution (i.e., the effective-NP). CMRs were calculated based on the stable average non-acidic loading rates from the HCTs. Due to the presence of clay minerals (i.e., illite, muscovite and kaolinite) in the rock at the Project (SRK 2024a), sodium and potassium were included in the CMRs to account for cation exchange. Figure 6-6 provides a plot of the CMR, accounting for cation exchange, versus the sulfate production rate. The CMRs in this figure indicate a site-specific NPR of 1.20 can be used to classify mine rock for the Project as PAG versus *non-PAG*.

Telkwa Mining has opted for the time being to continue to use an NPR criterion of 2.0 as a cut off for exploration drillhole rock with an NPR less than 2.0 being classified as PAG and materials with an NPR >= 2.0 being classified as *non-PAG*. This criterion was selected to ensure that the Project will not classify PAG material as *non-PAG* and is also overpredicting the amount of PAG rock that must be stored for geotechnical dam design and stability analysis, liner design, and to ensure sufficient equipment was available for PAG rock handling. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, an application to revise the proposed NPR criterion will be submitted to the BC MMCM and BC MECCS.

SRK (2024a) determined for planning, regulatory, and operational phases an NPR cut off criterion of 2.0 for this deposit is both appropriate and defensible to use as a cut off for other materials besides rock with materials with an NPR less than 2.0 being classified as PAG and materials with an NPR >= 2 being classified as *non-PAG* for other materials such as overburden, construction non-rock materials, surface soils (topsoil), coal, and processed rock.



https://srk.sharepoint.com/sites/NA1CT027.002/Internal/0100 MLARD/020 Reinterpretation of Kinetic Test Database/06_NPR Crit Evaluation/[NPR_Crit_1CT027.002_JED_MKH_Rev00.xlsx]

Figure 6-6: Carbonate Molar Ratios Accounting for Cation Exchange versus Sulfate Release Rates

6.1.4 Potentially Acid Generating (PAG) Material Lag Time and Submersion Timing

A key aspect of the ML/ARDMP is the flooding of PAG materials in the management ponds prior to the onset of acidic drainage. The estimated lag times to acidic conditions and details of the derivation of the lag times are provided in Appendix 13.15-A.

Based on the average bulk properties of PAG materials, the minimum lag time is approximately 4.2 years under laboratory conditions. The predicted lag times, based on the HCTs were conservative and underestimate the lag times that would be expected under field conditions. The 2019 field barrel test program provided additional empirical evidence and supported the initial lag times predictions (SRK 2024a). For example, based on the results up to November 2023, except for the Zone 6 barrel, all barrels produced alkaline drainage over the four-year testing period. The Zone 6 barrel started producing acidic drainage in October 2023 (i.e., four years into the testing period).

Based on the lag times expected under operational conditions, PAG material will be placed and flooded in the management ponds within an average of 6 months after excavation but no longer than 12 months.

Processed rock (e.g., tailings) will also be placed in the management ponds. Depletion calculations using the empirical open system at near neutral pH method (MEND 2009) on these materials (SRK 2024a) indicate the lag time to acidic drainage is 6 years under laboratory conditions. Again, lag times would be longer under operational conditions due to differences in field and laboratory conditions (e.g., lower average field temperature, larger size of material, etc.).

Coal samples were not included in the SRK (2024a) study. Historical testing of Tenas Coal samples was conducted on three coal samples (Norecol Dames and Moore 1999) and indicated that coal can produce acidity immediately with one (1) sample producing acidic drainage at the start of the test. The other two coal samples did not produce acidic conditions during the 14-week testing period. Based on these testing results, there is uncertainty in the timing of the onset of acidic conditions in coal and drainage from coal stockpiles will be monitored and if acidic drainage occurs, some of the stockpiled material will be covered with tarping, and the drainage will be subjected to lime water treatment.

Table 6-2: Estimated Acid Generation Lag Times in Months under Laboratory Conditions

Zone	Minimum	P5	P25	Average	P75	P95	Max
1	141	162	---	---	---	---	---
1a	32	32	47	60	65	67	91
2/3	16	19	30	66	71	145	---
4 (PAG)	4	12	37	50	48	62	69
4 (non-PAG)	---	---	---	---	---	---	---
5	54	67	119	---	---	---	---
55	22	30	63	101	76	135	---
6	26	29	65	154	---	---	---
7	32	38	77	151	161	---	---
8	22	27	62	138	140	---	---

6.1.5 Metal Leaching (ML)

Solid-phase analysis was completed on the mine material samples to identify elements that were elevated in the solid-phase. An element was screened as elevated if it was greater than 10 times the average crustal abundance (Smith and Huyck 1999). The following is a summary of constituents that were screened to be elevated in each material type (SRK 2024a):

- Mine rock – arsenic (20% of the samples), phosphorus (1% of the samples), selenium (1% of the samples) and sulfur (54% of the samples);
- Overburden:
- +2 mm-25 mm fraction – arsenic (67% of the samples) and cadmium (17% of the samples);
- -2 mm fraction – arsenic (17% of the samples), gold (17% of the samples) and tellurium (83% of the samples);
- +25 mm fraction – no elevated element concentrations;
- Processed Rock – arsenic (86% of the samples), selenium (86% of the samples), sulfur (100% of the samples) and tellurium (100% of the samples); and
- Construction material samples – no elevated element concentrations.

An elevated element concentration in the solid phase does not necessarily imply an elevated concentration will occur in the liquid phase since element leachability is dependent on several factors (e.g., mineralogy, pH, redox, etc.). Leachability of constituents was evaluated by scaling humidity cell and field barrel testing results to field conditions and coupling them with modelled site facility volumes to develop source terms for each material type that will be mined. The source terms were carried forward into the site water and load balance (SRK 2024b) to identify if element concentrations would be present at concentrations that would require additional mitigation (e.g., water treatment). The outcomes of this modelling indicate that water treatment will not be required if site drainage is neutral (SRK 2024b).

A key assumption in water quality modelling is the proposed PAG management strategy will prevent acid generating conditions and source terms were developed assuming neutral drainage conditions. If the PAG management strategy is not effective and pH is depressed, concentrations of several parameters (e.g., sulfate, aluminum, arsenic, cadmium, copper, iron, etc.) will increase (SRK 2024a). The efficacy of the PAG management strategy will be evaluated through ongoing operational water quality modelling. Water treatment is included as a Project mitigation strategy and will be implement should acidic drainage occur.

6.2 Mine Plan

The locations of major Project components for the Project's mine plan configuration are shown on Figure 6-1. The Project will employ a conventional shovel and truck extraction operation, like other rock quarry and surface mine operations in the region. To develop the EA Open Pit, TML will salvage surface soils (topsoil), excavate overburden, and drill and blast the rock in horizontal layers (or benches) and recover Run-of-Mine (ROM) Coal.

ROM coal will be extracted using conventional mining equipment and trucked to an onsite Coal Processing Plant (CPP) constructed north of the EA Open Pit on the west side of Goathorn Creek. Process water fed into the CPP will be reused or recycled or entrained in the processed rock and processed coal materials. The CPP will require makeup water to replace any water that is entrained in the processed coal and/or in the coarse and fine processed rock. The fine processed rock will be dewatered and combined with coarse processed rock material that will be able to be trucked to final storage locations which will be submerged underwater in the management ponds.

Mining of the Tenas Project will produce surface soils (topsoil), overburden, mine rock and ROM Coal from the EA Open Pit and processed rock and coal from the CPP. The following is the proposed management strategies for these materials:

- **Surface Soils (topsoil):** This is approximately the top 35 cm of material that contains the bulk of organic material and allows the growth of vegetation. Soil salvaged will be temporarily stored in stockpiles for use in reclamation or will be "direct placed" on reclaimed external or backfilled mine rock piles as per the Construction Environmental Management Plan in S13.0-C4 (CEMP) and Reclamation and Closure Plan S13.0-C15 (RCP). Surface soil has been classified as *non-PAG* (SRK 2024a);
- **Overburden:** This is the non-rock material between topsoil and rock that consists of gravel and till material with almost no organic material. Overburden material has been classified as *non-PAG* (SRK 2024a). Some will be placed within the embankments/buttresses of the management ponds or used as cover for *non-PAG* rock backfill to limit oxygen ingress or as cover material for the management ponds. The rest will be backfilled into the EA Open Pit;
- **Construction Materials**: The Tenas Project will be using materials from within the Project Footprint (Goathorn Gravel Quarry/Rock Quarry/Non-rock materials found along the Tenas Access Corridor and Rail Infrastructure) and offsite gravel deposits owned by independent third parties like Vihar. These materials have been classified as *non-PAG* (SRK 2024a);
- PAG rock: These are mine materials with an NPR of less than 2.0 (see Figure 6-1 and section 6.1.3). PAG rock will be placed into management ponds and submerged with a minimum of 0.5 m of water within an average of 6 months after excavation but no longer than 12 months. This management option minimizes the potential to form ARD by placement in a subaqueous setting to limit interaction with oxygen. PAG rock will be managed as follows:
  - In advance of, and during mining, TML proposes to progressively construct management ponds. The purpose of these ponds is to permanently store PAG material in subaqueous conditions to minimize sulfide oxidation and formation of acidic drainage;

  - The North Management Pond which is constructed first will be external to the north of the EA Open Pit. The East Management Pond is constructed next and will be external to the open pit and will be south of the North Management Pond, and northeast of the EA Open Pit. The West Management Pond is constructed last and will encompass the northern portion of the EA Open Pit plus an embankment to provide sufficient storage for PAG material (
  - PAG material will first be placed in the North Management Pond. PAG material will be progressively placed in lifts and then flooded so that exposure of PAG material to atmospheric oxygen is minimized. TML is proposing to place PAG rock underwater before it becomes acid generating. The timing to the onset of acid generation is discussed in section 6.1.4;
  - Once the storage capacity of the North Management Pond has been reached, storage will begin in the East Management Pond and subsequently in the West Management Pond. The Management Ponds will be maintained with at a 0.5m water cover during active use and under at least 1.5 m of water once the management pond's PAG rock storage capacity has been reached;
  - Once the ponds have reached the maximum PAG rock storage capacity, TML will place a 1 to 2 m layer of *non-PAG* rock on top of the submerged PAG material below the active water level of the management pond, followed by a 0.5 m overburden layer to create a dry landform above water, followed by approximately a 30 cm layer of reclamation materials (surface soils) to reduce evaporative losses from the water cover above the saturated PAG rock;
- ***Non-PAG* rock:** This is mine rock with low sulphur levels with an NPR that is greater than or equal to 2.0 (see 6.1.3). The *non-PAG* rock will be used as open pit backfill, in management pond embankments, buttresses or used as interim cover material over the management ponds at closure;
- **Processed Rock (tailings):** This is coarse and fine rock material separated from the processed coal during coal processing. These materials are classified as PAG and will be placed subaqueously into the management ponds.
- **ROM Coal:** This is coal that is excavated from the open pit and placed into several stockpiles for feeding into the Coal Processing Plant (CPP). This material is classified as PAG. Historical testing (Norecol, Dames & Moore 1999) indicates that coal can become acid generating in a shorter timeframe than processed rock; however, this was not confirmed as part of the SRK (2024a) study. Drainage from the coal stockpiles will be monitored and if for some reason ROM Coal is not processed, it will be placed in the management ponds;
- **Processed Coal:** This is coal that is produced by the CPP for the marketplace and is classified as PAG. Drainage from the processed coal stockpiles will be monitored and if for some reason becomes acidic this drainage will be collected and treated; and
- **EA Open Pit Walls:** Pit walls will be covered with *non-PAG* material to limit oxygen and water ingress from contacting open pit wall rock surfaces. Much of the open pit will be backfilled during the Operation and the Decommissioning and Reclamation Phases. Meteoric water contacting the

non-PAG covered open pit walls will report to an End Pit Lake, which will subsequently drain northwards by gravity and mix with Management Pond water prior to discharging.

Surface water management features (i.e., channels, sedimentation ponds and storage ponds) are illustrated in Figure 6-7 below. Upslope diversion channels will divert non-contact water away from the material stockpiles and surface mine areas, into existing natural watercourses. Downslope collection channels will collect runoff from the material storage areas and divert it into the sedimentation ponds for treatment with approved flocculants/coagulants to reduce total suspended solid levels to regulatory levels. No water treatment is anticipated beyond normal sediment control (SRK 2024b); discharge water from the site will achieve the water quality criteria required to protect drinking water and fish and aquatic life downstream of the project.

The estimated material production schedule is provided in Table 6-3 below.

Table 6-3: Material Production Schedule

Year	Construction Materials (kBCM/Material)	Reclamation Materials (surface soils/topsoil) (kBCM)	Overburden (kBCM)	PAG Rock (kBCM)	*Non-PAG* Rock (kBCM)	Run-of-Mine Coal (ktonnes)	Processed Coal (ktonnes)	Processed Rock (ktonnes)
-0.5	125.0/OVB Haulroads	797	1,423	0	0	0	0	0
	16.4 Well Graded Base (WGB) Tenas Access Corridor (TAC)							
	10.0 Open Graded Base (OGB) TAC							
	4.0 ballast Rail Infrastructure							
	6.0 sub ballast Rail Infrastructure							
	7.0 high fines TAC							
0	175.0/OVB Haulroads	83	1032	327	0	263	196	67 (38m^3)
	21.6 high fines TAC							
	45.0 OGB TAC							
1	67.0/OVB Haulroads	140	1,082	1214	337	1050	768	282 (161m^3)
	5.0 high fines TAC							
	15.0 OGB TAC							
2	67.0/OVB Haulroads	366	3729	1549	641	1050	764	286 (163m$^{3)}$
	5.0 high fines TAC							
	15.0 OGB TAC							
3	67.0/OVB Haulroads	140	1,668	1,712	1,738	1,050	803	247 (141m^3)
	5.0 high fines TAC							
	15.0 OGB TAC							
4	50.0/OVB Haulroads	28	904	1,769	741	1,050	773	277 (158m^3)
	5.0 high fines TAC							
	15.0 OGB TAC							
5	5.0 high fines TAC	25	815	1,980	1,238	1,050	776	274 (157m^3)
	15.0 OGB TAC							
6 to10	25.0 high fines TAC	194	4,242	7,819	9,760	5,250	3,809	1,441 (823m^3)
	75.0 OGB TAC							
11 to 15	25.0 high fines TAC	292	4,709	7,753	7,434	5,250	3,968	1,282 (733m^3)
	75 OGB TAC							
16 to 21	30.0 high fines TAC	199	1,805	6,783	6,817	6,003	4,418	1,585 (906m^3)
	90.0 OGB TAC							
Total	551.0/OVB Haulroads	2,264	21,409	30,906	28,706	22,016	16,275	5,741 (3,280m^3)
	133.6 high fines TAC							
	16.4 WGB TAC							
	370.0 OGB TAC							
	4.0 ballast Rail Infrastructure							
	6.0 sub ballast Rail Infrastructure							

Note: kBCM=thousand bank cubic metres; ktonnes=thousand tonnes

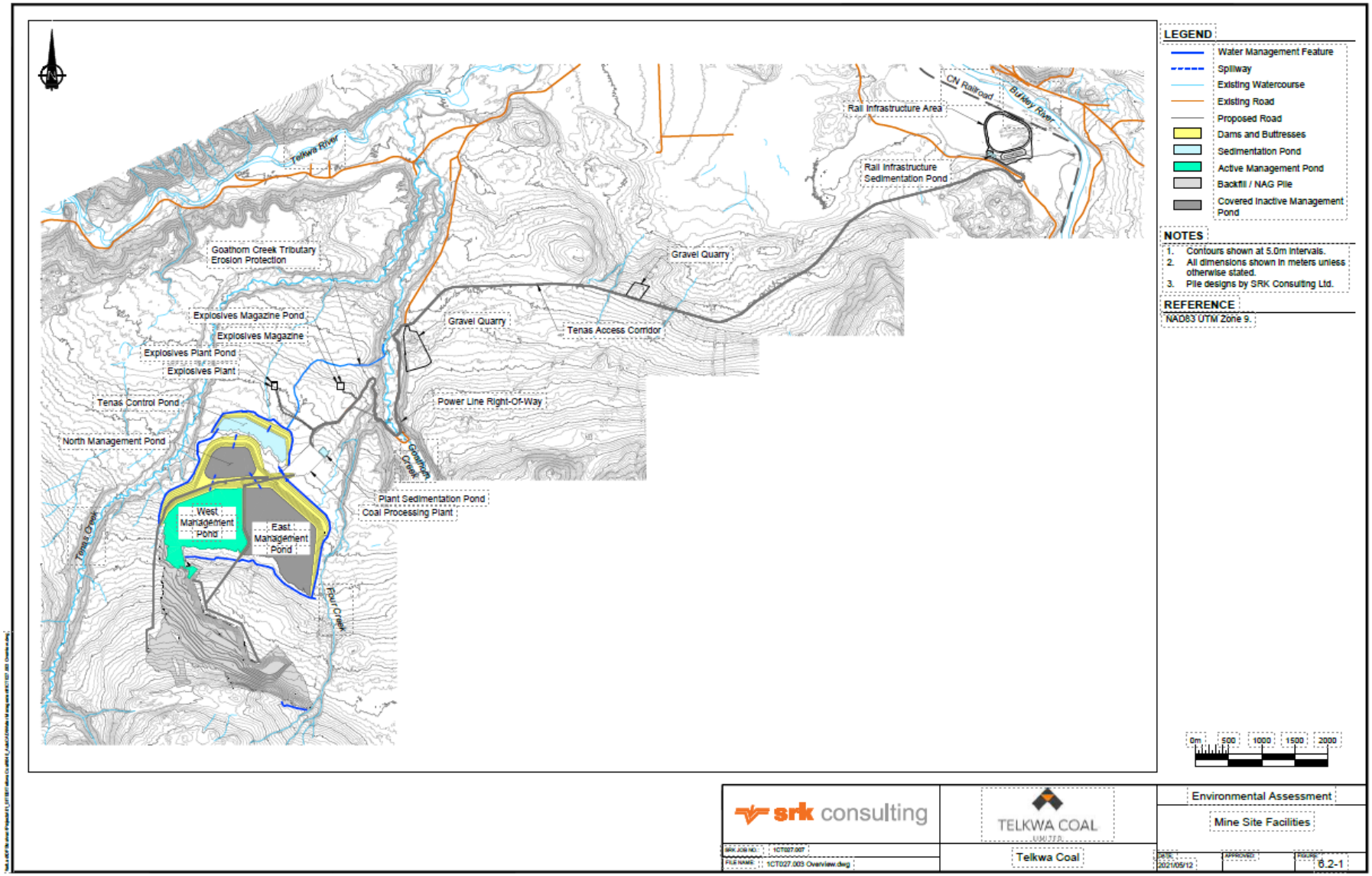


Figure 6-7: Tenas Project Components and Water Management Features

6.3 Material Handling and Coal Processing

Figure 6-8 below provides a flow chart for the material handling methodology for the Project. As presented, any surplus overburden and *non-PAG* material will be placed within the critical backfill portions and/or buttress area of the embankments for the management ponds or backfilled into the open pit.

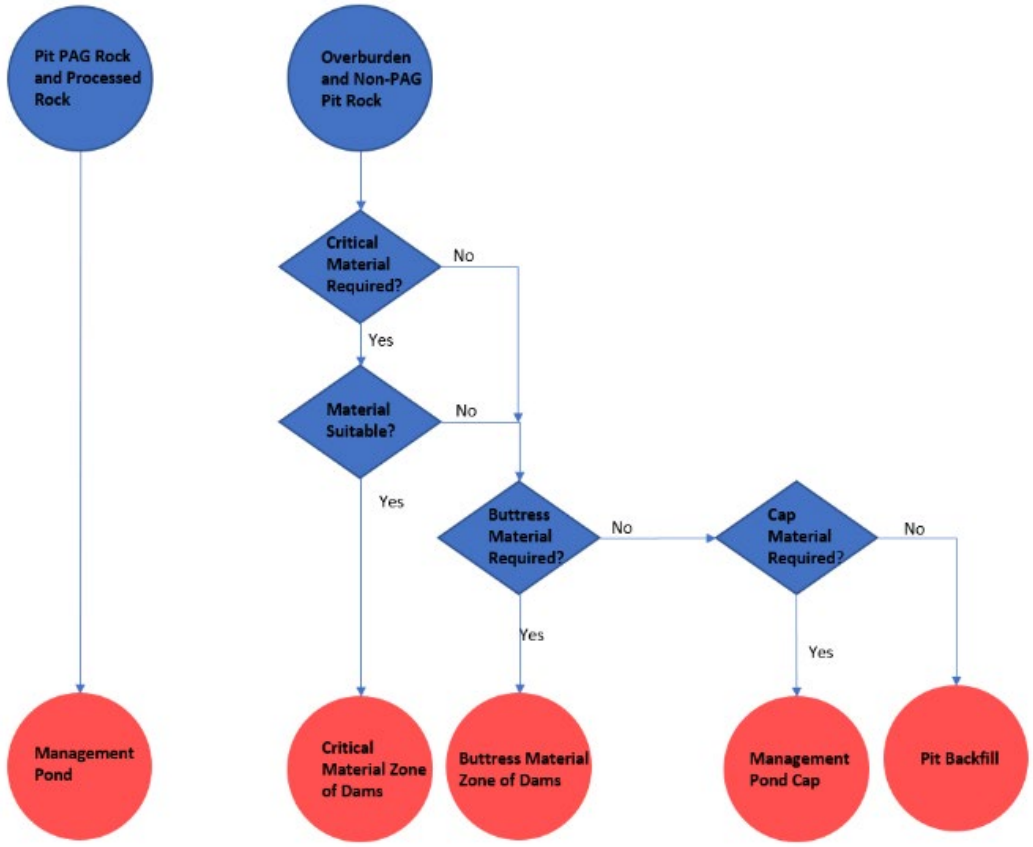


Figure 6-8: Material Management Decision Matrix

The Coal Processing Plant (CPP) flowsheet is provided below in Figure 6-9 below. The proposed flowsheet is typical of other western Canadian metallurgical coal operations; however, TML will use centrifuges for processed coal dewatering versus coal and/or natural gas fueled coal dryers to minimize GHG and dust emissions. As shown, material entering the CPP leaves in one of two streams, processed coal, or processed rock, with the former being sold on the marketplace and the latter being disposed of in the management ponds

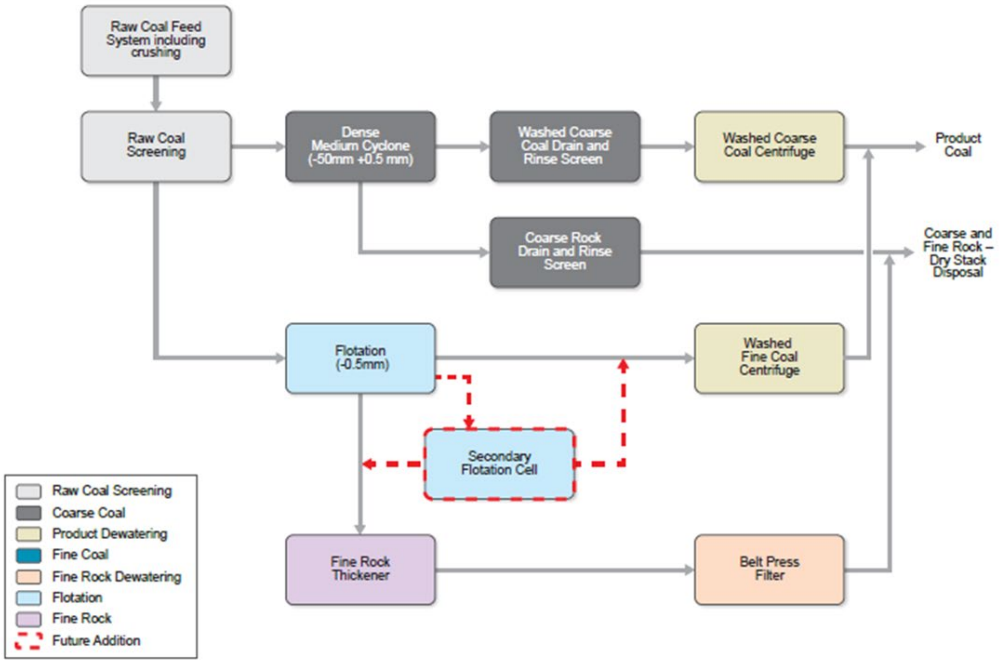


Figure 6-9: Coal Processing Flowsheet

6.4 Operational Monitoring & Geochemical Classification Criteria

6.4.1 Scope of Criteria

These criteria apply to chip samples collected during the drilling of blastholes and to free dig materials (e.g., overburden/surface soils/construction materials), and from processed rock/coal. Classification of ARD is based on zone, material type, and the NPR for the chip sample collected and their distribution within the blast pattern.

6.4.2 Classification Based on Material Type

Rock excavated during mining from all zones and materials will be considered PAG unless operational verification testing demonstrates it is *non-PAG* using the NPR classification provided in Section 6.4.3. Processed rock, processed coal and ROM coal are also considered PAG.

Overburden, surface soils (topsoil), and construction materials will be considered *non-PAG* but will still need verification testing.

6.4.3 Classification Based on Neutralization Potential Ratio (NPR)

As stated earlier in section 6.1.3 SRK (2024a) determined that an NPR cut off criteria of 1.20 for this deposit could be used to classify rock as PAG or non-PAG during verification testing. However, Telkwa Mining will continue to use the more conservative NPR criterion of 2.0 as a cut off versus the site-specific value of 1.20 to identify exploration drillhole and blasthole rock as PAG and *non-PAG*. Rock with an NPR less than 2.0 being classified as PAG and rock with an NPR >= 2.0 being classified as *non-PAG*. This criterion was selected to ensure that Telkwa Mining is overpredicting the amount of PAG rock that must be stored for geotechnical dam design and stability analysis, liner design, and to ensure sufficient equipment was available for PAG rock handling. This criterion will be reviewed as additional information is gathered for the permitting application at which point if the data supports it, TML will apply for an amendment to the NPR criterion.

SRK (2024a) determined for both planning, regulatory, and operational phases an NPR cut off criterion of 2.0 for this deposit is both appropriate and defensible to use as a cut off for other materials besides rock with materials with an NPR less than 2.0 being classified as PAG and materials with an NPR >= 2 being classified as *non-PAG* for other materials such as overburden, construction non-rock materials, surface soils (topsoil), coal, and processed rock.

6.4.4 Operational Monitoring Procedures for Materials

6.4.4.1 Mine Rock

Portions of Zones 1, and 4 might be classified as *non-PAG* based on their exploration drillhole or blasthole properties (SRK 2024a) and an operational NPR cut-off of 2.0. As noted in **section 6.1** all rock zones potentially contain a component of PAG and *non-PAG* materials. PAG rock in Zones 1, and 4 will be identified using the site-specific NPR of 2.0 through sample monitoring in advance of excavation of material via blasthole sampling. Rock with an NPR less than 2.0 will be classified as PAG and placed underwater in the management ponds. Mine rock with an NPR greater than or equal to 2.0 will be classified as *non-PAG* and will either be used as open pit backfill, used in management and/or control pond embankments and buttresses, placed inside the management ponds, or used as the final cover material for the management ponds and/or EA Open Pit walls. The following sections provide the procedures for sample collection, testing and analysis. If verification is not completed on rock excavated this material will be assumed to be PAG and placed in the management ponds for permanent disposal.

6.4.4.2 Sample Collection

Each blast will consist of the following approximate attributes:

- Blast hole depth of 13 m;
- Blast hole spacing of 9.3 m; and
- Blast hole burden of 8.0 m.

A blast pattern will be approximately 140 m by 60 m, producing approximately 100,000 bank cubic meters (BCM) of rock per blast.

Geochemical samples will be collected from blast hole drill cuttings at intervals of approximately 18.6 m or two times blast hole spacing distance and 16 m or two times the burden distance along burden. Composite samples throughout the entire drillhole length of designated blastholes should be created through collection of chips from the blasthole and coning and quartering the sample to create a homogenized sample representative of the entire blast hole. If multiple zones are intersected in one drillhole, composite samples of thickness of each zone will be collected from the blastholes. Samples are to be bagged and labelled with a unique sample ID and the location, time, date, drill rig, and stratigraphic unit the sample was collected from. Approximately 3 to 5 kilograms (kg) of sample should be collected and stored in case future analysis is required.

6.4.4.1.2 Determine the Blast hole Neutralization Potential Ratio (NPR)

The following are the steps to calculate the NPR of each sample:

- Measure total carbon and total inorganic carbon using standard procedures (MEND 2009):
- Measure total carbon using standard Leco furnace procedures;

- Measure total inorganic carbon (TIC) through evolving CO_2 with an HCl leach;
- Calculate the NP of the sample using Equation 1 below;

  〖NP〗_effective (〖kg CaCO〗_3/t)=0.56×〖TIC〗_LECO (%)×83.3 (EQ1)

- Measure total sulfur using standard Leco furnace procedures;
- Calculate the AP of the sample using Equations 3 and 4 below; and

  〖"S" ^"2-" 〗_"calculated " "(%) = 0.93×" 〖"Total-S" 〗_"measured" " (%) - 0.02 " (EQ3)

  $$\text{AP } (kg\ CaCO_3/\text{t}) = S^{2-}_{\text{calculated}}\ (\%) \times 31.25 \qquad \text{(EQ4)}$$

- Calculate the NPR of the sample by dividing the NP by the AP.

Blast holes with an NPR<2.0 are classified as PAG while holes with an NPR>=2.0 are classified as *non-PAG*.

6.4.4.1.3 Delineate Potentially Acid Generating (PAG) and non-PAG Rock

Blasts may consist of a mix of PAG and *non-PAG* rock, as defined by blasthole sample results. Rock is only considered *non-PAG* in the blast hole grid where the package of rock is contained within four *non-PAG* blastholes. Rock adjacent to PAG holes is considered PAG. An example of PAG and *non-PAG* rock delineation is provided in Figure 6-10. If verification testing shows increasing variability the sampling program can be increased to take a sample from every blasthole versus every second blasthole as illustrated in Figure 6-10.

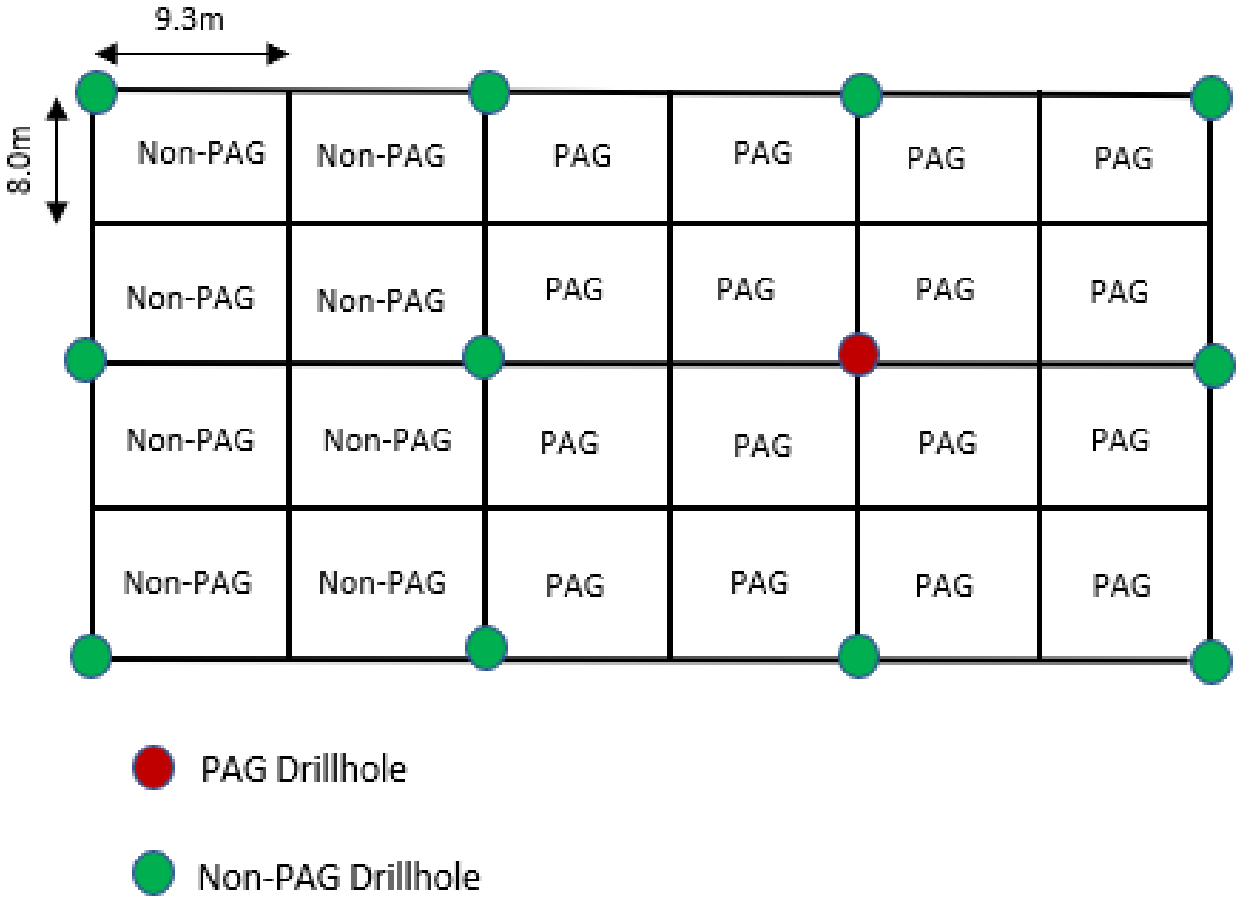


Figure 6-10: Example of Blast Grid non-PAG and PAG Rock

6.4.4.1.4 Laboratory Testing

Application of the above criteria will require collection of samples to confirm and/or update, as necessary, the operational NP and AP calculation methods. A minimum of one (1) confirmation sample per blast should be collected for testing as follows:

- If all blastholes are classified as either *non-PAG* or PAG, one (1) confirmation sample should be collected for confirmatory analysis; or
- If a blast is classified as having both *non-PAG* and PAG blastholes, one (1) *non-PAG*, and one (1) PAG sample should be collected for confirmatory analysis.
- These samples should be submitted to an accredited lab for the following analyses:
- Paste pH;
- Total sulphur by Leco furnace;
- Sulfur as sulfate following HCl leach;
- TIC measured from evolved CO_2; and
- Elemental analysis using ICP-MS following an aqua regia digestion using ultra low detection limits to understand metal leaching potential.

6.4.4.1.5 Non-PAG Rock Pile Testing

Random quarterly non-PAG rock pile samples will be taken from active non-PAG rock lifts in areas where rock has been placed during the last quarter. The number of samples will be based on using roughly a 200 by 200-m grid pattern and taking a sample on every node of this grid. The same criteria will be used as for operational blasthole verification testing with material having an NPR < 2.0 being designated as PAG, while materials with an NPR >= 2.0 being designated as non-PAG. If PAG material is identified by these grid points additional sampling will be conducted in 25-m offset concentric circles from this location until a non-PAG sample is measured as illustrated by Figure 6-11 below.

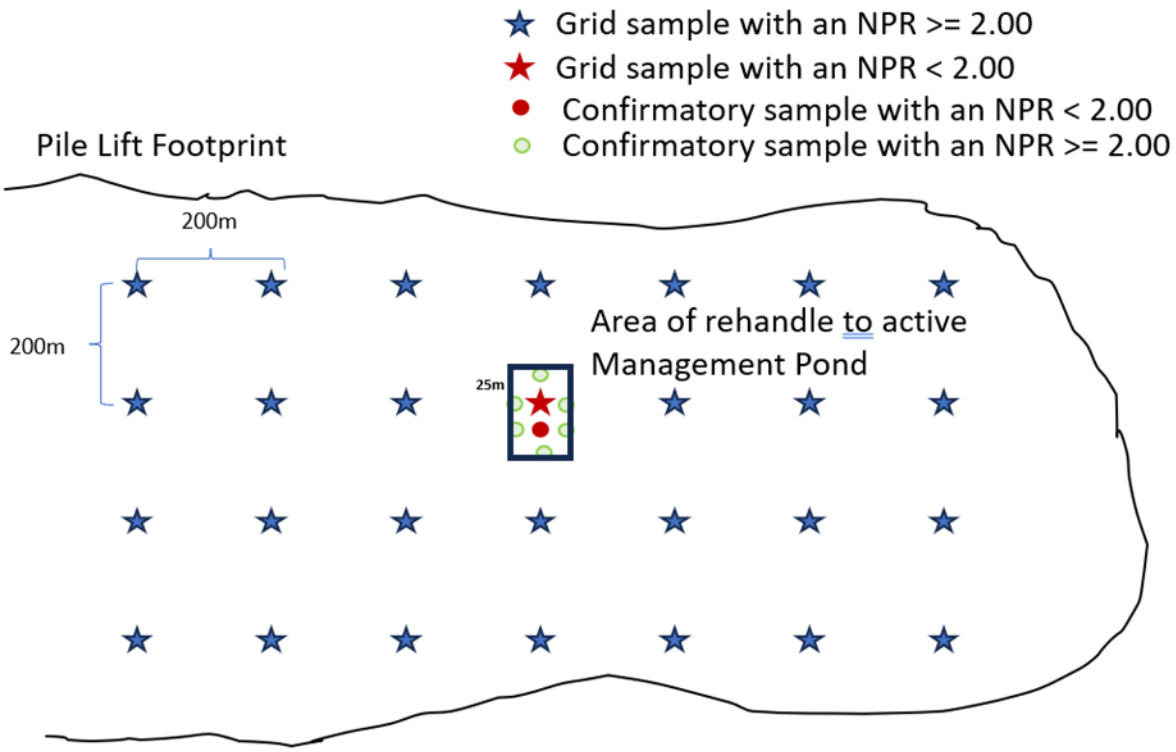


Figure 6-11: Non-PAG Pile Lift Material Confirmation Testing

Once the *non-PAG* rock pile area is defined by confirmatory testing and a bulk NPR and sulfur % has been calculated based on the sample testing completed; the following actions will be taken:

- If the bulk NPR for the sample is less than 2.0 an investigation will be completed, including a survey of the material's location and review of material that was placed there via the site electronic tracking system, and
- Then a risk assessment will be conducted to determine if this this material will be rehandled and placed underwater in one of the active management ponds.

6.4.4.3 Overburden

Geochemical testing (SRK 2024a) indicates that overburden is depleted in sulfide and is *non-PAG*. Overburden samples collected as part of the supplemental geochemical characterization (SRK 2024a) were *non-PAG*. Overburden is expected to be *non-PAG* with confirmatory testing planned at a frequency of one sample per 10,000 m^3 of excavated overburden. Composite samples from the excavation are to be bagged and labelled with a unique sample ID and the location, time, date, and stratigraphic unit the sample was collected from. Approximately 3 to 5 kg of sample should be collected and stored in case future analysis is required. Laboratory testing will be conducted on one sample per month when over 10,000 m^3 of overburden is excavated and these samples should be submitted to an accredited lab for the following analyses:

- Paste pH;
- Total sulphur by Leco furnace;
- Sulfur as sulfate following HCl leach;
- TIC measured from evolved CO_2; and
- Elemental analysis using ICP-MS following an aqua regia digestion using ultra low detection limits to understand metal leaching potential.

6.4.4.4 Surface Soils (topsoil)

Surface soils (*topsoil)* for the Project area are expected to be *non-PAG* due to the lack of sulfur present in this unit. Confirmatory testing planned at a frequency of one sample per 100,000 m^3 of salvaged surface soils will be completed.

6.4.4.5 Run-of-Mine (ROM) Coal, Processed Rock, and Processed Coal

Geochemical testing (SRK 2024a) indicates that coal materials for the Project have an excess of sulfur above neutralizing minerals and has been classified as PAG. Samples collected as part of the supplemental geochemical characterisation (SRK 2024a) were PAG. No verification testing is required as ROM, Processed coal and rock will be classified as PAG, and processed rock will be placed underwater into the management ponds while ROM Coal is processed into processed rock and processed coal with processed coal being shipped off site to market prior to material producing acid rock drainage.

6.4.4.6 Construction Materials

Geochemical testing (SRK 2024a) indicates that construction materials selected for this Project are depleted in sulfide and are *non-PAG*. Construction materials can be considered *non-PAG* with confirmatory testing of one sample per 10,000 m^3 of provided construction materials. Composite samples from the excavation are to be bagged and labelled with a unique sample ID and the location, time, and date. Approximately 3 to 5 kg of sample should be collected and stored in case future analysis is required. Laboratory testing will be conducted on one sample per month when over 10,000 m^3 of construction materials is excavated and these samples should be submitted to an accredited lab for the following analyses:

- Paste pH;
- Total sulphur by Leco furnace;
- Sulfur as sulfate following HCl leach;
- TIC measured from evolved CO_2; and
- Elemental analysis using ICP-MS following an aqua regia digestion using ultra low detection limits to understand metal leaching potential.

In the event of blasting being required for construction materials the same confirmatory sampling for rock will be used for blastholes.

7 Monitoring

TML will conduct regular inspections of the laboratory equipment, sampling equipment, results collected and personnel carrying out the tasks to ensure proper procedures are being followed and there is no potential for PAG material being placed in the incorrect location. Inspections will be recorded and provided to the Environmental Coordinator and Mine Manager.

Performance Objectives

Table 7-1 below highlights the performance objectives and targets required to ensure the proper implementation of this ML/ARDMP.

Table 7-1: Performance Objectives

Objectives	Target
Inductions completed	Metal leaching/acid rock drainage (ML/ARD) induction complete and additional training complete for those that require it
Samples taken of blasted rock and results recorded in the geochemical database	Target zero with no samples missed.
Potentially acid generating (PAG) volumes placed in correct location	Incorrect placement; target zero
Actual PAG volumes reconciled, and results assessed versus models	Targets met
Inspection of management ponds completed	Improvement: for more frequent inspections made, if needed; continual improvement
PAG rock submerged within 6 months	Verify timely water cover
Tracking documents and volumetrics	Up to date and are being completed; target met
Management pond PAG requirements met	Management ponds were covered with *non-PAG* material on top of the submerged PAG material followed by a 1 to 2 m *non-PAG* layer followed by an 0.5 m overburden layer to create a dry landform above water, followed by approximately a 30 cm layer of reclamation materials(soil) to reduce evaporative losses from the water cover above the saturated PAG rock

8 Reporting

8.1 General Reporting

Reporting completed by TML will confirm consistent implementation of the MLARDMP. Summary reports of evaluation activities and results will be compiled and reviewed annually.

8.2 Compliance Reporting

Compliance reporting will be subject to the Environmental Assessment Certificate (EAC), and *MA/EMA* permit conditions. The information gathered during monitoring practices will be summarized with information from other management plans into an Annual Environmental Management Summary Report and upon permitting completion, the Annual Environmental Reports as required by *MA/EMA* permits. Community engagement activities will be an aspect of the Socio-economic Management Plan (S13.0-C16) (SEMP). The SEMP will have requirements related to reporting on community engagement programs.

Furthermore, events requiring emergency response have other regulatory reporting responsibilities and they will be fulfilled as required.

8.3 Internal Reporting

Details of monitoring will be reported internally on an annual basis according to the adaptive management framework of the EMS. The EMS annual report will provide results of monitoring, assessment of performance objectives where applicable, and any other pertinent information.

TML staff or contractors will be strongly encouraged to report any inefficiencies to management for evaluation consideration.

8.4 Geochemical Database

A geochemical database will be developed to maintain operational monitoring results. The database will include the following information:

Sample attributes:

- Collection date and time;
- Sample location;
- Sample depth intervals;
- Drillhole ID for mine rock;
- Sample mass;
- Sample zone;

- A description of the lithological composition of the sample;
- Any other visible attributes of the sample;
- Blast volume, ARD classification and storage location;
- Testing results: total sulfur, TIC and calculated NP, AP, and NPR values; and
- Confirmatory ABA and elemental analysis results including: paste pH, total sulfur, sulfate sulfur, TIC, NP, NPR, ICP-MS elemental analysis results.

8.5 Monthly Reporting

ML/ARD results will be reviewed monthly by environmental/engineering staff and discussed with the Environmental Coordinator and Mine Superintendent. The results including raw data and QA/QC will be provided in the Annual Reclamation Report.

8.6 Annual Reporting Requirements

Results from implementation of this plan, as approved by BC MMCM's Chief Inspector of Mines, will be provided in annual reporting for the *Mines Act* permit and submitted by March 31 each year. For mined rock, the annual reporting will ensure requirements for inventorying of mine rock as specified in Section 10.5.7 of the Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMLI 2021) are met. This will include:

- The quantities (mass and volume) of each type of mine rock (specified as each stratigraphical zone);
- The location and cumulative areas of storage facilities based on the past and the current reporting year; and
- Results of the monitoring specified in this plan.

Annual seep surveys will be conducted along the toe of mine rock storage areas during the freshet to identify any new seeps. Freshet provides the best opportunity to observe seepage. If new seeps are identified, water is collected and analyzed for major ions and dissolved trace elements. A specific seep survey sampling procedure with sample locations will be developed as seep locations are identified following placement of materials.

8.7 General Reporting

Reporting completed by TML will confirm consistent implementation of the MLARDMP. Summary reports of evaluation activities and results will be compiled and reviewed annually.

8.8 Compliance Reporting

Compliance reporting will be subject to the Environmental Assessment Certificate (EAC), and *MA/EMA* permit conditions. The information gathered during monitoring practices will be summarized with information from other management plans into an Annual Environmental Management Summary Report and upon permitting completion, the Annual Environmental Reports as required by *MA/EMA* permits. Community engagement activities will be an aspect of the Socio-economic Management Plan (S13.0-C16) (SEMP). The SEMP will have requirements related to reporting on community engagement programs.

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- Sample mass;
- Sample zone;
- A description of the lithological composition of the sample;
- Any other visible attributes of the sample;
- Blast volume, ARD classification and storage location;
- Testing results: total sulfur, TIC and calculated NP, AP, and NPR values; and
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- The location and cumulative areas of storage facilities based on the past and the current reporting year; and
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Annual seep surveys will be conducted along the toe of mine rock storage areas during the freshet to identify any new seeps. Freshet provides the best opportunity to observe seepage. If new seeps are identified, water is collected and analyzed for major ions and dissolved trace elements. A specific seep survey sampling procedure with sample locations will be developed as seep locations are identified following placement of materials.

Primary responsibilities have been assigned to the following roles or groups:

8.13 Mine Manager

The Mine Manager bears overall responsibility for all phases of the Project, and responsibility for onsite environmental monitoring and compliance relating to Construction, Operation, Decommissioning and Reclamation, and Post-Closure phase activities. The Mine Manager reports to the executive steering committee for TML and will coordinate with this group to ensure that Project objectives are being met.

Specifically, the Mine Manager will:

- Complete an annual review of the ML/ARDMP;
- Provide personnel, equipment, or other assistance to ensure compliance with applicable regulations, acts, guidelines, permits and policies for the protection of the environment;
- Investigate improvements in any trend and assess whether the practices responsible for the improvements can be applied to other areas of the Project; and
- Deteriorating trends will be studied to determine the root cause. When the cause is identified, the Mine Manager or their delegate will implement a suitable corrective action.

8.14 Mine Superintendent

- The Mine Superintendent reports to the Mine Manager:
- Complete quarterly inspections of management pond infrastructure;
- Provide equipment and personnel to carry out sampling and monitoring of PAG materials and water management infrastructure when requested; and
- Review ML/ARD results monthly by environmental/engineering staff and discuss with the Environmental Coordinator.

8.15 Environmental Coordinator

The Environmental Coordinator reports to the Mine Superintendent:

- Oversee compliance with regulations, acts, guidelines, permits and policies;
- Provide expertise for decisions regarding protection of the environment and ML/ARD management;
- Oversee appropriate monitoring and inspections are performed as required or needed;
- Complete an annual review of the ML/ARDMP;
- Ensure compliance of ML/ARD monitoring programs with the approved *MA/EMA* permits and SPPs; and
- Complete reporting for regulatory agencies and for the Annual Environmental Management Summary Report to Indigenous groups as related to this ML/ARDMP.

8.16 Quality Assurance /Quality Control (QA/QC) Technician and Environmental Technician

The QA/QC Technician and Environmental Technician report to the Environmental Coordinator and will:

- Participate in required training;
- Understand and perform assigned tasks and duties;
- Report to the Environmental Coordinator any discrepancies, concerns, or questions regarding tasks, duties, or procedures in a prompt manner; and
- Sample mine rock, processed rock, ROM coal and open pit surfaces.

8.17 Employees

TML staff as outlined above have primary responsibility for ensuring *MA/EMA* permits, EMS and related management plans, operation maintenance and surveillance programs for open pits, material storage piles, management, and control ponds, and SPP requirements are met with respect to sampling, analysis of mine material classification, mine material placement, and confirmatory monitoring.

9 Communication

Communication of the ML/ARDMP at TML will be based on internal requirements and will primarily take place through this ML/ARDMP and relevant SPPs. Any significant change to the ML/ARDMP will be communicated to the Project's employees and contractors through a site-wide email, announcements over radio channels by Minesite supervision and bulletins posted around the Project's Minesite. When effective to do so, maps will be marked with changes.

9.1 Training and Awareness

ML/ARD management requires special handling, monitoring, and tracking. Employees, contractors, and subcontractors who are involved in implementation of the ML/ARDMP at the Project will be provided with appropriate training or be required under contract to have that training.

9.2 Employee and Contractor Training

The training of personnel involved in Construction, Operation, Decommissioning and Reclamation phase activities on the Project who are dealing with PAG and *non-PAG* material to understand it is a critical factor in achieving the objectives outlined in this ML/ARDMP. Those responsible for the management, implementation, and operation of any aspect of this ML/ARDMP will be competent for their role. Prior to the commencement of work onsite, employees and contractors, including those responsible for dealing with material movement onsite, will:

- Attend an induction session that will provide a brief overview of the types of materials mined on site and how they are managed; and
- Review and understand the requirements of the ML/ARDMP and the Code.

In addition, workers will receive additional training specific to concepts and sampling requirements for ML/ARD, if required for the work they are undertaking.

9.3 Visitor Training

Visitors will not be required to be knowledgeable of this ML/ARDMP as they will be under the direction of TML employees and will not be allowed to be in a situation involving PAG material management.

10 Evaluation and Adaptive Management

10.1 Evaluation

A review of the ML/ARDMP will be completed by the Mine Manager and Environmental Coordinator on an annual basis to compare data, trends, and implementation of the management plans and their objectives. This process will include a review of the management plan deliverables and input received from stakeholders.

10.2 Adaptive Management

A philosophy of adaptive management will be adopted to make sure that management plans and mitigation measures are consistently meeting or exceeding performance targets. This will be achieved through periodic reviews of the ML/ARDMP and the results of monitoring programs.

10.3 Continual Improvement

TML will work towards continual improvement at the Minesite to ensure the accurate tracking and segregation of PAG and *non-PAG* materials and ensure appropriate handling of materials. The Mine Manager or delegate will investigate improvements in any trend and assess whether the practices responsible for the improvements can be applied to other areas of the Project. Deteriorating trends will be studied to determine the root cause. When the cause is identified, the Mine Manager or their delegate will implement a suitable corrective action.

Examples of corrective actions could include:

- additional supervision and control of material management;
- additional training of employees and contractors on procedures;
- enhancement of maintenance or monitoring measures; and
- additional supervisory oversight.

TML will amend the ML/ARDMP as required based on annual evaluations and feedback from relevant stakeholders. Any proposed changes will be sent out for review by stakeholders before being finalized and implemented into the ML/ARDMP.

11 Change Management

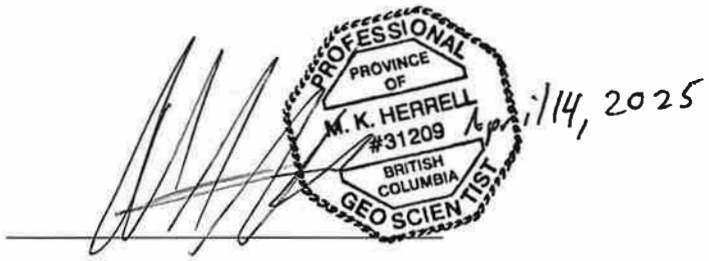
Changing any part of the ML/ARDMP requires the use of a formalized process. If significant changes are being planned to objectives, management plan structure, operational milestones, communication and/or information management, it is required that the Management of Change (MOC) procedure in the EMS be followed. Minor edits and/or updates to this ML/ARDMP will be controlled through version control and content approval functions.

12 Conclusion

Management of PAG materials at TML is important to meet future EAC and *MA/EMA* permit conditions and ensure environmental protection from ML/ARD. Through implementation of this ML/ARDMP and relevant SPPs, TML will ensure the efficient sampling of PAG rock, correct placement, and timing on provision of water cover over PAG rock in management ponds.

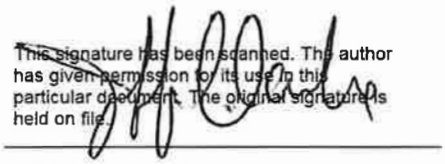
Closure

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EGBC Permit to Practice Reg. No.: EGBC 1003655

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix 13.12A Tenas Project Geochemical Characterization Update, SRK

TELKWA COAL
LIMITED

Telkwa Coal – Tenas Project Geochemical Characterization Update

Prepared for

Telkwa Mining Ltd.

Prepared by

srk consulting

SRK Consulting (Canada) Inc.
CAPR002933
November 2024

Telkwa Coal – Tenas Project
Geochemical Characterization Update

November 2024

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File Name: Telkwa_MLARD_Characterization_Update_CAPR002933_FINAL_20241115.docx

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Executive Summary

A comprehensive historical geochemical characterization program was completed for the Tenas Project located near the town of Telkwa, British Columbia for Manalta Coal Ltd. This program (Norecol Dames and Moore 1999) included geochemical testing of over 700 samples. However, this program had several limitations including:

- Total sulfur was used to calculate acid potential (i.e., sulfate was not measured, and sulfide could not be estimated);
- Neutralization potential was determined using the Sobek-NP method;
- Total inorganic carbon content was not evaluated; and,
- Selenium and other elemental data were limited in the solid-phase and kinetic testing program.

TML retained SRK Consulting (Canada) Inc. to collect supplemental samples to calibrate the historic dataset to current methods. SRK reviewed the core and logs with TML geologists in February 2018 and identified 173 samples for geochemical testing. Additional infill drill core samples were collected in 2019 to expand the geochemical dataset by a further 79 samples.

During the geochemical testing program, TML also collected and sent the following samples to the analytical lab for geochemical testing:

- Overburden
  - Six overburden samples (2018);
  - 19 overburden samples (2019); and,
  - One overburden sample (2023) collected during sonic drilling from the management ponds in 2021.
- Processed Rock
  - Three samples of coarse processed rock (2018 and 2019); and,
  - Four samples of fine processed rock (2018 and 2019).
- Construction Material
  - Two samples of rock material that will be used to construct the surfacing material for the Tenas Access Corridor;
  - Five overburden samples collected from five test pits along the proposed Tenas Access Corridor that will be used for constructing the base and subbase portions of this road; and,
  - Nine samples from four test pits in the vicinity of the Rail Infrastructure.

The results are summarized as follows.

Drill Core Results

The results of the mine rock geochemical characterization showed that a strong correlation exists between total sulfur and sulfide and between Sobek-NP and modified-NP. Regression equations derived from correlating these parameters allows sulfide and modified NP to be calculated in the historical dataset.

The mineralogical results confirmed the presence of iron carbonates in the mine rock samples. A strong positive relationship exists between modified-NP and calcium plus magnesium suggesting that modified-NP provides a reasonable estimate of the effective-NP.

The static geochemical testing results indicate that acid generating potential is controlled by stratigraphic rock zones. This is consistent with the historical geochemical test results (Norecol Dame and Moore 1999). Using an NPR criterion of 2.0 to characterize materials as potentially acid generating (PAG) or non-PAG, the following zones were identified to be PAG and non-PAG based on the zones' average weighted neutralizing potential ratio:

- **Non-PAG**– Zone 1, parts of zone 4, and zone 8; and
- **PAG** – Zones 1a, 2/3, parts of zone 4, 5, 55, 6, and 7.

All non-PAG rock zones contain both PAG and non-PAG material and verification testing of blastholes is required for final determination of material type and if verification testing is not completed rock zones will be treated as PAG.

Elemental concentrations were compared to the average crustal abundance (Smith and Huyck 1999) to identify parameters that are elevated in the solid phase. A parameter was screened as elevated if its concentration was greater than 10 times the average crustal abundances. The following elements were screened to be elevated in the solid phase:

- 14% of arsenic analyses;
- <1% of phosphorus, and selenium analyses; and
- 56% of sulfur analyses.

Loadings of the following parameters are expected to increase as pH decreases: acidity, sulfate, aluminum, cadmium, copper, iron, lead, nickel, strontium, and zinc. The concentrations of these parameters were evaluated in the water and load balance developed for the Project.

TML proposes to store PAG Rock under saturated conditions to limit sulfide oxidation. The sulfide oxidation rates in the humidity cell samples were used to estimate the lag time acid generation. The evaluation indicated that for the average bulk properties of PAG Rock, the minimum lag time of the average bulk properties of PAG rock under laboratory conditions is approximately 4.2 years. A minimum lag time of 0.3 years is estimated for PAG Rock units with minimum NPRs less than or equal to 0.1.

Overburden

The overburden samples had NPRs greater than two and were classified as non-PAG.

The following elements were screened to have concentrations greater than 10 times the average crustal abundances and were screened to be elevated in the solid phase:

- +2 mm to -25 mm fraction:
  - 67% (4 of 6 samples) of arsenic measurements; and
  - 17% (1 of 6 samples) of cadmium measurements.
- -2 mm fraction
  - 17% (1 of 6 samples) of arsenic and gold measurements; and,
  - 83% (5 of 6 samples) of tellurium measurements.

There were no elevated concentrations in the +25 mm fraction. A higher frequency of elevated parameters was observed in the +2 to -25 mm fraction in comparison to the -2 mm and +25 mm fractions.

Tellurium was the only element to be elevated in the 2019 and 2023 overburden samples. The 2019 and 2023 humidity cells maintained a circumneutral to alkaline pH throughout the 40 and 35 weeks of testing respectively. Except for aluminum, chromium, and iron, loadings of constituents maintained slight decreasing trends throughout the testing period.

Processed Rock

TML provided three coarse and four fine processed rock samples to Bureau Veritas. One fine processed rock was classified as non-PAG, and the remaining samples were classified as PAG. The historical processed rock samples were PAG and TML proposes to manage processed rock as PAG.

Humidity cell testing was completed on the combined coarse and the combined fine processed rock samples as well as on a subsequent fine processed rock sample produced in 2019. The coarse processed rock sample became acidic after 68 weeks (i.e., 1.3 years) of testing. An associated increase of several constituent loadings also occurred as the pH decreased. The fine processed rock samples remained alkaline for the duration of the testing period and, constituent loadings remained generally consistent for the duration of the testing period. Processed rock loadings were used to develop source terms that were carried forward into the water and load balance (SRK 2021).

As noted above, the coarse processed rock sample became acid generating after 1.3 years of testing. Depletion calculations on the 2018 processed rock sample indicate the sulfide in the sample will be depleted prior to the NP and the sample is classified as non-PAG. The 2019 fine processed rock sample is predicted to become acidic after 20 years under laboratory conditions.

Construction Materials

Construction material samples had low sulfur content and modified NPs exceeding AP. As a result, construction materials are classified non-PAG. No solid-phase concentrations were screened to be greater than 10 times the average crustal abundances in the construction samples.

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1 Introduction

Telkwa Mining Ltd. (TML) submitted an Environmental Assessment Certificate (EAC) application for the Tenas Project in 2022, located for the Telkwa Property, near the town of Telkwa, British Columbia (Figure 1-1).TML proposes to mine coal using open pit methods. Mining and washing of coal will produce the following mine material streams that will need to be managed:

- Surface Soils (topsoil);
- Overburden;
- Mine rock;
- Processed rock (tailings);
- Run-of-Mine Coal; and
- Processed coal.

The baseline geochemical characteristics of materials to be produced from mining the deposit have been established through two previous geochemical studies (Norecol, Dames and Moore 1999; SRK 2022a). Geochemical testing data indicate that both potentially acid generating (PAG) and non-potentially acid generating (non-PAG) materials will be produced during operations and acid rock drainage potential is constrained by sedimentary packages, with acid potential increasing with proximity to coal seams.

Since completion of the baseline geochemical characterization study, TML have collected and submitted additional mine rock, overburden, processed rock, and processed coal samples for geochemical testing. This report provides an update to the baseline geochemical characterization study incorporating testing results that have become available since the completion of the SRK (2022a) baseline characterization study.

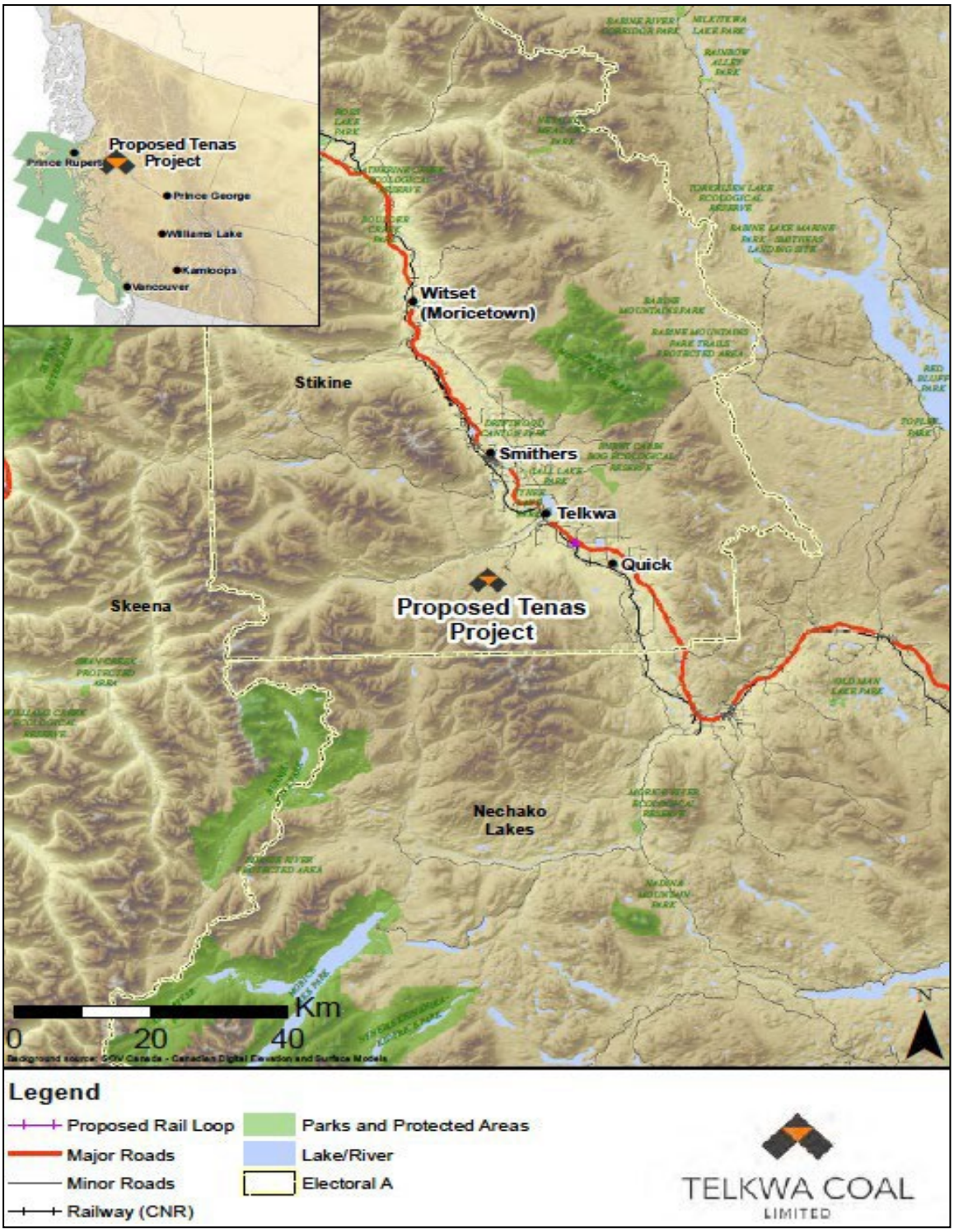


Figure 1-1: Location of the Telkwa Coal Tenas Project

2 Project Background

2.1 Bedrock Geology

The Tenas Project is located within the northeast/southwest trending Skeena Arch, which separates Jurassic-age sedimentary rocks of the Bowser Basin in the north from the Jurassic to Cretaceous-age sedimentary rocks of the Nechako Basin to the south. The coal-bearing sedimentary rock sequence of the Project is associated with the Lower Cretaceous age Skeena Group, and unconformably overlies the Jurassic-age Hazelton volcanic group. A simplified stratigraphic column of the Tenas deposit is presented in Figure 2-1.

2.1.1 Jurassic Hazelton Volcanic Group

The volcanic rocks include andesite, trachyte, and basalt with associated tuffs and breccias.

2.1.2 Lower Cretaceous Skeena Group

The Lower Cretaceous Skeena Group includes marine and continental sediments interbedded with coal seams, often correlated over long lateral distances. It is subdivided into four units (Units I through IV) and a unit of undivided sediments overlying the four units (Figure 2-1).

The economic coal seams in the Tenas area are in Coal Zone 1 of Unit I and includes two seams: C seam and 1 seam (upper and lower). Coal Zones 2 through 10, located in Unit III (Figure 2-1), are absent from the Tenas area. Units I through IV are summarized below.

Unit I (modified after Ledda, 1998)

The basal unit, Unit I, was deposited in a fluvial environment and, in the Telkwa Property, rests unconformably over the eroded Hazelton volcanic basement of Jurassic age. Because it was deposited over an undulating surface the Unit I stratigraphy has been observed to display variability in thickness, often over short lateral distances. This variability is most evident in the lower sedimentary assemblage, between the basement contact and the lowermost Unit I coals. As such, Unit I can be more than 100 m in thickness and consists mainly of conglomerate, sandstone, mudstone, and coal.

Coals within this unit, collectively referred to as Coal Zone 1, formed in poorly drained backswamps and are characterized by lateral variation throughout the study area. The Unit I coals can consist of up to 12 individual seams that collectively contribute up to 11.9 m of coal to the unit's overall thickness. Sands and gravels were typically deposited in braided channels and bars while mudstones accumulated in floodplains. Indications are that there was periodic marine influence during deposition of the unit. Deposition of Unit I ended with a marine transgression and deposition of Unit II.

Unit II (Ledda, 1998)

Unit II was deposited within a deltaic / shallow marine environment and consists of up to 140 m of sandstone, silty mudstone and occasional thin coaly mudstone. Sands were deposited in

distributary channels and mouth-bars while mudstones and silty mudstones accumulated in interdistributary bays. Thin discontinuous peat beds, none of which are of economic significance, accumulated in local salt marshes.

Unit III (modified after Ledda, 1998)

Unit III is indicative of the second regressive episode for the area and represents the deposition of the 2nd main coal-bearing stratigraphic sequence. The unit averages 85 m in thickness and is comprised of sandstone, siltstone, carbonaceous mudstone, and thick, laterally extensive coal seams. Restricted nearshore marine, tidal flat and coastal swamp environments persisted throughout much of the deposition of Unit III. Sandstone units were deposited within tidal channels while interbedded sandstones and siltstones were deposited nearshore within intertidal environments. Mudstones are representative of tidal flat deposits. Significant marine influence during deposition of the entire unit is indicated.

Coal Zones 2 through 11 are represented in Unit III, collectively contributing to up to 17 coal seams of economic significance. The coal zones were likely formed in freshwater peat swamps, located landward of the tidal flat, somewhat isolated from influxes of brackish water. The presence of sulfur in some of the coal seams suggests, however, that the peat was infiltrated periodically by marine water. Thus, the major coal seams are interpreted to have formed from peat accumulated in a freshwater marsh that was proximal to a brackish environment. The Snuggedy Swamp of South Carolina is considered a modern analogue for the paleoenvironment in which Unit III was deposited.

2.1.3 Intrusions

Tertiary and Cretaceous-age porphyritic dykes and sills commonly intrude this sequence, the most notable of which includes a Tertiary granodiorite intrusion located on the north side of the Telkwa River. These intrusions are not present in the Tenas area.

2.1.4 Geological Structures

The sedimentary sequence in the Tenas area is folded into a syncline in which the gently (typically 10 to 20°) northeast-dipping western limb of the syncline subcrops on the western side of the pit area, while the moderately (40 to 45°) southwest-dipping eastern limb subcrops on the eastern side of the pit. Faulting is generally near-vertical, and can be subdivided into two main groups, one which strikes approximately northwest/southeast and the other which strikes approximately northeast/southwest.

2.2 Surficial Geology

The surficial geology in the Project area consists primarily of two types of deposits, glacial clay- or silt-rich till, and sand and glaciofluvial sand and gravel outwash. At upper elevations and south of the proposed pit, the terrain is mapped as having bedrock outcrops to a limited extent or thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick. North of the proposed pit and towards Tenas Creek and Goathorn Creek, drillholes report thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick underlain by a thick sand and gravel outwash deposit that can exceed 100 m.

Other types of deposits are present locally. Patches of glaciolacustrine deposits are scattered throughout the morainal landscape in low ridges and in depressions; the sediments comprise bedded and laminated mud, and minor sand and gravel (Clague 1984). Recent fluvial deposits form the narrow floodplains of Goathorn Creek and Tenas Creek, which are 40 m to 80 m deep incised into the subdued morainal landscape, and the wide floodplains of the Telkwa and Bulkley Rivers. The fluvial deposits range from extremely coarse, poorly sorted gravel on steep alluvial fans to moderately to well-sorted sand and mud on low-gradient floodplains (Clague 1984).

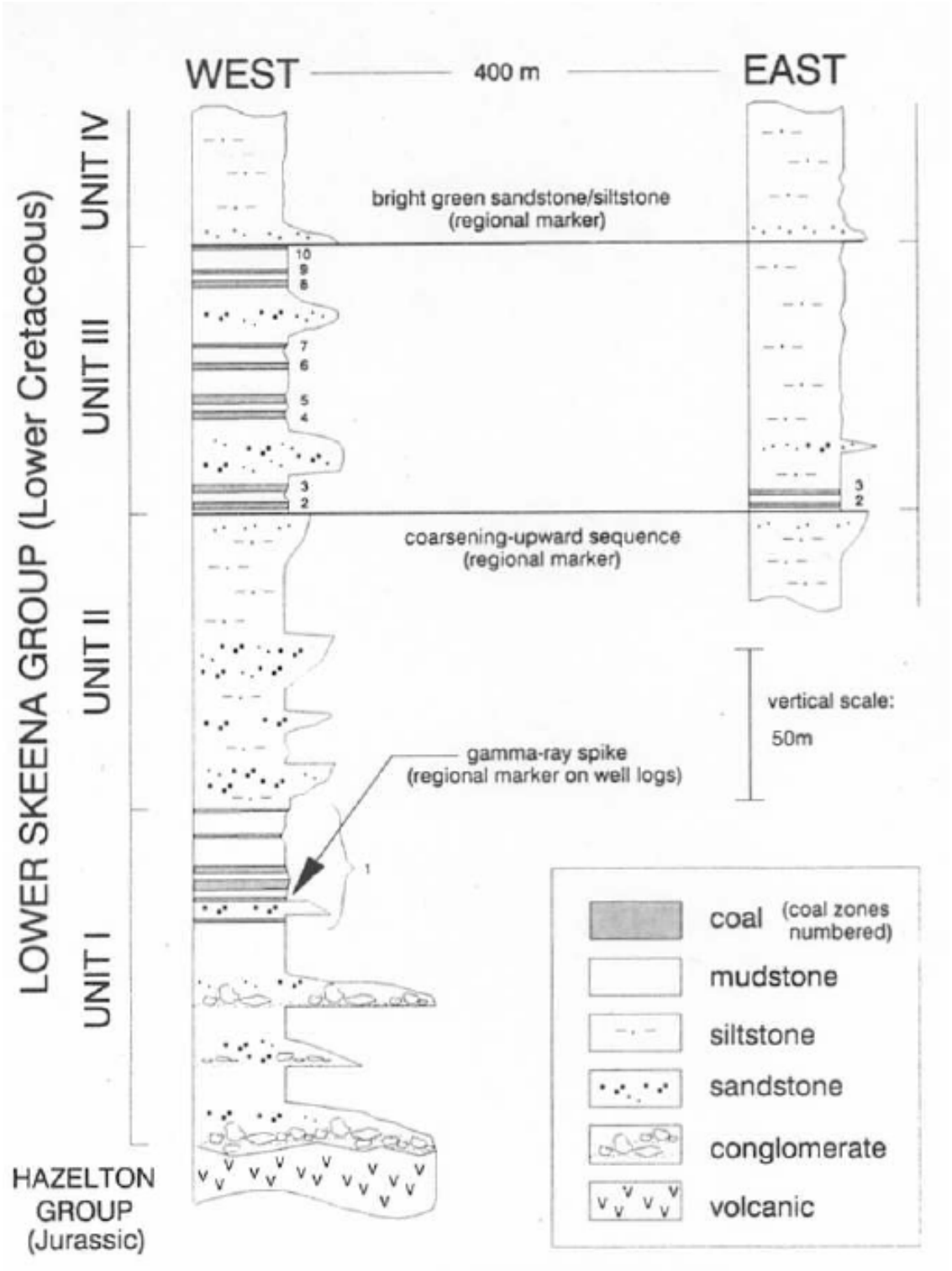


Figure 2-1: Stratigraphic Sequence of Lower Cretaceous Skeena Group Sediments. Source: Telkwa Coal Ltd

2.3 Historic Geochemical Testing

Norecol Dames and Moore (1999) completed a comprehensive geochemical characterization program of the Telkwa Mine for Luscar Coal Ltd. The geochemical characterization included geochemical testing of samples collected from Tenas, Telkwa North, and Goathorn Deposits. TML is only proposing to mine the Tenas deposit as part of the current EAC application and the historical geochemical results for this deposit are summarized here.

Approximately 700 samples of mine rock, overburden, and coal (including cleaning intervals) were collected continuously down drillholes in the proposed pit boundary of the Tenas Deposit. Samples were submitted for the following analyses:

- Acid base accounting (total sulfur, Sobek-NP and paste pH);
- Laboratory kinetic tests including MEND humidity cell tests and column trickle tests; and
- On-site kinetic tests were also developed.

Due to the use of Sobek-NP, a neutralization potential ratio (NPR) cut-off of three (3.0) was used to characterize samples as PAG or non-PAG with samples less than 3.0 being classified as PAG.

The historical geochemical testing results indicated the following:

- Acid rock drainage (ARD) potential is characterized according to stratigraphic “zones”, with zones being delineated by the coal seams;
- Zones can be classified as dominantly PAG or dominantly non-PAG, but all rock zones contain PAG and non-PAG material;
- ARD potential is driven by sulfur content with zone medians varying from 0.6 % to 1.7 %; and,
- Neutralising potential (NP) zone medians varied from 30 to 42 kg $CaCO_3$/t.

Based on the acid base accounting (ABA) results, Norecol Dames and Moore (1999) characterized the following zones as non-PAG or PAG:

- Non-PAG: Zone 0 (overburden), Zone 1, Zone 4, and Zone 7/8, and
- PAG: Zone 1a, Zone 2/3, Zone 5, Zone 55, and Zone 6.

Process rock (reject/tailing) samples were also collected. Acid base accounting (ABA) of these samples indicated these materials were uniformly PAG.

The bulk element contents of the samples showed no enrichments above crustal values; however, there was only limited selenium data. Water samples collected from a seep downstream of a bulk sample site were used to evaluate metal leaching. The seeps were non-acidic and indicated metal concentrations indicative of pyrite weathering under basic weathering conditions. At sulfate concentrations typically in the hundreds of mg/L range, selenium concentrations were <0.0002 mg/L.

Based on the results, Norecol Dames and Moore (1999) concluded that ARD management will be required for the Tenas Project.

2.4 Supplemental Mine Rock Sampling Programs

TML retained SRK to collect supplemental samples in 2018 to calibrate the historic dataset to current methods. SRK reviewed the core and logs with TML geologists in February 2018 and identified 173 samples for geochemical testing.

Further mine rock samples were collected in 2019 to expand the dataset.

2.5 Other Sampling

Sampling of overburden, processed rock, and material to be used in construction was completed between 2018 and 2024 to expand the dataset and to ensure all materials exposed during the mining operations are geochemically characterized.

3 Summary of Mine Material Management Plan

Mining of the Tenas deposit will produce surface soils (topsoil), mine rock, processed rock (tailings) and overburden. Previous geochemical testing (Norecol Dames & Moore 1999; SRK 2022a) indicates that a large volume of mine rock that will be excavated from the Tenas Deposit, along with the coal and processed rock, will be PAG with ARD potential stratigraphically constrained in zones that are generally separated by coal seams. The previous geochemical testing results indicate that PAG management will be required.

Management of mine rock and processed rock is summarized in the following sections.

3.1 Management of PAG Rock, Processed Rock, and Processed Coal

In advance of, and during mining, TML proposes to progressively construct management ponds. The purpose of the ponds is to store PAG and processed rock permanently in saturated conditions to minimize sulfide oxidation, limiting acidic drainage from occurring. Three management ponds will be constructed. The North Management Pond (NMP) will be constructed first and will be external to the open pit, located north of the open pit. The East Management Pond (EMP) will be constructed next and will be external to the EA Open Pit and will be south of the NMP, and northeast of the open pit. The West Management Pond (WMP) will be constructed last and will encompass the northern portion of the EA Open Pit plus an embankment to provide sufficient storage for PAG rock (Figure 3-1).

PAG and processed rock will be placed in the management ponds while Run-of-Mine Coal is processed into processed rock and processed coal with processed coal being shipped off site to market prior to producing ARD.

PAG rock will first be placed in the NMP. PAG rock will be progressively placed in lifts and then flooded so that exposure of PAG rock to atmospheric oxygen is minimized. TML is proposing to place all PAG Rock underwater before it becomes acid generating. The timing to the onset of acid

generation is discussed in Section 6.2.7; PAG Rock will be placed in the management ponds and submerged with a minimum of 1.0 m of water within an average of 6 months after excavation but no longer than 12 months. Once the storage capacity of the NMP has been reached, storage will begin in the EMP and subsequently in the WMP. The management ponds will be maintained with a one-metre water cover during active use and under at least two-meters of water once the maximum management pond PAG Rock storage capacity has been reached.

Once the ponds have reached the maximum PAG Rock storage capacity, TML will place a one to two metre layer of non-PAG Rock on top of the submerged PAG Rock below the active water level of the management pond, followed by at least one metre overburden layer to create a dry landform above water, followed by approximately a 30 cm layer of reclamation materials (surface soils) to reduce evaporative losses from the water cover above the saturated PAG Rock.

3.2 Management of Non-PAG Rock and Overburden

Non-PAG Rock and overburden will be used as open pit backfill, in management pond embankments, buttresses or used as interim cover material over the management ponds at closure.

3.3 Open Pit Walls

The open pit walls will be covered with non-PAG Rock and overburden to limit oxygen and water ingress from contacting open pit wall rock surfaces. Much of the open pit will be backfilled during the Operation and the Decommissioning and Reclamation Phases. Meteoric water contacting the non-PAG covered open pit walls will report to an end pit lake, which will subsequently drain northwards by gravity and mix with Management Pond water prior to discharging.

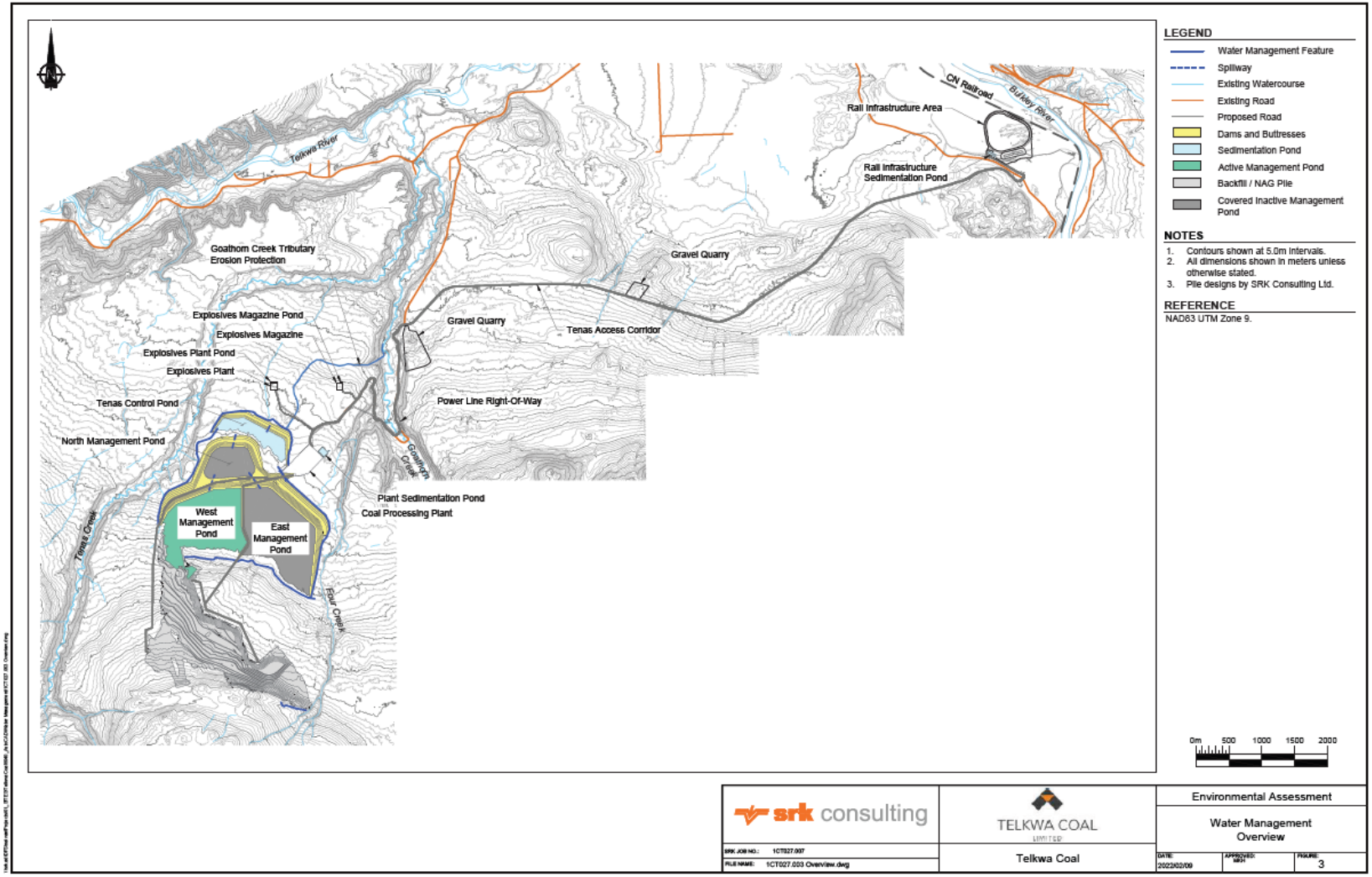


Figure 3-1: Tenas Project Mine Site Facilities at Closure

4 Conceptual Geochemical Model

4.1 Management Ponds

Mining of the Tenas deposit will produce pyrite (FeS_2) bearing PAG Rock. Under natural conditions, the pyrite is stable in bedrock where it is isolated from atmospheric oxygen. However, following blasting and mining of the bedrock, pyrite in the mine rock will be exposed to atmospheric oxygen prior to being placed in the management ponds. Similarly, pyrite in processed rock will be oxygen unlimited until submerged underwater in the management ponds. Under these conditions, pyrite will oxidize in the presence of oxygen and water according to the following reaction:

$$FeS_{2\,(s)} + 3\tfrac{1}{2}O_{2\,(g)} + H_2O_{\,(l)} \leftrightarrow Fe^{2+}{}_{(aq)} + 2SO_4^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \text{ (Rxn 1)}$$

As seen in Rxn 1, pyrite oxidation produces sulfate, iron, and acidity. The iron liberated from the sulfide can subsequently oxidize to ferric iron in neutral pH water according to the following reaction:

$$Fe^{2+}{}_{(aq)} + \tfrac{1}{4}O_{2\,(g)} + 2\tfrac{1}{2}H_2O_{\,(l)} \leftrightarrow Fe(OH)_{3\,(s)} + 2H^+{}_{(aq)} \text{ (Rxn 2)}$$

The above reaction also produces acidity. Mineralogical testing indicates pyrite is the main sulfide mineral at the Tenas Project, Reactions 1 and 2 are plausible mechanisms for acid production in mine rock mined from the Tenas Pit or in processed rock produced from washing of Run-of-Mine coal.

Acidic conditions do not immediately form since acid production can be neutralized inthe presence of carbonate minerals according to the following reactions:

$$CaCO_{3(s)} + H^+{}_{(aq)} \leftrightarrow HCO_3^-{}_{(aq)} + Ca^{2+}{}_{(aq)} \text{ (Rxn 3)}$$

$$CaCO_{3(s)} + 2H^+{}_{(aq)} \leftrightarrow H_2CO_{3(aq)} + Ca^{2+}{}_{(aq)} \text{ (Rxn 4)}$$

Some metal carbonates (e.g., siderite, and ankerite) offer limited buffering potential, since during dissolution, oxidation of the metal cation produces acidity, which offsets the neutralization produced from the carbonate ion. Buffering by Reactions 3 and 4 results in a lag time to the onset of acid generation. For example, acid conditions will not occur until carbonate minerals are consumed.

Acidity can also be neutralized through dissolution of oxyhydroxide and aluminosilicate minerals; however, due to the dissolution kinetics of these minerals, they often produce insufficient neutralization potential to produce neutral drainage (i.e., these minerals are more reactive under acidic conditions). A detailed assessment of the carbonate mineralogy is provided in Section 6.2.2 of this report. Carbonate minerals have been identified at the Tenas Project and Reactions 3 and 4 are the predominant neutralization reactions for the project.

TML proposes to manage PAG Rock through placement in the management ponds prior to becoming acidic, thereby lowering oxygen availability limiting the rates of Reaction 1.

4.2 Processed Rock

Processed rock is expected to be PAG and oxidize according to Reaction 1. TML proposes to place the PAG rock in the management ponds to limit oxygen and water contact. Prior to placement in the management ponds, processed rock will oxidize producing soluble load by Reaction 1 (section 4.1) that will flush from the processed rock during placement into the management ponds. After the processed rock is placed in the management ponds, oxygen content will be limited, reducing the rate of Reaction 1.

4.3 Non-PAG Rock and Overburden

Overburden and non-PAG Rock will be placed within the critical backfill portions and/or buttress areas of the embankments for the management ponds or backfilled into the open pit. Overburden and non-PAG Rock will oxidize according to Reaction 1. However, as the non-PAG Rock contain more neutralization potential than acid generating potential, the sulfide will be consumed prior to the neutralization potential and acidic drainage from these materials will not occur. Oxidation products will still be produced and will be flushed by water in contact with non-PAG Rock. This load will mix with other mine site water sources prior to being used in the Coal Processing Plant or discharged from site.

4.4 Open Pit Wall Rock Runoff

At closure, an end pit lake will form in the backfilled open pit. A high wall will exist above the pit lake composed mainly of Zone 6 sedimentary rock. Based on the site-specific criterion (see Section 6.2.6.1), this unit is PAG. The end pit lake will be a mixture of open pit wall rock runoff, direct precipitation, and runoff from non-PAG backfill. The end pit lake will drain by gravity and mix with the management pond before being discharged during Post-closure.

4.5 Explosives Usage

Nitrogen load will be produced from explosives usage. The source of nitrogen comes from ammonium nitrate fuel oil (ANFO) during misfires or spillage during the loading of blastholes or from incomplete detonation of ANFO. The wasted ANFO will report to the open pit sumps and stored in mine rock. As ammonium nitrate (AN) is highly soluble, water in contact with wasted ANFO will dissolve AN producing ammonia, nitrite, and nitrate.

5 Methods

5.1 Sample Selection

5.1.1 2018 Drill Core

TML completed five drill holes for the Tenas deposit in January 2018.

Figure 5-1 presents the location of the 2018 drill holes. Historical drill holes are also provided. Drilling was planned to be spatially representative of the open pit and to ensure that all stratigraphic zones were sampled (e.g., not all holes encountered every zone).

Following completion of the drill holes, Stephen Day (SRK Geochemist) visited the site to inspect the core and select intervals for geochemical sampling. Intervals ranged from approximately 15 centimetres (cm) near the coal seams up to nine metres (m) in interbedded material between the coal seams. The average sample thickness was 2.1 m. Sample intervals are provided in Appendix A.

5.1.2 2019 Drill Core

TML completed four drill holes for the Tenas Deposit in 2019. TML collected 74 samples from these drillholes for geochemical testing. Figure 5-1 presents the location of the 2019 drill holes. Drilling was planned to be spatially representative of the open pit.

5.1.3 Overburden

Six overburden samples were collected from four test pits by TML in 2018 to geochemically characterize glacial materials planned to be removed by mining. Different size fractions were evaluated to determine if carbonate and sulfur minerals fractionate to inform blending studies should TML decide to consider this management strategy in the future.

In 2019, 19 overburden samples were collected by TML. The samples were collected to incorporate sample variability in the sampling program. The 19 samples were combined by Bureau Veritas to form one composite sample for humidity cell testing.

In 2021, 30 overburden samples were collected by TML within the footprint of the management ponds. The samples were collected to incorporate sample variability in the sampling program. The 30 overburden samples were combined by SNC Lavalin to form one composite sample for humidity cell testing. The sample was collected to characterize material beneath the management ponds which should be like what is within the adjacent open and submitted for laboratory test work in 2023.

5.1.4 Processed Rock

In 2018, TML provided two samples of fine and coarse processed rock to Bureau Veritas. Due to limited sample masses, the two fine and two coarse processed rock samples were combined into bulk fine and bulk coarse processed rock samples for humidity cell testing. Acid base accounting and elemental analyses were completed on the individual samples prior to the samples being combined.

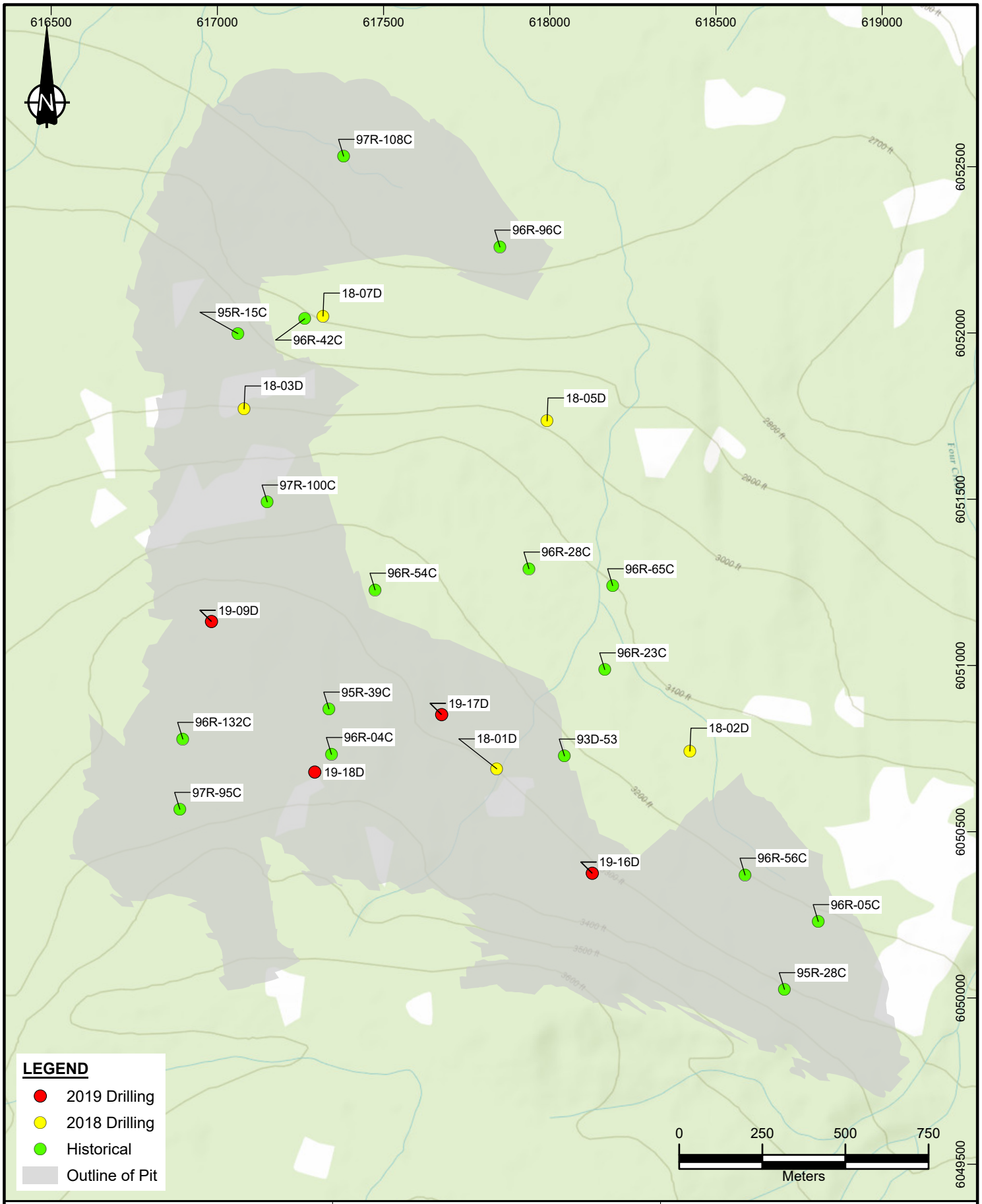
In 2019, TML provided two additional fine and one coarse processed rock samples for acid base accounting and elemental analyses to confirm the static results of the 2018 samples. A subsequent fine processed rock humidity cell test (HCT) was initiated in 2019 as the 2018 fine processed rock HCT results indicated this sample was non-PAG, which is not consistent with the historical dataset (Norecol, Dames and Moore 1999).

.

5.1.5 Construction Materials

TML provided the following samples, intended to be used as construction material for the Project, for geochemical testing:

- Two samples of rock that will be used to construct the surfacing material for the Tenas Access Corridor;
- Five overburden samples collected from five test pits along the proposed Tenas Access Corridor that will be used for constructing the base and sub-base portions of this road; and
- Nine samples from four test pits in the vicinity of the Rail Infrastructure which will be used for constructing the base and sub-base portions of the rail right of way and loading area.



C:\Users\MSMITH\SRK Consulting\FS873 Telkwa - Internal\1040_AutoCAD\GIS\Projects\CAPR002933_Tenas_Drilling\CAPR002933_Tenas_Drilling.aprx - L-Geochem Sampling

srk consulting

SRK JOB NO.: CAPR002933

LAYOUT: L-Geochem Sampling

TELKWA MINING LIMITED

Tenas Project Supplemental Geochemical Characterization

Location of the Tenas Project 2018, 2019 and Historic Drill Holes

DATE:	APPROVED:	FIGURE:
Nov 2024	MH	5-1

5.2 Sample Analysis

Samples were shipped to Bureau Veritas, formerly Maxxam Analytics, in Burnaby, British Columbia, for geochemical testing. The following sections provide the analysis completed on each sample type.

5.2.1 2018 Drill Core

2018 drill core samples were analyzed for the following:

- Paste pH, paste conductivity, total sulfur, total carbon, total carbonate, sulfate by hydrochloric acid method, neutralization potential (standard Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

Two neutralization potential determinations (standard Sobek and modified ABA) were completed on the drill core samples to evaluate if the historical NP results, which were based on the standard Sobek method, could be corrected to the modified ABA method (MEND 1991).

A subset of the 2018 samples was submitted for HCTs and mineralogical analyses based on the results of the above analyses. Except for overburden (Zone 0), one humidity cell was selected from each interburden zone. Samples were selected to evaluate the timing to the onset of acid generation and bulk leaching content, with respect to selenium and arsenic. Therefore, the sample selection was biased to samples that had one of the following:

- Samples that had higher sulfur contents and lower NP;
- Samples that had relatively elevated solid-phase selenium concentrations; or
- Samples that had elevated solid-phase arsenic concentrations.

Appendix B provides a list of the samples that were selected for HCT and a rationale for the selection of the sample.

Each sample selected for HCT was also submitted for mineralogical analysis by X-ray diffraction (XRD) with Rietveld refinement.

An additional six samples from 2018 were selected for mineralogical analysis from samples with modified- NP exceeding Sobek-NP. The mineralogical analysis (Appendix B) was to confirm the carbonate content of the samples because the ABA results indicated that modified-NP exceeded Sobek-NP in several samples with Sobek-NPs between 60 and 80 kg $CaCO_3$/tonne (see Section 6.2.4.1). It is possible that these unusual results occurred because the selection of the acid normality for use in the sample digestion was based on an incorrect fizz rating and the short duration of the Sobek-NP test is insufficient to digest all carbonate minerals present in the sample. Additionally, titration does not occur until the pH is less than 2.5 in the modified ABA test whereas the Sobek (1978) procedure only requires 3 millilitres (mL) of acid to be added. It is possible that insufficient acid was added in the Sobek-NP determinations to digest all the carbonate minerals.

5.2.2 2019 Drill Core

2019 drill core samples were analyzed for the following:

- Paste pH, total sulfur, total carbon, total carbonate, sulfate by hydrochloric acid method, neutralization potential (modified Sobek method), total inorganic carbon and trace element scan by ICP-MS following aqua regia digestion.

Unlike the 2018 samples, which were in part used to evaluate if the historical NP measurements using the standard Sobek method could be correlated to the modified ABA method, the neutralization potential of the 2019 samples was only determined by modified ABA method as the 2018 program provided data that the correlation was valid for the samples recovered prior to 2018.

5.2.3 Overburden Samples

A split of the 2018 overburden samples was collected and evaluated for moisture content. Subsequently, samples were air dried and dry sieved into -2 mm, +2-25 mm and +25 mm fractions and weighed. A split of the +25 mm fraction was also wet sieved to -25 mm. The -2 mm and -25 mm fractions were analyzed for the following:

- Paste pH, total sulfur, total carbonate, sulfate by hydrochloric acid method, neutralization potential (Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

Only one sample had +25 mm grains (Maxxam, 2018, pers. Comm.). Therefore, the +2-25 mm fraction was also analyzed for the geochemical tests in the above bullet.

The 2019 and 2023 overburden samples were submitted for static geochemical tests as above. HCTs were initiated on the 2019 composite sample and the 2023 composite sample based on samples recovered in 2021.

5.2.4 Processed Rock

The processed rock samples (fine and coarse) were submitted for the following tests:

- Paste pH, total sulfur, total carbonate, sulfate by hydrochloric acid method, neutralization potential (Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

Three of the processed rock samples were also submitted for HCTs.

5.2.4.1 Construction Materials

The samples of material intended to be used as construction material for the Project were submitted for the following tests:

- Paste pH, total sulfur, total carbonate, sulfate by hydrochloric acid method, neutralization potential (Sobek and modified methods), total inorganic carbon, and trace element scan by ICP-MS following aqua regia digestion.

6 Results

6.1 Quality Assurance/Quality Control

SRK screened the 2018 and 2019 static test and kinetic test results against its internal QA/QC procedures. Table 6-1 presents a summary of the QA/QC results for mine rock. While some data failed quality SRKs screening criteria, the number of failures is considered acceptable. Tables are not presented for other material types since most of the other tests passed the screening criteria. The one exception to this was one coarse reject sample (UI3970) had a fizz test rating not consistent with the measured NP.

Based on the number of samples collected versus those that failed SRK's QA/QC criteria, it is SRK's opinion that data quality is acceptable for the purpose of the Project.

Table 6-1. Summary of QA/QC Result for 2018 and 2019 Samples

QC Test	SRK QC Criteria	Results
Paste pH		
Lab Duplicate (n=29)	For any samples, +/- 0.5 difference pH unit	All passed
Split Duplicate(n=17)	For any samples, +/- 0.5 difference pH unit	0.64
Standard Reference Material (n=6)	Within specified tolerance ranges	All passed
TIC		
Lab Blank (n=9 for Total Carbon, n=3 for TIC)	<2X detection limit (DL)	All passed
Carbon balance (Total C > TIC) (n=247)	For samples > 10X the detection limit (DL), Total Carbon should be greater than Total Inorganic Carbon, if not the % difference should be within +/-20%	All passed
Lab Duplicate (n=16 for TIC, n=8 for Total Carbon)	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed
Split Duplicate (n=17 for TIC, n=17 for Total Carbon)	For samples > 10X the detection limit (DL), % RPD within +/-30%	T18-03D A-010 - SPLIT DUP (Maxxam ID=TD4057) in Total Carbon has RPD=54%
Standard Reference Material (n=19 for Total C, n=12 for TIC)	Within specified tolerance ranges.	All passed
Total S & Total Sulfate		
Lab Blank (n= 9 for Total S, n=6 for Total Sulfate)	<2X detection limit (DL)	All passed
Sulfur balance (total S > sulfate S) (n=247)	For samples > 10X the detection limit (DL), Total Sulfur should be greater than Total Sulfate, if not the % difference should be within +/-20%	All passed
Lab Duplicate (n=8 for Total S, n=15 for Total Sulfate)	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed
Split Duplicate (n=17 for Total S, n=17 for Total Sulfate)	For samples > 10X the detection limit (DL), % RPD within +/-30%	29521 - SPLIT DUP RPD% is 34%
Standard Reference Material (n=19 for Total S, n=8 for Total Sulfate)	Within specified tolerance ranges.	All passed
Modified-NP		
NP consistent with paste pH (n=247)	Negative NP has paste pH <= 5	Samples T18-02D-A-016, 28674, 28677, 28683, 28687, 28691, 28692, 28700 have a positive NP while pH is below 5
Lab Duplicate (n=27 for NP, n=28 for fizz test)	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/- 20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed
Split Duplicate (n=17 for Total for fizz test, n=17 for NP)	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/- 20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	T18-02D A-034 - SPLIT DUP (Maxxam ID=TD4015) and T18-03D A-010 - SPLIT DUP (Maxxam ID=TD4057) have RPD over 30% in NP
Fizz test rating with NP (n=247)	Max NP does not exceed fizz test rating	Samples T18-01D-A-002, T18- 02D-A-019, 28661, 28670, 28670 - SPLIT DUP, 28685, 28694, 28704 exceed max NP values
Modified-NP and TIC		
Comparison between Modified-NP and TIC (n=247)	Check for trends/co-relation	TIC higher than NP
Elements		
Lab Blank (n=22)	<2X Detection Limit	All passed
Lab Duplicate (n=8)	For samples >10X detection limit (DL), % RPD within +/- 30%, ok 10% of metal scan failing.	All passed
Split Duplicate (n=107)	For samples >10X detection limit (DL), % RPD within +/- 30%, ok 10% of metal scan failing.	Less than 10% of metal scan failing
Standard Reference Material (n=31)	Within specified tolerance ranges.	All passed

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6.2 Drill Core Samples

The following sections present select acid base accounting (ABA) and element content results as they relate to acid generating potential. Mineralogical testing results are also presented. Results here are evaluated based on stratigraphic zones.

Detailed ABA and elemental results are provided in Appendix C and D, respectively.

6.2.1 Elemental Content

To evaluate parameters that were elevated in the solid-phase and may have the potential to leach, elemental concentrations for the samples were compared to the average crustal abundances (Smith and Huyck 1999). This dataset represents a consensus of the overall crustal abundance and does not consider abundances in lithological units. An element was screened as enriched in the solid phase if its concentration was greater than 10 times the average crustal abundances. The following elements were screened to be elevated in the solid phase:

- 14% of arsenic analyses;
- <1% of phosphorus and selenium analyses; and
- 56% of sulfur analyses.

Detailed comparisons are provided in Appendix D. Trace element concentrations were not available for the historical results and the above percentages are based on the samples collected as part of the supplemental geochemistry characterization program.

An elevated solid-phase concentration does not necessarily imply it will be elevated in contact waters. The solid-phase screening is completed to flag parameters that need to be evaluated in other geochemical tests.

6.2.2 Mineralogy

Mineralogical results for the 2018 samples are provided in Table 6-2. Sample T18-02D-A-002 (Zone 2) reported 49 % amorphous material (UBC 2019). Mineralogical results are normalized to 100% by convention which does not include amorphous material. As this can provide an overestimate of mineral species related to acid generation potential, mineral percentages for sample T18-02D-A-002 were normalized to 100% considering the amorphous material was present in the sample. This approach was considered reasonable since sulfur and carbonate contents were more aligned with the acid base accounting results when sample T18-02D-A-002 was corrected for amorphous material content.

The samples are predominantly composed of quartz, plagioclase feldspar clay minerals illite-muscovite and kaolinite. Kaolinite content increases with depth in the stratigraphic sequence with mineral content increasing to greater than 50 % below Zone 5. Illite-muscovite concurrently decreases with depth in the stratigraphic sequence and was not detected in the samples collected below Zone 55. Plagioclase feldspar content also decreases with depth and was only detected in one sample below Zone 5 suggesting that that most feldspathic rock deeper in the stratigraphic

sequence has been weathered to kaolinite. Quartz content was generally consistent in all the samples collected (Table 6-2).

Pyrite (FeS_2) and marcasite (FeS_2) were the only sulfide minerals detected in the mineralogical analysis. Pyrite was highest in the samples collected from Zone 2/3 (Table 6-2). Gypsum was the only other sulfur species detected in the mineralogical analysis in quantities less than 2.5 % in the Zones 2/3, 5 and 6 samples.

The following carbonate minerals were detected in one or more samples: ankerite-dolomite ($Ca(Fe,Mg,Mn)(CO_3)_2$ – $CaMg(CO_3)_2$), calcite ($CaCO_3$), siderite ($FeCO_3$), siderite/calcian ($(Fe,Ca)CO_3$), dolomite ($CaMg_{0.75}Fe_{0.25}(CO_3)_2$), and ankerite ($CaCO_3.FeCO_3$). The mineralogical results indicate that iron carbonates are important and total inorganic carbon (TIC) content may not be suitable for use as a direct proxy for neutralization potential.

The sulfide and carbonate mineralogical results, as they relate to acid potential and neutralization potential, are discussed in more detail in the following sections.

Table 6-2. Mineralogy X-Ray Diffraction Results for the 2018 samples

Mineral Name	Empirical Formula	Unit	Zone														
			1		1a		2/3		4		5		55	6		7	8
			28836	28661	T18-02D-A-011	T18-02D-A-004	T18-02D-A-016	T18-01D-A- 002	28681	T18-02D-A-019	28684	T18-02D-A-021	T18-03D-A-006	28704	T18-02D-A-028	T18-02D-A-034	28711
Anatase	TiO_2	%	1.7	0.80	1.3	1.1	1.9	---	1.6	1.1	1.5	0.80	1.7	1.4	0.80	1.7	1.8
Ankerite-Dolomite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2 – CaMg(CO_3)_2$	%	---	21	---	14	---	40	---	12	---	24	---	---	23	---	---
Brookite	TiO_2	%	---	---	1.1	---	---	---	---	---	---	---	---	---	---	---	---
Calcite	$CaCO_3$	%	4.4	0.20	---	---	---	---	---	0.50	0.40	3.9	---	2.0	1.4	---	1.0
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	%	5.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Cristobalite	SiO2	%	---	---	---	---	0.50	---	0.50	---	---	---	---	---	---	---	---
Dawsonite	$NaAl(CO_3)(OH)_2$	%	---	---	---	---	0.60	---	---	---	---	---	---	---	---	---	---
Gorceixite	$BaAl_3(PO_4)(PO_3OH)(OH)_6$	%	---	---	---	---	---	---		---	---	0.40		---	---		
Gypsum	$CaSO_4·2H_2O$	%	---	---	---	---	1.9	---	---	---	1.2	---	---	2.4	---	---	---
Illite-Muscovite	$K_{0.65}Al_{2.0}Al_{0.65}Si_{3.35}O_{10}(OH)_2$	%	19	12	15	15	21	---	12	6.0	16	5.2	2.2	---	---		
Kaolinite	$Al_2Si_2O_5(OH)_4$	%	16	11	16	15	22	25	22	25	26	20	58	50	54	56	64
Magnetite	Fe_3O_4	%	---	---	---	---	0.50	---	0.20	---	0.40	---	---	---	---	---	---
Marcasite	FeS_2	%	---	---	0.80	---	---	---	---	---	---	---	---	---	---	---	---
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	%	12	7.8	8.5	8.0	5.6	---	4.5	4.7	6.1	3.3	---	---	1.5	---	---
Pyrite	FeS_2	%	2.5	1.0	4.5	0.80	7.0	22	3.8	1.5	4.7	2.2	0.3	6.4	0.40	4.1	0.8
Quartz	SiO_2	%	36	34	4.0	35	36	13	35	31	39	28	37	29	18	36	29
Rutile	TiO_2	%	0.86	0.50	0.80	0.70	0.60	---	0.70	---	0.70	0.30	---	---	---	---	---
Siderite	$Fe^{2+}CO_3$	%	---	7.3	5.4	6.8	2.5	---	9.2	---	2.1	6.3	0.3	0.30	1.3	0.20	0.20
Siderite, calcian	$(Fe^{2+},Ca)\ CO_3$	%	2.0	5.2	1.1	4.0	---	---	7.4	6.6	---	6.3	---	---	---	---	---
Dolomite	$CaMg_{0.75}Fe_{0.25}(CO_3)_2$	%	---	---	3.5	---	---	---	---	11	---	---	---	---	---	1.6	2.7
Ankerite	$CaCO_3.FeCO_3$	%	0.39	---	---	---	---	---	2.8	---	2.0	---	0.3	8.9	---	---	1.3
Sum		%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

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6.2.3 Sulfur Species

Figure 6-1 provides a comparison of total sulfur to sulfide sulfur where the sulfide sulfur (S^{2-}) has been calculated using the following equation (EQ1):

$$S^{2-} = S_{ICP} - S_{HCl} \quad \text{(EQ1)}$$

Where:

- S_{ICP} is the total sulfur content determined during the trace element scan.
- S_{HCl} is the acid soluble sulfur (sulfate) determined by Leco during the ABA testing.

Estimating sulfide concentrations by this method, rather than using Leco sulfur minus acid soluble sulfur (S_{HCl}), is preferred because the S_{ICP} does not include organic sulfur species whereas Leco sulfur includes all sulfur species. Organic sulfur is present in coal deposits and therefore, using EQ1 avoids overestimating the sulfide content.

As can be seen in Figure 6-1, the majority of the total sulfur is present as sulfide in all zones. Highest total sulfur concentrations typically occur in Zone 2/3, in the footwall Zones 6 and 7 (Figure 6-1). Sulfate is generally low (average of 0.045%) in the samples as indicated based on the difference between S-ICP (open circles for 2018 samples and open triangles for 2019 samples on Figure 6-1), which is a measure of sulfide plus sulfate, and the calculated sulfide concentrations using EQ1. Sulfate concentrations increase at higher total sulfur concentrations; however, sulfide is still the dominant sulfur species. At higher total sulfur concentrations, larger deviations from the 1:1 line occur indicating the presence of organic sulfur, which is common in coal deposits.

A regression analysis of the samples indicates there is a strong correlation (i.e., r=0.99) between total sulfur and sulfide sulfur (Figure 6-1). Total sulfur can therefore be used as a proxy for estimating sulfide using the following mathematical relationship:

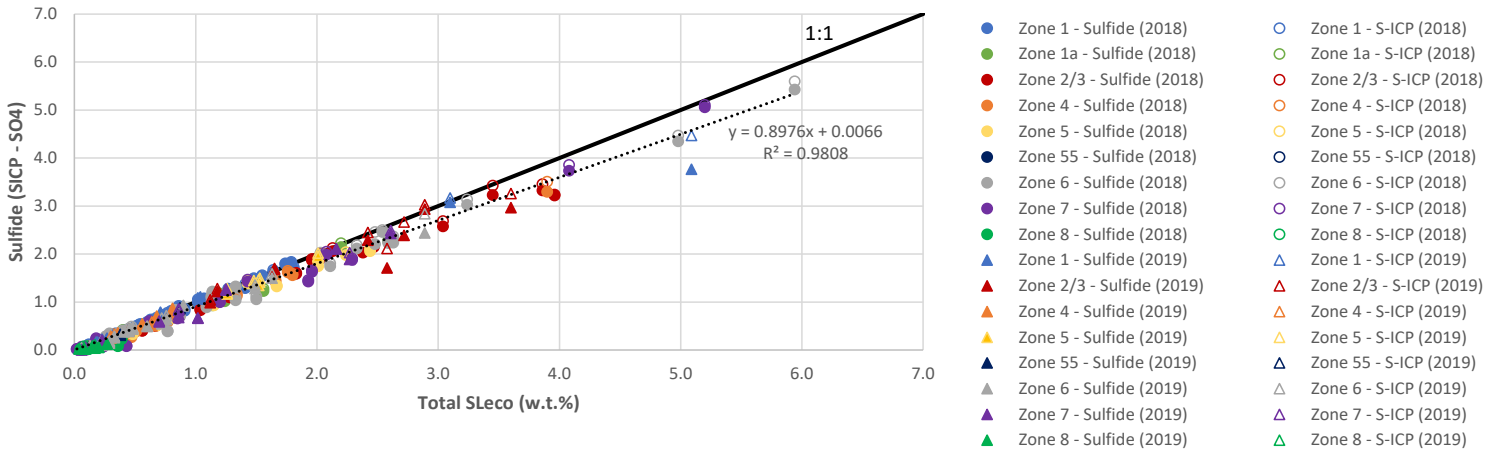
$$S^{2-}_{calculated} = 0.90 \times \text{Total-}S_{measured} - 0.01 \quad \text{(EQ2)}$$

Mineralogical analyses (Table 6-2) for the 2018 samples indicate pyrite is the predominant sulfur mineral in the samples. Based on estimated pyrite content, total sulfur calculated using the mineralogical analysis (S_{XRD}) generally corresponds to the total sulfur by Leco (Figure 6-2). Therefore, use of EQ2 to estimate sulfide sulfur is reasonable.

S_{XRD} generally exceeds S_{Leco} (Figure 6-2). This can occur because the mineralogical results are normalized to 100%. XRD does not detect amorphous phases and minerals at lower percentages and the normalization of detectable mineral species to 100% can result in an overestimation of the detectable species.

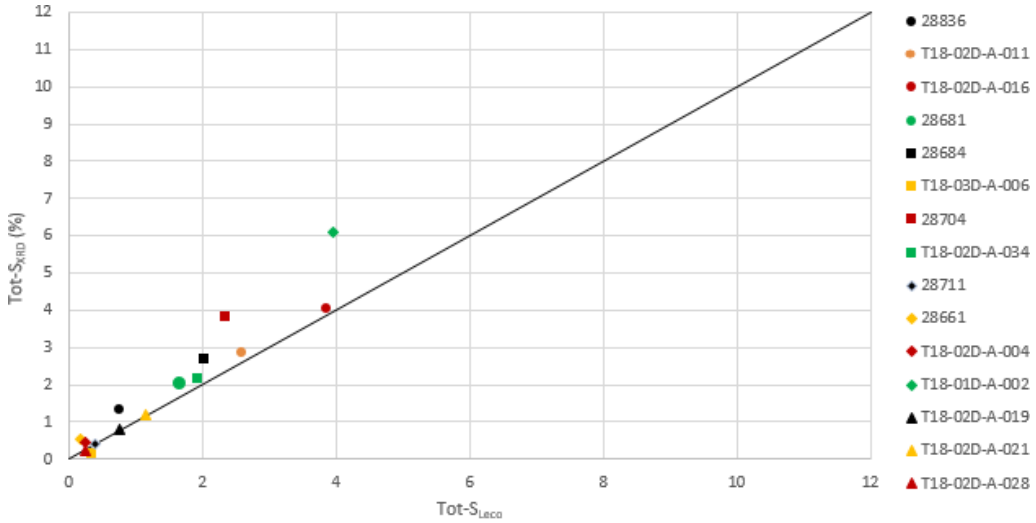
The calculated sulfide sulfur can subsequently be used to estimate AP by the following equation (EQ3):

$$AP = S^{2-}_{calculated} \times 31.25 \quad \text{(EQ3)}$$



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Figure 6-1: Total Sulfur versus Calculated Sulfide Sulfur (2018 & 2019 Samples)



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Figure 6-2: Leco Total Sulfur versus Mineralogical Sulfur (2018 Samples)

6.2.4 Neutralization Potential

Neutralization potential (NP) was estimated using the following three methods:

- MEND (1991) Modified-NP determination;
- Sobek (1978) NP determination; and
- Estimated based on total inorganic carbonate (TIC) content (referred to as Carbonate-NP).

The historical geochemical testing program (Norecol Dames & Moore 1999) used the Sobek (1978) method for determining NP. This method was included as part of the 2018 supplemental characterization program to evaluate if the historical NP results could be calibrated to the modified-NP method, which is more commonly used in current practice. The modified-NP method is preferred for the following reasons:

- The sample is not boiled which minimizes the extent of silicate-NP digestion, which is typically not readily reactive under ambient conditions;
- The initial pH of the solution must be less than 2.5 prior to titration to ensure dissolution of all available carbonates. The Sobek-NP method only requires 3 mL of acid be added to the sample regardless of the pre-titration pH; and
- The 24-hour testing period, in comparison to 3 hours in the Sobek (1978) method, provides sufficient time for oxidation of ferrous iron liberated through iron carbonate digestion.

Carbonate-NP (CNP) was estimated assuming that all the total inorganic carbon is present as calcium carbonate. A key objective of this approach was to determine if a relationship exists between measured-NP (i.e., modified-NP) and theoretical-NP estimated from TIC since measurement of TIC is more practical than other lab intensive methods under operating conditions.

Details of the NP determinations are presented in the following subsections.

6.2.4.1 Comparison of Sobek and Modified-NP Determinations

Modified-NP versus Sobek-NP for the 2018 samples is presented in Figure 6-3. Sobek-NP generally exceeds modified-NP except between values of approximately 60 to 80 kg $CaCO_3$/t (Figure 6-3.). As discussed in Section 5.2.1., these unusual results may be occurring because of the selection of the acid normality used in the sample digestion. Mineralogical testing was completed on the following six samples with modified-NP values exceeding Sobek-NP values: 28661 (Zone 1), T18-02D-A-004 (Zone 1a), T18-01-A-002 (Zone 2/3), T18-02D-A-019 (Zone 4), T18-02D-A-021 (Zone 5) and T18-02D-A-028.

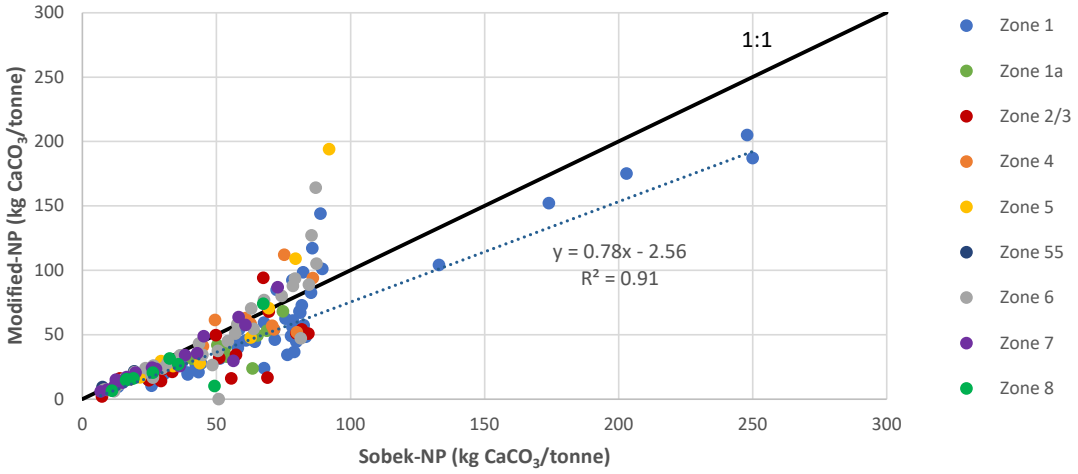
The mineralogical results identified relatively high concentrations of ankerite-dolomite and siderite in these samples and lower relative concentrations of calcite and dolomite (Table 6-2). Calculation of CNP following iron carbonate correction using the method of Day (2009) indicates a strong positive correlation (r=0.97) between the modified-NP method and TIC, estimated based on mineralogical results ($TIC_{Fe\text{-}corrected}$) (Figure 6-4). Based on the agreement of these two approaches, including samples where modified-NP exceeds Sobek-NP, it is likely that the Sobek-NP is

underestimated between 60 and 80 kg $CaCO_3$/t, likely because of insufficient acid addition during sample digestion.

A strong positive correlation (r=0.91) exists between Sobek-NP and modified-NP methods for samples where modified-NP does not exceed Sobek-NP. Modified-NP can be mathematically estimated from the following equation:

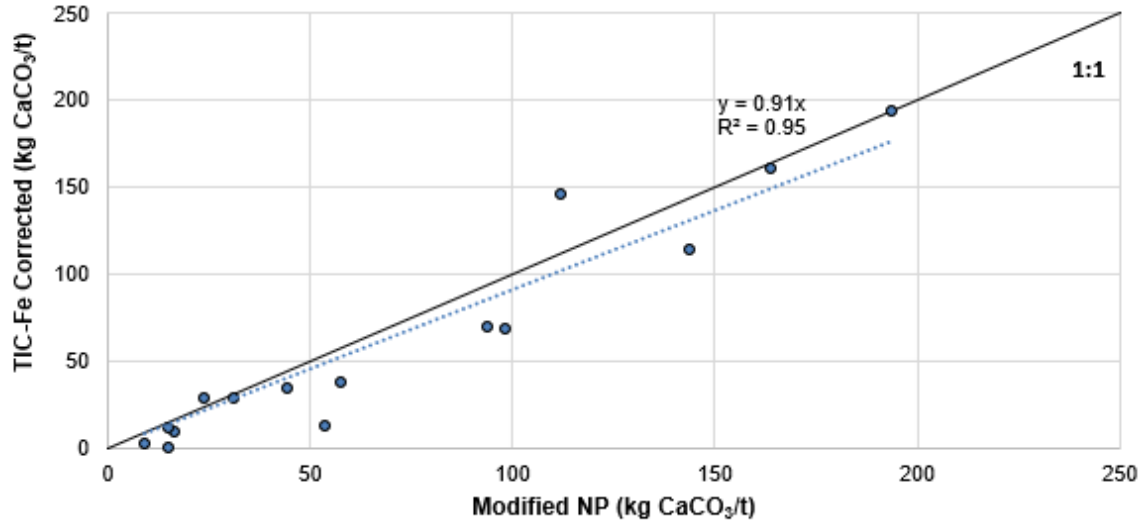
$Modified_{NP}=0.8*Sobek_{NP}-2.6$ (EQ4)

Although modified-NP exceeds Sobek-NP between approximately 60 and 80 kg $CaCO_3$/t (Figure 6-3.), Equation 4 (EQ4) was used to adjust the historical data since this will provide a conservative estimate of the corrected-NP (e.g., the corrected-NP would be higher if there was closer agreement between Sobek and modified-NP methods in this range).



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Figure 6-3: Modified-NP versus Sobek-NP (2018 Samples)



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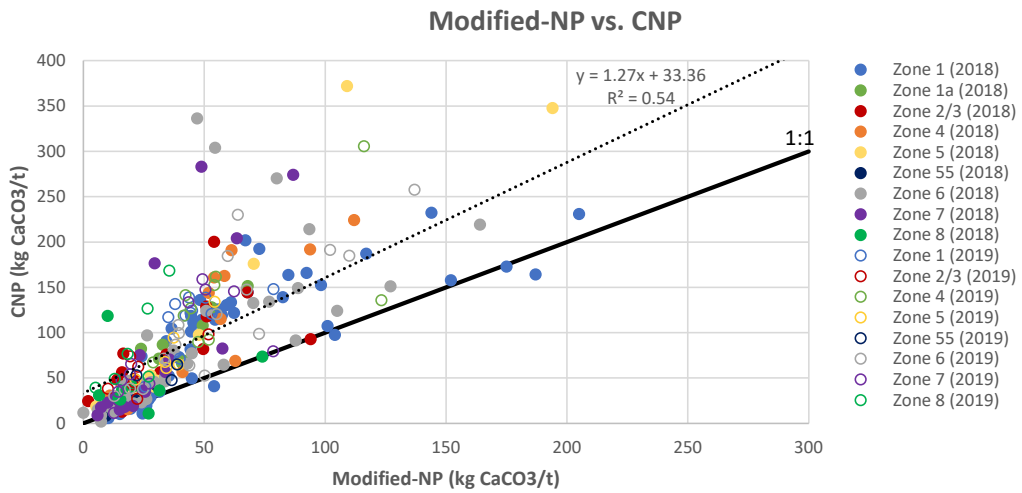
Figure 6-4: Modified-NP versus $TIC_{Fe\text{-}corrected}$

6.2.4.2 Comparison of Carbonate-NP (CNP) and Modified-NP Determinations

Modified-NP versus CNP, estimated from total inorganic content (TIC), is presented in Figure 6-5. A positive correlation (r=0.54) exists between CNP and modified-NP. CNP exceeds modified-NP in almost all 2018 samples, indicating the presence of iron carbonates in the samples. This is consistent with the mineralogical results that identified the presence of iron carbonates (e.g., ankerite and siderite) to varying degrees in each of the stratigraphic zones (Table 6-2). Like the 2018 samples, CNP exceeds modified-NP in 97% of the 2019 samples, suggesting that iron carbonates are also present in these samples. (Figure 6-6)

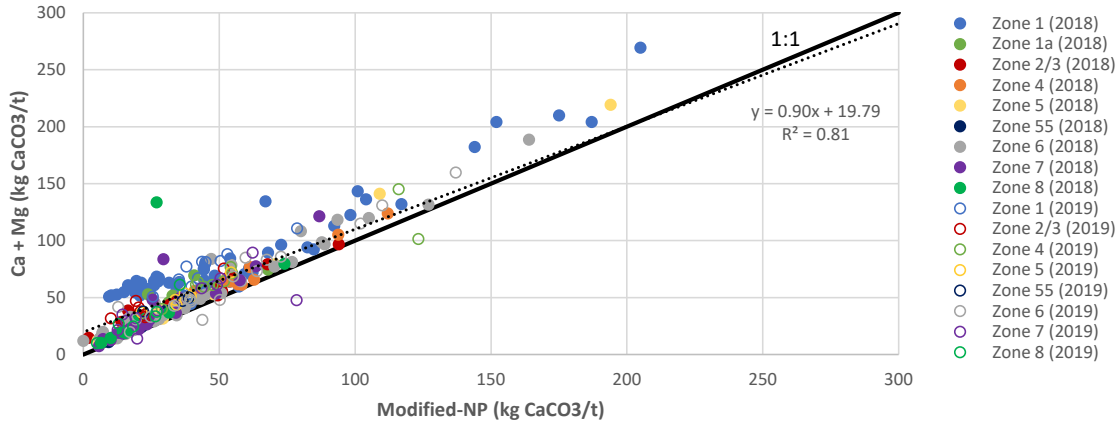
A strong correlation also exists between the TIC concentrations, estimated from the mineralogical results ($TIC_{XRD\text{-}total}$), to $TIC_{Fe\text{-}corrected}$ (Figure 6-7). This relationship indicates the carbonate-NP, or the effective-NP ($NP_{effective}$) can be estimated using the following equation (EQ5):

$$NP_{effective}(kg\ CaCO_3/t)=0.56\times TIC_{Leco}(\%)\times 83.3 \quad (EQ5)$$



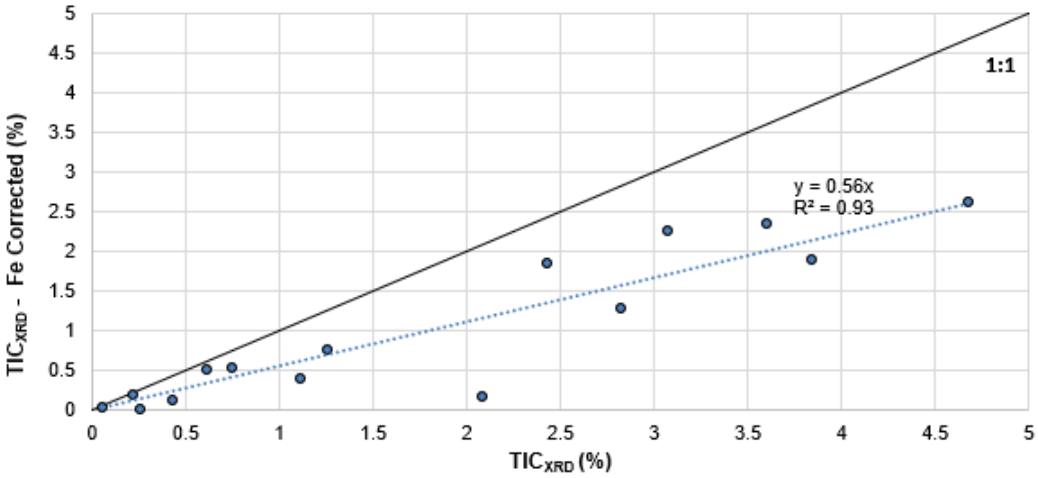
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Figure 6-5: Modified-NP versus CNP



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Figure 6-6: Modified-NP versus Ca+Mg



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Figure 6-7: TIC_{XRD} versus TIC_{XRD}-Fe corrected (2018 Samples)

6.2.4.3 Summary of NP Determinations

Based on a comparison of the three NP determination approaches completed as part of the supplemental geochemistry program the following conclusions can be made:

- A positive correlation exists between modified-NP and Sobek-NP and the regression equation derived from this relationship can be used to "calibrate" the historic dataset to modified-NP methods;
- A strong positive correlation exists between modified-NP and calcium plus magnesium (in equivalent units) and modified-NP is interpreted to represent dissolution of calcium and magnesium carbonates (i.e., effective-NP); and
- Mineralogical results for the 2018 samples indicate there is a strong positive correlation between the modified-NP and TIC when corrected for the presence of iron carbonates. The mineralogical results can be used to estimate the effective-NP from analytical TIC measurements by Leco.

6.2.5 Constituent Leaching Potential

Loading rates calculated using the HCT results can be used to evaluate trends of elements to provide a qualitative indication of the leaching potential of these parameters. The loading rates can also be used to develop water and load balance input source terms to evaluate if constituent concentrations pose environmental risk when accounted for in the context of the proposed mine waste and water management strategies. The development of the source terms for use in the water and load balance are documented separately (SRK, 2022b). Loadings are interpreted here to provide a qualitative interpretation of elemental leaching potential.

6.2.5.1 Historic HCTs

The historical dataset (Norecol Dames & Moore 1999) included five mine rock humidity cells composed of samples collected from test pits and drill holes. The sample depths were not provided in the historical dataset; however, a sample interval number was provided for some of the samples. Where it was possible to relate the sample interval number to the corresponding static test sample ID and stratigraphic zone from the historic drill hole logs, the historic humidity cells were considered as part of the current study. All other humidity cells were not interpreted. The following historical humidity cell test results from Norecol Dames & Moore (1999) were carried forward into the current study:

- Two humidity cells (HC-11 and HC-13) from Zone 1.
- One humidity cell for each of the following zones:
  - Zone 1a (HC-3);
  - Zone 2/3 (HC-5); and
  - Zone 4 (HC-8).

6.2.5.2 HCTs

Nine mine rock humidity cells, one per zone, were initiated as part of the 2018 program and were subsequently discontinued at different times once the objectives of the tests were achieved. Table 6-3 provides the test duration of the discontinued humidity cell tests.

One humidity cell sample (HC-10; Zone 6) and the QA/QC method blank humidity cell (HC-3) continued up to week 130 of testing but were temporarily paused in April 2021 at the request of TML. These HCTs were nitrogen purged and placed in cold storage. Both cells were reactivated in September 2023 and have reached testing week 188.

Table 6-3. Humidity Cell Test Durations

Humidity Cell Number	Zone	Testing Duration (weeks)
HC-3	Method Blank	188
HC-4	Zone 1	66
HC-5	Zone 1a	66
HC-6	Zone 2/3	106
HC-7	Zone 4	106
HC-8	Zone 5	66
HC-9	Zone 55	66
HC-10	Zone 6	188
HC-11	Zone 7	66
HC-12	Zone 8	66
HC-13	Overburden	40

Figure 6-8 provides a plot of the humidity cell pH and loadings for select parameters. Select parameters are defined as those that provide insight to acid generation potential (alkalinity, acidity, and sulfate), were screened to be greater than 10 times the average crustal abundances (arsenic, phosphorus, and selenium) or had increasing concentrations during the testing period (aluminum, cadmium, copper, iron, lead, nickel, strontium and zinc). The historic humidity cell results are presented in Figure 6-8 as dashed lines for comparison purposes.

Except for the Zone 2/3 and 5 humidity cells, all cells maintained alkaline pH values (Figure 6-8). The Zone 5 humidity cell has maintained a circumneutral pH near 7 and the Zone 2/3 pH decreased to a minimum of 2.2 during the testing period.

The Zone 2/3 humidity cell pH decreased to less than 4.5 after 18 weeks of testing and reached its minimum pH at week 47. The pH slightly increased after week 47 but maintained a pH less than 3 for the remainder of the testing period. As the pH decreased, there was an associated increase in several constituent loadings, including: acidity, sulfate, aluminum, cadmium, copper, iron, lead, nickel, strontium, and zinc (Figure 6-8). The results suggest that if acidic drainage occurs from mine rock prior to placement of PAG Rock in the Management Ponds, concentrations of these parameters will increase. After approximately 50 weeks of testing, several constituent loadings began to decrease and a decreasing trend in loadings was maintained until the end of the testing period, implying the mass inventory of these constituents is becoming depleted.

In other cells, alkalinity loadings remained generally consistent during the testing period. Zone 5 had a slight initial decreasing trend in alkalinity but stabilized after approximately week 40.

Loadings of other constituents generally decreased throughout the testing period (Figure 6-8). This generally occurs when the pH remains stable, and the mass inventory is depleted through time. One exception was strontium in Zones 1a and 4. This constituent had an increasing trend for these zones over the testing period.

After the zone 6 HCT was restarted, there was a second flush of constituent load, like the initial weeks of testing (e.g., weeks 1 to 5). This flush was evident in the following constituents: alkalinity, sulfate, arsenic, cadmium, copper, iron, lead, nickel, selenium, strontium, and zinc. This indicates that the sample continued to oxidize while it was in cold storage despite being nitrogen purged. Once the stored oxidized mass was flushed from this sample, post-restart release rates were comparable to the release rates prior to the sample being temporarily placed in cold storage.

The long-term steady state constituent concentrations were used to develop source terms, which were carried forward into a water and load balance to evaluate site facility and discharge water quality during operations and in post-operations. Details of the source term derivation and results of the water and load balance are documented in SRK (2021).

Consistent with 2018 humidity cell testing results, except for the 2018 Zone 2/3 HCT that is producing acidic drainage, the historical humidity cell tests maintained circumneutral to alkaline pH values throughout the 58-week testing period. Loadings of alkalinity, acidity, sulfate, nickel, strontium, and zinc were similar to the loadings calculated from the 2018 humidity cell testing results. However, loadings of the following parameters were higher in the historical humidity cells:

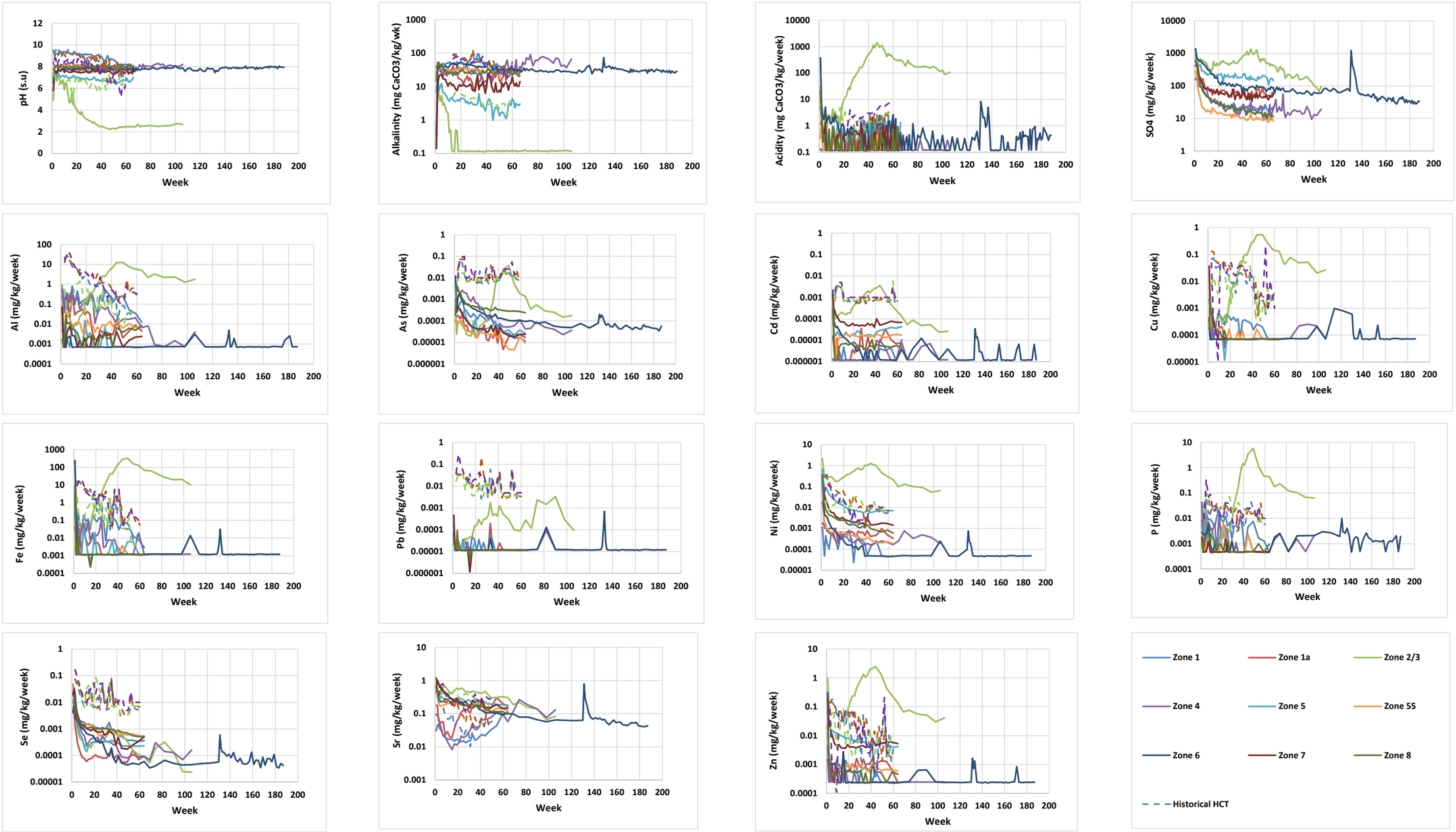
aluminum, arsenic, cadmium, copper, iron, lead, phosphorus, and selenium. It is possible the loadings are higher in the historical humidity cell tests because of a smaller samples size (200 grams) being used in the test and the grain size of the sample being finer than <1/4", resulting in additional flushing of the sample.

6.2.5.3 Field Barrel Tests

The kinetic testing programme was expanded in 2019 to include nine field barrel tests to evaluate release rates and acidic lag times from materials under ambient conditions. Nine field barrels were constructed at the Project site and have been monitored intermittently between October 2019 and November 2023 (SRK, 2024). A summary of the program and results is provided below. Full details of the testing program are provided in Appendix E.

Apart from Barrel 6 (Zone 6/7), all barrels remained alkaline during the four-year data collection period. Sulfate loadings were higher in barrels that are characterized as PAG based on the weighted NPRs. in comparison to non-PAG barrels. In addition, the calcium and magnesium release rates were also higher in PAG barrels relative to non-PAG barrels. Release rates of these constituents as well as the alkaline pH of the leachates and alkalinity production rates indicate carbonate mineral dissolution is buffering acid production from sulfide oxidation. Acidity and sulfate release rates increased during the last sampling round (October 2023) in Barrel 4 (Zone 2/3) indicating this barrel may go acidic soon.

The PAG management strategy for the project is to place all PAG Rock underwater in the management ponds within a period of 12 months. Barrel 6 became acid generating in October 2023, four years after the barrel testing program was constructed and all other barrels maintained alkaline pH values. The barrel results support the proposed period for inundation of PAG Rock is reasonable.



https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 300 Humidity Cell testing/05 HCT Figures/0_Mine Rock/[10_Select_Parameter_Loads_1CT027.002_MKH_R0.xlsx

Figure 6-8: Select Parameter Humidity Cell Loading Rates – Mine Rock Samples

6.2.6 Acid Generating Potential

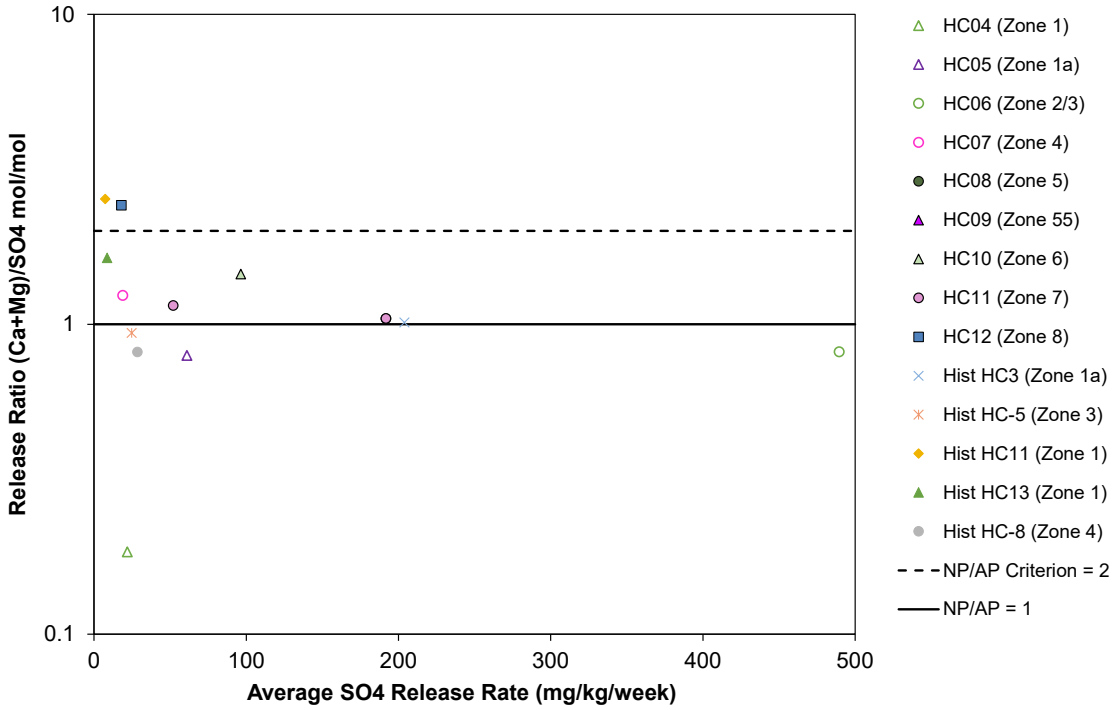
The neutralization potential ratio (NPR), the ratio of the neutralization potential (NP) to the acid potential (AP) is used to classify mine waste rock as PAG), non-PAG or as having uncertain acid generating potential. The following sections provide the acid generating potential of the drill core samples.

6.2.6.1 Classification Criteria

HCT results can be used to calculate the carbonate molar ratio (CMR), which is the ratio of calcium and magnesium from carbonates to the sulfate production rate, expressed as follows:

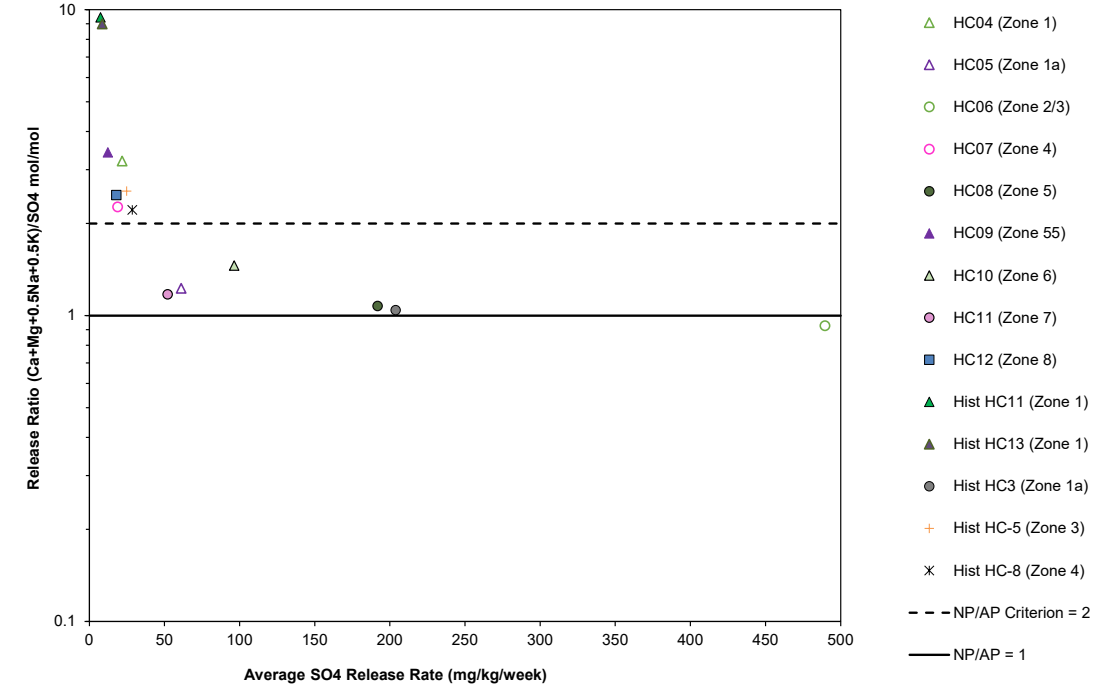
$$\frac{(Ca+Mg)}{SO_4} \text{ mol/mol}$$

If it is determined that the calcium and magnesium loads in the humidity cell test are attributed to carbonate minerals, this ratio represents the NPR when the pH in the test is neutral. As discussed in Section 6.2.4.1, a strong positive correlation exists between NP_{XRD}, following correction for iron carbonates, and modified NP. In addition, a strong positive correlation exists between modified-NP and calcium plus magnesium (see Section 6.2.4.2). These lines of evidence provide confidence that the modified-NP is a measure of calcium and magnesium carbonate dissolution (i.e., the effective-NP). CMRs for the humidity cell tests were calculated based on the stable average non-acidic loading rates observed in humidity cell tests. Figure 6-9 provides a comparison of the CMR to the average sulfate release rate. This figure indicates there are very low CMRs at low sulfate production rates (e.g., Zone 1). This is indicative of cation exchange which is expected based on the presence of the clay minerals illite-muscovite and kaolinite (Table 6-2) present in the samples. Figure 6-10 provides a plot of the CMR, accounting for cation exchange, versus the sulfate production rate. The CMRs indicate that the critical NPR for mine rock at the Tenas project is 1.20. However, an NPR of 2.0 has been selected to conservatively classify mine rock as either PAG or non-PAG.



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Figure 6-9: Carbonate Molar Ratios versus Sulfide Release Rates



https://srk.sharepoint.com/sites/NA1CT027.002/Internal/0100 MLARD/020 Reinterpretation of Kinetic Test Database/06_NPR Crit Evaluation/[NPR_Crit_1CT027.002_JED_MKH_Rev00.xlsx]

Figure 6-10: Carbonate Molar Ratios Accounting for Cation Exchange versus Sulfide Release Rates

It is standard convention to classify samples with an NPR less than 1 as PAG and samples between the PAG and non-PAG cut-offs (i.e., between 1 and 2) as having uncertain acid generating potential. Operationally, all rock having an NPR less than 2 will be managed as PAG Rock.

6.2.6.2 Acid Generating Potential

Figure 6-11 provides a plot of the NPR versus acid potential content. Historical samples, corrected using Equations 2 and 4, are presented as triangle symbols, 2018 samples are presented as filled circles and 2019 samples are presented as open circles. All stratigraphic zones had PAG or non-PAG samples; however, a higher density of PAG samples occurs in Zones 1a, 2/3, 5, 6, and 7 (Figure 6-12). A higher density of non-PAG samples occurs in Zones 1, 4, 55, and 8 (Figure 6-13). The samples plotted in Figure 6-11 to Figure 6-13) cannot be weighted equally since sample lengths varied from a few centimetres to several metres (see Section 5.1.1). To evaluate the overall acid generating potential of stratigraphic zones, the modified-NP and AP were weighted to sample intercept lengths in each zone and summed to calculate a zonal average NPR. The weighted average NPRs for each zone are provided in Table 6-4.

As can be seen in Table 6-4, seven out of nine zones (Zones 1a, 2/3, 4, 5, 55, 6 and 7) have mean NPRs less than or equal to 2.0 and are classified as PAG, even though all zones, with the exception of Zone 1a, have a component of non-PAG Rock (i.e., the non-PAG Rock is included in the PAG estimates as part of the mine plan). Zones 1 and 8 are classified as non-PAG based on their weighted NPR value. All minimum NPR values were PAG, and the 5th percentile NPRs were greater than 2.0 in all zones apart from Zone 8. Zone 4 contains quantities of both PAG and non-PAG Rock.

PAG Rock in Zone 4 is generally limited to the western and northern areas of the open pit as shown by color coded maps provided by Appendix F. Samples from other areas in this open pit were identified to be non-PAG. These zones were delineated in the mine plan when estimating quantities of PAG and non-PAG Rock.

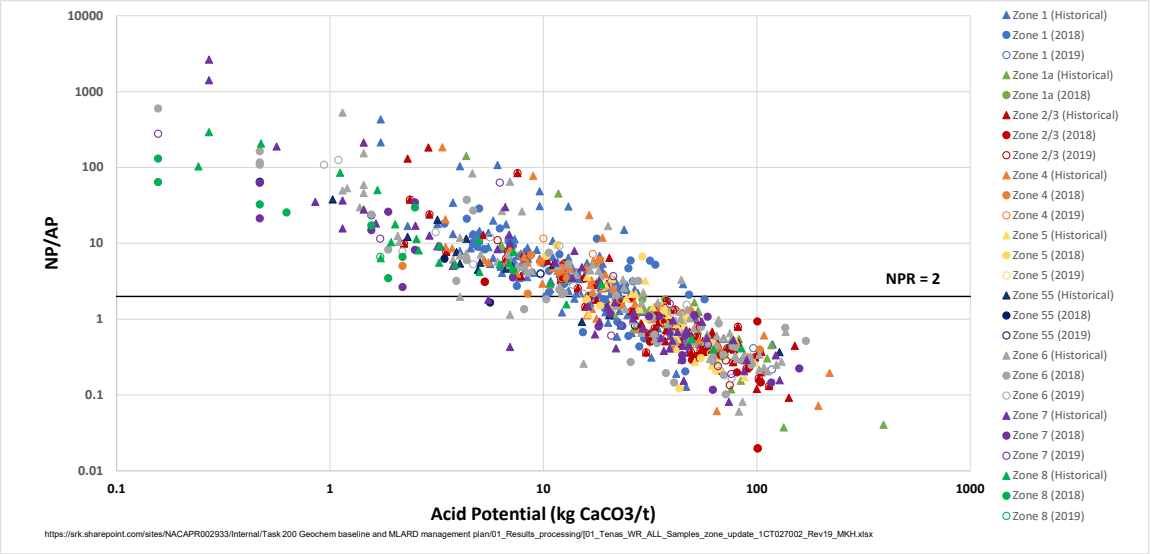


Figure 6-11: Acid Potential versus NPR

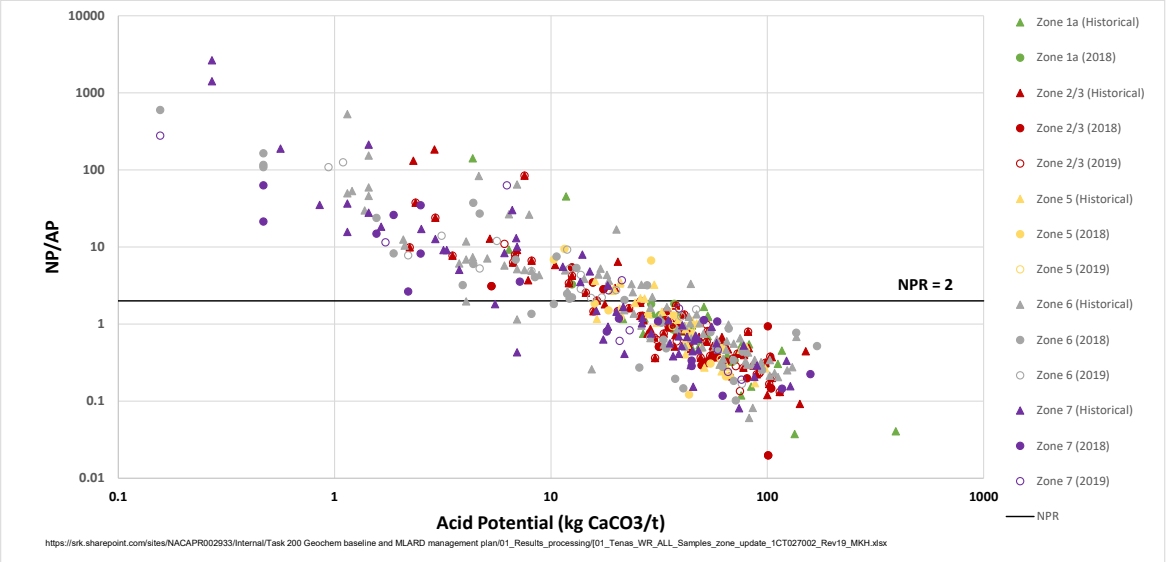


Figure 6-12: NPR versus Acid Potential for primarily PAG zones of 1a, 2/3, 5, 6, and 7

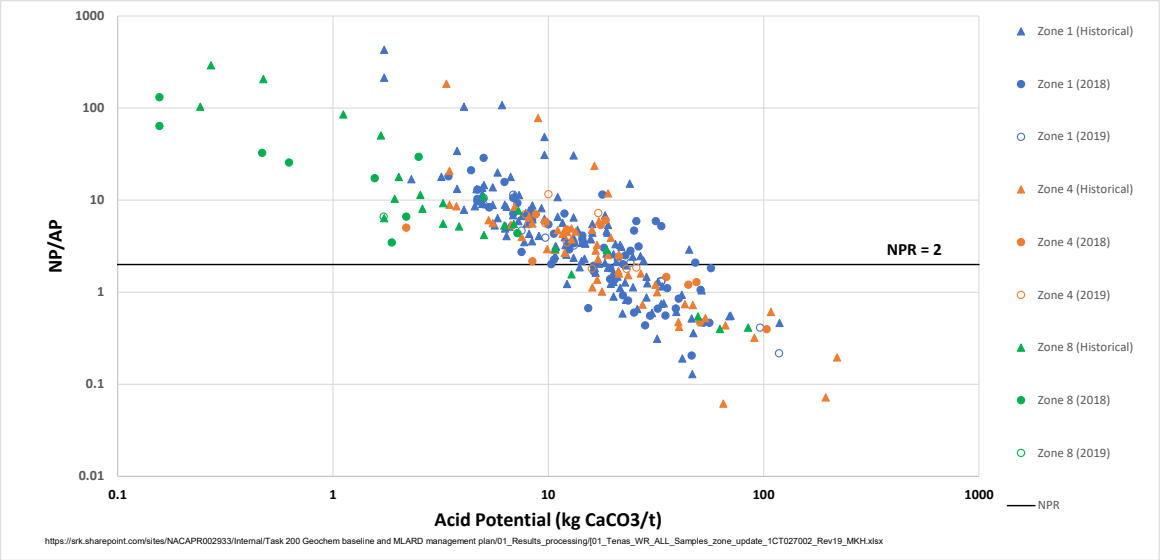


Figure 6-13: NPR versus Acid Potential for primarily non-PAG zones of Zones 1, 4, 55 and 8

Table 6-4: Weighted NPR by Stratigraphic Zone (shaded cells indicate an NPR≤2)

Zone	Count	Minimum	P5	P25	Mean	P75	P95	Max
1	19	1.7	1.98	2.9	3.1	4.8	6.6	8.8
1a	11	0.39	0.39	0.58	0.74	0.82	1.1	1.1
2/3	19	0.20	0.24	0.36	0.80	1.8	5.6	11
4 (PAG)	8	0.05	0.15	0.45	0.61	0.76	0.85	0.86
4 (non-PAG)	18	3.1	3.1	4.0	4.9	6.2	11	21
4	21	0.65	0.82	1.5	2.6	3.9	10	13
5	24	0.27	0.37	0.76	1.2	1.6	2.5	3.0
55	12	0.32	0.36	0.79	1.9	8.7	25	27
6	25	0.39	0.46	0.94	1.8	4.4	12	64
7	19	0.27	0.33	0.76	1.7	4.7	78	293
8	12	0.39	3.2	6.4	5.0	11	31	45

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[Telkwa_RptTables_1CT027.002_MKH_R2.xlsx]

6.2.7 Lag Times to the Onset to Acid Generation

A large volume of the mine rock to be mined at the Tenas Project is PAG rock (Section 6.2.6.2). As discussed in Section 2.4, PAG Rock will be placed in management ponds and submerged to reduce the rate of oxidation of sulfides. This strategy requires PAG rock to be flooded prior to the onset of acid generating conditions. Therefore, the timing to the onset of acid generation is key to the proposed PAG management strategy. Another consideration to the placement of the PAG Rock in the management ponds is flushing of oxidation products prior to the onset of acid generating conditions. The timing of exposure of PAG Rock to oxygen is directly proportional to the oxidative mass that will be flushed during placement, which can also degrade the water quality in the

management ponds. Flushing of soluble oxidation products in the management ponds is addressed in the site water and load balance provided in SRK (2022c).

The time or delay to onset of ARD (t_{onset}) depends on both the site-specific availability of reactive neutralization potential (NP*) and the rate at which reactive neutralization potential (R_{NP*}) is depleted. For PAG rock samples, the onset of acid generating conditions can be calculated using the following equation:

$$t_{onset} = NP^*/R_{NP^*} \quad (EQ6)$$

The rate at which carbonate is depleted is a function of the acid generation (sulfide oxidation) rate (R_S). In molar terms, the rate of carbonate depletion to sulfide depletion is the same as the NP/AP criterion for PAG Rock ($\{NP^*/AP^*\}_{crit}$).

$$R_{NP*}/ R_S = \{NP^*/AP^*\}_{crit} \quad (EQ7)$$

Assuming a direct linear relationship between oxidation rate and sulfur content and conservatively a zero-order chemical reaction, then

$$R_S = k.AP^*_0 \quad (EQ8)$$

where k is the slope of the line and the rate constant; and AP_0 is the initial sulfide content. A non-zero intercept is implied because if no sulfide is present then the rate of sulfide oxidation is zero.

When equations 6, 7 and 8 are combined, the delay to onset is:

$$t_{onset} = \frac{\left(NP^*/AP^*\right)_0}{k.\left(NP^*/AP^*\right)_{crit}} \quad (EQ\ 9)$$

Therefore, the delay to onset is function of NP*/AP* of the sample, the overall rate of oxidation of sulfide (k) and the effectiveness of neutralization ($\{NP^*/AP^*\}_{crit}$). Longer delays are indicated for rock higher NP*/AP* assuming constant values for the two other factors.

The NP^*/AP^*_{crit} was assigned a value of 2.0 (see Section 6.2.6.1) and the overall oxidation of sulfide (k) (Figure 6-14) was estimated based on steady-state oxidation rates in the 2018 and historic humidity cell test results, and the static test sulfide concentrations for these samples. One historic humidity cell sample (Zone 4 HC-8) was excluded from the analysis since this sample had a sulfide oxidation rate that was atypical for a sample with a high sulfide concentration, which did not fit the trend of the other samples. The Zone 2/3 sample was also eliminated because the loading rate from this humidity cell was representative of acidic conditions.

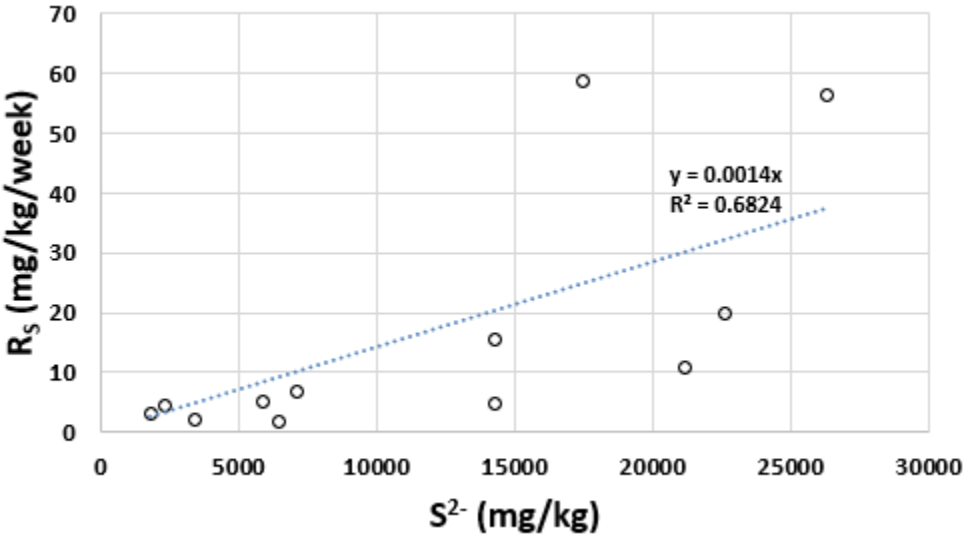
The onset to acid generation for PAG Rock was estimated using Equation 9 and the range of weighted NPRs for each zone (Table 6-5). Based on the geographical distribution of PAG and non-PAG Rock in Zone 4 (see Section 6.2.6.2), the PAG rock component of this zone is split out using

an NPR of 2.0 to avoid bias (i.e., underestimation) in the depletion calculations in PAG areas of Zone

The evaluation indicates that for the average bulk properties of PAG Rock, the minimum lag time is approximately 4.2 years based on laboratory conditions. A minimum lag time of 0.4 years is estimated for PAG Rock areas with minimum NPRs of 0.1.

It is important to note that lag times are estimated based on oxidation rates measured under laboratory conditions. The humidity cell testing is designed to accelerate weathering under controlled conditions. There are several factors that can reduce the oxidation rate under ambient conditions, including temperature differences and oxygen ingress into freshly blasted mine rock.

The predicted lag times, based on the HCTs were conservative and overestimate the lag times that would be expected under field conditions. The 2019 field barrel test program provided additional empirical evidence and supported the initial lag times predictions (SRK 2024).



https://srk.sharepoint.com/sites/NA1CT027.002/Internal/0100 MLARD/020 Reinterpretation of Kinetic Test Database/03_ResultsProcessing/01_WR/[WR_HCT_Interpretation_1CT027002_MKH_R5.xlsx

Figure 6-14: Sulfide Oxidation Rate vs. Sulfide Concentration

Table 6-5: Estimated Acid Generation Lag Times in Months under Laboratory Conditions

Zone	Minimum	P5	P25	Average	P75	P95	Max
1	141	162	---	---	---	---	---
1a	32	32	47	60	65	67	91
2/3	16	19	30	66	71	145	---
4 (PAG)	4	12	37	50	48	62	69
4 (non-PAG)	---	---	---	---	---	---	---
5	22	30	63	101	76	135	---
55	26	29	65	154	---	---	---
6	32	38	77	151	161	---	---
7	22	27	62	138	140	---	---
8	32	---	---	---	---	---	---

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[01_Tenas_WR_ALL_Samples_zone_update_1CT027002_Rev20_JCE.xlsx]

6.3 Overburden Samples

The following sections present a summary of the geochemical testing results for overburden samples. Full ABA and elemental content results are provided in Appendix G and H, respectively.

6.3.1 Grain Size

The mass of each of the six 2018 overburden sample size fraction following sieving is presented in Table 6-6. The + 2 mm– 25 mm fraction represents the largest size fraction ranging from 74 % to 83 % of the samples. The -2 mm fraction represents the second largest size fraction ranging from 16 % to 26 % of the total sample. Only one sample (T18-10-S-BLK-02 9.0-9.5m) reported grains in the +25 mm fraction; however, this was a minor fraction (1.5 %) of the entire sample (Table 6-6).

Table 6-6. 2018 Overburden Sample Size Fraction Masses and Percentages

Sample ID	+25mm (kg)	-25mm+2mm (kg)	-2mm (kg)	+25mm (%)	-25mm+2mm (%)	-2mm (%)
T18-03-S-SPT4 6.0-6.45m	0	0.66	0.14	0	83	17
T18-10-S-SPT2 3.0-3.45m	0	0.57	0.17	0	77	23
T18-13-S-SPT2 4.5-4.95m	0	0.64	0.22	0	74	26
T18-13-S-SPT5 12.0-12.45m	0	0.52	0.19	0	74	26
T18-10-S-BLK-02 9.0-9.5m	0.12	6.5	1.3	1.5	82	16
T18-02-S SPT-14 6.0-6.45m	0	0.58	0.18	0	77	23

6.3.2 Sulfide and Carbonate Mineral Fractionation

The distribution of sulfide sulfur and carbonate content by size fraction for the 2018 overburden samples are presented in Figure 6-15 and Figure 6-16, respectively. Only the -2 mm and +2 mm–25 mm fractions are presented since only one sample result was available from the +25 mm fraction.

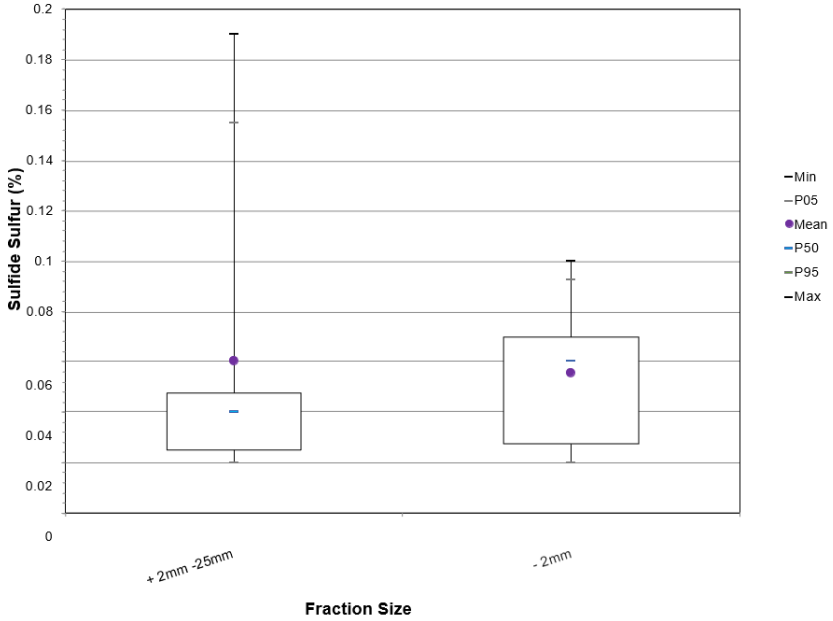
A larger range in sulfide sulfur concentrations is seen in the +2 mm–25 mm fraction in comparison to the -2 mm fraction (Figure 6-15). The maximum concentration (0.19%) in the +2 mm–25 mm fraction is higher than the maximum in the -2 mm fraction (0.10) but the minimum, P05, mean, median concentrations are similar between these two size fractions (Figure 6-15) indicating that sulfide does not preferentially fractionate to one size fraction. The sulfide concentration (0.02%) in the +25 mm fraction is equal to the minimum in the other two fractions.

Similar to the sulfide concentrations, a larger TIC range of concentrations is seen in the +2 mm–25 mm fraction in comparison to the -2 mm fraction (Figure 6-16). The median concentrations are similar between the two populations, and it therefore cannot be concluded confidently that TIC fractionates in the overburden samples. The +25 mm sample had a TIC concentration of the 0.21%, which is comparable to the 25th percentile value in the +2 mm–25 mm fraction.

The NPR in the +2 mm–25 mm and the -2 mm was similar (Figure 6-17). The NPR ranged from 5.5 to 89 in the +2 mm–25 mm fraction and from 18 to 86 in the -2 mm fraction. All samples had NPRs greater than two and are therefore classified as non-PAG. The NPR of the sample from the +25 mm was 128 and is therefore, also classified as non-PAG.

All of the 2019 samples were classified as non-PAG based on the low sulfide concentrations which ranged from below the reporting detection limit to 0.060 %, with a median of 0.015 and high NPRs which ranged between 13 and 74, with a median of 28 (Table 6-7).

The 2023 overburden sample is classified as non-PAG based on the low sulfide concentration (0.065 %) and NPR of 15 (Table 6-7).



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Figure 6-15: Sulfide Sulfur Size Fraction Box and Whisker Plot

Note: boxes represent the 25th and 75th percentiles. Whiskers provided the statistical spread on extrema and 5th and 95th percentiles

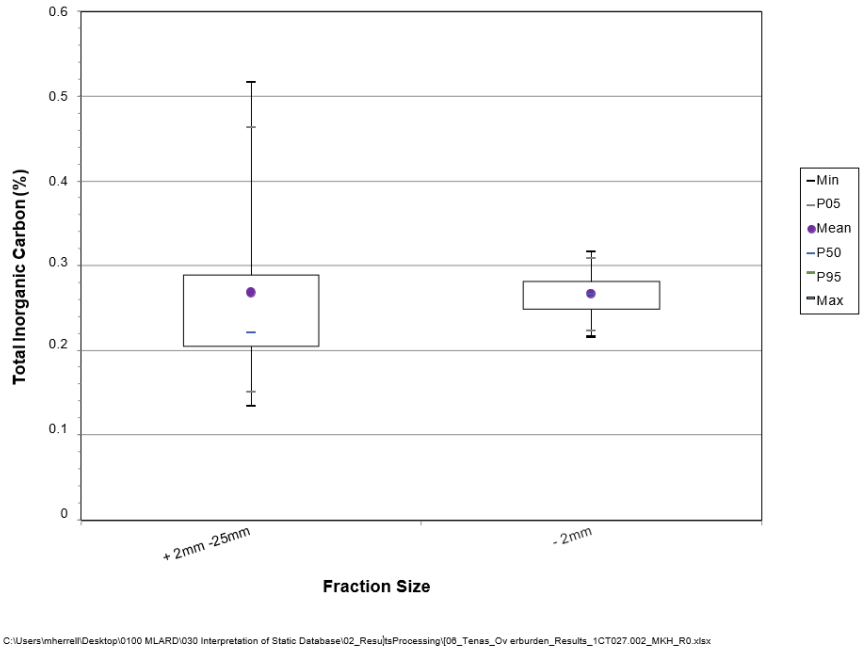


Figure 6-16: Total Inorganic Carbon Fraction Box and Whisker Plot

Note: boxes represent the 25th and 75th percentiles. Whiskers provided the statistical spread on extrema and 5th and 95th percentiles.

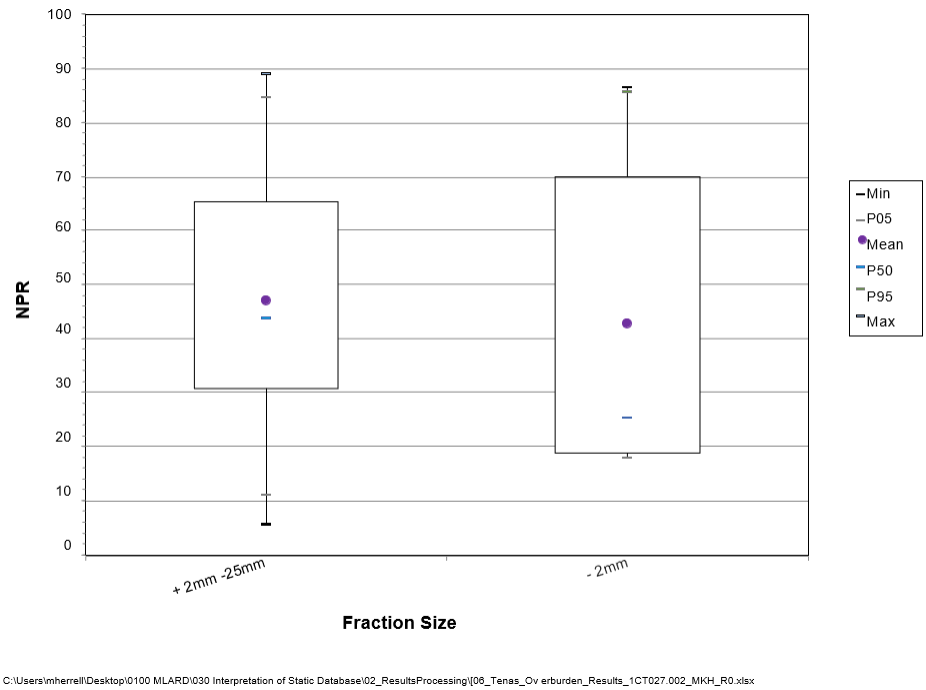


Figure 6-17: NPR Fraction Box and Whisker Plot

Note: boxes represent the 25th and 75th percentiles. Whiskers provided the statistical spread on extrema and 5th and 95th percentiles.

Table 6-7: Summary of Overburden Acid Base Accounting Results

Sample ID	Bureau Veritas (formerly Maxxam) Sample ID	Sample Depth (m)		Paste pH (s.u.)	Carbon Species (w.t.%)			Sulfur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios	
		From	To		Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulfate	S_{ICP}	Sulfide (S_{ICP} – SO_4)	AP (Sulfide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek-NPR (Sulfide)
2018																
+25mm fraction																
+25MM - T18-10-S-BLK-02 9.5	UJ3985	9	9.5	8.8	---	0.21	0.77	<0.020	0.010	<0.020	0.010	0.31	18	33	56	104
+2mm-25mm fraction																
+2MM - T18-03-S-SPT4 6.0-6.45	UJ3987	6	6.45	7.9	---	0.23	0.84	0.19	0.020	0.19	0.17	5.3	19	29	3.6	5.5
+2MM - T18-10-S-SPT2 3.0-3.45	UJ3988	3	3.45	8.1	---	0.20	0.74	0.030	0.010	0.020	0.010	0.31	17	28	54	89
+2MM - T18-13-S-SPT2 4.5-4.95	UJ3989	4.5	4.95	8.2	---	0.31	1.1	0.040	0.010	0.040	0.030	0.94	26	39	27	41
+2MM - T18-13-S-SPT5 12.0-12.45	UJ3990	12	12.45	8.3	---	0.21	0.78	<0.02	<0.010	<0.02	0.015	0.47	18	34	38	71
+2MM - T18-10-S-BLK-02 9.0-9.5	UJ3991	9	9.5	8.5	---	0.13	0.49	0.04	<0.010	0.040	0.035	1.1	11	30	10	27
+2MM - T18-02-S SPT-14 6.0-6.45m	UJ3993	6	6.45	8.3	---	0.52	1.9	0.05	<0.010	0.050	0.045	1.4	43	66	31	47
-2mm fraction																
-2MM - T18-03-S-SPT4 6.0-6.45	TO9565	6	6.45	8.0	0.75	0.26	0.95	0.070	0.020	0.070	0.050	1.6	22	28	14	18
-2MM - T18-10-S-SPT2 3.0-3.45	TO9566	3	3.45	8.3	0.87	0.25	0.90	0.020	0.010	<0.02	0.010	0.31	20	26	65	83
-2MM - T18-13-S-SPT2 4.5-4.95	TO9567	4.5	4.95	8.0	0.62	0.32	1.2	0.080	0.050	0.10	0.050	1.6	26	32	17	21
-2MM - T18-13-S-SPT5 12.0-12.45	TO9568	12	12.45	8.3	0.43	0.22	0.79	<0.020	0.010	<0.020	0.010	0.31	18	27	57	86
-2MM - T18-10-S-BLK-02 9.0-9.5	TO9570	9	9.5	8.2	0.73	0.27	1.0	0.040	0.020	0.050	0.030	0.94	23	28	24	30
-2MM - T18-02-S SPT-14 6.0-6.45m	TO9571	6	6.45	8.1	0.89	0.28	1.0	0.060	0.020	0.070	0.050	1.6	24	28	15	18
Bulk Samples																
ORIGINAL - T18-03-5-SPT2	TV0022	3	3.45	8.2	0.63	0.19	0.70	<0.020	0.010	<0.020	0.010	0.31	16	23	51	75
ORIGINAL - T18-03-5-SPT6	TV0175	10.5	10.95	8.4	1.0	0.43	1.6	0.10	0.010	0.10	0.090	2.8	36	37	13	13
ORIGINAL - T18-03-5-SPT5	TV0176	7.5	7.95	8.4	0.75	0.38	1.4	0.090	0.010	0.090	0.080	2.5	32	38	13	15
2019																
29632	VW1525	---	---	7.9	0.49	0.0082	0.030	<0.02	<0.01	<0.02	0.015	0.47	0.68	7.7	1.5	16
29633	VW1526	---	---	8.4	0.48	0.13	0.46	<0.02	<0.01	<0.02	0.015	0.47	10	19	22	39
29634	VW1527	---	---	8.3	0.67	0.20	0.73	<0.02	<0.01	<0.02	0.015	0.47	17	18	35	37
29635	VW1528	---	---	8.4	0.50	0.15	0.54	<0.02	<0.01	<0.02	0.015	0.47	12	21	26	45
29636	VW1529	---	---	8.4	0.68	0.25	0.90	<0.02	<0.01	<0.02	0.015	0.47	20	27	44	57
29637	VW1530	---	---	8.5	0.72	0.23	0.86	0.040	<0.01	0.050	0.045	1.4	20	28	14	20
29638	VW1531	---	---	8.4	0.77	0.29	1.1	0.040	<0.01	0.050	0.045	1.4	24	30	17	21
35029	VW1532	---	---	8.2	0.47	0.08	0.28	<0.02	<0.01	<0.02	0.015	0.47	6.4	14	14	30
35030	VW1533	---	---	8.3	0.77	0.24	0.88	0.060	0.01	0.070	0.060	1.9	20	25	11	13
35031	VW1534	---	---	8.4	0.74	0.27	0.98	0.070	0.01	0.070	0.060	1.9	22	28	12	15
29655	VW1535	---	---	8.3	0.50	0.068	0.25	<0.02	<0.01	<0.02	0.015	0.47	5.7	13	12	27
29656	VW1536	---	---	8.4	0.78	0.20	0.72	<0.02	<0.01	<0.02	0.015	0.47	16	29	35	61
29657	VW1537	---	---	8.4	0.79	0.29	1.1	0.030	<0.01	0.040	0.035	1.1	25	30	22	28
29658	VW1538	---	---	8.3	0.83	0.31	1.1	0.040	0.01	0.070	0.060	1.9	25	28	14	15
29659	VW1539	---	---	8.3	0.82	0.27	0.98	0.040	<0.01	0.050	0.045	1.4	22	27	16	19
29660	VW1540	---	---	8.4	0.73	0.26	0.96	0.040	<0.01	0.030	0.025	0.78	22	29	28	38
35021	VW1541	---	---	8.0	0.52	0.035	0.13	<0.02	<0.01	<0.02	0.015	0.47	3.0	12	6	25
35022	VW1542	---	---	8.5	0.51	0.27	0.99	<0.02	<0.01	<0.02	0.015	0.47	23	31	48	65
35024	VW1543	---	---	8.6	0.59	0.30	1.1	<0.02	<0.01	<0.02	0.015	0.47	25	35	53	74
2023																
Overburden Composite Sample from Sonic Drilling Program in 2021 for Management Ponds	UJ3986	---	---	8.4	0.94	0.24	0.88	0.060	<0.010	0.070	0.065	2.0	20	31	10	15

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[Telkwa_RptTables_1CT027.002_MKH_R2.xlsx]

6.3.3 Elemental Content

To identify parameters that were elevated in the solid-phase and may have the potential to leach, elemental concentrations of the 2018 samples were compared to the average crustal abundances (Smith and Huyck (1999). The following elements were screened to have concentrations greater than 10 times the average crustal abundances (Appendix H):

- +2 mm–25 mm fraction:
  - 67% (4 of 6 samples) of arsenic measurements;
  - 17% (1 of 6 samples) of bismuth and cadmium measurements; and
  - 33% (2 of 6 samples) of tellurium measurements.
- -2 mm fraction
  - 17% (1 of 6 samples) of arsenic and gold measurements; and,
  - 83% (5 of 6 samples) of tellurium measurements.
- There were no elevated concentrations in the +25 mm fraction

Detailed comparisons are provided in Appendix H. A higher frequency of elevated parameters was observed in the +2–25 mm fraction in comparison to the -2 mm and +25 mm fractions.

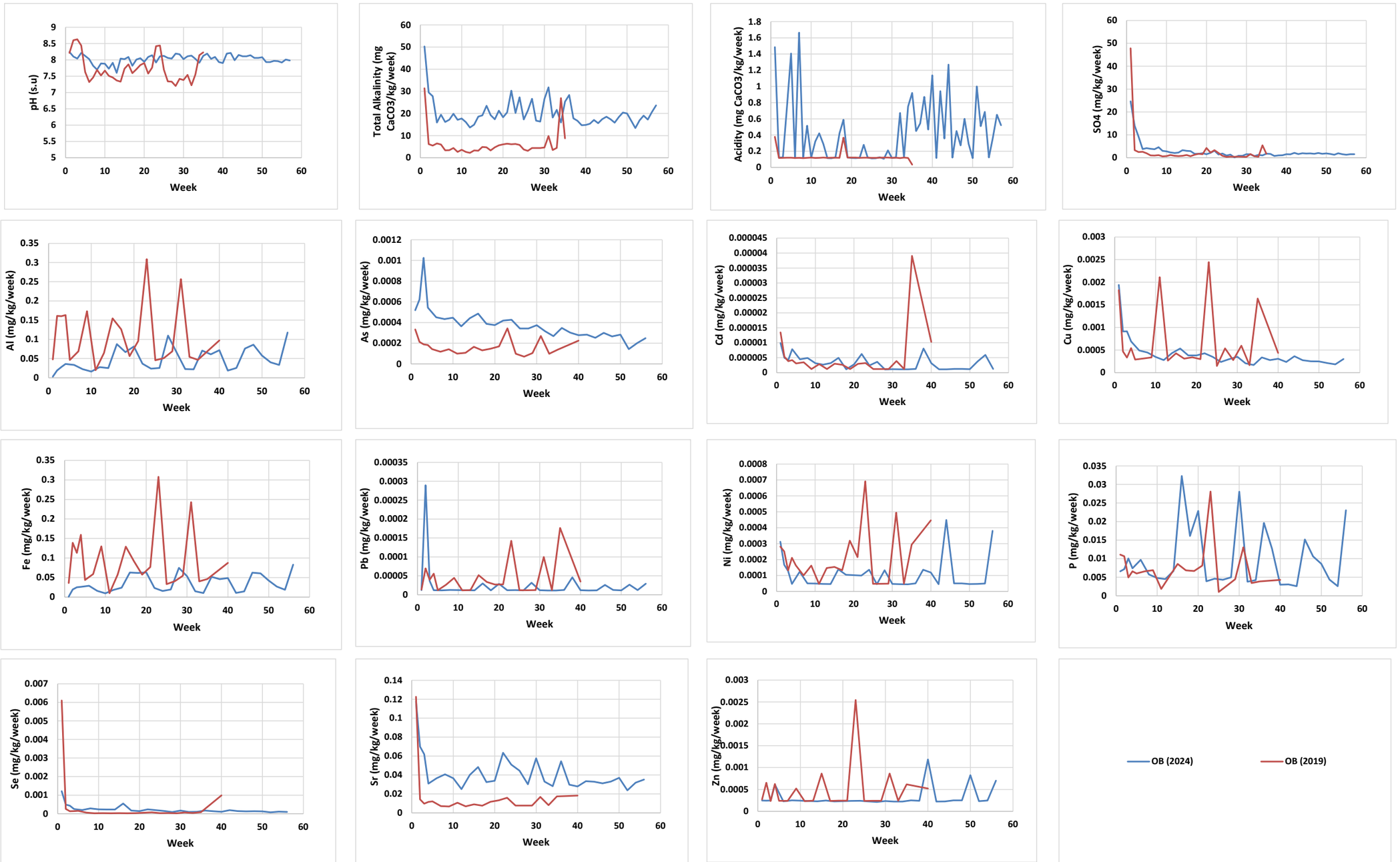
Tellurium was the only element screened to have a concentration greater than 10 times the average crustal abundance in all the 19 overburden samples and the 2023 overburden sample.

6.3.4 Constituent Leaching Potential

A humidity cell was initiated on the 2019 composite sample and ran for 40 weeks before it was terminated. An additional overburden humidity cell was initiated in 2023. At the time this report was produced, data were available up to week 57. Figure 6-18 provides a plot of the humidity cell pH and loadings for the same select parameters identified for mine rock (Section 6.2.5).

Both the 2019 and 2023 cells maintained a circumneutral to alkaline pH. The pH of the 2019 cell ranged between 7.2 and 8.6 and after the initial first flush of the cell, alkalinity decreased before becoming reasonably stable after week 2 (Figure 6-18). The pH of the 2023 cell ranged between 7.6 and 8.2 and after the initial first flush of the cell in the first 5 weeks of testing, alkalinity decreased before becoming reasonably stable after week 4 (Figure 6-18).

Loadings of other constituents maintained slight decreasing trends throughout the testing period (Figure 6-18). An exception to this can be seen in loadings of aluminium, chromium, and iron which see an overall increasing trend.



https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 300 Humidity Cell testing/05 HCT Figures/1_Overburden/[OB_Select_Parameter_Loads_CAPR002933_MKH_R0.xlsx

Figure 6-18: Select Parameter Humidity Cell Loading Rates – Overburden Samples

6.4 Processed Rock

The following sections present the processed rock geochemical test results. Detailed ABA and elemental analysis results are provided in Appendices I and J, respectively.

6.4.1 Mineralogy

One coarse processed rock sample was submitted for mineralogy by Rietveld XRD. Results of this analysis are provided in Table 6-8. Most of the coarse processed rock were present as amorphous minerals. Most of the crystalline phases were kaolinite and quartz.

Sulfur is present in the sample as pyrite and iron carbonates ankerite, and siderite were also detected. This implies that a component of the NP in the processed rock will not provide net neutralizing potential.

Table 6-8. Coarse Processed Rock Mineralogical Results

Mineral	Relative %
Kaolinite	20
Quartz	11
Ankerite	2.3
Siderite	1.2
Pyrite	1.7
Amorphous	65

6.4.2 Acid Base Accounting

A summary of the processed rock acid base accounting results is provided in Table 6-9. Total sulfur concentrations in the coarse processed rock ranged from 2.8 to 4.1 % and from 1.9 to 3.9 % in the fine processed rock. Nearly all the total sulfur was present as sulfide, which calculated using EQ1 ranged from 1.8 to 3.4 % in the fine processed rock and from 3.0 to 3.7 % in the coarse processed rock. The sulfide concentration (3.0%) of one coarse processed rock sample (UI3971) was greater than the total sulfur concentration (2.8%), perhaps because of some organic sulfur being lost on ignition.

The NP was higher in the fine processed rock (61 to 192 kg $CaCO_3$/t) in comparison to the coarse fraction (36 to 111 kg $CaCO_3$/t). Except for one coarse processed rock sample (UI3970), carbonate-NP was like the modified-NP indicating, that for most samples, the modified-NP provides a reasonable estimate of the effective-NP of the samples. The carbonate-NP in samples WT7431 and WP0671 was greater than the modified-NP indicating the presence of siderite in the sample. This was confirmed by mineralogy in the coarse processed rock (see Section 6.4.1) In addition, the carbonate-NP in sample UI3970 (56 kg $CaCO_3$/t) was approximately half of the modified-NP value of 111 kg $CaCO_3$/t. The NP of the processed coal sample was 3.2 kg $CaCO_3$/t. The carbonate-NP (2.5 kg $CaCO_3$/t) was like the modified-NP indicating, that the modified-NP overestimated the effective-NP of the sample.

Both coarse processed rock samples and all but one fine processed rock samples (UI3972) had NPR values less than two and are classified as PAG. Fine processed rock sample UI3972 had an NPR of 3.4 and is classified as non-PAG. Previous testing of processed rock samples (Norecol Dames and Moore 1999) indicated all processed rock samples are PAG and confirmed the classification of most of the processed rock samples as PAG. Even though one fine processed rock sample is non-PAG, TML plans to manage all processed rocks as PAG.

6.4.3 Elemental Content

The element content of the seven processed rock samples was compared to the average crustal abundances (Smith and Huyck, 1999) to identify parameters that were elevated in the solid phase. The following elements were screened to have concentrations greater than 10 times the average crustal abundances (Appendix J): sulfur and tellurium in all processed rock samples, arsenic in five of seven samples and selenium in six of the seven processed rock samples. Coarse processed rock sample WP0671 was not elevated in arsenic and selenium.

6.4.4 Constituent Leaching Potential

Loading rates for the processed rocks were calculated using the four humidity cell results to evaluate trends of elements to provide a qualitative indication of the leaching potential of these parameters. Figure 6-19 provides a plot of the humidity cell pH and loadings for the same select parameters identified for mine rock (Section 6.2.5). No new parameters were screened to be greater than the average crustal abundances in the processed rock samples and no additional constituents were included in the select parameter list..

The coarse processed rock sample was tested for 140 weeks before being terminated. Although this sample became acidic and constituent concentrations are increasing, TML plans to manage all processed rock as PAG and place them in the management pond before they become acidic. Therefore, the objective of this sample (i.e., to evaluate the lag time to the onset of acid generation) has been achieved. The 2018 and 2019 fine processed rock samples were tested for 74 and 55 weeks, respectively. The processed coal sample was initiated in March 2024 with the test still running.

The pH of the coarse processed rock sample HCT remained circumneutral until a steep decline in pH began at week 68 in the testing period. The pH rapidly decreased to a pH of 4 and then continued to decrease at a slower rate. (Figure 6-19). A corresponding increase in several constituent loadings occurred as the pH decreased in the coarse processed rock sample (Figure 6-19).

The pH in the fine processed rock humidity cell samples remained alkaline for the duration of the testing period and constituent loadings were generally stable.

6.4.5 Lag Times to the Onset of Acid Generation

Processed rock will be placed in the management ponds with mine rock to limit oxidation of these materials. A key aspect of the mine plan is to have the processed rock submerged in the management ponds prior to the onset of acid generation. To test the efficacy of this management strategy, the humidity cell test results were used to estimate the timing to the onset of acid generation.

The 2018 coarse processed rock sample became acidic after approximately 68 weeks (i.e., 1.3 years) of testing. This represents a minimum timeframe to the onset of acid generation of these materials because the test was conducted under laboratory conditions. Under ambient conditions, lag times will be longer since oxidation rates will be lower under field temperature.

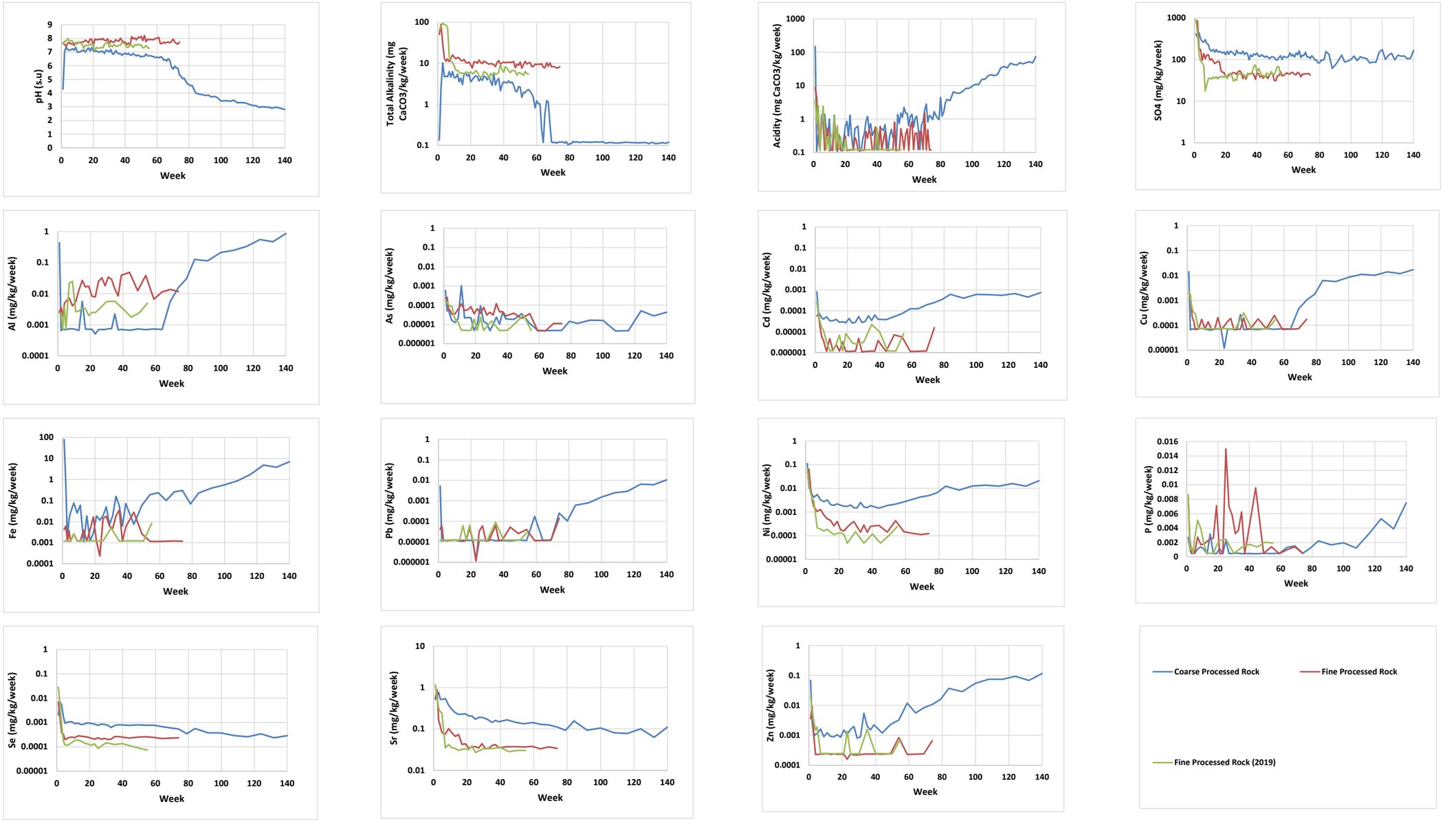
The 2018 and 2019 fine processed rock samples did not become acid generating during the testing period. Lag times to acidic conditions were calculated based on sulfide and NP depletion rates using sulfate, calcium, and magnesium production rates in the humidity cell tests of these sample. The sulfide in the 2018 fine processed rock sample is predicted to be consumed prior to the NP in this sample, indicating this sample is non-PAG. Depletion calculations completed on the 2019 fine processed rock sample indicate this sample is PAG. However, the carbonate-NP is estimated to be depleted after 20 years under laboratory conditions, indicating there is a long lag time prior to fine processed rock becoming acid generating.

Although one sample of fine processed rock was classified as non-PAG based on the static and kinetic test results, TML plans to manage all processed rock as PAG. Based on the timing to onset of acid generation of the coarse processed rock, it is recommended that the processed rock be placed in the management ponds within 1.3 years of being produced.

Table 6-9: Summary of Processed Rock Acid Base Accounting Results

Year	Sample ID	Bureau Veritas (formerly Maxxam) Sample ID	Description	Paste pH (s.u.)	Carbon Species (w.t.%)			Sulfur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios		HCT Reference
					Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulfate	S_{ICP}	Sulfide ($S_{ICP} - SO_4$)	AP (Sulfide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek-NPR (Sulfide)	
Fine Fraction																	
2018	183104	UI3972	Fine Processed Rock	7.8	26	2.3	8.6	1.9	0.02	1.8	1.8	57	196	192	3.4	3.4	2018 Fine Processed Rock
2018	182962	UI3973	Fine Processed Rock	7.6	16	1.8	6.7	2.7	0.02	2.7	2.7	84	151	157	1.8	1.9	
2019	TAILINGS	WP0672	Fine Processed Rock	6.2	43	0.8	3.1	3.0	0.05	3.1	3.0	95	71	61	0.7	0.6	2019 Fine Processed Rock
2019	TELKWA TAILINGS COMPOSITE	WT7431	Fine Processed Rock	7.6	22	2.3	8.6	3.9	0.07	3.5	3.4	109	194	158	1.8	1.4	-
Coarse Fraction																	
2018	183104	UI3970	Coarse Processed Rock	6.2	35	0.7	2.5	3.8	0.05	3.7	3.7	116	56	111	0.5	1.0	2018 Coarse Processed Rock
2018	182962	UI3971	Coarse Processed Rock	6.8	33	0.4	1.4	2.8	0.03	3.1	3.0	96	32	36	0.3	0.4	
2019	JIG CCR	WP0671	Coarse Processed Rock	3.7	47	0.5	1.9	4.1	0.16	3.8	3.6	119	43	30	0.4	0.3	-

Source: /srk.sharepoint.com/sites/NACAPR002933/Internal/Task 200 Geochem baseline and MLARD management plan/01_Results_processing/[Telkwa_RptTables_1CT027.002_MKH_R2.xlsx]



https://srk.sharepoint.com/:x:/r/sites/NACAPR002933/Internal/Task%20300%20Humidity%20Cell%20testing/05%20HCT%20Figures/Telkwa_RptFigures_1CT027.002_MKH_R3.xlsx?d=w4d5a4e87ce9b4f239aa274a99f5f8a6c&csf=1&web=1&e=TNkC8S

Figure 6-19: Select Parameter Humidity Cell Loading Rates – 2018 & 2019 Processed Rock Samples

6.5 Construction Materials

TML provided the following samples that will be used in construction of the haul road and the rail load out area:

- One sample representative of rock to be used to construct the haul road;
- Five test pit samples collected along the proposed alignment of the haul road; and
- Nine samples from four test pits around the proposed Rail Infrastructure.

Due to similarities in their geochemical properties, as will be discussed below, these samples are collectively referred to here as construction materials. The following section provides a summary of the construction material results. Detailed acid base accounting and elemental results are provided in Appendices F and G, respectively.

6.5.1 Acid Base Accounting

Table 6-10 provides a summary of the construction material acid base accounting results. Apart from one Rail Infrastructure sample (TP18-20 0.7-0.8), all the samples had alkaline paste pH results. Total sulfur and sulfide were low in all the samples. Sulfide was only detected in four of 15 of the samples (Table 6-10) and was below detection in the remaining 11 samples.

Modified-NP exceeded carbonate-NP in all the samples (Table 6-10). The NP far exceed the AP in all samples resulting in NPRs much greater than two (Table 6-10). Therefore, all the construction materials are characterized as non-PAG.

6.5.2 Elemental Content

Compared to 10 times the average crustal abundances (Smith and Huyck 1999), tellurium was observed to be enriched in the solid phase in 60% (9 of 15 samples) of the measurements.

Table 6-10: Summary of Construction Material Acid Base Accounting Results

Sample ID	Maxxam Sample ID	Sample Depth (m)			Paste pH (s.u.)	Carbon Species (w.t.%)			Sulfur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios	
		From	To	Thickness		Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulfate	S_{ICP}	Sulfide (S_{ICP} – SO_4)	AP (Sulfide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek-NPR (Sulfide)
Quarry Sample																	
ROCK ROAD CONSTRUCTION	UU1350	---	---	---	8.8	0.2	0.1	0.36	<0.02	<0.01	<0.02	0.01	0	8	15	52	93
ROCK MATERIAL FOR ROADS	ZB0881	---	---	---	8.7	0.8	0.6	2.3	<0.02	<0.01	<0.02	0.01	0	53	45	339	289
Road Samples																	
T18-29	VH0513	---	---	---	8.1	1.0	0.35	1.3	0.03	<0.01	0.02	0.01	0	30	40	189	257
T18-32	VH0514	---	---	---	7.9	1.0	0.3	1.2	0.04	0.01	0.04	0.01	0	26	39	84	124
T18-35	VH0515	---	---	---	7.5	0.7	0.01	<0.08	<0.02	<0.01	<0.02	0.01	0	1	8	5.8	49
T18-36	VH0516	---	---	---	7.7	0.4	0.01	<0.08	0.02	<0.01	0.02	0.01	0	1	6	5.8	38
T18-39	VH0517	---	---	---	7.6	0.2	0.01	<0.08	0.04	<0.01	0.03	0.01	0	1	7	2.9	23
Rail Loop Samples																	
TP18-23, 1.3-1.4	VH0584	1.3	1.4	0.10	8.3	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	9	5.8	56
TP18-23, 2.6-2.7	VH0585	2.6	2.7	0.10	8.3	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	6	5.8	40
TP18-24 1.9-2.1	VH0586	1.9	2.1	0.20	8.5	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	7	5.8	45
TP18-24 1-1.2	VH0587	1	1.2	0.20	8.5	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	7	5.8	43
T18-25, 2.1-2.3	VH0588	2.1	2.3	0.20	8.5	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.0	0	1	9	5.8	57
T18-25 3.2-3.4	VH0589	3.2	3.4	0.20	8.7	0.1	0.011	<0.08	0.1	<0.01	<0.02	0.01	0	1	8	5.8	48
TP18-20 0.3-0.4	VH0590	0.3	0.4	0.10	7.1	0.4	0.011	<0.08	<0.02	<0.01	<0.02	0.01	0.2	1	7	6	46
TP18-20 0.7-0.8	VH0591	0.7	0.8	0.10	6.9	0.4	0.011	<0.08	<0.02	<0.01	<0.02	0.01	0	1	6	5.8	40
TP18-20 1.8-2.0	VH0592	1.8	2	0.20	8.3	0.1	0.011	<0.08	<0.02	<0.01	<0.02	0.01	0	1	5	5.8	33

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7 Summary

The following sections provide a summary of the supplemental geochemical test results for each sample type.

7.1 PAG Classification Criteria

Geochemical testing of drill core samples indicates there is a strong correlation between NP_{XRD}, following correction for iron carbonates, and modified NP. In addition, a strong positive correlation exists between modified-NP and calcium plus magnesium. Therefore, the calcium and magnesium loads in the humidity cell test are attributed to carbonate dissolution under neutral conditions. An NPR of 2.0 was used to classify all material as PAG or non-PAG.

7.2 Drill Core

7.2.1 Sulfur Content

Geochemical testing of drill core samples indicate that most of the total sulfur is present as sulfide and a strong positive correlation exists between these two parameters. Therefore, the regression equation (Equation 2) can be used to calibrate the historical data set to sulfide concentrations to estimate acid potential more accurately. Additionally, this relationship can be used operationally.

7.2.2 Neutralization Potential

The mineralogical results indicate that iron carbonates are abundant in the drill core samples. Correction of the TIC for iron carbonates results in a strong positive correlation to the modified-NP and additionally, calcium plus magnesium is also strongly positively correlated to modified-NP indicating that the modified-NP provides a reasonable estimate of the effective-NP. The mineralogical results can be used to estimate the effective-NP from analytical TIC measurements by Leco.

A strong positive correlation exists between Sobek-NP and modified-NP and the regression equation (Equation 4) from correlating these parameters can be used to calculate modified-NP from the historical dataset.

7.2.3 Acid Generating Potential

Consistent with the historical geochemical characterization (Norecol, Dames and Moore 1999) the supplemental geochemical testing results indicate that acid generating potential is controlled by stratigraphic units. All units contain some component of PAG Rock or non-PAG rock; however, when the bulk properties of each stratigraphic unit are considered, the following zones were identified to be PAG and non-PAG based on the mean NPR in each zone:

- **Non-PAG** – Zones 1 and 8.
- **PAG** – Zones 1a, 2/3, 4, 5, 55, 6, and 7.

During operations zones 1a, 2/3, 5, 55, 6 and 7 will be treated operationally as PAG. The PAG potential of all other units will need to be determined through operational geochemical testing.

7.2.4 Leaching Potential

The following elements were screened to be elevated in the solid phase:

- 14% of arsenic analyses;
- <1% of phosphorus and selenium analyses; and
- 56% of sulfur analyses.

The concentrations of these parameters will be evaluated in the water and load balance that is currently being developed.

7.2.5 Lag Time to Acid Generation

The sulfide oxidation rates in the humidity cell samples were used to estimate the lag time acid generation. The evaluation indicated that for the average bulk properties of PAG Rock, the lag time varies from approximately 4.2 to 13 years under laboratory conditions. A minimum lag time under laboratory conditions of 0.4 years is estimated for PAG Rock units with minimum NPR of 0.1.

7.3 Overburden

7.3.1 Grain Size, Acid generating Potential and Neutralizing Potential

Overburden samples were collected during the 2018 supplementary program. Different size fractions were evaluated to determine if carbonate and sulfur minerals fractionate to inform blending studies. Based on six samples collected from four test pits, a larger range was observed in sulfide and NP in the +2 mm–25 mm fraction in comparison to the -2 mm fraction. Based on the similarities to central statistics of the two samples sets, it cannot be concluded with confidence that sulfide and NP preferentially fractionate to one grain size. All the samples and size fractions had NPRs greater than two and are characterized as non-PAG.

Additional overburden samples collected in 2019 and 2023 were also classified as non PAG due to low sulfide content and NPR values above 2.0.

7.3.2 Leaching Potential

A higher frequency of elevated parameters was observed in the +2–25 mm fraction in comparison to the -2 mm and +25 mm fractions. The following elements were screened to have concentrations greater than 10 times the average crustal abundances and were screened to be elevated in the solid phase:

- +2 mm–25 mm fraction:
  - 67% (4 of 6 samples) of arsenic measurements; and,
  - 17% (1 of 6 samples) of bismuth and cadmium measurements.
- -2 mm fraction

  - 17% (1 of 6 samples) of arsenic and gold measurements; and,
  - 83% (5 of 6 samples) of tellurium measurements
- There were no elevated concentrations in the +25 mm fraction.

For the 2019 and 2023 overburden samples, tellurium was greater than 10 times the average crustal abundance (Smith and Huyck 1999). Data for the HCTs of both samples show that the cells maintained a circumneutral to alkaline pH throughout the testing period. Except for aluminum, chromium and iron, loadings of constituents maintained slight decreasing trends throughout the testing period.

7.4 Processed Rock

7.4.1 Acid Generating Potential

Acid base accounting results indicate that six out of the seven processed rock samples are PAG using an NPR criterion of 2.0. Depletion calculations on the humidity cell tests indicate that NP will be consumed prior to sulfide in the coarse processed rock sample and the 2019 fine processed rock sample. Sulfide will be consumed prior to NP in the 2018 fine processed rock sample. These results indicate the coarse and 2019 processed rock samples are PAG and the 2018 fine processed rock sample is non-PAG. The historical results (Norecol Dames and Moore 1999) indicated that all processed rock were PAG. Based on the samples collected as part of this study and the historical testing results, TML will manage all processed rock as PAG.

7.4.2 Leaching Potential

Arsenic, sulfur, selenium, and tellurium were greater than 10 times the average crustal abundances (Smith and Huyck 1999). The coarse processed rock sample became acidic after 68 weeks of testing. An associated increase in several constituents was also observed to occur as the pH in this sample declined. TML proposes to place processed rock in the Management Ponds prior to the onset of acid generation. If the processed rock is inundated with water prior to acid generation, increases in constituent loads associated with a decline in pH will not occur.

The pH in the fine processed rock samples remained alkaline for the duration of the testing period. Loadings of all constituents decreased to steady-state conditions.

The loadings from the processed rock humidity cells were used to develop source terms that are carried forward into the water and load balance for the project (SRK 2021).

7.4.3 Lag Time to Acid Generation

The coarse processed rock sample became acidic after 1.3 years of testing. This occurred under laboratory conditions and represents a minimum lag time to acid generation for coarse processed rock. The 2018 fine processed rock sample sulfide is predicted to be depleted prior to the NP confirming the non-PAG classification of this sample based on the ABA results. The 2019 fine processed rock sample is expected to become acidic; however, based on the humidity cell reaction

rates, long lag times are expected (i.e., 20 years under laboratory conditions) prior to acid generation occurring.

7.5 Construction Materials

TML provided the following construction material samples to Bureau Veritas, formerly Maxxam Analytics for geochemical testing:

- Two samples representative of rock to be used for surfacing material for the Tenas Access Corridor;
- Five test pit samples collected along the proposed alignment of the Tenas Access Corridor that represent material that will be used for base and subbase materials; and
- Nine samples from four test pits around the proposed Rail Infrastructure.

All samples had lower sulfur content and modified NPs exceeding AP. As a result, all construction materials are non-PAG.

Compared to 10 times the average crustal abundances (Smith and Huyck 1999), tellurium was observed to be enriched in the solid phase in 60 % (9 of 15 samples) of the measurements

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and reviewed by

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA M. K. HERRELL #31209 GEOSCIENTIST November 15, 2024.

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Principal Consultant (Geochemistry)

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A – Mine Rock Sample Intervals for Static Testing

2018 Mine Rock Samples: Sample Selection for Static Test Work					
Hole-ID	**Sample ID**	**Sample Type**	**From (m)**	**To (m)**	**Mass (kg)**
T18-01D	T18-01D-A-001	ARD	9.98	12.03	27.4
T18-01D	T18-01D-A-002	ARD	12.03	13.29	16.9
T18-01D	T18-01D-A-003	ARD	13.29	15.8	33.6
T18-01D	T18-01D-A-004	ARD	15.8	17.2	18.7
T18-01D	T18-01D-A-005	ARD	17.2	21.31	55.0
T18-01D	T18-01D-A-006	ARD	21.89	22.08	2.5
T18-01D	T18-01D-A-007	ARD	24.7	24.84	1.9
T18-01D	T18-01D-A-008	ARD	24.84	27.7	38.3
T18-01D	T18-01D-A-009	ARD	27.7	30.1	32.1
T18-01D	T18-01D-A-010	ARD	30.1	33.7	48.2
T18-01D	T18-01D-A-011	ARD	33.7	36.53	37.9
T18-01D	T18-01D-A-012	ARD	38.52	39.2	9.1
T18-01D	T18-01D-A-013	ARD	40.3	43.93	48.6
T18-01D	T18-01D-A-014	ARD	43.93	44.39	6.2
T18-01D	T18-01D-A-015	ARD	44.75	47.2	32.8
T18-01D	T18-01D-A-016	ARD	47.2	50	37.5
T18-01D	T18-01D-A-017	ARD	50	50.72	9.6
T18-01D	T18-01D-A-018	ARD	51.02	53.2	29.2
T18-01D	T18-01D-A-019	ARD	53.2	56.2	40.1
T18-02D	T18-02D-A-001	ARD	8.35	12.03	49.2
T18-02D	T18-02D-A-002	ARD	12.03	15.3	43.8
T18-02D	T18-02D-A-003	ARD	15.3	18.58	43.9
T18-02D	T18-02D-A-004	ARD	18.58	21.3	36.4
T18-02D	T18-02D-A-005	ARD	21.3	24.3	40.1
T18-02D	T18-02D-A-006	ARD	24.3	27.3	40.1
T18-02D	T18-02D-A-007	ARD	27.3	28.8	20.1
T18-02D	T18-02D-A-008	ARD	28.8	30.3	20.1
T18-02D	T18-02D-A-009	ARD	30.3	32.88	34.5
T18-02D	T18-02D-A-010	ARD	32.88	33.94	14.2
T18-02D	T18-02D-A-011	ARD	33.94	36.86	39.1
T18-02D	T18-02D-A-012	ARD	36.86	39.3	32.6
T18-02D	T18-02D-A-013	ARD	39.3	41.75	32.8
T18-02D	T18-02D-A-014	ARD	41.75	45.18	45.9
T18-02D	T18-02D-A-015	ARD	45.18	48.3	41.7
T18-02D	T18-02D-A-016	ARD	48.3	48.76	6.2
T18-02D	T18-02D-A-017	ARD	50.44	50.5	0.8
T18-02D	T18-02D-A-018	ARD	50.5	52.8	30.8
T18-02D	T18-02D-A-019	ARD	52.8	54.3	20.1
T18-02D	T18-02D-A-020	ARD	54.3	58.08	50.6
T18-02D	T18-02D-A-021	ARD	58.08	60.3	29.7
T18-02D	T18-02D-A-022	ARD	60.3	63.3	40.1
T18-02D	T18-02D-A-023	ARD	63.3	66.3	40.1
T18-02D	T18-02D-A-024	ARD	66.3	67.8	20.1
T18-02D	T18-02D-A-025	ARD	67.8	68.56	10.2
T18-02D	T18-02D-A-026	ARD	75.62	78.3	35.9
T18-02D	T18-02D-A-027	ARD	78.3	79.35	14.0
T18-02D	T18-02D-A-028	ARD	79.35	79.54	2.5
T18-02D	T18-02D-A-029	ARD	79.54	80.72	15.8
T18-02D	T18-02D-A-030	ARD	79.54	84.3	63.7
T18-02D	T18-02D-A-031	ARD	84.3	84.53	3.1
T18-02D	T18-02D-A-032	ARD	84.53	86.64	28.2
T18-02D	T18-02D-A-033	ARD	86.64	87.48	11.2
T18-02D	T18-02D-A-034	ARD	87.48	88.8	17.7
T18-02D	T18-02D-A-035	ARD	88.8	90.3	20.1
T18-02D	T18-02D-A-036	ARD	90.3	90.93	8.4
T18-02D	T18-02D-A-037	ARD	90.93	92.52	21.3
T18-02D	T18-02D-A-038	ARD	92.52	94.29	23.7
T18-02D	T18-02D-A-039	ARD	94.29	94.8	6.8
T18-02D	T18-02D-A-040	ARD	94.8	96.3	20.1
T18-02D	T18-02D-A-041	ARD	96.3	97.8	20.1

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
T18-02D	T18-02D-A-042	ARD	97.8	99.3	20.1
T18-02D	T18-02D-A-043	ARD	99.3	100.8	20.1
T18-02D	T18-02D-A-044	ARD	100.8	102.3	20.1
T18-02D	T18-02D-A-045	ARD	102.3	103.8	20.1
T18-02D	T18-02D-A-046	ARD	103.8	105.3	20.1
T18-02D	T18-02D-A-047	ARD	105.3	106.8	20.1
T18-02D	T18-02D-A-048	ARD	106.8	107.92	15.0
T18-02D	T18-02D-A-049	ARD	107.92	108.3	5.1
T18-02D	T18-02D-A-050	ARD	108.3	109.8	20.1
T18-02D	T18-02D-A-051	ARD	109.8	111.21	18.9
T18-02D	T18-02D-A-052	ARD	111.21	111.3	1.2
T18-02D	T18-02D-A-053	ARD	111.3	111.95	8.7
T18-02D	T18-02D-A-054	ARD	111.95	112.6	8.7
T18-02D	T18-02D-A-055	ARD	112.6	112.8	2.7
T18-02D	T18-02D-A-056	ARD	112.8	114.3	20.1
T18-02D	T18-02D-A-057	ARD	114.3	114.91	8.2
T18-02D	T18-02D-A-058	ARD	114.91	115.8	11.9
T18-02D	T18-02D-A-059	ARD	115.8	117.3	20.1
T18-02D	T18-02D-A-060	ARD	117.3	118.8	20.1
T18-02D	T18-02D-A-061	ARD	118.8	120.3	20.1
T18-02D	T18-02D-A-062	ARD	120.3	121.8	20.1
T18-02D	T18-02D-A-063	ARD	121.8	123.3	20.1
T18-02D	T18-02D-A-064	ARD	123.3	124.8	20.1
T18-03D	T18-03D-A-005	ARD	10.78	10.8	0.3
T18-03D	T18-03D-A-006	ARD	12.57	12.82	3.3
T18-03D	T18-03D-A-007	ARD	12.82	13.44	8.3
T18-03D	T18-03D-A-008	ARD	13.44	14.08	8.6
T18-03D	T18-03D-A-009	ARD	17.54	18.46	12.3
T18-03D	T18-03D-A-010	ARD	19.02	19.37	4.7
T18-03D	T18-03D-A-011	ARD	19.37	19.97	8.0
T18-03D	T18-03D-A-012	ARD	19.97	20.5	7.1
T18-03D	T18-03D-A-013	ARD	20.5	22.25	23.4
T18-03D	T18-03D-A-014	ARD	22.25	23.16	12.2
T18-03D	T18-03D-A-015	ARD	23.16	23.56	5.4
T18-03D	T18-03D-A-016	ARD	23.56	25	19.3
T18-03D	T18-03D-A-017	ARD	25	26.12	15.0
T18-03D	T18-03D-A-018	ARD	26.12	28	25.2
T18-03D	T18-03D-A-019	ARD	28	29.06	14.2
T18-03D	T18-03D-A-020	ARD	29.06	30	12.6
T18-03D	T18-03D-A-021	ARD	30	32.5	33.5
T18-03D	T18-03D-A-022	ARD	32.5	32.9	5.4
T18-03D	T18-03D-A-023	ARD	32.9	33.05	2.0
T18-03D	T18-03D-A-024	ARD	33.05	34.53	19.8
T18-03D	T18-03D-A-025	ARD	34.53	35.5	13.0
T18-03D	T18-03D-A-026	ARD	35.5	36.26	10.2
T18-03D	T18-03D-A-027	ARD	36.26	38.5	30.0
T18-03D	T18-03D-A-028	ARD	38.5	39.08	7.8
T18-03D	T18-03D-A-029	ARD	39.08	40.49	18.9
T18-03D	T18-03D-A-030	ARD	40.49	41.5	13.5
T18-03D	T18-03D-A-031	ARD	41.5	43	20.1
T18-03D	T18-03D-A-032	ARD	43	44.4	18.7
T18-03D	T18-03D-A-033	ARD	44.4	46.4	26.8
T18-05D	28651	ARD	13.5	22.5	120.4
T18-05D	28652	ARD	22.5	23.2	9.4
T18-05D	28653	ARD	23.2	30.6	99.0
T18-05D	28654	ARD	30.6	33.5	38.8
T18-05D	28655	ARD	33.5	37.4	52.2
T18-05D	28656	ARD	37.4	38.9	20.1
T18-05D	28657	ARD	38.9	42.4	46.8
T18-05D	28658	ARD	42.4	46	48.2
T18-05D	28659	ARD	46	49.6	48.2

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
T18-05D	28660	ARD	49.6	53.2	48.2
T18-05D	28661	ARD	53.2	56.8	48.2
T18-05D	28662	ARD	56.8	59.6	37.5
T18-05D	28663	ARD	59.6	62.3	36.1
T18-05D	28664	ARD	62.3	65.3	40.1
T18-05D	28665	ARD	65.3	68.4	41.5
T18-05D	28666	ARD	68.4	71.4	40.1
T18-05D	28667	ARD	71.4	75.1	49.5
T18-05D	28668	ARD	75.1	78.6	46.8
T18-05D	28669	ARD	78.6	82.1	46.8
T18-05D	28670	ARD	82.1	85.6	46.8
T18-05D	28671	ARD	85.6	88.3	36.1
T18-05D	28672	ARD	88.3	91.4	41.5
T18-05D	28673	ARD	91.4	93.55	28.8
T18-05D	28674	ARD	93.55	94.25	9.4
T18-05D	28675	ARD	94.25	96.9	35.5
T18-05D	28676	ARD	96.9	99.2	30.8
T18-05D	28677	ARD	99.2	99.4	2.7
T18-05D	28678	ARD	101.6	101.9	4.0
T18-05D	28679	ARD	101.9	106.3	58.9
T18-05D	28680	ARD	106.3	108.7	32.1
T18-05D	28681	ARD	108.7	111.1	32.1
T18-05D	28682	ARD	111.1	111.3	2.7
T18-05D	28683	ARD	111.3	111.8	6.7
T18-05D	28684	ARD	111.8	112.3	6.7
T18-05D	28685	ARD	112.3	115.5	42.8
T18-05D	28686	ARD	115.5	118.7	42.8
T18-05D	28687	ARD	118.7	118.9	2.7
T18-05D	28688	ARD	126.2	126.4	2.7
T18-05D	28689	ARD	126.4	128.8	32.1
T18-05D	28690	ARD	128.8	131.2	32.1
T18-05D	28691	ARD	131.2	131.4	2.7
T18-05D	28704	ARD	131.4	132.2	10.7
T18-05D	28692	ARD	132.2	132.4	2.7
T18-05D	28693	ARD	132.4	133.2	10.7
T18-05D	28694	ARD	133.2	133.4	2.7
T18-05D	28695	ARD	133.4	134.4	13.4
T18-05D	28696	ARD	134.4	134.6	2.7
T18-05D	28697	ARD	134.6	135.3	9.4
T18-05D	28698	ARD	135.3	139.1	50.8
T18-05D	28699	ARD	139.1	139.3	2.7
T18-05D	28700	ARD	139.3	140.5	16.1
T18-05D	28705	ARD	140.5	141.2	9.4
T18-05D	28706	ARD	141.2	141.4	2.7
T18-05D	28707	ARD	141.4	142.1	9.4
T18-05D	28708	ARD	142.1	142.5	5.4
T18-05D	28709	ARD	142.5	143.9	18.7
T18-05D	28710	ARD	143.9	144.1	2.7
T18-05D	28711	ARD	144.1	144.4	4.0
T18-05D	28712	ARD	144.4	147.4	40.1
T18-05D	28713	ARD	147.4	147.7	4.0
T18-05D	28714	ARD	147.7	150.4	36.1
T18-05D	28715	ARD	150.4	151.7	17.4
T18-05D	28716	ARD	151.7	154.8	41.5
T18-05D	28717	ARD	154.8	158	42.8
T18-07D	28836	ARD	6.9	10.4	46.8
T18-07D	28837	ARD	10.4	14.8	58.9
T18-07D	28838	ARD	14.8	18.3	46.8
T18-07D	28839	ARD	18.3	22.2	52.2
T18-07D	28840	ARD	22.2	26.1	52.2
T18-07D	28841	ARD	26.1	30	52.2

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
T18-07D	28842	ARD	30	33.9	52.2
T18-07D	28843	ARD	33.9	38.2	57.5
T18-07D	28844	ARD	38.2	42.3	54.9
T18-07D	28845	ARD	42.3	44.2	25.4
T18-07D	28846	ARD	44.2	49.8	74.9
T18-07D	28847	ARD	49.8	52.8	40.1
T18-07D	28848	ARD	52.8	57.15	58.2
T18-07D	28849	ARD	57.15	61.5	58.2
T18-07D	28850	ARD	61.5	63.4	25.4
T18-07D	29501	ARD	63.4	66.8	45.5
T18-07D	29502	ARD	66.8	69.6	37.5
T18-07D	29503	ARD	69.6	72.4	37.5
T18-07D	29504	ARD	72.4	75.6	42.8
T18-07D	28786	ARD	75.6	78.8	42.8
T18-07D	29505	ARD	78.8	84	69.6
T18-07D	29506	ARD	84	86.9	38.8
T18-07D	29507	ARD	86.9	92.2	70.9
T18-07D	29508	ARD	92.2	96.3	54.9
T18-07D	29509	ARD	96.3	104.7	112.4
T18-07D	29510	ARD	104.7	107.8	41.5
T18-07D	29511	ARD	107.8	111.1	44.2
T18-07D	29512	ARD	111.1	114.2	41.5
T18-07D	29513	ARD	114.2	117.4	42.8
T18-07D	29514	ARD	117.4	120.6	42.8
T18-07D	29515	ARD	120.6	123.8	42.8
T18-07D	29516	ARD	123.8	127.5	49.5
T18-07D	29517	ARD	127.5	129.3	24.1
T18-07D	29518	ARD	129.3	132.4	41.5
T18-07D	29519	ARD	132.4	133.8	18.7
T18-07D	29520	ARD	133.8	134	2.7
T18-07D	29521	ARD	134	134.6	8.0
T18-07D	29522	ARD	134.6	135.55	12.7
T18-07D	29523	ARD	135.55	135.6	0.7
T18-07D	29524	ARD	135.6	136.4	10.7
T18-07D	29525	ARD	136.4	137	8.0
T18-07D	29526	ARD	137	140.1	41.5
T18-07D	29527	ARD	140.1	140.5	5.4
T18-07D	29528	ARD	140.5	141.5	13.4
T18-07D	29529	ARD	141.5	141.7	2.7
T18-07D	29530	ARD	141.7	143.6	25.4
T18-07D	29531	ARD	143.6	146	32.1
T18-07D	29532	ARD	146	146.5	6.7
T18-07D	29533	ARD	146.5	150.3	50.8
T18-07D	29534	ARD	150.3	153.7	45.5
T18-07D	29535	ARD	153.7	158.3	61.5

2019 Mine Rock Samples: Sample Selection for Static Test Work					
Hole-ID	**Sample ID**	**Sample Type**	**From (m)**	**To (m)**	**Mass (kg)**
19-09D	1146024	ARD	4.45	5.9	19.4
19-09D	1146025	ARD	5.9	8	28.1
19-09D	1146026	ARD	8.0	10.75	36.8
19-09D	1146030	ARD	13.25	14.75	20.1
19-09D	1146034	ARD	18.85	20.2	18.1
19-09D	1146035	ARD	20.2	21.9	22.7
19-09D	1146036	ARD	21.9	23.4	20.1
19-09D	1146037	ARD	23.4	24.9	20.1
19-09D	1146038	ARD	24.9	26.4	20.1
19-09D	1146046	ARD	26.4	26.8	5.4
19-09D	1146039	ARD	26.8	27.75	12.7
19-09D	1146040	ARD	27.9	28.7	10.7

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
19-09D	1146041	ARD	28.85	30.7	24.8
19-09D	1146042	ARD	30.7	32.7	26.8
19-09D	1146043	ARD	32.7	34	17.4
19-09D	1146044	ARD	34	35.4	18.7
19-09D	1146045	ARD	35.4	35.9	6.7
19-16D	1146051	ARD	6.4	8	21.4
19-16D	1146052	ARD	8.0	9.4	18.7
19-16D	1146053	ARD	9.4	11.7	30.8
19-16D	1146054	ARD	11.7	14.7	40.1
19-16D	1146055	ARD	14.7	17.7	40.1
19-16D	1146056	ARD	17.7	20.9	42.8
19-16D	1146057	ARD	20.9	22.1	16.1
19-16D	1146058	ARD	22.1	24.7	34.8
19-16D	1146059	ARD	24.7	26.3	21.4
19-16D	1146060	ARD	26.3	28.3	26.8
19-16D	1146061	ARD	28.3	30.2	25.4
19-16D	1146062	ARD	30.2	32.2	26.8
19-16D	1146063	ARD	32.2	34	24.1
19-16D	1146064	ARD	34	34.45	6.0
19-16D	1146068	ARD	36.35	38.7	31.4
19-16D	1146069	ARD	38.7	40.4	22.7
19-16D	1146070	ARD	40.4	43.2	37.5
19-16D	1146071	ARD	43.2	45.6	32.1
19-16D	1146072	ARD	45.6	49.2	48.2
19-16D	1146073	ARD	49.2	50.05	11.4
19-16D	1146079	ARD	56.55	58.75	29.4
19-16D	1146080	ARD	58.9	61	28.1
19-16D	1146081	ARD	61.15	61.85	9.4
19-16D	1146082	ARD	62	63.9	25.4
19-16D	1146083	ARD	64.05	67.6	47.5
19-16D	1146084	ARD	67.6	70	32.1
19-17D	1146085	ARD	8.4	8.7	4.0
19-17D	1146086	ARD	8.85	11.45	34.8
19-17D	1146087	ARD	11.6	12	5.4
19-17D	1146088	ARD	12.15	14.5	31.4
19-17D	1146089	ARD	14.5	17.45	39.5
19-17D	1146090	ARD	19.6	22	32.1
19-17D	1146091	ARD	22	25	40.1
19-17D	1146092	ARD	25	26.4	18.7
19-17D	1146093	ARD	26.4	29.5	41.5
19-17D	1146095	ARD	29.5	31.05	20.7
19-17D	1146098	ARD	37.05	38.8	23.4
19-17D	1146099	ARD	38.8	41.5	36.1
19-17D	1146100	ARD	41.5	42.75	16.7
19-17D	1146401	ARD	42.75	45.75	40.1
19-17D	1146402	ARD	45.75	47.5	23.4
19-17D	1146403	ARD	47.5	48.7	16.1
19-17D	1146404	ARD	48.7	50.5	24.1
19-17D	1146405	ARD	50.5	53.5	40.1
19-17D	1146406	ARD	53.5	54.95	19.4
19-17D	1146407	ARD	55.1	55.6	6.7
19-17D	1146408	ARD	55.75	56.75	13.4
19-17D	1146409	ARD	56.75	58.25	20.1
19-17D	1146410	ARD	58.25	59.2	12.7
19-18D	1146411	ARD	3	5.45	32.8
19-18D	1146414	ARD	7.35	9.2	24.8
19-18D	1146415	ARD	9.2	10	10.7
19-18D	1146416	ARD	10	13	40.1
19-18D	1146417	ARD	13	15.2	29.4
19-18D	1146418	ARD	15.2	17.75	34.1
19-18D	1146421	ARD	19.85	20.15	4.0

Hole-ID	Sample ID	Sample Type	From (m)	To (m)	Mass (kg)
19-18D	1146422	ARD	23.4	23.5	1.3
19-18D	1146423	ARD	23.5	25.8	30.8
19-18D	1146424	ARD	25.8	28.7	38.8
19-18D	1146425	ARD	28.7	31.3	34.8
19-18D	1146426	ARD	31.3	33.3	26.8
19-18D	1146427	ARD	33.3	35.5	29.4

Appendix B – Mine Rock Sample Selection for Kinetic Testing

Mine Rock Samples: Sample Selection for Kinetic Test Work

Zone	Sample Number	Zone Check	Rock Type	Sample Selected for XRD	Sample Selected for HCT	Paste pH	Sulfide (%)	AP (kg CaCO3/t)	Mod-NP (kg $CaCO_3$/t)	Sobek-NP (kg CaCO3/t)	CO3-NP (kg CaCO3/t)	Carbonate/ Mod-NP	NPR	As (ppm)	Se (ppm)	ARD Classification	Comments
1	28836	1	siltstone	x	x	8.24	0.71	22.1875	44.8	54.5	50	1.1	2.46	8.2	0.4	non-PAG	70th percentile S2- median NP 35% NPR 25th percentile As 95th percentile Se
	28661	1	siltstone	x		9.39	0.16	5	144	88.8	232	1.6	17.76	9.9	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
1a	T18-02D-A-011	1A	mudstone	x	x	8.22	2.26	70.625	23.8	63.5	82	3.5	0.90	13.5	0.3	PAG	75th percentile S2- minimum mod-NP Median NPR median As and Se Can be used to estimate AG onset (neutral paste pH, low NP)
	T18-02D-A-004	1A	mudstone	x		9.59	0.2	6.25	98.3	82.3	153	1.6	13.17	14	0.1	non-PAG	Mod-NP>>>>Sobek-NP
2-3	T18-02D-A-016	3	mudstone	x	x	3.78	3.33	104.0625	8	18	30	3.7	0.17	29.8	0.3	PAG	95th percentile S2- Low NP 75th percentile As and Se
	T18-01D-A-002	2	mudstone	x		6.65	3.22	100.625	90.3	67.5	93	1.0	0.67	6.8	0.2	PAG	Mod-NP>>>>Sobek-NP
4	28681	4	siltstone	x	x	8.24	1.43	44.6875	54	71.5	161	3.0	1.60	75.5	<0.1	Uncertain	80th percentile S2- Median NP 35th percentile NPR 90th percentile As Minimum/median Se
	T18-02D-A-019	4	mudstone	x		8.88	0.59	18.4375	112	75.3	224	2.0	4.08	8.8	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
5	28684	5	siltstone	x	x	6.13	1.75	54.6875	16.8	21.5	35	2.1	0.39	43.3	0.3	PAG	80th percentile S2- 20th percentile NP & NPR 80th percentile As 70th percentile Se
	T18-02D-A-021	5	bentonite layer	x		8.84	0.93	29.0625	194	92	348	1.8	3.17	9.7	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
55	T18-03D-A-006	55	mudstone	x	x	7.68	0.18	5.625	9.3	7.5	8	0.9	1.33	1.4	<0.1	Uncertain	Uncertain ARD potential 70th percentile S2- Minimum NP Median As Minimum Se
6	28704	6	siltstone	x	x	5.98	2.12	66.25	58	57.8	65	1.1	0.87	55.5	0.4	PAG	PAG 80th percentile S2- 75th percentile NP 80th percentile As 75th percentile Se
	T18-02D-A-028	6	mudstone	x		9.24	0.14	4.375	164	87	219	1.3	19.89	1.4	<0.1	non-PAG	Mod-NP>>>>Sobek-NP
7	T18-02D-A-034	7	mudstone	x	x	6.51	1.43	44.6875	15	12.5	15	1.0	0.28	21	0.2	PAG	75th percentile S2- 30th percentile NP Mod NP>>>Sobek-NP 10th percentile NPR 80th percentile As 10th percentile Se
8	28711	8	siltstone	x	x	7.62	0.23	7.1875	31.5	32.5	36	1.1	4.52	28.1	0.4	non-PAG	60th percentile S2- 40th percentile NPNP>>>Sobek-NP 25th percentile NPR Maximum As 90th percentile Se

Appendix C – Mine Rock ABA Analysis Results

Mine Rock Samples: ABA Results

Drill Hole	Sample Number	Maxxam Sample ID	Sample Depth (m)			ABA Zone	Class	Lithology	Paste pH (su)	Paste EC (µs/cm)	Carbon Species (w.t.%)				Sulphur Species (w.t.%)							Potentials (kg CaCO3/tonne)					Neutralization Potential Ratios					Mine Plan Inputs			
			From	To	Thickness						Total-C	Total Inorganic Carbon	CO2	CO3	Total-S	Sulphate	SICP	Sulphate (DL)	SICP (DL)	Sulphide (Total - SO4)	Sulphide (SICP - SO4)	AP (Total Sulphur)	AP (Sulphide)	CO3-NP	Sobek-NP	Modified Sobek-NP	CO3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)	Sulphide-S	AP	NP	NPR
2018 Sampling Programme																																			
T18-02D	T18-02D-A-001	TD3978	8.35	12.03	3.68	1	waste	MDST	8.8	709	2.8	1.2	4.5	6.1	0.23	0.02	0.19	0.02	0.19	0.21	0.17	7.2	5.3	101	64	45	14	8.9	6.2	12	8.4	0.2	5	45	8.4
T18-02D	T18-02D-A-002	TD3979	12.03	15.3	3.27	1	waste	MDST	9.1	955	3.4	1.3	4.9	6.7	0.21	0.01	0.16	0.01	0.16	0.2	0.15	6.6	4.7	111	61	46	17	9.3	6.9	13	9.7	0.2	5	46	9.7
T18-02D	T18-02D-A-003	TD3980	15.3	18.58	3.28	1	waste	MDST	9.5	1020	3.7	2.0	7.3	9.9	0.19	0.02	0.16	0.02	0.16	0.17	0.14	5.9	4.4	166	78	92	28	13	16	18	21	0	4	92	21
T18-02D	T18-02D-A-004	TD3981	18.58	21.3	2.72	1	waste	MDST	9.6	1040	3.9	1.8	6.7	9.1	0.26	0.01	0.21	0.01	0.21	0.25	0.2	8.1	6.3	153	82	98	19	10	12	13	16	0	6	98	16
T18-02D	T18-02D-A-005	TD3983	21.3	24.3	3	1	waste	MDST	8.9	1230	3.8	1.3	4.9	6.6	0.43	0.02	0.36	0.02	0.36	0.41	0.34	13	11	111	72	46	8.2	5.3	3.4	6.8	4.3	0.3	11	46	4.3
T18-02D	T18-02D-A-006	TD3984	24.3	27.3	3	1	waste	MDST	8.8	1770	2.7	1.5	5.6	7.6	0.55	0.02	0.48	0.02	0.48	0.53	0.46	17	14	126	72	54	7.3	4.2	3.1	5.0	3.7	0.5	14	54	3.7
T18-05D	28651	TH0788	13.5	22.5	9	1	waste	SLST	8.4	2210	2.2	0.89	3.25	4.4	0.42	0.05	0.39	0.05	0.39	0.37	0.34	13	11	74	68	24	5.6	5.2	1.8	6.4	2.3	0.3	11	24	2.3
T18-05D	28652	TH0789	22.5	23.2	0.7	1	waste	SLST	8.1	3350	2.8	1.1	4.0	5.4	1.4	0.09	1.4	0.09	1.4	1.3	1.3	44	40	91	77	34	2.1	1.7	0.78	1.9	0.85	1.29	40	34	0.85
T18-05D	28653	TH0790	23.2	30.6	7.4	1	waste	SLST	9.2	2040	3.3	1.7	6.4	8.7	0.8	0.04	0.81	0.04	0.81	0.76	0.77	25	24	145	81	68	5.8	3.2	2.7	3.4	2.8	0.8	24	68	2.8
T18-05D	28654	TH0791	30.6	33.5	2.9	1	waste	SLST	9.5	2080	3.4	1.6	6.0	8.2	0.19	0.02	0.17	0.02	0.17	0.17	0.15	5.9	4.7	136	83	48	23	14	8.1	18	10	0	5	48	10
T18-05D	28655	TH0792	33.5	37.4	3.9	1	waste	SLST	9.4	1690	2.9	1.3	4.6	6.3	0.41	0.02	0.42	0.02	0.42	0.39	0.4	13	13	104	79	37	8.1	6.2	2.8	6.3	2.9	0.4	13	37	2.9
T18-05D	28656	TH0793	37.4	38.9	1.5	1	waste	SLST	9.5	1480	2.8	1.4	5.0	6.9	0.33	0.02	0.34	0.02	0.34	0.31	0.32	10	10	114	82	55	11	7.9	5.3	8.2	5.5	0.3	10	55	5.5
T18-05D	28657	TH0794	38.9	42.4	3.5	1	waste	SLST	9.3	1700	2.7	1.6	5.7	7.8	0.5	0.03	0.49	0.03	0.49	0.47	0.46	16	14	130	68	59	8.3	4.3	3.8	4.7	4.1	0.5	14	59	4.1
T18-05D	28658	TH0795	42.4	46	3.6	1	waste	SLST	8.0	1510	2.7	1.5	5.5	7.5	0.63	0.02	0.6	0.02	0.6	0.61	0.58	20	18	124	80	55	6.3	4.1	2.8	4.4	3.03	0.58	18	55	3.0
T18-05D	28659	TH0796	46	49.6	3.6	1	waste	SLST	9.5	1500	2.8	1.7	6.1	8.3	0.86	0.02	0.86	0.02	0.86	0.84	0.84	27	26	139	85	83	5.2	3.2	3.1	3.2	3.1	0.8	26	83	3.1
T18-05D	28660	TH0797	49.6	53.2	3.6	1	waste	SLST	9.4	1420	2.9	1.4	5.2	7.1	0.45	0.02	0.44	0.02	0.44	0.43	0.42	14	13	118	80	45	8.4	5.7	3.2	6.1	3.4	0.4	13	45	3.4
T18-05D	28661	TH0799	53.2	56.8	3.6	1	waste	SLST	9.4	1350	4.3	2.8	10.2	14	0.19	0.02	0.18	0.02	0.18	0.17	0.16	5.9	5.0	232	89	144	39	15	24	18	29	0.16	5	144	29
T18-05D	28662	TH0800	56.8	59.6	2.8	1	waste	SLST	9.4	1300	3.2	1.6	5.9	8.0	0.17	0.01	0.16	0.01	0.16	0.16	0.15	5.3	4.7	133	79	61	25	15	11	17	13	0	5	61	13
T18-05D	28663	TH0801	59.6	62.3	2.7	1	waste	SLST	9.3	1360	3.1	1.4	5.0	6.9	0.25	0.02	0.24	0.02	0.24	0.23	0.22	7.8	6.9	114	78	49	15	10.0	6.3	11	7.1	0.2	7	49	7.1
T18-05D	28664	TH0802	62.3	65.3	3	1	waste	SLST	9.4	1220	3.0	1.5	5.4	7.3	0.12	0.01	0.12	0.01	0.12	0.11	0.11	3.8	3.4	122	76	62	32	20	17	22	18	0	3	62	18
T18-05D	28665	TH0803	65.3	68.4	3.1	1	waste	SLST	9.2	1300	3.2	1.5	5.5	7.5	0.28	0.02	0.28	0.02	0.28	0.26	0.26	8.8	8.1	126	78	56	14	8.9	6.4	9.6	6.9	0.3	8	56	6.9
T18-05D	28666	TH0804	68.4	71.4	3	1	waste	SLST	9.2	1310	4.1	2.4	8.9	12.1	0.26	0.02	0.25	0.02	0.25	0.24	0.23	8.1	7.2	202	81	67	25	10	8.2	11	9.3	0.2	7	67	9.3
T18-05D	28667	TH0805	71.4	75.1	3.7	1	waste	SLST	9.3	1300	4.4	2.3	8.5	11.5	0.25	0.02	0.24	0.02	0.24	0.23	0.22	7.8	6.9	192	82	73	25	10	9.3	12	11	0	7	73	11
T18-05D	28668	TH0806	75.1	78.6	3.5	1	waste	SLST	9.2	1790	3.6	2.0	7.2	9.8	0.44	0.02	0.4	0.02	0.4	0.42	0.38	14	12	164	73	85	12	5.3	6.2	6.1	7.1	0.4	12	85	7.1
T18-05D	28669	TH0807	78.6	82.1	3.5	1	waste	SLST	8.5	1840	2.8	1.4	5.3	7.2	0.78	0.02	0.75	0.02	0.75	0.76	0.73	24	23	119	83	57	4.9	3.4	2.4	3.6	2.5	0.7	23	57	2.5
T18-05D	28670	TH0808	82.1	85.6	3.5	1	waste	SLST	9.1	1710	3.4	2.2	8.2	11.2	0.89	0.03	0.83	0.03	0.83	0.86	0.8	28	25	187	86	117	6.7	3.1	4.2	3.4	4.7	0.8	25	117	4.7
T18-07D	28836	TH0854	6.9	10.4	3.5	1	waste	MDST	8.2	1400	2.0	0.59	2.18	3.0	0.74	0.02	0.73	0.02	0.73	0.72	0.71	23	22	50	55	45	2.1	2.4	1.9	2.5	2.0	0.7	22	45	2.0
T18-01D	T18-01D-A-002	TD3951	13.6	14	0.4	2	1	C	6.7	89	67	1.1	4.1	5.6	4.0	0.02	3.2	0.02	3.2	3.9	3.2	124	101	93	68	90	0.75	0.55	0.73	0.67	0.9	3.22	101	90	0.9
T18-01D	T18-01D-A-001	TD3950	12.38	13.6	1.22	2	waste	MDST	6.8	1701	4.3	0.67	2.47	3.4	2.4	0.06	2.1	0.06	2.1	2.3	2.0	74	63	56	51	32	0.76	0.69	0.43	0.8	0.5	2.03	63	32	0.5
T18-02D	T18-02D-A-012	TD3990	36.86	39.3	2.44	2	waste	SLST	8.5	1140	4.8	0.58	2.12	2.9	2.5	0.02	2.2	0.02	2.2	2.5	2.2	77	67	48	29	14	0.62	0.38	0.18	0.44	0.21	2.15	67	14	0.21
T18-02D	T18-02D-A-013	TD3991	39.3	41.75	2.45	2	waste	SLST	8.2	877	18	0.35	1.3	1.8	1.8	0.02	1.6	0.02	1.6	1.8	1.6	57	50	30	25	15	0.52	0.43	0.25	0.5	0.29	1.59	50	15	0.29
T18-05D	28673	TH0812	91.4	93.97	2.57	2	waste	MDST	6.8	2920	4.2	0.59	2.16	2.9	2.1	0.07	2.1	0.07	2.1	2.1	2.1	67	64	49	34	21	0.74	0.5	0.32	0.52	0.33	2.06	64	21	0.33
T18-05D	28674	TH0813	93.97	94.61	0.64	2	waste	C	3.4	710	67	0.15	0.56	0.76	3.0	0.11	2.7	0.11	2.7	2.9	2.6	95	81	13	14	15	0.13	0.15	0.15	0.17	0.18	2.58	81	15	0.18
T18-01D	T18-01D-A-006	TD3955	18.70	19.000	0.3	3	1	C	8.7	824	2.8	0.92	3.38	4.6	0.24	0.02	0.19	0.02	0.19	0.22	0.17	7.5	5.3	77	69	17	10	9.2	2.2	13	3.1	0.2	5	17	3.1
T18-01D	T18-01D-A-003	TD3952	14.00	15.8	1.8	3	waste	MDST	8.3	865	3.3	0.67	2.47	3.4	1.2	0.02	1.0	0.02	1.0	1.1	1.0	36	32	56	56	16	1.5	1.5	0.44	1.8	0.51	1.01	32	16	0.51
T18-01D	T18-01D-A-004	TD3953	15.8	17.2	1.4	3	waste	MDST	8.5	871	3.1	1.5	5.7	7.7	1.3	0.02	1.1	0.02	1.1	1.3	1.1	40	34	129	84	51	3.2	2.1	1.3	2.5	1.5	1.1	34	51	1.5
T18-01D	T18-01D-A-005	TD3954	17.2	18.70	1.5	3	waste	MDST	8.4	824	4.7	1.4	5.2	7.1	1.0	0.02	0.85	0.02	0.85	1.0	0.83	33	26	118	80	51	3.6	2.5	1.6	3.1	2.0	0.8	26	51	2.0
T18-01D	T18-01D-A-007	TD3956	19.000	21.31	2.31	3	waste	MDST	8.7	829	5.6	2.4	8.8	12.0	0.67	0.02	0.52	0.02	0.52	0.65	0.5	21	16	200	82	54	9.6	3.9	2.6	5.2	3.5	0.5	16	54	3.5
T18-02D	T18-02D-A-014	TD3992	41.75	45.18	3.43	3	waste	MDST	9.3	1120	4.7	1.7	6.4	8.7	0.56	0.01	0.41	0.01	0.41	0.55	0.4	18	13	144	70	68	8.3	4.0	3.9	5.6	5.4	0.4	13	68	5.4
T18-02D	T18-02D-A-015	TD3994	45.18	48.3	3.12	3	waste	MDST	9.1	855	4.3	0.98	3.6	4.9	0.7	0.01	0.57	0.01	0.57	0.69	0.56	22	18	82	50	50	3.7	2.3	2.3	2.8	2.8	0.6	18	50	2.8
T18-02D	T18-02D-A-016	TD3995	48.3	48.76	0.46	3	waste	MDST	3.8	2900	6.6	0.36	1.31	1.8	3.9	0.13	3.5	0.13	3.5	3.7	3.3	121	104	30	18	8	0.25	0.15	0.07	0.17	0.08	3.33	104	8	0.08
T18-05D	28675	TH0814	94.61	96.9	2.29	3	waste	MDST	7.5	1400	5.1	0.52	1.92	2.6	2.0	0.03	1.9	0.03	1.9	1.9	1.9	61	58	44	30	23	0.71	0.49	0.37	0.51	0.39	1.87	58	23	0.39
T18-05D	28676	TH0815	96.9	97.61	0.71	3	waste	SLST	6.6	2950	8.5	0.91	3.33	4.5	2.0	0.1	2.0	0.1	2.0	1.9	1.9	64	60	76	57	34	1.2	0.9	0.54	0.96	0.57	1.92	60	34	0.57
T18-05D	28677	TH0816	97.61	99.97	2.36	3	waste	SLST	3.4	2360	7.6	0.29	1.07	1.5	3.5	0.2	3.4	0.2	3.4	3.3	3.2	108	101	24	7.3	-0.3	0.23	0.068	-0.003	0.072	-0.003	3.23	101	0	-0.003
T18-01D	T18-01D-A-008	TD3957	22.89	27.7	4.81	4	waste	MDST	9.0	910	4.1	2.3	8.4	11.5	0.7	0.02	0.58	0.02	0.58	0.68	0.56	22	18	192	86	94	8.8	3.9	4.3	4.9	5.4	0.6	18	94	5.4
T18-01D	T18-01D-A-009	TD3958	27.7	30	2.3	4	waste	MDST	7.8	1593	10	1.7	6.3	8.6	1.3	0.04	1.2	0.04	1.2	1.3	1.1	42	35	144	80	52	3.4	1.9	1.2	2.3	1.5	1.1	35	52	1.5
T18-02D	T18-02D-A-017	TD3996	50.44	50.5	0.06	4	waste	MDST	7.8	1520	10	0.19	0.68	0.93	0.47	0.03	0.3	0.03	0.3	0.44	0.27	15	8.4	15	19	18	1.1	1.3	1.2	2.2	2.2	0.3	8	18	2.2
T18-02D	T18-02D-A-018	TD3997	50.5	52.8	2.3	4	waste	MDST	9.2	790	3.5	2.0	7.2	9.7	0.51	0.01	0.4	0.01	0.4	0.5	0.39	16	12	163	63	58	10	3.9	3.7	5.2	4.8	0.4	12	58	4.8
T18-02D	T18-02D-A-019	TD3998	52.8	54.3	1.5	4	waste	MDST	8.9	1110	4.3	2.7	9.9	13.4	0.77	0.01	0.6	0.01	0.6	0.76	0.59	24	18	224	75	112	9.3	3.1	4.7	4.1	6.1	0.6	18	112	6.1
T18-02D	T18-02D-A-020	TD3999	54.3	58.08	3.78	4	waste	MDST	9.2	1710	4.3	0.83	3.03	4.1	1.8	0.03	1.6	0.03	1.6	1.8	1.6	56	49	69	61	63	1.2	1.1	1.1	1.2	1.3	1.6	49	63	1.3
T18-05D	28678	TH0817	101.97	102.17	0.2	4	waste	SLST	8.6	968	5.4	0.37	1.34	1.8	0.12	0.01	0.08	0.01	0.08	0.11	0.07	3.8	2.2	30	13	11	8.1	3.5	2.9	6.1	5.0	0.1	2	11	5.0
T18-05D	28679	TH0818	102.17	106.3	4.13	4	waste	SLST	9.5	1270	3.0	1.4	5.1	6.9	0.32	0.02	0.33	0.02	0.33	0.3	0.31	10	9.7	115	71	57	12	7.1	5.7	7.3	5.9	0.3	10	57	5.9
T18-05D	28680	TH0819	106.3	108.7	2.4	4	waste	SLST	9.5	946	3.9	2.3	8.4	11.5	0.29	0.01	0.29	0.01	0.29	0.28	0.28	9.1	8.8	191	63	61	21	7.0	6.8	7.2	7.0	0.3	9	61	7.0
T18-05D	28681	TH0821	108.7	111.1	2.4	4	waste	SLST	8.2	1310	4.9	1.9	7.1	9.6	1.7	0.03	1.5	0.03	1.5	1.6	1.4	52	45	161	72	54	3.1	1.4	1.0	1.6	1.2	1.4	45	54	1.2
T18-05D	28682	TH0822	111.1	111.9	0.8	4	waste	MDST	8.1	1460	5.2	0.45	1.65	2.2	1.8	0.03	1.7	0.03	1.7	1.7	1.6	55	51	38	28	24	0.68	0.51	0.43	0.55	0.47	1.62	51	24	0.47
T18-05D	28683	TH0823	111.9	112.1	0.2	4	waste	C	3.7	1780	52	0.68	2.49	3.4	3.9	0.21	3.5	0.21	3.5	3.7	3.3	122	103	57	45	41	0.46	0.37	0.34	0.44	0.4	3.3	103	41	0.4
T18-01D	T18-01D-A-010	TD3959	30	33.7	3.7	5	waste	SLST	8.1	889	2.2	0.64	2.33	3.2	0.68	0.02	0.61	0.02	0.61	0.66	0.59	21	18	53	44	28	2.5	2.1	1.3	2.4	1.5	0.6	18	28	1.5
T18-01D	T18-01D-A-011	TD3961	33.7	36.39	2.69	5	waste	SLST	8.0	953	2.6	0.39	1.44	2.0	0.82	0.02	0.69	0.02	0.69	0.8	0.67	26	21	33	34	26	1.3	1.3	1.0	1.6	1.2	0.7	21	26	1.2
T18-02D	T18-02D-A-021	TD4000	58.08	60.3	2.22	5	waste	SLST	8.8	831	6.0	4.2	15.3	21	1.2	0.01	0.94	0.01	0.94	1.1	0.93	36	29	348	92	194	9.7	2.6	5.4	3.2	6.7	0.9	29	194	6.7
T18-02D	T18-02D-A-022	TD4001	60.3	63.3	3	5	waste	SLST	9.0	1030	2.4	0.48	1.77	2.4	0.68	0.02	0.53	0.02	0.53	0.66	0.51	21	16	40	29	29	1.9	1.4	1.4	1.8	1.8	0.5	16	29	1.8
T18-02D	T18-02D-A-023	TD4002	63.3	66.3	3	5	waste	SLST	9.2	577	3.9	2.1	7.7	10.6	0.48	0.02	0.35	0.02	0.35	0.46	0.33	15	10	176	70	71	12	4.6	4.7	6.7	6.8	0.3	10	71	6.8
T18-02D	T18-02D-A-024	TD4003	66.3	67.8	1.5	5	waste	SLST	7.6	1030	5.1	0.41	1.49	2.0	1.7	0.02	1.4	0.02	1.4	1.7	1.3	52	42	34	24	23	0.65	0.46	0.44	0.58	0.55	1.33	42	23	0.55
T18-02D	T18-02D-A-025	TD4005	67.8	68.56	0.76	5	waste	SLST	5.3	1780	5.0	0.27	0.98	1.34	2.4	0.06	2.1	0.06	2.1	2.4	2.1	76	64	22	14	14	0.29	0.18	0.18	0.21	0.21	2.06	64	14	0.21
T18-03D	T18-03D-A-005	TD4051	10.5	10.8	0.3	5	waste	MDST	6.4	1470	3.5	0.56	2.07	2.8	2.2	0.06	2.0	0.06	2.0	2.2	2.0	70	62	47	33	30	0.67	0.48	0.43	0.54	0.49	1.98	62	30	0.49
T18-05D	28684	TH0824	112.1	112.6	0.5	5	waste	SLST	6.1	2660	5.2	0.42	1.55	2.1	2.0	0.1	1.9	0.1	1.9	1.9	1.8	63	55	35	22	17	0.56	0.34	0.27	0.39	0.31	1.75	55	17	0.31
T18-05D	28685	TH0825	112.6	115.5	2.9	5	waste	SLST	9.2	674	6.6	4.5	16.4	22	0.44	0.02	0.39	0.02	0.39	0.42	0.37	14	12	372	80	109	27	5.8	7.9	6.9	9.4	0.4	12	109	9.4
T18-05D	28686	TH0826	115.5	119.3	3.8	5	waste	SLST	8.1	865	4.8	1.2	4.3	5.8	1.3	0.02	1.2	0.02	1.2	1.2	1.2	39	37	98	63	48	2.5	1.6	1.2	1.7	1.3	1.2	37	48	1.3
T18-05D	28687	TH0827	119.3	119.5	0.2	5	waste	SLST	4.8	1810	6.5	0.22	0.82	1.12	1.4	0.07	1.5	0.07	1.5	1.4	1.4	45	43	19	8.3	5.3	0.42	0.19	0.12	0.19	0.12	1.39	43	5	0.12
T18-03D	T18-03D-A-010	TD4056	18.6	19.4	0.8	6	1	C	8.3	228	5.3	0.15	0.55	0.75	0.2	<0.01	0.13	0.005	0.13	0.2	0.13	6.3	3.9	13	13	13	2.0	2.0	2.0	3.3	3.2	0.1	4	13	3.2
T18-03D	T18-03D-A-011	TD4058	19.4	19.6	0.2	6	1	C	8.3	474	34	0.32	1.17	1.6	0.77	0.01	0.4	0.01	0.4	0.76	0.39	24	12	27	27	26	1.1	1.1	1.1	2.2	2.1	0.4	12	26	2.1
T18-03D	T18-03D-A-022	TD4070	32.25	32.65	0.4	6	8	SHC	7.6	662	30	0.18	0.66	0.9	1.3	0.02	1.3	0.02	1.3	1.3	1.3	42	41	15	12	6.0	0.36	0.28	0.14	0.29	0.15	1.31	41	6	0.15
T18-01D	T18-01D-A-012	TD3962	38.52	40.71	2.19	6	waste	FLT	7.6	1890	13	1.5	5.5	7.4	5.0	0.12	4.5	0.12	4.5	4.9	4.4	156	136	124	87	105	0.8	0.56	0.67	0.64	0.77	4.35	136	105	0.77
T18-01D	T18-01D-A-013	TD3963	40.71	43.93	3.22	6	waste	MDST	8.7	928	5.2	1.8	6.6	8.9	1.1	0.03	0.92	0.03	0.92	1.1	0.89	34	28	149	85	89	4.4	2.5	2.6	3.0	3.2	0.9	28	89	3.2
T18-01D	T18-01D-A-014	TD3964	43.93	44.75	0.82	6	waste	MDST	8.9	424	5.3	4.0	14.8	20	0.27	0.01	0.23	0.01	0.23	0.26	0.22	8.4	6.9	336	82	47	40	9.7	5.6	12	6.8	0.2	7	47	6.8
T18-02D	T18-02D-A-026	TD4006	75.62	78.3	2.68	6	waste	SLST	8.3	592	2.6	0.93	3.39	4.6	0.87	0.02	0.72	0.02	0.72	0.85	0.7	27	22	77	54	45	2.8	2.0	1.6	2.5	2.0	0.7	22	45	2.0
T18-02D	T18-02D-A-027	TD4007	78.3	79.35	1.05	6	waste	SLST	6.8	1100	3.7	0.54	1.98	2.7	2.6	0.03	2.3	0.03	2.3	2.6	2.2	81	70	45	30	24	0.56	0.37	0.29	0.43	0.34	2.23	70	24	0.34
T18-02D	T18-02D-A-028	TD4008	79.35	79.54	0.19	6	waste	MDST	9.2	345	5.5	2.6	9.6	13.1	0.26	0.01	0.15	0.01	0.15	0.25	0.14	8.1	4.4	219	87	164	27	11	20	20	37	0	4	164	37
T18-02D	T18-02D-A-029	TD4009	79.54	80.72	1.18	6	waste	MDST	6.3	1730	7.3	0.79	2.89	3.9	2.1	0.06	1.8	0.06	1.8	2.1	1.8	66	55	66	44	43	1.0	0.66	0.65	0.8	0.79	1.75	55	43	0.79
T18-03D	T18-03D-A-009	TD4055	17.5	18.6	1.1	6	waste	MDST	7.2	1370	5.0	0.55	2.03	2.8	1.3	0.05	1.1	0.05	1.1	1.3	1.0	42	33	46	37	34	1.1	0.89	0.81	1.1	1.0	1.0	33	34	1.0
T18-03D	T18-03D-A-012	TD4059	19.6	20.5	0.9	6	waste	MDST	8.8	590	2.1	0.29	1.06	1.4	0.1	0.01	0.07	0.01	0.07	0.09	0.06	3.1	1.9	24	16	16	7.7	5.0	5.0	8.3	8.3	0.1	2	16	8.3
T18-03D	T18-03D-A-013	TD4060	20.5	22.25	1.75	6	waste	MDST	8.7	630	3.3	0.96	3.53	4.8	0.09	0.01	0.06	0.01	0.06	0.08	0.05	2.8	1.6	80	51	37	29	18	13	32	24	0	2	37	24
T18-03D	T18-03D-A-014	TD4061	22.25	23.16	0.91	6	waste	MDST	9.6	623	5.1	3.6	13.4	18	0.04	0.01	<0.05	0.01	0.025	0.03	0.015	1.3	0.47	304	64	55	243	51	44	136	116	0	0	55	116
T18-03D	T18-03D-A-015	TD4062	23.16	23.56	0.4	6	waste	MDST	9.4	802	5.1	1.5	5.5	7.4	0.08	0.01	<0.05	0.01	0.025	0.07	0.015	2.5	0.47	124	57	51	50	23	20	122	108	0	0	51	108
T18-03D	T18-03D-A-016	TD4063	23.56	25	1.44	6	waste	MDST	9.6	897	5.1	2.6	9.4	12.8	0.07	0.02	<0.05	0.02	0.025	0.05	0.005	2.2	0.16	214	79	94	98	36	43	508	598	0	0	94	598
T18-03D	T18-03D-A-017	TD4064	25	26.12	1.12	6	waste	MDST	9.6	701	4.6	1.6	5.9	8.0	0.08	0.01	<0.05	0.01	0.025	0.07	0.015	2.5	0.47	134	68	77	54	27	31	145	164	0	0	77	164
T18-03D	T18-03D-A-018	TD4065	26.12	28	1.88	6	waste	MDST	7.4	1900	3.0	0.54	1.99	2.7	0.45	0.05	0.45	0.05	0.45	0.4	0.4	14	13	45	32	28	3.2	2.3	2.0	2.5	2.2	0.4	13	28	2.2
T18-03D	T18-03D-A-019	TD4066	28	29.06	1.06	6	waste	MDST	7.8	2350	2.8	1.6	5.8	7.9	0.47	0.07	0.49	0.07	0.49	0.4	0.42	15	13	133	63	70	9.0	4.3	4.8	4.8	5.4	0.4	13	70	5.4
T18-03D	T18-03D-A-020	TD4067	29.06	30	0.94	6	waste	MDST	8.5	1120	3.5	0.81	2.97	4.0	0.26	0.02	0.29	0.02	0.29	0.24	0.27	8.1	8.4	68	45	34	8.3	5.5	4.2	5.3	4.1	0.3	8	34	4.1
T18-03D	T18-03D-A-021	TD4069	30	32.25	2.25	6	waste	MDST	8.7	1100	3.8	0.56	2.06	2.8	0.29	0.02	0.35	0.02	0.35	0.27	0.33	9.1	10	47	26	19	5.2	2.8	2.1	2.5	1.8	0.3	10	19	1.8
T18-05D	28688	TH0828	126.6	126.8	0.2	6	waste	MDST	8.0	583	6.0	0.22	0.8	1.09	0.29	0.02	0.28	0.02	0.28	0.27	0.26	9.1	8.1	18	14	11	2.0	1.5	1.2	1.7	1.4	0.3	8	11	1.4
T18-05D	28689	TH0829	126.8	128.8	2	6	waste	MDST	8.1	729	2.1	0.55	2.01	2.7	0.4	0.03	0.41	0.03	0.41	0.37	0.38	13	12	46	33	29	3.7	2.6	2.3	2.7	2.5	0.4	12	29	2.5

Drill Hole	Sample Number	Maxxam Sample ID	Sample Depth (m)			ABA Zone	Class	Lithology	Paste pH (su)	Paste EC (µs/cm)	Carbon Species (w.t.%)				Sulphur Species (w.t.%)							Potentials (kg CaCO3/tonne)					Neutralization Potential Ratios					Mine Plan Inputs			
			From	To	Thickness						Total-C	Total Inorganic Carbon	CO2	CO3	Total-S	Sulphate	SICP	Sulphate (DL)	SICP (DL)	Sulphide (Total - SO4)	Sulphide (SICP - SO4)	AP (Total Sulphur)	AP (Sulphide)	CO3-NP	Sobek-NP	Modified Sobek-NP	CO3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)	Sulphide-S	AP	NP	NPR
T18-05D	28690	TH0830	128.8	131.6	2.8	6	waste	MDST	6.7	1300	8.0	0.62	2.27	3.1	2.5	0.04	2.5	0.04	2.5	2.5	2.5	79	77	52	37	34	0.65	0.46	0.43	0.47	0.44	2.46	77	34	0.44
T18-05D	28691	TH0832	131.6	131.9	0.3	6	waste	MDST	3.0	1400	59	0.17	0.62	0.85	2.6	0.13	2.4	0.13	2.4	2.5	2.2	82	70	14	13	8	0.17	0.15	0.1	0.18	0.11	2.24	70	8	0.11
T18-05D	28704	TH0843	131.9	132.2	0.3	6	waste	C	6.0	1170	42	0.78	2.84	3.9	2.3	0.07	2.2	0.07	2.2	2.3	2.1	73	66	65	58	58	0.89	0.79	0.8	0.87	0.88	2.12	66	58	0.88
T18-05D	28692	TH0833	132.2	132.5	0.3	6	waste	P	3.0	3320	4.3	0.14	0.51	0.7	2.5	0.25	2.5	0.25	2.5	2.2	2.2	78	69	12	51	-2	0.15	0.66	0	0.74	0	2	69	-2	0
T18-05D	28693	TH0834	132.5	132.85	0.35	6	waste	C	5.7	365	75	0.26	0.97	1.32	1.5	0.06	1.1	0.06	1.1	1.4	1.1	47	33	22	20	21	0.47	0.42	0.44	0.59	0.63	1.06	33	21	0.63
T18-05D	28694	TH0835	132.85	133.6	0.75	6	waste	MDST	9.1	483	5.1	1.8	6.6	9.1	0.18	0.02	0.17	0.02	0.17	0.16	0.15	5.6	4.7	151	86	127	27	15	23	18	27	0	5	127	27
T18-05D	28695	TH0836	133.6	134.4	0.8	6	waste	MDST	8.7	776	5.2	3.2	11.9	16	0.37	0.02	0.36	0.02	0.36	0.35	0.34	12	11	270	74	80	23	6.4	6.9	7.0	7.5	0.3	11	80	7.5
T18-05D	28696	TH0837	134.4	135	0.6	6	waste	MDST	6.6	2610	11	1.1	4.0	5.5	5.9	0.17	5.6	0.17	5.6	5.8	5.4	186	170	91	79	88	0.49	0.42	0.47	0.46	0.52	5.43	170	88	0.52
T18-05D	28697	TH0838	135	135.8	0.8	6	waste	C	5.6	1030	61	0.28	1.01	1.4	3.2	0.11	3.1	0.11	3.1	3.1	3.0	101	95	23	24	24	0.23	0.23	0.24	0.25	0.25	3.03	95	24	0.25
T18-07D	29516	TH0888	123.8	127.5	3.7	6	waste	MDST	8.2	1720	9.0	0.34	1.24	1.7	2.0	0.04	2.0	0.04	2.0	2.0	2.0	63	62	28	26	17	0.44	0.41	0.27	0.42	0.28	1.99	62	17	0.28
T18-07D	29517	TH0889	127.5	129.3	1.8	6	waste	SLST	8.6	1280	3.0	1.2	4.3	5.8	0.19	0.03	0.17	0.03	0.17	0.16	0.14	5.9	4.4	97	49	26	16	8.2	4.4	11	6.0	0.1	4	26	6.0
T18-07D	29518	TH0890	129.3	132.4	3.1	6	waste	SST	8.3	1550	3.3	0.49	1.8	2.5	1.1	0.04	1.1	0.04	1.1	1.1	1.1	35	34	41	26	17	1.2	0.74	0.47	0.77	0.48	1.09	34	17	0.48
T18-07D	29519	TH0891	132.4	133.8	1.4	6	waste	MDST	8.2	1290	2.9	0.11	0.4	0.55	1.1	0.02	1.2	0.02	1.2	1.1	1.2	36	38	9.1	8.5	7.3	0.26	0.24	0.2	0.23	0.19	1.2	38	7	0.19
T18-07D	29520	TH0892	133.8	134	0.2	6	waste	C	8.4	1130	3.2	0.09	0.33	0.45	0.83	0.02	0.84	0.02	0.84	0.81	0.82	26	26	7.5	9.5	7.0	0.29	0.37	0.27	0.37	0.27	0.82	26	7	0.27
T18-07D	29521	TH0893	134	134.6	0.6	6	waste	C	7.3	790	48	0.022	0.08	0.109	2.6	0.03	2.3	0.03	2.3	2.6	2.3	82	72	1.8	8.0	7.3	0.022	0.097	0.089	0.11	0.1	2.29	72	7	0.1
T18-03D	T18-03D-A-028	TD4076	37.8	38.1	0.3	7	8	MDST	9.0	552	4.1	0.27	1.0	1.4	0.02	0.01	<0.05	0.01	0.025	0.01	0.015	0.63	0.47	23	12	10	36	19	16	26	21	0	0	10	21
T18-01D	T18-01D-A-015	TD3965	44.75	47.2	2.45	7	waste	MDST	8.8	428	6.8	2.1	7.8	10.6	0.11	0.01	<0.05	0.01	0.025	0.1	0.015	3.4	0.47	176	56	30	51	16	8.6	120	63	0	0	30	63
T18-02D	T18-02D-A-030	TD4010	80.72	84.3	3.58	7	waste	MDST	7.3	1240	4.3	0.46	1.67	2.3	0.85	0.04	0.7	0.04	0.7	0.81	0.66	27	21	38	26	24	1.4	0.98	0.91	1.3	1.2	0.7	21	24	1.2
T18-02D	T18-02D-A-031	TD4011	84.3	84.53	0.23	7	waste	MDST	7.8	1090	9.3	0.99	3.63	4.9	2.0	0.03	1.7	0.03	1.7	1.9	1.6	61	51	83	61	58	1.3	0.99	0.94	1.2	1.1	1.6	51	58	1.1
T18-02D	T18-02D-A-032	TD4012	84.53	86.64	2.11	7	waste	MDST	8.2	669	2.5	0.68	2.49	3.4	1.2	0.01	1.0	0.01	1.0	1.2	1.0	38	31	57	38	34	1.5	1.0	0.91	1.2	1.1	1.0	31	34	1.1
T18-02D	T18-02D-A-033	TD4013	86.64	87.48	0.84	7	waste	MDST	7.1	1220	5.0	2.4	9.0	12.2	2.3	0.03	1.9	0.03	1.9	2.3	1.9	72	59	204	58	64	2.9	0.81	0.89	0.99	1.1	1.9	59	64	1.1
T18-02D	T18-02D-A-034	TD4014	87.48	89	1.52	7	waste	MDST	6.5	913	27	0.18	0.66	0.9	1.9	0.03	1.5	0.03	1.5	1.9	1.4	60	45	15	13	15	0.25	0.21	0.25	0.28	0.34	1.43	45	15	0.34
T18-03D	T18-03D-A-023	TD4071	32.65	32.9	0.25	7	waste	MDST	6.7	1750	2.0	0.85	3.1	4.2	5.2	0.05	5.1	0.05	5.1	5.2	5.1	163	158	70	43	36	0.43	0.26	0.22	0.27	0.22	5.06	158	36	0.22
T18-03D	T18-03D-A-024	TD4072	32.9	34.53	1.63	7	waste	MDST	8.6	550	17	0.3	1.1	1.5	0.62	0.03	0.61	0.03	0.61	0.59	0.58	19	18	25	13	15	1.3	0.66	0.75	0.71	0.8	0.58	18	15	0.8
T18-03D	T18-03D-A-025	TD4073	34.53	35.5	0.97	7	waste	MDST	9.4	447	6.7	3.4	12.4	17	0.06	0.01	0.07	0.01	0.07	0.05	0.06	1.9	1.9	283	45	49	151	24	26	24	26	0	2	49	26
T18-03D	T18-03D-A-026	TD4074	35.5	36.26	0.76	7	waste	MDST	8.8	676	7.3	0.42	1.53	2.1	0.18	0.02	0.25	0.02	0.25	0.16	0.23	5.6	7.2	35	36	26	6.2	6.5	4.5	5.1	3.5	0.2	7	26	3.5
T18-03D	T18-03D-A-027	TD4075	36.26	37.8	1.54	7	waste	MDST	9.1	430	13	0.9	3.31	4.5	0.07	0.01	0.06	0.01	0.06	0.06	0.05	2.2	1.6	75	28	23	34	13	11	18	15	0	2	23	15
T18-05D	28698	TH0839	135.8	139.1	3.3	7	waste	SLST	6.7	1610	4.2	0.34	1.23	1.7	1.4	0.04	1.5	0.04	1.5	1.4	1.4	45	45	28	15	13	0.63	0.34	0.29	0.34	0.29	1.43	45	13	0.29
T18-05D	28699	TH0840	139.1	139.9	0.8	7	waste	SLST	5.3	1830	4.3	0.21	0.78	1.06	2.1	0.06	2.1	0.06	2.1	2.0	2.0	65	62	18	9.3	7.3	0.27	0.14	0.11	0.15	0.12	1.99	62	7	0.12
T18-05D	28700	TH0842	139.9	140.9	1	7	waste	C	3.8	1500	51	0.22	0.8	1.09	4.1	0.12	3.9	0.12	3.9	4.0	3.7	128	117	18	17	17	0.14	0.13	0.13	0.14	0.15	3.74	117	17	0.15
T18-05D	28705	TH0844	140.9	141.2	0.3	7	waste	MDST	8.8	392	12	3.3	12.1	16	0.19	0.02	0.1	0.02	0.1	0.17	0.08	5.9	2.5	274	73	87	46	12	15	29	35	0	3	87	35
T18-05D	28706	TH0845	141.2	142.1	0.9	7	waste	MDST	8.0	341	21	0.11	0.39	0.53	0.24	0.01	0.08	0.01	0.08	0.23	0.07	7.5	2.2	8.9	6.8	5.8	1.2	0.91	0.77	3.1	2.7	0.1	2	6	2.7
T18-02D	T18-02D-A-035	TD4016	89	90.3	1.3	8	waste	MDST	8.6	581	4.0	0.31	1.15	1.6	0.08	0.01	<0.05	0.01	0.025	0.07	0.015	2.5	0.47	26	17	15	10	6.6	6.1	35	33	0	0	15	33
T18-02D	T18-02D-A-036	TD4017	90.3	90.93	0.63	8	waste	MDST	8.8	417	3.9	0.33	1.22	1.7	0.11	0.01	0.08	0.01	0.08	0.1	0.07	3.4	2.2	28	16	15	8.1	4.7	4.2	7.5	6.6	0.1	2	15	6.6
T18-02D	T18-02D-A-037	TD4018	90.93	92.52	1.59	8	waste	MDST	9.0	532	8.7	0.44	1.61	2.2	0.12	<0.01	<0.05	0.005	0.025	0.12	0.02	3.8	0.63	37	19	16	9.8	5.1	4.3	30	26	0	1	16	26
T18-05D	28708	TH0847	142.6	143	0.4	8	waste	MDST	7.9	661	2.3	0.37	1.36	1.9	0.09	0.01	0.07	0.01	0.07	0.08	0.06	2.8	1.9	31	11	6.5	11	3.9	2.3	5.9	3.5	0.1	2	7	3.5
T18-05D	28709	TH0848	143	143.9	0.9	8	waste	MDST	8.5	724	3.0	0.49	1.79	2.4	0.05	0.02	<0.05	0.02	0.025	0.03	0.005	1.6	0.16	41	26	21	26	17	13	168	131	0	0	21	131
T18-05D	28710	TH0849	143.9	144.1	0.2	8	waste	MDST	7.6	496	2.7	0.13	0.47	0.64	0.08	0.03	0.08	0.03	0.08	0.05	0.05	2.5	1.6	11	36	27	4.3	14	11	23	17	0	2	27	17
T18-05D	28711	TH0850	144.1	144.4	0.3	8	waste	MDST	7.6	538	23	0.43	1.59	2.2	0.39	0.01	0.24	0.01	0.24	0.38	0.23	12	7.2	36	33	32	3.0	2.7	2.6	4.5	4.4	0.2	7	32	4.4
T18-05D	28712	TH0851	144.4	148	3.6	8	waste	MDST	8.1	464	2.6	1.4	5.2	7.1	0.06	0.02	<0.05	0.02	0.025	0.04	0.005	1.9	0.16	118	49	10	63	26	5.3	316	64	0	0	10	64
T18-05D	28713	TH0852	148	148.2	0.2	8	waste	C	8.7	329	43	0.88	3.24	4.4	0.36	0.01	0.09	0.01	0.09	0.35	0.08	11	2.5	74	68	74	6.5	6.0	6.6	27	30	0	3	74	30
T18-03D	T18-03D-A-006	TD4052	12.57	12.82	0.25	55	waste	MDST	7.7	694	14	0.1	0.37	0.5	0.33	0.02	0.2	0.02	0.2	0.31	0.18	10	5.6	8.4	7.5	9.3	0.82	0.73	0.9	1.3	1.7	0.2	6	9	1.7
T18-03D	T18-03D-A-007	TD4053	12.82	13.44	0.62	55	waste	MDST	8.6	479	3.1	0.5	1.84	2.5	0.07	0.01	<0.05	0.01	0.025	0.06	0.015	2.2	0.47	42	33	30	19	15	14	70	65	0	0	30	65
T18-03D	T18-03D-A-008	TD4054	13.44	14.9	1.46	55	waste	MDST	8.2	381	14	0.31	1.14	1.6	0.22	0.01	0.12	0.01	0.12	0.21	0.11	6.9	3.4	26	19	22	3.8	2.8	3.1	5.6	6.3	0.1	3	22	6.3
T18-02D	T18-02D-A-007	TD3985	27.3	28.8	1.5	1a	waste	MDST	8.8	2170	2.2	0.88	3.21	4.4	1.3	0.02	1.2	0.02	1.2	1.2	1.1	39	36	73	58	40	1.9	1.5	1.0	1.6	1.1	1.1	36	40	1.1
T18-02D	T18-02D-A-008	TD3986	28.8	30.3	1.5	1a	waste	MDST	8.8	2150	2.0	0.82	3.02	4.1	1.2	0.03	1.1	0.03	1.1	1.2	1.0	39	32	69	50	42	1.8	1.3	1.1	1.6	1.3	1.0	32	42	1.3
T18-02D	T18-02D-A-009	TD3987	30.3	32.88	2.58	1a	waste	MDST	8.5	2810	2.5	1.3	4.7	6.5	1.6	0.05	1.3	0.05	1.3	1.5	1.2	49	38	108	65	49	2.2	1.3	1.0	1.7	1.3	1.2	38	49	1.3
T18-02D	T18-02D-A-010	TD3988	32.88	33.94	1.06	1a	waste	MDST	8.9	1980	2.8	1.5	5.6	7.7	1.1	0.02	0.95	0.02	0.95	1.1	0.93	36	29	128	69	53	3.6	1.9	1.5	2.4	1.8	0.9	29	53	1.8
T18-02D	T18-02D-A-011	TD3989	33.94	36.86	2.92	1a	waste	MDST	8.2	1670	7.0	0.99	3.62	4.9	2.6	0.03	2.3	0.03	2.3	2.6	2.3	81	71	82	64	24	1.0	0.78	0.29	0.9	0.34	2.26	71	24	0.34
T18-05D	28671	TH0810	85.6	88.3	2.7	1a	waste	SLST	8.3	2350	4.6	1.8	6.7	9.1	1.3	0.05	1.2	0.05	1.2	1.3	1.2	41	37	151	75	68	3.7	1.8	1.6	2.0	1.8	1.2	37	68	1.8
T18-05D	28672	TH0811	88.3	91.4	3.1	1a	waste	SLST	5.3	2460	12	0.49	1.79	2.4	2.2	0.08	2.2	0.08	2.2	2.1	2.2	69	67	41	26	23	0.59	0.38	0.33	0.39	0.33	2.15	67	23	0.33
T18-07D	28837	TH0855	10.4	14.8	4.4	1a	waste	MDST	8.7	2100	2.7	0.49	1.8	2.5	1.6	0.04	1.7	0.04	1.7	1.6	1.6	51	51	41	59	54	0.8	1.1	1.1	1.1	1.1	1.6	51	54	1.1
T18-07D	28838	TH0856	14.8	18.3	3.5	1a	waste	SLST	8.5	2440	1.8	0.13	0.48	0.65	1.8	0.05	1.7	0.05	1.7	1.8	1.7	57	53	11	32	25	0.19	0.57	0.43	0.62	0.47	1.68	53	25	0.47
T18-07D	28839	TH0857	18.3	22.2	3.9	1a	waste	SLST	8.8	1300	1.2	0.38	1.4	1.9	1.3	0.03	1.3	0.03	1.3	1.2	1.3	40	39	32	37	26	0.8	0.93	0.66	0.94	0.67	1.25	39	26	0.67
T18-07D	28840	TH0858	22.2	26.1	3.9	1a	waste	SLST	8.6	1550	1.1	0.28	1.01	1.4	0.74	0.03	0.74	0.03	0.74	0.71	0.71	23	22	23	30	21	0.99	1.3	0.89	1.3	0.92	0.71	22	21	0.92
T18-07D	28841	TH0859	26.1	30	3.9	1a	waste	SLST	8.4	1160	1.4	0.22	0.82	1.12	1.0	0.03	0.98	0.03	0.98	1.0	0.95	32	30	19	26	17	0.58	0.81	0.51	0.88	0.56	0.95	30	17	0.56
T18-07D	28842	TH0860	30	33.9	3.9	1a	waste	SLST	9.0	1810	1.2	0.19	0.71	0.97	1.2	0.04	1.2	0.04	1.2	1.1	1.1	37	35	16	31	20	0.44	0.83	0.53	0.87	0.56	1.12	35	20	0.56
T18-07D	28843	TH0861	33.9	38.2	4.3	1a	waste	SLST	8.3	1920	1.2	0.071	0.26	0.35	1.5	0.02	1.5	0.02	1.5	1.5	1.5	46	46	5.9	13	9.5	0.13	0.29	0.21	0.29	0.21	1.48	46	10	0.21
T18-07D	28844	TH0862	38.2	42.3	4.1	1a	waste	FLT	8.4	1120	1.3	0.24	0.87	1.19	1.0	0.03	1.1	0.03	1.1	0.99	1.0	32	32	20	28	21	0.62	0.88	0.67	0.87	0.66	1.03	32	21	0.66
T18-07D	28845	TH0863	42.3	44.2	1.9	1a	waste	SLST	9.0	1370	1.1	0.14	0.52	0.71	0.86	0.02	0.92	0.02	0.92	0.84	0.9	27	28	12	26	12	0.44	0.97	0.46	0.92	0.44	0.9	28	12	0.44
T18-07D	28846	TH0865	44.2	49.8	5.6	1a	waste	SST	9.0	1530	1.1	0.35	1.28	1.7	0.68	0.03	0.68	0.03	0.68	0.65	0.65	21	20	29	37	28	1.4	1.7	1.3	1.8	1.4	0.7	20	28	1.4
T18-07D	28847	TH0866	49.8	52.8	3	1a	waste	SLST	8.4	1740	1.3	0.31	1.15	1.6	0.65	0.02	0.64	0.02	0.64	0.63	0.62	20	19	26	36	27	1.3	1.8	1.3	1.9	1.4	0.6	19	27	1.4
T18-07D	28848	TH0867	52.8	57.15	4.35	1a	waste	SLST	9.2	1760	1.3	0.068	0.25	0.34	0.52	0.02	0.51	0.02	0.51	0.5	0.49	16	15	5.7	26	10	0.35	1.6	0.63	1.7	0.67	0.49	15	10	0.67
T18-07D	28849	TH0868	57.15	61.5	4.35	1a	waste	SLST	9.2	1550	1.4	0.12	0.45	0.61	0.8	0.02	0.82	0.02	0.82	0.78	0.8	25	25	10	25	15	0.41	0.98	0.6	0.98	0.6	0.8	25	15	0.6
T18-07D	28850	TH0869	61.5	63.4	1.9	1a	waste	FLT	8.5	2180	3.1	1.9	6.9	9.5	0.91	0.04	0.86	0.04	0.86	0.87	0.82	28	26	158	174	152	5.6	6.1	5.3	6.8	5.9	0.8	26	152	5.9
T18-07D	29501	TH0870	63.4	66.8	3.4	1a	waste	MDST	8.7	1660	1.8	0.34	1.24	1.7	0.77	0.03	0.78	0.03	0.78	0.74	0.75	24	23	28	39	19	1.2	1.6	0.79	1.7	0.81	0.75	23	19	0.81
T18-07D	29502	TH0871	66.8	69.6	2.8	1a	waste	SLST	8.8	1330	2.8	1.3	4.7	6.4	1.6	0.02	1.6	0.02	1.6	1.5	1.5	48	48	107	90	101	2.2	1.8	2.1	1.9	2.1	1.5	48	101	2.1
T18-07D	29503	TH0872	69.6	72.4	2.8	1a	waste	SLST	8.6	1290	1.9	0.23	0.86	1.17	1.7	0.02	1.8	0.02	1.8	1.7	1.8	54	56	20	42	26	0.36	0.78	0.48	0.76	0.46	1.79	56	26	0.46
T18-07D	29504	TH0873	72.4	75.6	3.2	1a	waste	SST	8.7	1270	2.8	1.2	4.3	5.8	1.8	0.02	1.8	0.02	1.8	1.8	1.8	56	57	98	133	104	1.7	2.4	1.9	2.3	1.8	1.8	57	104	1.8
T18-07D	28786	TH0874	75.6	78.8	3.2	1a	waste	SST	8.2	980	3.6	2.1	7.6	10.4	1.1	0.01	1.1	0.01	1.1	1.1	1.1	33	33	173	203	175	5.2	6.1	5.2	6.1	5.2	1.1	33	175	5.2
T18-07D	29505	TH0876	78.8	84	5.2	1a	waste	SLST	8.6	1110	1.9	0.45	1.66	2.3	0.54	0.02	0.54	0.02	0.54	0.52	0.52	17	16	38	44	28	2.2	2.6	1.6	2.7	1.7	0.5	16	28	1.7
T18-07D	29506	TH0877	84	86.9	2.9	1a	waste	SLST	8.7	1160	3.4	2.0	7.2	9.8	1.0	0.02	1.0	0.02	1.0	1.0	1.0	32	32	164	250	187	5.1	7.8	5.8	7.9	5.9	1.0	32	187	5.9
T18-07D	29507	TH0878	86.9	92.2	5.3	1a	waste	SLST	8.9	800	4.1	2.8	10.2	14	0.6	0.02	0.59	0.02	0.59	0.58	0.57	19	18	231	248	205	12	13	11	14	12	1	18	205	12
T18-07D	29508	TH0879	92.2	96.3	4.1	1a	waste	SLST	8.6	975	1.8	0.42	1.53	2.1	0.55	0.02	0.54	0.02	0.54	0.53	0.52	17	16	35	51	32	2.0	3.0	1.8	3.2	1.9	0.5	16	32	1.9
T18-07D	29509	TH0880	96.3	104.7	8.4	1a	waste	SLST	8.4	977	2.2	0.47	1.72	2.3	0.27	0.02	0.26	0.02	0.26	0.25	0.24	8.4	7.5	39	39	21	4.6	4.7	2.4	5.2	2.7	0.2	8	21	2.7
T18-07D	29510	TH0881	104.7	107.8	3.1	1a	waste	MDST	8.5	1160	2.7	0.63	2.3	3.1	0.63	0.02	0.64	0.02	0.64	0.61	0.62	20	19	52	51	35	2.7	2.6	1.8	2.6	1.8	0.6	19	35	1.8
T18-07D	29511	TH0882	107.8	111.1	3.3	1a	waste	MDST	8.5	1080	2.9	0.98	3.59	4.9	0.18	0.01	0.18	0.01	0.18	0.17	0.17	5.6	5.3	82	59	44	15	10	7.9	11	8.3	0.2	5	44	8.3
T18-07D	29512	TH0883	111.1	114.2	3.1	1a	waste	MDST	8.4	1160	2.5	0.47	1.72	2.3	0.34	0.02	0.35	0.02	0.35	0.32	0.33	11	10	39	43	21	3.7	4.1	2.0	4.2	2.0	0.3	10	21	2.0
T18-07D	29513	TH0884	114.2	117.4	3.2	1a	waste	MDST	8.4	1210	2.4	0.8	2.92	4.0	0.4	0.02	0.42	0.02	0.42	0.38	0.4	13	13	66	54	41	5.3	4.3	3.3	4.3	3.3	0.4	13	41	3.3
T18-07D	29514	TH0885	117.4	120.6	3.2	1a	waste	MDST	8.3	1630	2.3	1.0	3.8	5.2	1.2	0.02	1.2	0.02	1.2	1.1	1.2	36	37	87	54	33	2.4	1.5	0.91	1.5	0.9	1.17	37	33	0.9
T18-07D	29515	TH0887	120.6	123.8	3.2	1a	waste	MDST	8.3	1250	2.0	0.86	3.14	4.3	1.2	0.02	1.2	0.02	1.2	1.2	1.2	37	37	71	41	31	1.9	1.1	0.84	1.1	0.86	1.17	37	31	0.86
2019 Sampling Programme																																			
19-09D	1146024	BAJ890	4.45	5.90	1.45	4	waste		8.03	---	6.6	3.7	13	18	0.36	0.04	0.36	0.04	0.36	0.32	0.32	11	10	306	---	116	27	---	10	---	12	0.32	10	116	12
19-09D	1146025	BAJ891	5.90	8.00	2.1	4	waste	MDST	7.62	---	3.5	1.1	4.0	5.4	0.81	0.05	0.87	0.05	0.87	0.76	0.82	25	26	90	---	48	3.5	---	1.9	---	1.9	0.82	26	48	1.9
19-09D	1146026	BAJ892	8.00	10.75	2.75	5	waste	SLST	7.36	---	4.7	0.81	3.0	4.1	1.5	0.06	1.5	0.06	1.45	1.42	1.39	46	43	68	---	34	1.5	---	0.73	---	0.78	1.4	43	34	0.78
19-09D	1146030	BAJ893	13.25	14.75	1.5	55	waste	MDST	7.54	---	5.9	0.78	2.9	3.9	0.38	0.02	0.33	0.02	0.33	0.36	0.31	12	10	65	---	39	5.5	---	3.3	---	4.0	0.31	10	39	4.01
19-09D	1146034	BAJ894	18.85	20.20	1.35	6	waste	MDST	7.43	---	29	0.63	2.3	3.1	1.5	0.08	1.4	0.08	1.36	1.41	1.28	47	40	53	---	50	1.1	---	1.1	---	1.3	1.3	40	50	1.3
19-09D	1146035	BAJ895	20.20	21.90	1.7	6	waste	SLST	8.29	---	4.9	2.2	8.1	11	0.41	0.01	0.39	0.01	0.39	0.40	0.38	13	12	185	---	110	14	---	8.6	---	9.3	0.38	12	110	9.3
19-09D	1146036	BAJ896	21.90	23.40	1.5	6	waste	SLST	7.72	---	4.9	2.8	10	14	0.45	0.04	0.43	0.04	0.43	0.41	0.39	14	12	230	---	64	16	---	4.5	---	5.2	0.39	12	64	5.2
19-09D	1146037	BAJ897	23.40	24.90	1.5	6	waste	SLST	7.07	---	3.8	0.46	1.7	2.3	0.90	0.01	0.93	0.01	0.93	0.89	0.92	28	29	38	---	19	1.4	---	0.69	---	0.67	0.92	29	19	0.67
19-09D	1146038	BAJ898	24.90	26.40	1.5	6	waste	SLST	8.17	---	4.4	2.2	8.1	11	0.48	0.03	0.47	0.03	0.47	0.45	0.44	15	14	184	---	60	12	---	4.0	---	4.3	0.44	14	60	4.3
19-09D	1146039	BAJ899	26.80	27.75	0.95	6	waste	SLST	8.15	---	6.6	0.76	2.8	3.8	0.23	0.07	0.17	0.07	0.17	0.16	0.10	7.2	3.1	64	---	44	8.9	---	6.1	---	14	0.10	3.1	44	14

Drill Hole	Sample Number	Maxxam Sample ID	Sample Depth (m)			ABA Zone	Class	Lithology	Paste pH (su)	Paste EC (µs/cm)	Carbon Species (w.t.%)				Sulphur Species (w.t.%)							Potentials (kg CaCO3/tonne)					Neutralization Potential Ratios					Mine Plan Inputs			
			From	To	Thickness						Total-C	Total Inorganic Carbon	CO2	CO3	Total-S	Sulphate	SICP	Sulphate (DL)	SICP (DL)	Sulphide (Total - SO4)	Sulphide (SICP - SO4)	AP (Total Sulphur)	AP (Sulphide)	CO3-NP	Sobek-NP	Modified Sobek-NP	CO3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)	Sulphide-S	AP	NP	NPR
19-09D	1146040	BAJ900	27.90	28.70	0.8	6	Coal	C	8.25	---	16	0.86	3.1	4.3	0.60	0.01	0.50	0.01	0.50	0.59	0.49	19	15	71	---	33	3.8	---	1.8	---	2.2	0.49	15	33	2.2
19-09D	1146041	BAJ901	28.85	30.70	1.85	7	waste	SST	8.6	---	7.2	4.0	15	20	0.23	0.01	0.21	0.01	0.21	0.22	0.20	7.2	6.3	336	---	394	47	---	55	---	63	0.20	6.3	394	63
19-09D	1146042	BAJ902	30.70	32.70	2	7	waste	SLST	8.15	---	3.3	0.79	2.9	3.9	0.09	<0.01	0.06	0.01	0.06	0.09	0.06	2.8	1.7	65	---	20	23	---	7.0	---	12	0.06	1.7	20	12
19-09D	1146043	BAJ903	32.70	34.00	1.3	7	waste	SST	8.95	---	6.8	1.6	5.9	8.0	0.06	<0.01	<0.02	0.01	0.01	0.06	0.01	1.9	0.16	133	---	44	71	---	23	---	278	0.01	0.16	44	278
19-09D	1146044	BAJ904	34.00	35.40	1.4	8	waste	SST	8.22	---	2.6	0.92	3.4	4.6	0.04	<0.01	0.03	0.01	0.03	0.04	0.03	1.3	0.78	77	---	18	61	---	15	---	23	0.03	0.78	18	23
19-09D	1146045	BAJ905	35.40	35.90	0.5	8	waste	SHC	8.74	---	18	0.62	2.3	3.1	0.20	<0.01	0.06	0.01	0.06	0.20	0.06	6.3	1.7	51	---	27	8.2	---	4.3	---	16	0.06	1.7	27	16
19-16D	1146051	BAJ906	6.40	8.00	1.6	1	waste	SLST	8.3	---	3.2	1.8	6.5	8.9	0.23	0.01	0.23	0.01	0.23	0.22	0.22	7.2	6.9	148	---	79	21	---	11	---	11	0.22	6.9	79	11
19-16D	1146052	BAJ907	8.00	9.40	1.4	1	waste	SLST	8.18	---	3.0	1.4	5.3	7.2	0.19	0.01	0.17	0.01	0.17	0.18	0.16	5.9	5.0	121	---	53	20	---	8.9	---	11	0.16	5.0	53	11
19-16D	1146053	BAJ908	9.40	11.70	2.3	1	waste	MDST	8.2	---	3.3	1.5	5.5	7.5	0.18	0.01	0.17	0.01	0.17	0.17	0.16	5.6	5.0	124	---	45	22	---	8.0	---	9.0	0.16	5.0	45	9.0
19-16D	1146054	BAJ909	11.70	14.70	3	1	waste	MDST	8.13	---	3.2	1.4	5.2	7.0	0.27	0.01	0.25	0.01	0.25	0.26	0.24	8.4	7.5	117	---	35	14	---	4.2	---	4.7	0.24	7.5	35	4.7
19-16D	1146055	BAJ910	14.70	17.70	3	1	waste	MDST	8.21	---	3.5	1.6	5.8	7.9	0.32	0.01	0.32	0.01	0.32	0.31	0.31	10	10	131	---	38	13	---	3.8	---	3.9	0.31	10	38	3.9
19-16D	1146056	BAJ911	17.70	20.90	3.2	1	waste	MDST	8.4	---	3.2	1.4	5.2	7.1	0.45	0.01	0.43	0.01	0.43	0.44	0.42	14	13	119	---	42	8.5	---	3.0	---	3.2	0.42	13	42	3.2
19-16D	1146057	BAJ912	20.90	22.10	1.2	1	waste	SST	8.33	---	2.8	1.7	6.1	8.3	0.71	0.02	0.79	0.02	0.79	0.69	0.77	22	24	138	---	51	6.2	---	2.3	---	2.1	0.77	24	51	2.1
19-16D	1146058	BAJ913	22.10	24.70	2.6	1	waste	MDST	8.41	---	2.8	1.7	6.1	8.3	1.0	0.02	1.09	0.02	1.1	1.0	1.1	32	33	139	---	44	4.4	---	1.4	---	1.3	1.1	33	44	1.3
19-16D	1146059	BAJ914	24.70	26.30	1.6	1	waste	SST	8.2	---	2.3	1.5	5.4	7.3	1.0	0.04	1.1	0.04	1.1	1.0	1.1	33	33	122	---	44	3.8	---	1.4	---	1.3	1.1	33	44	1.3
19-16D	1146060	BAJ915	26.30	28.30	2	1	waste	SLST	7.31	---	4.9	0.86	3.1	4.3	3.1	0.09	3.2	0.09	3.2	3.0	3.1	97	96	71	---	40	0.74	---	0.41	---	0.41	3.1	96	40	0.41
19-16D	1146061	BAJ916	28.30	30.20	1.9	2	waste	SST	6.55	---	8.9	0.55	2.0	2.7	2.9	0.09	3.0	0.09	3.0	2.8	2.9	90	92	45	---	21	0.50	---	0.23	---	0.23	2.9	92	21	0.23
19-16D	1146062	BAJ917	30.20	32.20	2	2	waste	SST	7.75	---	4.0	1.2	4.3	5.9	1.7	0.02	1.7	0.02	1.7	1.6	1.7	52	53	98	---	52	1.9	---	1.0	---	0.98	1.7	53	52	0.98
19-16D	1146063	BAJ918	32.20	34.00	1.8	3	waste	SLST	5.7	---	16	0.52	1.9	2.6	2.4	0.16	2.5	0.16	2.5	2.3	2.3	76	72	43	---	20	0.57	---	0.27	---	0.29	2.3	72	20	0.29
19-16D	1146064	BAJ919	34.00	34.45	0.45	3	waste	MDST	3.49	---	44	0.32	1.2	1.6	3.6	0.29	3.3	0.29	3.3	3.3	3.0	113	93	27	---	22	0.24	---	0.20	---	0.24	3.0	93	22	0.24
19-16D	1146069	BAJ920	38.70	40.40	1.7	4	waste	SST	8.33	---	3.2	1.6	6.0	8.1	0.56	<0.01	0.55	0.01	0.55	0.56	0.55	18	17	136	---	123	7.8	---	7.0	---	7.2	0.55	17	123	7.2
19-16D	1146070	BAJ921	40.40	43.20	2.8	4	waste	SLST	7.49	---	3.3	1.4	5.2	7.1	0.85	0.04	0.78	0.04	0.78	0.81	0.74	27	23	119	---	42	4.5	---	1.6	---	1.8	0.74	23	42	1.8
19-16D	1146071	BAJ922	43.20	45.60	2.4	4	waste	SLST	7.5	---	4.1	1.7	6.2	8.5	0.45	0.04	0.43	0.04	0.43	0.41	0.39	14	12	141	---	42	10	---	3.0	---	3.5	0.39	12	42	3.5
19-16D	1146072	BAJ923	45.60	49.20	3.6	5	waste	SLST	6.63	---	5.0	1.1	4.2	5.7	1.5	0.08	1.5	0.08	1.5	1.5	1.4	48	44	95	---	37	2.0	---	0.78	---	0.84	1.4	44	37	0.84
19-16D	1146073	BAJ924	49.20	50.05	0.85	5	waste	SLST	7.15	---	4.3	0.58	2.1	2.9	2.0	0.07	2.0	0.07	2.0	1.9	2.0	63	61	48	---	22	0.77	---	0.34	---	0.35	2.0	61	22	0.35
19-16D	1146079	BAJ925	56.55	58.75	2.2	55	waste	SLST	7.16	---	2.1	0.64	2.3	3.2	0.87	0.02	0.88	0.02	0.88	0.85	0.86	27	27	53	---	22	1.9	---	0.81	---	0.82	0.86	27	22	0.82
19-16D	1146080	BAJ926	58.90	61.00	2.1	6	Coal	C	4.66	---	35	0.36	1.3	2	2.9	0.40	2.8	0.40	2.8	2.5	2.4	90	76	30	---	13	0.33	---	0.14	---	0.17	2.4	76	13	0.17
19-16D	1146081	BAJ927	61.15	61.85	0.7	7	waste	SLST	7.71	---	4.8	1.7	6.4	8.7	1.3	0.02	1.3	0.02	1.3	1.2	1.3	39	39	146	---	62	3.7	---	1.59	---	1.6	1.3	39	62	1.6
19-16D	1146082	BAJ928	62.00	63.90	1.9	7	Coal	C	5.91	---	24	0.52	1.9	2.62	2.3	0.14	2.0	0.14	2.0	2.1	1.9	71	59	44	---	27	0.62	---	0.38	---	0.46	1.9	59	27	0.46
19-16D	1146083	BAJ929	64.05	67.60	3.55	7	waste	SLST	7.52	---	5.9	1.8	6.5	8.8	0.70	0.02	0.61	0.02	0.61	0.68	0.59	22	18	147	---	51	6.7	---	2.3	---	2.7	0.59	18	51	2.7
19-16D	1146084	BAJ930	67.60	70.00	2.4	8	waste	SLST	7.96	---	18	2.0	7.4	10	0.27	0.01	0.13	0.01	0.13	0.26	0.12	8.4	3.8	168	---	36	20	---	4.2	---	9.5	0.12	3.8	36	9.5
19-17D	1146085	BAJ931	8.40	8.70	0.3	1	Coal	C	3.1	---	46	0.49	1.8	2.4	5.1	0.70	4.5	0.70	4.5	4.4	3.8	159	118	40	---	26	0.25	---	0.16	---	0.22	3.8	118	26	0.22
19-17D	1146086	BAJ932	8.85	11.45	2.6	2	waste	MDST	4.85	---	4.5	0.46	1.7	2.3	2.7	0.28	2.7	0.28	2.7	2.4	2.4	85	75	38	---	10	0.45	---	0.12	---	0.14	2.4	75	10	0.14
19-17D	1146087	BAJ933	11.60	12.00	0.4	2	Coal	C	3.16	---	41	0.11	0.41	0.56	2.6	0.41	2.1	0.41	2.1	2.2	1.7	81	53	9	---	-3	0.12	---	-0.04	---	-0.06	1.7	53	-3.0	-0.06
19-17D	1146088	BAJ934	12.15	14.50	2.35	3	waste	MDST	7.07	---	2.7	0.75	2.7	3.7	1.2	0.06	1.3	0.06	1.3	1.1	1.2	37	38	62	---	23	1.7	---	0.62	---	0.60	1.2	38	23	0.60
19-17D	1146089	BAJ935	14.50	17.45	2.95	3	waste	MDST	5.6	---	6.4	0.89	3.3	4.4	1.1	0.06	1.1	0.06	1.1	1.1	0.99	35	31	74	---	19	2.1	---	0.55	---	0.62	0.99	31	19	0.62
19-17D	1146090	BAJ936	19.60	22.00	2.4	4	waste	MDST	8.58	---	3.6	1.9	7.1	9.7	0.30	0.01	0.26	0.01	0.26	0.29	0.25	9.4	7.8	162	---	55	17	---	5.8	---	7.0	0.25	7.8	55	7.0
19-17D	1146091	BAJ937	22.00	25.00	3	4	waste	MDST	8.58	---	3.3	1.8	6.7	9.1	0.33	0.02	0.33	0.02	0.33	0.31	0.31	10	10	153	---	54	15	---	5.3	---	5.6	0.31	10	54	5.6
19-17D	1146092	BAJ938	25.00	26.40	1.4	4	waste	MDST	6.61	---	8.5	0.81	3.0	4.0	0.64	0.08	0.59	0.08	0.59	0.56	0.51	20	16	67	---	29	3.4	---	1.4	---	1.8	0.51	16	29	1.8
19-17D	1146093	BAJ939	26.40	29.50	3.1	5	waste	MDST	7.49	---	4.4	1.6	5.9	8.0	1.3	0.10	1.3	0.10	1.3	1.2	1.2	39	37	134	---	54	3.4	---	1.4	---	1.5	1.2	37	54	1.5
19-17D	1146095	BAJ940	29.50	31.05	1.55	5	waste	MDST	7.37	---	3.8	0.73	2.7	3.7	1.3	0.07	1.2	0.07	1.2	1.2	1.2	39	37	61	---	34	1.5	---	0.87	---	0.94	1.2	37	34	0.94
19-17D	1146098	BAJ941	37.05	38.80	1.75	6	waste	MDST	7.56	---	3.6	1.4	5.3	7.2	0.76	0.08	0.72	0.08	0.72	0.68	0.64	24	20	121	---	55	5.1	---	2.3	---	2.8	0.64	20	55	2.8
19-17D	1146099	BAJ942	38.80	41.50	2.7		waste		6.93	---	9.2	1.0	3.8	5.2	0.72	0.12	0.67	0.12	0.67	0.60	0.55	23	17	87	---	38	3.9	---	1.7	---	2.2	0.55	17	38	2.2
19-17D	1146100	BAJ943	41.50	42.75	1.25	6	waste	SLST	7.99	---	2.1	0.44	1.6	2.2	0.13	0.02	0.090	0.02	0.09	0.11	0.07	4.1	2.2	37	---	17	9.1	---	4.2	---	7.8	0.070	2.2	17	7.8
19-17D	1146401	BAJ944	42.75	45.75	3	6	waste	SLST	8.94	---	4.9	3.1	11	15	0.060	<0.01	0.040	0.01	0.04	0.06	0.04	1.9	1.1	258	---	137	137	---	73	---	125	0.035	1.1	137	125
19-17D	1146402	BAJ945	45.75	47.50	1.75	7	waste	MDST	7.72	---	5.6	0.95	3.5	4.8	0.86	0.15	0.83	0.15	0.83	0.71	0.68	27	21	79	---	79	3.0	---	2.9	---	3.7	0.68	21	79	3.7
19-17D	1146403	BAJ946	47.50	48.70	1.2	7	waste	MDST	4.45	---	9.3	0.57	2.1	2.8	2.2	<0.01	2.1	0.01	2.1	2.2	2.1	68	66	47	---	16	0.70	---	0.23	---	0.24	2.1	66	16	0.24
19-17D	1146404	BAJ947	48.70	50.50	1.8	7	waste	MDST	5.54	---	14	0.42	1.5	2.1	2.6	0.06	2.5	0.06	2.5	2.6	2.4	82	76	35	---	14	0.43	---	0.18	---	0.19	2.4	76	14	0.19
19-17D	1146405	BAJ948	50.50	53.50	3	7	waste	MDST	7.13	---	4.3	0.65	2.4	3.2	0.86	0.12	0.86	0.12	0.86	0.74	0.74	27	23	54	---	19	2.0	---	0.71	---	0.83	0.74	23	19	0.83
19-17D	1146406	BAJ949	53.50	54.95	1.45	7	waste	SLST	8.96	---	3.4	1.9	7.0	9.5	0.080	0.11	0.05	0.11	0.05	-0.03	-0.06	2.5	-1.9	159	---	49	64	---	20	---	-26	-0.06	-2	49	-26
19-17D	1146407	BAJ950	55.10	55.60	0.5	7	Coal	C	4.17	---	50	0.14	0.50	0.68	1.0	<0.01	0.67	0.01	0.67	1.02	0.67	32	21	11	---	13	0.36	---	0.40	---	0.61	0.67	21	13	0.61
19-17D	1146408	BAJ951	55.75	56.75	1	8	waste	MDST	8.26	---	3.1	1.5	5.6	7.6	0.08	0.03	0.05	0.03	0.05	0.05	0.02	2.5	0.6	127	---	27	51	---	11	---	42.4	0.020	0.6	27	42
19-17D	1146409	BAJ952	56.75	58.25	1.5	8	waste	MDST	7.38	---	8.1	0.59	2.2	2.9	0.17	0.07	0.11	0.07	0.11	0.10	0.04	5.3	1.3	49	---	13	9.2	---	2.4	---	10.4	0.040	1.3	13	10
19-17D	1146410	BAJ953	58.25	59.20	0.95	8	waste	MDST	7.63	---	7.9	0.47	1.7	2.4	0.15	0.01	0.09	0.01	0.09	0.14	0.08	4.7	2.5	39	---	5	8.4	---	1.07	---	2.0	0.080	2.5	5.0	2.0
19-18D	1146416	BAJ954	10.00	13.00	3	4	waste	MDST	7.59	---	2.8	1.1	4.1	5.5	0.68	0.03	0.71	0.03	0.71	0.65	0.68	21	21	92	---	52	4.3	---	2.4	---	2.4	0.68	21	52	2.4
19-18D	1146417	BAJ955	13.00	15.20	2.2	4	waste	MDST	7.44	---	3.2	1.5	5.6	7.6	0.30	0.03	0.29	0.03	0.29	0.27	0.26	9.4	8.1	127	---	44	14	---	4.7	---	5.5	0.26	8.1	44	5.5
19-18D	1146418	BAJ956	15.20	17.75	2.55	5	waste	MDST	6.59	---	6.8	0.78	2.9	3.9	1.5	0.12	1.5	0.12	1.5	1.4	1.4	48	42	65	---	40	1.4	---	0.83	---	0.94	1.4	42	40	0.94
19-18D	1146421	BAJ957	19.85	20.15	0.3	55	waste	SLST	7.78	---	4.9	0.57	2.1	2.8	0.12	0.01	0.06	0.01	0.06	0.11	0.05	3.8	1.6	48	---	37	13	---	9.7	---	23	0.050	1.6	37	23
19-18D	1146422	BAJ958	23.55	23.50	0.05	6	waste	MDST	7.08	---	12	0.46	1.7	2.3	0.29	0.04	0.19	0.04	0.19	0.25	0.15	9.1	4.7	38	---	25	4.2	---	2.7	---	5.3	0.15	4.7	25	5.3
19-18D	1146423	BAJ959	23.50	25.80	2.3	6	waste	MDST	6.77	---	13	1.2	4.3	5.9	1.6	0.09	1.6	0.09	1.59	1.54	1.50	51	47	99	---	73	1.9	---	1.4	---	1.6	1.5	47	73	1.6
19-18D	1146424	BAJ960	25.80	28.70	2.9	6	waste	MDST	7.34	---	3.8	1.2	4.4	6.0	0.33	0.03	0.29	0.03	0.29	0.30	0.26	10	8.1	99	---	40	10	---	3.8	---	4.9	0.26	8.1	40	4.9
19-18D	1146425	BAJ961	28.70	31.30	2.6	6	waste	SST	8.35	---	3.8	2.3	8.4	11.5	0.06	0.01	0.04	0.01	0.04	0.05	0.03	1.9	0.9	191	---	102	102	---	54	---	109	0.030	0.94	102	109
19-18D	1146426	BAJ962	31.30	33.30	2	6	waste	MDST	8.15	---	4.9	1.8	6.5	8.8	0.22	0.01	0.19	0.01	0.19	0.21	0.18	6.9	5.6	147	---	68	21	---	9.8	---	12	0.18	5.6	68	12
19-18D	1146427	BAJ963	33.30	35.50	2.2	6	waste	MDST	7.57	---	4.6	1.3	4.8	6.5	0.48	0.03	0.47	0.03	0.47	0.45	0.44	15	14	108	---	39	7.2	---	2.6	---	2.9	0.44	14	39	2.9

Appendix D – Mine Rock Elemental Analysis Results

Mine Rock Samples: Elemental Analysis Results

Hole-ID	Sample ID	Maxxam	Sample Depth (m)		ABA Zone	Sample	Lithology	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
		Sample ID	From	To		Type		%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
T18-01D	T18-01D-A-001	TD3950	12.38	13.6	2	waste	MDST	0.48	12.3	1.5	<20	158	0.37	0.76	0.71	23.9	18.2	45.7	3.39	1.3	0.27	0.14	1.4	0.6	403	1.14	0.051	52.7	0.016	89.8	2.15	0.38	11.1	<0.1	74.5	0.12	1.5	<0.001	0.08	0.3	24	<0.05	166
T18-01D	T18-01D-A-002	TD3951	13.6	14	2	coal	C	0.07	6.9	0.5	<20	36.5	0.13	2.23	0.38	14.4	5.6	16.6	2.97	1.5	0.18	0.02	<0.5	1	168	0.5	0.014	19.6	0.001	42.9	3.12	0.86	6	0.2	204	0.12	0.2	0.006	0.02	0.2	66	<0.05	44.3
T18-01D	T18-01D-A-003	TD3952	14	15.8	3	waste	MDST	0.58	5.3	0.3	<20	285	0.21	0.26	0.13	11.5	20.4	30.7	3.45	1.4	0.07	0.17	1.4	0.5	278	0.57	0.111	23.2	0.012	22	1.11	0.06	10.5	<0.1	59.9	0.09	0.8	<0.001	0.03	0.4	25	<0.05	89
T18-01D	T18-01D-A-004	TD3953	15.8	17.2	3	waste	MDST	0.54	11.7	0.5	<20	268	0.19	0.87	0.08	17.3	24.4	32.8	6.53	1.5	0.078	0.15	2.7	0.95	941	0.91	0.101	38.9	0.017	14.7	1.24	0.03	12.7	0.2	89.2	0.07	0.9	<0.001	0.03	0.3	36	<0.05	107
T18-01D	T18-01D-A-005	TD3954	17.2	18.7	3	waste	MDST	0.51	13.1	<0.2	<20	299	0.2	0.91	0.09	20	18.7	35.9	5.25	1.4	0.064	0.14	1.9	0.8	1700	1.36	0.093	37.4	0.027	15.5	0.87	0.07	11.8	0.1	94.1	0.13	0.6	<0.001	0.03	0.4	34	<0.05	111
T18-01D	T18-01D-A-006	TD3955	18.7	19	3	coal	C	0.54	9	1.1	<20	324	0.23	0.81	0.09	19.7	11.7	45.2	2.87	1.3	0.017	0.15	2.7	0.45	3110	0.48	0.129	28	0.021	14	0.2	0.05	14.2	0.2	88.3	0.08	1.5	<0.001	0.03	0.2	31	<0.05	98.8
T18-01D	T18-01D-A-007	TD3956	19	21.31	3	waste	MDST	0.67	8	2	<20	287	0.19	1.38	0.06	35.7	15.8	40.6	9.1	1.7	0.031	0.16	3.3	0.85	2900	1.51	0.118	51.8	0.053	15.2	0.57	0.06	20.6	0.4	112	0.05	1.3	<0.001	0.02	0.3	62	<0.05	130
T18-01D	T18-01D-A-008	TD3957	22.89	27.7	4	waste	MDST	0.7	10.2	0.5	<20	274	0.16	2.61	0.04	20.3	17.7	33.8	6.73	1.6	0.034	0.15	2.8	0.97	2130	0.61	0.109	36.9	0.042	11.3	0.64	0.04	14.6	0.2	122	0.02	2	<0.001	0.03	0.3	49	<0.05	95.8
T18-01D	T18-01D-A-009	TD3958	27.7	30	4	waste	MDST	0.55	19	0.3	<20	220	0.18	1.12	0.09	36.6	15.9	35	7.3	1.6	0.111	0.13	2	0.89	1290	3.23	0.103	64	0.036	20.5	1.28	0.11	14.9	0.6	95.6	0.03	0.7	<0.001	0.06	0.4	51	<0.05	109
T18-01D	T18-01D-A-010	TD3959	30	33.7	5	waste	SLST	0.53	11.9	1.5	<20	200	0.21	0.84	0.06	23.4	18	33.3	2.2	1.5	0.059	0.14	1.3	0.45	395	1.29	0.082	45.2	0.016	14.4	0.61	0.04	11.2	0.2	80.9	0.07	1.1	<0.001	0.03	0.3	30	<0.05	117
T18-01D	T18-01D-A-011	TD3961	33.7	36.39	5	waste	SLST	0.5	13.5	0.2	<20	177	0.2	0.7	0.04	18.8	17.8	33.4	1.89	1.6	0.075	0.14	1.1	0.37	499	0.91	0.067	31.5	0.016	11.1	0.75	0.04	10.9	0.1	73.4	0.05	0.7	<0.001	0.03	0.4	28	<0.05	112
T18-01D	T18-01D-A-012	TD3962	38.52	40.71	6	waste	FLT	0.4	22.7	0.7	<20	98.9	0.22	3.66	0.12	20.3	19.3	42.6	5.73	1.3	0.247	0.12	2.4	0.69	275	7.09	0.04	54.1	0.012	15.5	4.45	0.23	10.4	0.5	140	0.13	0.8	<0.001	0.2	0.3	32	<0.05	104
T18-01D	T18-01D-A-013	TD3963	40.71	43.93	6	waste	MDST	0.49	8.3	<0.2	<20	198	0.18	2.69	0.06	18	13.4	34.7	4.9	1.3	0.067	0.12	1.9	0.72	735	0.39	0.059	24.5	0.038	12.2	0.96	0.04	12.2	0.2	118	0.05	0.6	<0.001	0.04	0.3	29	<0.05	93.8
T18-01D	T18-01D-A-014	TD3964	43.93	44.75	6	waste	MDST	0.53	2.2	<0.2	<20	148	0.1	1.33	0.14	9.8	18.2	29.3	14.2	1.3	0.024	0.09	2.9	1.23	3160	1.23	0.06	13.4	0.062	17.9	0.23	0.05	10.6	0.2	88	<0.02	0.6	<0.001	0.1	0.3	42	<0.05	90.1
T18-01D	T18-01D-A-015	TD3965	44.75	47.2	7	waste	MDST	1.82	2.5	<0.2	<20	440	0.08	2.38	0.28	32	31.4	64.8	8.15	4.2	0.026	0.08	14.1	0.59	1250	1.85	0.068	36.7	0.76	12.3	0.04	0.15	16.8	0.2	470	0.04	1.2	0.006	0.05	0.5	79	<0.05	137
T18-02D	T18-02D-A-001	TD3978	8.35	12.03	1	waste	MDST	0.47	11.1	0.5	<20	131	0.21	1.09	0.1	20.2	22.4	47.8	3.52	1.4	0.088	0.15	2.9	0.8	645	0.66	0.096	54.3	0.051	13.2	0.2	0.1	10	0.2	72.9	0.1	4	<0.001	0.05	0.4	30	<0.05	110
T18-02D	T18-02D-A-002	TD3979	12.03	15.3	1	waste	MDST	0.51	11.8	<0.2	<20	162	0.24	1.05	0.09	24.8	26.1	53.5	3.82	1.4	0.071	0.17	2.7	0.82	849	0.9	0.197	74.7	0.046	14.4	0.17	0.09	10.6	0.1	71	0.07	4.1	<0.001	<0.02	0.4	35	<0.05	113
T18-02D	T18-02D-A-003	TD3980	15.3	18.58	1	waste	MDST	0.55	10.6	0.4	<20	164	0.2	2.53	0.08	19.4	28.1	44.6	4.29	1.4	0.041	0.16	3.8	1.21	963	0.57	0.194	58.3	0.082	12.9	0.16	0.09	10.9	<0.1	132	0.07	3.9	<0.001	<0.02	0.4	36	<0.05	104
T18-02D	T18-02D-A-004	TD3981	18.58	21.3	1	waste	MDST	0.57	14	0.2	<20	165	0.22	2.76	0.1	19.5	28.9	49.4	4.24	1.7	0.052	0.16	4.8	1.3	869	0.68	0.205	58.2	0.081	13.4	0.22	0.09	11.2	0.1	162	0.06	4.3	<0.001	0.02	0.5	39	<0.05	108
T18-02D	T18-02D-A-005	TD3983	21.3	24.3	1	waste	MDST	0.52	12.7	0.6	<20	167	0.29	0.84	0.09	31.5	25.6	58.4	4.4	1.4	0.081	0.16	2.4	0.96	626	1.84	0.226	92.6	0.039	17.1	0.37	0.12	12.6	0.3	77.5	0.11	4	<0.001	0.04	0.4	45	<0.05	137
T18-02D	T18-02D-A-006	TD3984	24.3	27.3	1	waste	MDST	0.5	10.1	0.8	<20	191	0.14	0.91	0.1	12	15.1	33	5.07	1	0.053	0.16	1.4	1	440	0.18	0.324	23.5	0.017	6.87	0.49	0.03	13.8	0.3	85.8	0.08	1.2	<0.001	0.02	0.4	33	<0.05	98.9
T18-02D	T18-02D-A-007	TD3985	27.3	28.8	1	waste	MDST	0.54	18.5	1.2	<20	213	0.12	0.81	0.08	14.9	10.9	36.2	3.52	1.2	0.091	0.15	0.8	0.59	194	0.4	0.34	22.6	0.019	12.3	1.16	0.04	14.3	0.6	89	0.05	0.6	<0.001	0.04	0.3	31	<0.05	96
T18-02D	T18-02D-A-008	TD3986	28.8	30.3	1	waste	MDST	0.66	14.9	0.3	<20	216	0.14	1.04	0.06	11.3	12	36.6	2.99	1.6	0.049	0.18	0.5	0.6	177	0.26	0.359	15.2	0.008	9	1.12	0.02	13.2	0.4	98.7	0.08	0.7	<0.001	0.05	0.2	27	<0.05	92.3
T18-02D	T18-02D-A-009	TD3987	30.3	32.88	1	waste	MDST	0.49	21.3	0.5	<20	184	0.09	0.98	0.14	11.8	17.8	23.7	4.86	1	0.201	0.18	1.3	0.84	291	1.55	0.325	30.8	0.025	9.53	1.32	0.06	12.5	0.3	118	0.03	0.4	<0.001	0.13	0.4	30	<0.05	91.9
T18-02D	T18-02D-A-010	TD3988	32.88	33.94	1	waste	MDST	0.52	16	<0.2	<20	153	0.08	0.96	0.07	15.4	30.9	18.6	5.9	1.3	0.05	0.19	1.3	0.98	383	0.82	0.272	21.6	0.004	7.88	1.04	0.03	11.8	0.4	86.1	<0.02	0.4	<0.001	0.05	0.2	32	<0.05	84.3
T18-02D	T18-02D-A-011	TD3989	33.94	36.86	1	waste	MDST	0.43	14.1	0.5	<20	107	0.12	0.96	0.16	25.5	24.4	26.4	4.51	1.3	0.159	0.13	0.8	0.7	584	1.49	0.203	37.3	0.003	14.5	2.29	0.07	11.2	0.3	78.6	0.04	0.3	<0.001	0.08	0.2	31	<0.05	127
T18-02D	T18-02D-A-012	TD3990	36.86	39.3	2	waste	SLST	0.43	12.4	<0.2	<20	119	0.22	0.24	0.03	19.5	17.7	39.3	3.5	1.2	0.144	0.14	0.6	0.55	317	1.69	0.202	41.9	0.002	13.5	2.13	0.06	10.4	0.3	43.8	0.08	0.4	<0.001	0.05	0.4	24	<0.05	102
T18-02D	T18-02D-A-013	TD3991	39.3	41.75	2	waste	SLST	0.32	5.3	<0.2	<20	103	0.22	0.27	0.14	15.2	12.6	36.4	2.25	1	0.121	0.11	0.7	0.35	144	1.12	0.159	31	0.003	16.6	1.63	0.07	7.8	<0.1	53.7	0.1	0.4	<0.001	0.03	0.3	23	<0.05	84.3
T18-02D	T18-02D-A-014	TD3992	41.75	45.18	3	waste	MDST	0.46	8.3	<0.2	<20	142	0.16	1.46	0.05	17.3	19.8	29.1	5	1.1	0.048	0.14	2.1	1.04	1020	0.41	0.212	35.9	0.015	11.8	0.43	0.04	10.9	<0.1	83.9	0.04	0.8	<0.001	0.02	0.2	31	<0.05	91.7
T18-02D	T18-02D-A-015	TD3994	45.18	48.3	3	waste	MDST	0.44	12.2	0.3	<20	133	0.17	0.99	0.05	21.7	22.6	32.1	3.07	1.2	0.061	0.14	1.3	0.66	1190	0.43	0.2	39.6	0.005	11.3	0.61	0.05	11	0.2	79.9	0.09	0.5	<0.001	<0.02	0.2	35	<0.05	111
T18-02D	T18-02D-A-016	TD3995	48.3	48.76	3	waste	MDST	0.56	27.8	1.1	<20	110	0.27	0.49	0.1	24.8	17.9	33	3.71	1.5	0.257	0.15	2.2	0.31	392	1.44	0.168	66	0.07	19.2	3.35	0.09	9.5	0.3	74.5	0.11	0.9	<0.001	0.05	0.5	29	<0.05	93.3
T18-02D	T18-02D-A-017	TD3996	50.44	50.5	4	waste	MDST	0.46	0.4	1.3	<20	154	0.17	0.53	0.03	0.9	8.7	38.9	0.48	0.9	<0.005	0.13	<0.5	0.2	128	0.08	0.23	2.6	0.006	5.42	0.32	<0.02	6.8	<0.1	46.9	0.11	0.2	<0.001	<0.02	0.1	18	<0.05	19
T18-02D	T18-02D-A-018	TD3997	50.5	52.8	4	waste	MDST	0.51	12.6	1.4	<20	166	0.17	1.15	0.05	20.1	14.8	35.7	6.28	1.1	0.037	0.14	2.4	0.79	2230	0.59	0.223	26.7	0.023	8.53	0.41	0.04	16	0.1	96.4	0.08	0.5	<0.001	<0.02	0.2	59	<0.05	85.9
T18-02D	T18-02D-A-019	TD3998	52.8	54.3	4	waste	MDST	0.49	8.7	1.2	<20	171	0.13	2.85	0.05	19.2	17.3	27	6.68	1.2	0.042	0.13	2.6	1.28	1740	0.68	0.189	36.4	0.029	10.3	0.66	0.05	14	<0.1	180	0.08	0.7	<0.001	0.02	0.2	52	<0.05	88.3
T18-02D	T18-02D-A-020	TD3999	54.3	58.08	4	waste	MDST	0.47	12.7	0.8	<20	146	0.16	1.82	0.06	17.7	13.3	32.9	2.54	1.2	0.181	0.14	0.7	0.49	401	1.13	0.188	36.9	0.004	12.8	1.63	0.07	10.4	0.3	164	0.07	0.4	<0.001	0.09	0.2	29	<0.05	95.9
T18-02D	T18-02D-A-021	TD4000	58.08	60.3	5	waste	SLST	0.39	9.9	0.5	<20	199	0.15	5.78	0.04	14.7	22.8	18.7	6.88	1	0.063	0.12	1.9	1.82	1470	0.44	0.1	30.8	0.016	9.36	0.99	0.06	9.5	<0.1	180	0.08	0.8	<0.001	0.03	0.3	46	<0.05	82.8
T18-02D	T18-02D-A-022	TD4001	60.3	63.3	5	waste	SLST	0.45	10.8	1.8	<20	154	0.23	0.75	0.05	20.6	14.3	34.6	1.62	1.4	0.035	0.15	0.7	0.31	211	1.09	0.119	40.9	0.003	12.4	0.57	0.06	10.2	0.2	65	0.07	0.5	<0.001	0.02	0.3	25	<0.05	121
T18-02D	T18-02D-A-023	TD4002	63.3	66.3	5	waste	SLST	0.39	9.9	0.5	<20	132	0.17	1.34	0.02	15.7	18.2	24.8	7.12	1.1	0.043	0.12	2	1.11	1460	1	0.09	31.6	0.019	10.5	0.38	0.06	11.5	0.3	84.4	0.09	0.6	<0.001	0.02	0.3	46	<0.05	93.4
T18-02D	T18-02D-A-024	TD4003	66.3	67.8	5	waste	SLST	0.38	10.6	1.1	<20	104	0.21	0.5	0.09	16.3	12.3	34	2.3	1.1	0.090	0.12	0.6	0.36	231	1.6	0.071	31.9	0.002	10.6	1.49	0.05	11.7	0.2	49.2	0.12	0.4	<0.001	0.02	0.4	27	<0.05	112
T18-02D	T18-02D-A-025	TD4005	67.8	68.56	5	waste	SLST	0.43	12.5	0.3	<20	94.7	0.19	0.36	0.07	19.2	17.7	28.8	2.65	1.3	0.17	0.12	0.5	0.25	232	0.86	0.054	40.5	0.002	12.2	2.18	0.05	9.8	0.2	38	0.02	0.4	<0.001	0.03	0.3	24	<0.05	115
T18-02D	T18-02D-A-026	TD4006	75.62	78.3	6	waste	SLST	0.48	13.2	1.4	<20	158	0.27	1	0.05	20.2	18.9	52.1	2.93	1.4	0.076	0.14	1.7	0.67	270	1.83	0.043	54.2	0.007	11.9	0.77	0.08	11.5	0.2	92.3	0.09	0.9	<0.001	0.03	0.5	35	<0.05	114
T18-02D	T18-02D-A-027	TD4007	78.3	79.35	6	waste	SLST	0.45	14.1	0.9	<20	130	0.28	0.52	0.09	21.8	16.2	53.4	3.26	1.2	0.16	0.14	1	0.49	198	1.51	0.043	76.4	0.002	16.9	2.31	0.1	10.4	0.2	61	0.11	0.6	<0.001	0.05	0.4	30	<0.05	111
T18-02D	T18-02D-A-028	TD4008	79.35	79.54	6	waste	MDST	0.44	1.6	<0.2	<20	99	0.22	4.82	0.11	2.1	2.8	10	2.09	1.2	0.017	0.04	8.6	1.66	155	1	0.032	1.8	0.002	13.1	0.16	0.04	5.6	<0.1	242	0.05	1.6	<0.001	0.04	1.1	4	<0.05	55.6
T18-02D	T18-02D-A-029	TD4009	79.54	80.72	6	waste	MDST	0.4	19.3	0.5	<20	116	0.16	1.13	0.09	18	12.2	32.9	3.15	1.2	0.11	0.12	1.3	0.5	268	0.85	0.045	26	0.002	11.5	1.85	0.07	13	0.3	79.4	0.06	0.3	<0.001	0.06	0.2	29	<0.05	114
T18-02D	T18-02D-A-030	TD4010	80.72	84.3	7	waste	MDST	0.45	7.5	<0.2	<20	135	0.15	0.65	0.05	14.5	10.2	29.9	1.63	1.4	0.047	0.12	0.7	0.34	84	1.38	0.056	17	0.001	9.96	0.73	0.06	12.7	0.1	84	0.06	0.3	<0.001	0.02	0.3	24	<0.05	111
T18-02D	T18-02D-A-031	TD4011	84.3	84.53	7	waste	MDST	0.41	5.1	<0.2	<20	109	0.15	1.51	0.06	13.8	11.3	27.5	3.19	1.2	0.10	0.11	1.3	0.67	132	1.01	0.052	22.8	<0.001	10.5	1.76	0.07	11.7	0.1	117	0.1	0.4	<0.001	0.04	0.2	30	<0.05	75.8
T18-02D	T18-02D-A-032	TD4012	84.53	86.64	7	waste	MDST	0.46	8.1	0.8	<20	119	0.2	0.69	0.03	15.5	12	38.2	2.75	1.3	0.069	0.13	0.9	0.47	134	0.53	0.062	28.2	0.001	10.9	1.13	0.03	14.3	0.3	77.6	0.06	0.3	<0.001	0.04	0.2	29	<0.05	114
T18-02D	T18-02D-A-033	TD4013	86.64	87.48	7	waste	MDST	0.44	21.9	0.4	<20	118	0.16	1.17	0.05	16	15.7	30	10.1	1.3	0.25	0.12	3	1.17	649	1.53	0.058	27.9	0.005	9.63	1.99	0.09	12.3	0.2	85.5	0.07	0.7	<0.001	0.11	0.3	41	<0.05	69.6
T18-02D	T18-02D-A-034	TD4014	87.48	89	7	waste	MDST	0.36	22.2	<0.2	<20	73	0.19	0.42	0.53	13	7.4	51.9	1.6	1.1	0.12	0.08	0.7	0.2	81	1.6	0.065	20.5	0.001	29.6	1.56	0.2	8.6	0.2	50.1	0.07	0.7	<0.001	0.05	0.7	27	<0.05	115
T18-02D	T18-02D-A-035	TD4016	89	90.3	8	waste	MDST	0.6	3.2	<0.2	<20	79.5	0.14	0.49	0.38	18.3	8.2	63.6	0.96	1.8	0.02	0.08	1	0.17	251	0.28	0.082	20.1	0.004	12.5	0.04	0.06	9.3	<0.1	62.5	0.1	0.2	<0.001	0.03	0.2	34	<0.05	142
T18-02D	T18-02D-A-036	TD4017	90.3	90.93	8	waste	MDST	0.49	12.8	<0.2	<20	78.4	0.25	0.42	0.08	22.9	9.8	39.7	1.06	1.6	0.032	0.1	0.7	0.23	343	0.24	0.078	33.6	0.002	13.1	0.08	0.06	10.5	0.1	50.5	0.03	0.4	<0.001	<0.02	0.2	31	<0.05	94.4
T18-02D	T18-02D-A-037	TD4018	90.93	92.52	8	waste	MDST	0.49	2	0.2	<20	78.8	0.15	0.48	0.49	17.1	6.7	52.3	1.46	1.5	0.043	0.08	0.7	0.18	549	0.28	0.084	12.5	0.002	13.3	0.04	0.07	9.2	<0.1	50.1	0.02	0.2	<0.001	<0.02	0.2	40	<0.05	157
T18-03D	T18-03D-A-005	TD4051	10.5	10.8	5	waste	MDST	0.47	13.8	<0.2	<20	121	0.23	0.76	0.07	22.2	27.7	36.3	3.06	1.4	0.20	0.12	0.8	0.48	290	0.6	0.036	46.9	0.006	15.7	2.02	0.08	13.4	0.3	65.1	0.06	0.7	<0.001	0.2	0.3	53	<0.05	137
T18-03D	T18-03D-A-006	TD4052	12.57	12.82	55	waste	MDST	0.36	1.3	<0.2	<20	99.8	0.21	0.21	1.32	10	7.6	64.6	0.43	0.8	0.022	0.08	0.5	0.14	52	0.31	0.037	9.8	<0.001	30.6	0.19	0.1	8.5	<0.1	42.5	0.12	0.6	<0.001	0.06	0.3	30	<0.05	197
T18-03D	T18-03D-A-007	TD4053	12.82	13.44	55	waste	MDST	0.54	0.6	<0.2	<20	127	0.16	0.9	0.62	16.5	23.6	58.8	1.09	1.4	0.026	0.1	2.3	0.39	131	0.96	0.044	21.5	0.001	29.7	0.05	0.05	13.7	0.3	88.4	0.04	0.9	<0.001	0.03	0.2	50	<0.05	189
T18-03D	T18-03D-A-008	TD4054	13.44	14.9	55	waste	MDST	0.41	2	<0.2	<20	98.1	0.26	0.49	0.15	9.4	13.8	28.3	0.78	1.2	0.054	0.1	0.9	0.29	41	0.2	0.034	13.6	0.001	12.1	0.12	0.05	8.9	0.2	57.4	0.03	0.6	<0.001	<0.02	0.2	35	<0.05	89
T18-03D	T18-03D-A-009	TD4055	17.5	18.6	6	waste	MDST	0.51	18.8	1.5	<20	155	0.31	0.85	0.08	24.7	29.7	56.1	2.38	1.5	0.31	0.15	1.3	0.5	94	2.63	0.059	94.9	0.004	18.1	1.18	0.15	13.2	0.4	76.1	0.04	0.9	<0.001	0.17	0.4	48	<0.05	126
T18-03D	T18-03D-A-010	TD4056	18.6	19.4	6	coal	C	0.53	0.5	0.8	<20	90.2	0.3	0.36	0.12	1.6	2.1	11.7	0.33	1.3	0.039	0.03	2.2	0.13	16	1.18	0.058	2.6	0.001	26.8	0.14	0.05	2.9	0.1	41.9	<0.02	1.9	<0.001	0.06	0.8	3	<0.05	38.7
T18-03D	T18-03D-A-011	TD4058	19.4	19.6	6	coal	C	0.3	3.1	<0.2	<20	100	0.12	0.69	0.11	12.6	5.2	37.9	0.62	1	0.061	0.06	<0.5	0.29	58	1.09	0.078	9.4	<0.001	14	0.42	0.22	10.9	<0.1	58.1	0.09	0.3	0.001	0.05	0.2	25	<0.05	58.5
T18-03D	T18-03D-A-012	TD4059	19.6	20.5	6	waste	MDST	0.45	2.9	<0.2	<20	162	0.15	0.36	0.12	17.4	12.1	57.7	0.82	1.2	0.028	0.11	0.6	0.22	162	0.32	0.13	21.9	<0.001	25.3	0.08	0.07	14.5	<0.1	87.2	0.1	0.4	<0.001	0.03	0.2	37	<0.05	136
T18-03D	T18-03D-A-013	TD4060	20.5	22.25	6	waste	MDST	0.49	2.3	<0.2	<20	177	0.12	0.89	0.22	19.1	21.9	40.9	2.79	1.3	0.023	0.12	1.2	0.45	845	0.36	0.125	20.2	0.01	13.8	0.06	0.03	13.7	<0.1	111	0.03	0.8	<0.001	<0.02	0.2	53	<0.05	141
T18-03D	T18-03D-A-014	TD4061	22.25	23.16	6	waste	MDST	0.56	1.8	<0.2	<20	152	0.07	1.7	0.1	18	24.2	23.5	13	1.4	0.008	0.1	3.6	0.88	4230	0.33	0.108	13.9	0.132	10.7	0.03	0.03	12.9	<0.1	115	0.05	0.8	0.001	<0.02	0.3	74	<0.05	103
T18-03D	T18-03D-A-015	TD4062	23.16	23.56	6	waste	MDST	0.49	3.7	0.2	<20	170	0.13	1.29	0.19	21.2	25.7	33.3	4.55	1.2	0.025	0.1	2.2	0.53	4270	0.4	0.127	15.2	0.045	13.8	0.06	0.06	11.7	<0.1	112	<0.02	0.8	<0.001	0.02	0.4	63	<0.05	130
T18-03D	T18-03D-A-016	TD4063	23.56	25	6	waste	MDST	0.72	4.1	1.9	<20	188	0.12	3.14	0.16	24	28	26	6.98	1.6	0.027	0.13	3.2	0.97	2970	0.59	0.129	22	0.201	14.2	0.06	0.07	10.1	<0.1	174	0.04	0.8	0.002	0.03	0.3	53	<0.05	134
T18-03D	T18-03D-A-017	TD4064	25	26.12	6	waste	MDST	0.4	2.2	1.1	<20	148	0.12	1.93	0.11	12.9	38.5	20.7	4.32	0.9	0.023	0.11	2.6	0.8	1480	0.2	0.11	12.7	0.021	14.1	0.06	0.05	11	<0.1	142	0.05	0.7	<0.001	0.02	0.3	48	<0.05	118
T18-03D	T18-03D-A-018	TD4065	26.12	28	6	waste	MDST	0.53	11.1	1.1	<20	256	0.17	0.62	0.08	22	19.8	35.1	2.11	1.4	0.057	0.15	1	0.38	441	0.36	0.204	24.5	0.011	13	0.49	0.04	12.5	0.1	123	0.08	0.6	<0.001	0.04	0.2	40	<0.05	118
T18-03D	T18-03D-A-019	TD4066	28	29.06	6	waste	MDST	0.49	9.6	1.7	<20	187	0.08	1.87	0.06	16	34.9	22.7	4.71	1	0.053	0.12	3.2	0.74	1070	0.31	0.158	18.9	0.04	13.7	0.53	0.04	10	<0.1	171	0.07	1.1	<0.001	0.09	0.4	50	<0.05	101
T18-03D	T18-03D-A-020	TD4067	29.06	30	6	waste	MDST	0.5	6.1	<0.2	<20	256	0.15	0.6	0.11	18.2	16.1	36.4	2.91	1.2	0.049	0.15	1.2	0.47	864	0.39	0.22	19.1	0.013	10.6	0.3	<0.02	12.9	0.2	119	0.04	0.5	<0.001	0.02	0.2	40	<0.05	103
T18-03D	T18-03D-A-021	TD4069	30	32.25	6	waste	MDST	0.47	6.5	0.5	<20	273	0.26	0.27	0.29	16.4	10.8	42	2.18	1.1	0.043	0.16	1.1	0.36	774	0.43	0.223	20	0.006	13.9	0.36	0.03	12.6	0.6	110	0.16	0.6	<0.001	0.05	0.3	32	<0.05	134
T18-03D	T18-03D-A-022	TD4070	32.25	32.65	6	8	SHC	0.36	7.7	1.3	<20	153	0.21	0.24	0.6	18.1	8.2	69.5	1.53	1.7	0.13	0.11	<0.5	0.2	115	2.02	0.136	25.9	<0.001	32.8	1.5	0.16	10.8	0.4	79.4	0.08	0.3	0.001	0.08	0.2	68	<0.05	123
T18-03D	T18-03D-A-023	TD4071	32.65	32.9	7	waste	MDST	0.42	215	0.8	<20	74.8	0.09	0.75	0.39	32.8	43.8	41.9	6.32	1.3	0.081	0.11	1.9	0.75	507	18.6	0.098	50.6	0.006	54	5.13	0.48	11.7	0.9	115	0.05	0.4	<0.001	0.34	0.2	40	<0.05	178
T18-03D	T18-03D-A-024	TD4072	32.9	34.53	7	waste	MDST	0.39	3.9	0.4	<20	153	0.17	0.26	0.66	17	12.8	61.5	1.31	1.2	0.058	0.11	<0.5	0.29	252	0.98	0.136	25.4	0.001	34.4	0.64	0.1	10.1	0.5	77.6	0.06	0.3	<0.001	0.06	0.3	59	<0.05	168
T18-03D	T18-03D-A-025	TD4073	34.53	35.5	7	waste	MDST	0.43	3.9	0.7	<20	146	0.13	1.1	0.32	17.3	21.1	43.9	13.2	1.1	0.027	0.11	3.6	0.63	2630	0.54	0.109	18.3	0.054	24.2	0.08	0.06	13.8	0.2	84.7	0.1	0.4	0.001	0.04	0.2	92	<0.05	137
T18-03D	T18-03D-A-026	TD4074	35.5	36.26	7	waste	MDST	1.51	6.9	<0.2	<20	252	0.11	1.57	0.42	27.8	26.3	70.8	1.51	3.3	0.054	0.13	6.3	0.22	457	1.25	0.173	38.7	0.503	18	0.24	0.1	16.5	0.4	185	0.09	1	0.004	0.1	0.3	84	<0.05	163
T18-03D	T18-03D-A-027	TD4075	36.26	37.8	7	waste	MDST	0.44	1	<0.2	<20	149	0.13	0.53	0.55	14.6	12.1	67.2	3.22	1.4	0.039	0.1	2.4	0.32	685	0.42	0.144	14.5	0.013	17.5	0.06	0.06	14.2	0.4	82.8	0.08	0.4	<0.001	0.02	0.2	51	<0.05	129
T18-03D	T18-03D-A-028	TD4076	37.8	38.1	7	8	MDST	0.47	1.7	0.7	<20	166	0.14	0.21	0.65	12.1	8.1	63.1	0.94	1.1	0.022	0.13	0.8	0.18	206	0.21	0.163	10.8	0.002	23.6	0.03	0.07	11.4	0.3	80.6	0.11	0.2	<0.001	0.04	0.1	37	<0.05	163
T18-05D	28651	TH0788	13.5	22.5	1	waste	SLST	0.98	6	0.6	<20	201	0.36	0.8	0.08	16.3	26.2	44.4	3.31	3.1	0.068	0.23	3.3	0.91	417	0.51	0.27	48.9	0.035	13.3	0.41	<0.02	9.3	<0.1	66	0.07	3.9	<0.001	0.03	0.4	33	<0.05	120
T18-05D	28652	TH0789	22.5	23.2	1	waste	SLST	0.75	19.3	0.4	<20	220	0.1	0.99	0.2	12.9	23.9	18.3	3.9	1.8	0.37	0.28	3.3	0.8	366	0.95	0.411	36.2	0.028	6.87	1.45	0.03	8.4	0.3	66.2	0.05	1.8	<0.001	0.25	0.5	26	<0.05	93.7
T18-05D	28653	TH0790	23.2	30.6	1	waste	SLST	0.64	12.8	<0.2	<20	170	0.27	1.72	0.07	19.4	32.3	45.3	4.26	2.3	0.12	0.22	2.6	1.13	1250	0.84	0.232	57.1	0.044	13.7	0.86	0.05	9.2	<0.1	71.4	0.06	4.2	<0.001	0.04	0.4	41	<0.05	112
T18-05D	28654	TH0791	30.6	33.5	1	waste	SLST	0.54	10.6	<0.2	<20	169	0.26	1.16	0.08	20.3	32.3	47.8	4.23	2.1	0.052	0.2	3.2	0.98	897	0.59	0.213	59.9	0.049	13.7	0.18	0.03	9.4	<0.1	57	0.08	4.7	<0.001	0.02	0.5	44	<0.05	99.5
T18-05D	28655	TH0792	33.5	37.4	1	waste	SLST	0.56	9.9	<0.2	<20	184	0.29	0.8	0.08	22.3	29.7	54.9	3.78	1.9	0.083	0.21	3.1	0.78	530	0.66	0.231	58.7	0.042	16.4	0.43	0.04	9.1	<0.1	57.4	0.05	4.7	<0.001	0.03	0.5	42	<0.05	121
T18-05D	28656	TH0793	37.4	38.9	1	waste	SLST	0.49	7.4	<0.2	<20	175	0.23	1.09	0.06	19	34	33.8	3.93	1.8	0.065	0.19	3.8	0.94	502	0.43	0.215	47.6	0.038	11.5	0.34	0.04	9.7	<0.1	60.6	0.04	3.5	<0.001	0.03	0.5	41	<0.05	94.5
T18-05D	28657	TH0794	38.9	42.4	1	waste	SLST	0.49	8.4	<0.2	<20	164	0.2	1.28	0.07	19.2	34.7	29.6	3.95	1.7	0.081	0.19	3.6	0.94	516	0.47	0.207	47.8	0.038	12.8	0.51	0.05	9.8	<0.1	64.8	0.04	3.6	<0.001	0.04	0.5	40	<0.05	94.8
T18-05D	28658	TH0795	42.4	46	1	waste	SLST	0.52	8.5	0.6	<20	169	0.22	1.22	0.05	18.3	32.8	37.2	4.07	1.8	0.10	0.2	3.2	0.91	513	0.54	0.216	52.6	0.043	11.6	0.63	0.04	10.3	<0.1	65	0.06	3.9	<0.001	0.04	0.5	40	<0.05	100
T18-05D	28659	TH0796	46	49.6	1	waste	SLST	0.51	9.9	<0.2	<20	158	0.17	2.09	0.06	18.9	31.3	26.8	3.62	1.6	0.14	0.17	3.6	1.02	518	0.5	0.195	53	0.052	12.6	0.88	0.08	10.5	<0.1	94.4	0.05	4	<0.001	0.05	0.4	35	<0.05	96.7
T18-05D	28660	TH0797	49.6	53.2	1	waste	SLST	0.46	9.8	<0.2	<20	160	0.21	1.09	0.07	21	30.1	40.7	4.09	1.5	0.11	0.18	3.1	0.92	533	0.6	0.21	61.8	0.052	12.2	0.45	0.08	10.8	<0.1	63.7	0.07	4.3	<0.001	0.04	0.5	39	<0.05	105
*Screening Criteria								800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000	20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

Notes:

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Hole-ID	Sample ID	Maxxam Sample ID	Sample Depth (m)		ABA Zone	Sample Type	Lithology	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
			From	To				%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
T18-05D	28661	TH0799	53.2	56.8	1	waste	SLST	0.61	10.4	<0.2	<20	171	0.14	4.36	0.05	15.2	42.1	28.4	5.17	1.7	0.045	0.18	3.3	1.78	872	0.49	0.177	46	0.074	9.16	0.19	0.03	10.3	<0.1	155	0.04	3.3	<0.001	0.02	0.4	43	<0.05	85.9
T18-05D	28662	TH0800	56.8	59.6	1	waste	SLST	0.51	9.2	<0.2	<20	177	0.18	1.28	0.05	16.4	29.9	36.3	4.56	1.6	0.054	0.18	3	1.06	717	0.47	0.204	51.1	0.047	11.6	0.17	0.05	12.1	<0.1	76.7	0.04	3.5	<0.001	0.03	0.4	41	<0.05	101
T18-05D	28663	TH0801	59.6	62.3	1	waste	SLST	0.53	10	<0.2	<20	180	0.22	1.17	0.07	19.4	25.4	46.7	3.74	1.7	0.082	0.18	2.8	0.83	783	0.61	0.215	57.1	0.038	14.7	0.25	0.03	10.7	<0.1	78.2	0.05	3.4	<0.001	0.03	0.4	36	<0.05	107
T18-05D	28664	TH0802	62.3	65.3	1	waste	SLST	0.51	10	<0.2	<20	166	0.22	1.39	0.08	23	28.3	42.8	4.03	1.6	0.059	0.17	3	0.91	872	0.7	0.201	61.5	0.047	12.8	0.12	0.04	11.3	<0.1	86.7	0.04	3.9	<0.001	0.02	0.4	38	<0.05	107
T18-05D	28665	TH0803	65.3	68.4	1	waste	SLST	0.51	11.3	<0.2	<20	163	0.23	1.29	0.06	19.1	26.8	46.9	3.84	1.5	0.082	0.17	2.7	0.84	789	0.55	0.199	55.7	0.041	11.4	0.27	0.07	10.4	<0.1	82.4	0.05	3.3	<0.001	0.03	0.4	35	<0.05	106
T18-05D	28666	TH0804	68.4	71.4	1	waste	SLST	0.55	13.3	<0.2	<20	160	0.24	3.08	0.06	20.9	29.5	40.2	4.46	1.4	0.094	0.16	3.7	1.4	951	0.78	0.181	68.2	0.053	12	0.25	0.07	10.9	<0.1	162	0.03	3.9	<0.001	0.04	0.5	41	<0.05	101
T18-05D	28667	TH0805	71.4	75.1	1	waste	SLST	0.49	13.2	<0.2	<20	159	0.26	1.63	0.05	19.8	26.9	48.4	5.98	1.5	0.07	0.15	2.9	1.35	982	0.81	0.189	62.8	0.064	12.2	0.24	0.1	14.3	<0.1	122	0.08	3.4	<0.001	0.03	0.4	55	<0.05	108
T18-05D	28668	TH0806	75.1	78.6	1	waste	SLST	0.61	9.6	<0.2	<20	190	0.21	1.77	0.08	14.4	17.8	42.7	4.86	1.4	0.054	0.17	2.7	1.17	570	0.46	0.244	36.4	0.033	9.42	0.42	0.04	11.7	<0.1	158	0.05	1.6	<0.001	0.02	0.4	38	<0.05	101
T18-05D	28669	TH0807	78.6	82.1	1	waste	SLST	0.6	10.8	<0.2	<20	190	0.1	0.94	0.04	10.8	14.3	26.6	4.51	1.3	0.055	0.17	0.7	0.88	318	0.22	0.32	17.1	0.005	7.27	0.8	<0.02	14.1	<0.1	87.6	0.03	0.4	<0.001	0.03	0.2	40	<0.05	91.4
T18-05D	28670	TH0808	82.1	85.6	1	waste	SLST	0.7	15.3	<0.2	<20	212	0.11	3.23	0.07	9.2	14.2	25.1	4	1.6	0.048	0.16	1	1.25	333	0.41	0.238	16.4	0.034	7.82	0.84	<0.02	12	<0.1	190	0.05	0.6	<0.001	0.03	0.5	37	<0.05	79.3
T18-05D	28671	TH0810	85.6	88.3	1	waste	SLST	0.49	14.1	<0.2	<20	163	0.08	1.29	0.09	12.5	25.2	13.2	5.97	1.3	0.054	0.18	1.4	1.03	387	1.87	0.254	18.1	0.007	6.72	1.32	<0.02	11.7	<0.1	118	0.03	0.5	<0.001	0.06	0.3	37	<0.05	91.3
T18-05D	28672	TH0811	88.3	91.4	1	waste	SLST	0.44	17.4	<0.2	<20	117	0.21	0.5	0.08	16	16.2	28.3	2.89	1.4	0.135	0.13	<0.5	0.39	202	5.36	0.165	31.1	0.001	12.7	2.21	0.06	10.5	<0.1	57.6	<0.02	0.3	<0.001	0.09	0.8	27	<0.05	91.7
T18-05D	28673	TH0812	91.4	93.97	2	waste	MDST	0.44	21.3	<0.2	<20	129	0.21	0.54	0.02	19.5	18.9	33.4	3	1.4	0.114	0.14	0.6	0.48	272	0.68	0.16	43.2	0.002	13.9	2.11	0.04	10.3	<0.1	68.2	0.03	0.4	<0.001	0.04	0.3	24	<0.05	112
T18-05D	28674	TH0813	93.97	94.61	2	coal	C	0.18	58.8	<0.2	<20	58.6	0.12	0.63	0.02	2.8	3.8	10.4	2.09	1.3	0.116	0.02	3	0.19	40	0.9	0.027	4.8	0.075	9.41	2.75	0.17	3	<0.1	117	0.06	1.4	0.004	0.05	0.7	13	<0.05	10.3
T18-05D	28675	TH0814	94.61	96.9	3	waste	MDST	0.51	38.7	<0.2	<20	157	0.17	0.61	0.04	20.6	16.7	31.8	2.78	1.4	0.085	0.15	0.7	0.42	224	0.69	0.192	36.4	0.004	11.4	1.99	<0.02	10.1	<0.1	60.9	0.06	0.3	<0.001	0.05	0.2	22	<0.05	109
T18-05D	28676	TH0815	97.45	97.61	3	coal	SLST	0.5	50	<0.2	<20	151	0.2	0.66	0.05	20.9	21.8	28	4.32	1.5	0.09	0.15	0.8	0.73	514	0.7	0.144	43.7	0.007	11.7	2.08	<0.02	11.8	0.3	63	0.05	0.3	<0.001	0.03	0.3	35	<0.05	106
T18-05D	28677	TH0816	97.61	99.97	3	waste	SLST	0.46	99.7	<0.2	<20	102	0.27	0.11	0.07	22.1	14.1	31	3.92	1.6	0.194	0.15	0.5	0.29	323	1.81	0.154	57.7	0.002	16	3.54	0.04	7.5	0.5	38.4	0.06	0.3	<0.001	0.05	0.3	24	<0.05	93.8
T18-05D	28678	TH0817	101.97	102.17	4	waste	SLST	0.6	49.3	<0.2	<20	289	0.22	0.26	0.05	36.2	9.1	50.6	1.3	1.5	0.026	0.17	2	0.18	1920	2.1	0.249	50.3	0.007	11.4	0.09	<0.02	9.8	<0.1	58.2	0.07	0.3	<0.001	<0.02	0.3	28	<0.05	226
T18-05D	28679	TH0818	102.17	106.3	4	waste	SLST	0.62	35.8	<0.2	<20	263	0.18	1.47	0.03	20.1	14.9	41.1	3.95	1.5	0.027	0.17	2.2	0.61	2650	0.47	0.215	30.2	0.021	11.5	0.33	<0.02	14.3	<0.1	94	0.04	0.9	<0.001	<0.02	0.3	42	<0.05	96.9
T18-05D	28680	TH0819	106.3	108.7	4	waste	SLST	0.61	29.7	<0.2	<20	227	0.16	1.21	0.02	14.6	18.1	30.5	7.91	1.6	0.028	0.16	2.4	1.13	1520	0.32	0.169	21.8	0.026	9.1	0.3	0.03	15.8	<0.1	106	0.04	0.8	<0.001	<0.02	0.3	58	<0.05	83.5
T18-05D	28681	TH0821	108.7	111.1	4	waste	SLST	0.49	78.9	<0.2	<20	190	0.16	1.04	0.05	17	14.9	29.6	7.14	1.3	0.062	0.13	1.6	0.93	1280	1.39	0.149	26.9	0.013	9.93	1.62	0.06	13.9	<0.1	71.8	0.05	0.4	<0.001	0.04	0.3	48	<0.05	87
T18-05D	28682	TH0822	111.1	111.9	4	waste	MDST	0.45	30.8	<0.2	<20	179	0.19	0.69	0.08	15	12	29.5	2.29	1.2	0.109	0.12	0.6	0.32	344	1.62	0.145	27.2	0.009	13.1	1.73	0.05	11.6	<0.1	60.9	0.06	0.3	<0.001	0.06	0.4	32	<0.05	121
T18-05D	28683	TH0823	111.9	112.1	4	coal	C	0.14	89.4	<0.2	<20	46.4	0.08	1.47	0.12	5.1	18.4	8.58	3.58	0.8	0.226	0.02	1.7	0.47	352	4.4	0.02	17.2	0.083	4.15	3.52	0.43	3.9	0.4	127	0.02	0.4	0.003	0.08	0.4	27	<0.05	25
T18-05D	28684	TH0824	112.1	112.6	5	waste	SLST	0.44	45.6	0.6	<20	164	0.27	0.49	0.03	21.6	16.4	31.5	2.53	1.3	0.118	0.14	0.5	0.32	228	0.67	0.123	43.9	0.005	14.4	1.92	0.04	10.9	0.3	49.7	0.06	0.4	<0.001	0.06	0.2	24	<0.05	115
T18-05D	28685	TH0825	112.6	115.5	5	waste	SLST	0.43	35.3	0.9	<20	162	0.16	3	0.02	12.2	18.8	19.7	12	1.1	0.033	0.1	2.6	1.61	4530	0.47	0.09	26.8	0.06	8.45	0.41	0.09	12.1	<0.1	139	0.06	0.9	0.001	0.02	0.3	52	<0.05	72.2
T18-05D	28686	TH0826	115.5	119.3	5	waste	SLST	0.4	42.6	0.8	<20	147	0.23	1.12	0.04	20.2	15.6	29.7	3.88	1.3	0.119	0.11	1.4	0.61	851	0.5	0.083	43.3	0.01	14.4	1.25	0.05	12.9	0.4	67.2	0.04	0.6	<0.001	0.03	0.3	38	<0.05	118
T18-05D	28687	TH0827	119.3	119.5	5	waste	SLST	0.41	61.4	0.5	<20	144	0.25	0.22	0.05	22.7	12.1	35.3	1.84	1.2	0.116	0.11	0.6	0.17	194	0.75	0.075	40.4	0.01	13.2	1.42	0.08	9.6	0.4	38	0.05	0.4	<0.001	0.04	0.3	23	<0.05	137
T18-05D	28688	TH0828	126.6	126.8	6	waste	MDST	0.4	26.7	<0.2	<20	227	0.31	0.37	<0.01	6.6	8.9	42.3	0.59	1	0.031	0.13	<0.5	0.15	42	0.87	0.055	13.9	0.001	4.42	0.26	0.06	6.1	0.2	43.6	0.08	0.6	<0.001	0.03	0.3	23	<0.05	32.7
T18-05D	28689	TH0829	126.8	128.8	6	waste	MDST	0.47	82.3	1.2	<20	229	0.32	0.87	0.06	16.4	17	58	1.24	1.4	0.057	0.14	1.2	0.31	155	1.11	0.051	55.6	0.012	11.3	0.4	0.13	11.3	0.4	64	0.09	0.9	<0.001	0.05	0.3	26	<0.05	135
T18-05D	28690	TH0830	128.8	131.6	6	waste	MDST	0.38	66.9	0.5	<20	164	0.25	0.97	0.16	15.5	15	50.7	2.93	1.1	0.133	0.11	1	0.42	223	1.38	0.055	39.6	0.006	23.6	2.48	0.17	11.2	0.3	67	0.07	0.6	<0.001	0.12	0.3	25	<0.05	123
T18-05D	28691	TH0832	131.6	131.9	6	coal	MDST	0.16	64.9	<0.2	<20	61.5	0.16	0.43	0.14	8	3.4	15.4	1.89	0.8	0.12	0.02	<0.5	0.16	46	2.21	0.021	8.2	<0.001	15.7	2.47	0.22	7.6	<0.1	40.6	0.06	0.8	0.001	0.03	0.2	13	<0.05	22.5
T18-05D	28704	TH0843	131.9	132.2	6	waste	C	0.23	53	0.8	<20	62	0.14	1.87	0.1	5.3	5.8	11.4	2.14	1.1	0.121	0.02	2.3	0.43	51	1.23	0.02	3	0.002	12	2.12	0.15	3.9	0.4	57	<0.02	1	0.002	0.06	0.5	11	<0.05	36.4
T18-05D	28692	TH0833	132.2	132.5	6	coal	P	0.56	79.6	<0.2	<20	124	0.17	0.25	0.04	19.5	10.5	37.8	2.7	2	0.105	0.14	<0.5	0.14	80	2.25	0.075	21.7	0.016	12.2	2.53	0.04	9	0.4	50.4	0.04	0.7	<0.001	0.11	0.2	19	<0.05	82.2
T18-05D	28693	TH0834	132.5	132.85	6	waste	C	0.08	18.4	<0.2	<20	13	0.05	0.83	<0.01	1.7	2.2	5.79	0.88	0.3	0.057	<0.01	0.8	0.17	34	0.36	0.008	2.1	0.074	2.28	1.17	0.04	3	0.1	44.4	<0.02	0.5	0.002	<0.02	0.2	8	<0.05	7.4
T18-05D	28694	TH0835	132.85	133.6	6	coal	MDST	0.44	12.6	0.2	<20	193	0.14	3.59	0.02	5.4	14.1	20.5	1.85	1.4	0.013	0.1	0.8	1.02	245	0.36	0.067	7.2	0.011	7.09	0.18	0.02	10.9	0.2	129	0.03	1.8	<0.001	<0.02	0.3	32	<0.05	88.1
T18-05D	28695	TH0836	133.6	134.4	6	waste	MDST	0.61	19.3	<0.2	<20	192	0.12	2.44	<0.01	12.3	12.2	19.8	8.96	1.5	0.02	0.12	1.6	1.15	2720	1.07	0.073	11.8	0.069	6.46	0.37	0.04	10.8	0.4	96.9	0.02	0.7	<0.001	<0.02	0.4	35	<0.05	58.6
T18-05D	28696	TH0837	134.4	135	6	waste	MDST	0.44	79.8	0.6	<20	57.3	0.12	2.56	0.1	19.3	10.7	25	5.97	1.2	0.383	0.1	<0.5	0.84	216	6.45	0.065	30.3	0.001	16.9	5.75	0.12	10.2	0.7	92.2	0.03	0.1	<0.001	0.19	0.4	33	<0.05	54.2
T18-05D	28697	TH0838	135	135.8	6	coal	C	0.09	49.6	<0.2	<20	25.6	0.13	1.02	0.03	1.4	4.4	8.83	2.32	0.7	0.136	0.02	<0.5	0.1	23	2.98	0.014	2.8	<0.001	8.56	3.08	0.13	1.8	<0.1	26.4	<0.02	0.2	0.002	0.04	0.1	6	<0.05	5.8
T18-05D	28698	TH0839	135.8	139.1	7	waste	SLST	0.52	17.7	0.4	<20	142	0.23	0.37	0.08	20.5	13.9	37.4	2.14	1.7	0.107	0.13	<0.5	0.24	129	1.37	0.094	26	0.001	13.9	1.48	0.05	12.5	0.4	53.9	0.07	0.2	<0.001	0.06	0.5	25	<0.05	108
T18-05D	28699	TH0840	139.1	139.9	7	waste	SLST	0.49	28.9	<0.2	<20	129	0.24	0.23	0.11	23.6	10.5	38.9	2.39	1.6	0.106	0.12	<0.5	0.19	118	4.44	0.099	31.6	0.001	14.6	2.11	0.06	10.4	0.3	53.2	0.04	0.3	<0.001	0.08	1.5	24	<0.05	117
T18-05D	28700	TH0842	139.9	140.9	7	coal	C	0.2	68.8	<0.2	<20	40.4	0.17	0.6	0.29	9.6	3.3	33.4	3.01	1.1	0.29	0.04	<0.5	0.18	57	5	0.038	16.3	<0.001	20.4	3.73	0.3	6.1	0.3	31.4	0.06	0.4	0.002	0.2	0.4	40	<0.05	59.1
T18-05D	28705	TH0844	140.9	141.2	7	waste	MDST	0.59	8.6	<0.2	<20	84.1	0.09	2.27	0.51	8.5	31.5	43.8	9.05	1.6	0.006	0.08	2.2	1.57	1290	0.43	0.049	11.9	0.086	25.3	0.11	0.1	11.9	0.4	80.3	0.02	0.7	0.002	<0.02	0.3	88	<0.05	141
T18-05D	28706	TH0845	141.2	142.1	7	waste	MDST	0.62	3.1	<0.2	<20	86.5	0.18	0.16	0.1	10	2.9	46.4	0.29	1.9	0.029	0.05	1.1	0.08	30	1.06	0.076	9.6	0.002	12.2	0.08	0.08	5.7	0.3	39.2	0.02	0.5	0.002	<0.02	0.5	27	<0.05	60.5
T18-05D	28707	TH0846	142.1	142.6	7	coal	C	0.23	1	<0.2	<20	35.6	0.1	0.74	0.06	3.4	5.2	22.9	0.09	1	0.025	0.03	<0.5	0.09	25	0.84	0.039	3.3	<0.001	10.7	0.09	0.05	4	0.3	24.4	<0.02	<0.1	0.003	<0.02	0.1	76	<0.05	27.4
T18-05D	28708	TH0847	142.6	143	8	waste	MDST	0.54	16.7	0.3	<20	116	0.15	0.26	0.26	13.5	14.8	48.9	1.57	1.7	0.026	0.09	1.2	0.09	360	1.2	0.111	23.4	0.003	21.4	0.07	0.12	8.8	0.3	42.8	0.04	0.2	<0.001	0.06	0.2	47	<0.05	132
T18-05D	28709	TH0848	143	143.9	8	waste	MDST	1.36	13.6	0.6	<20	138	0.15	1.1	0.46	30.9	19.4	83.2	1.58	3.5	0.025	0.1	5.1	0.17	382	2.67	0.099	39.5	0.267	21.2	0.05	0.14	12.4	0.5	99.1	0.12	1.2	0.003	0.06	0.5	49	<0.05	158
T18-05D	28710	TH0849	143.9	144.1	8	waste	MDST	3.97	21.2	1	<20	297	0.07	5.27	0.33	66.4	49	91.4	0.18	7.6	0.027	0.05	16.8	0.05	30	5.87	0.095	83.3	1.94	14.5	0.08	0.31	24.5	0.3	719	0.11	2	0.013	0.15	1.4	71	<0.05	136
T18-05D	28711	TH0850	144.1	144.4	8	waste	MDST	0.51	26.5	<0.2	<20	84.6	0.14	1.05	0.5	9.5	5.5	49.8	0.53	1.6	0.063	0.09	<0.5	0.26	78	0.67	0.095	16.4	0.021	25.3	0.24	0.22	6.9	0.4	52.2	0.06	0.2	0.001	0.1	0.2	81	<0.05	150
T18-05D	28712	TH0851	144.4	148	8	waste	MDST	0.68	6.1	<0.2	<20	105	0.13	0.27	0.15	19.1	13.8	52	6.12	1.6	0.014	0.1	3.5	0.19	1060	0.13	0.094	19.4	0.027	19.8	0.05	0.07	13.1	0.2	50.6	0.06	0.5	<0.001	0.05	0.1	54	<0.05	111
T18-05D	28713	TH0852	148	148.2	8	coal	C	0.32	3.5	<0.2	<20	49.2	0.12	2.35	0.35	10.9	4.6	50.4	0.52	1	0.02	0.05	0.6	0.51	138	0.66	0.055	10	0.003	12.1	0.1	0.13	10.9	0.1	61.8	0.05	0.1	0.003	<0.02	0.2	75	<0.05	96.3
T18-07D	28836	TH0854	6.9	10.4	1	waste	MDST	2.12	8.3	<0.2	<20	315	0.15	1.77	0.1	13.7	28.4	47.6	3.61	5.5	0.043	0.24	4.4	0.86	346	0.21	0.254	35.5	0.039	9.23	0.76	0.02	10.4	0.4	140	0.04	2.2	<0.001	0.04	0.5	49	<0.05	114
T18-07D	28837	TH0855	10.4	14.8	1	waste	MDST	2.02	13.2	<0.2	<20	273	0.15	2.14	0.28	12.7	36.2	46.8	3.51	4.8	0.095	0.24	5.7	0.75	294	2.11	0.371	46.8	0.046	11.6	1.72	0.07	10.6	1.9	166	0.06	2.5	<0.001	0.08	1	43	<0.05	156
T18-07D	28838	TH0856	14.8	18.3	1	waste	SLST	1.97	18.9	<0.2	<20	254	0.13	0.92	0.42	13.1	37.2	27.2	3.89	4.1	0.086	0.29	8.3	0.72	228	1.91	0.477	29.4	0.068	9.57	1.74	0.06	8.8	1	154	<0.02	3.4	<0.001	0.17	0.8	34	<0.05	130
T18-07D	28839	TH0857	18.3	22.2	1	waste	SLST	2.06	12.7	<0.2	<20	261	0.08	0.9	0.07	15.2	53.5	17.1	4.49	4.7	0.12	0.27	6.3	0.93	308	1.17	0.319	39.7	0.047	9.68	1.34	0.06	8	0.3	109	0.02	2.1	0.002	0.14	0.4	42	<0.05	94.4
T18-07D	28840	TH0858	22.2	26.1	1	waste	SLST	2.22	7.8	1.3	<20	285	0.19	0.71	0.06	17.3	53.5	27.6	4.06	6.1	0.07	0.28	5.9	1.02	319	0.27	0.312	48.8	0.037	9.6	0.76	0.03	8.3	<0.1	94.8	0.03	3.1	0.003	0.05	0.3	50	<0.05	102
T18-07D	28841	TH0859	26.1	30	1	waste	SLST	2.36	8.1	0.7	<20	278	0.26	0.59	0.11	19.8	60.9	39.7	4.44	6.8	0.111	0.27	6.9	1.12	356	0.6	0.281	66.1	0.039	12.6	1.08	0.05	8.2	<0.1	84.6	<0.02	4.3	0.004	0.06	0.4	54	<0.05	115
T18-07D	28842	TH0860	30	33.9	1	waste	SLST	2.39	8.4	0.7	<20	287	0.26	0.82	0.1	21	61	37	4.21	7.1	0.122	0.29	7.9	1.07	345	0.43	0.279	70.5	0.09	13.8	1.24	0.07	8.3	<0.1	99.8	0.06	4.2	0.005	0.07	0.4	53	<0.05	118
T18-07D	28843	TH0861	33.9	38.2	1	waste	SLST	2.29	11.3	0.5	<20	256	0.33	0.34	0.07	23	62.7	51.5	4.21	7.1	0.147	0.29	5.5	1.03	390	1.43	0.296	79.1	0.053	17.6	1.62	0.07	8.2	0.1	87.5	0.07	5.5	0.003	0.07	0.4	54	<0.05	128
T18-07D	28844	TH0862	38.2	42.3	1	waste	FLT	2.25	8.7	1.7	<20	320	0.3	0.84	0.09	18.8	56.8	43.3	3.95	6.7	0.104	0.3	5.8	1.02	389	0.71	0.303	64.4	0.045	13.6	1.17	0.04	8.4	<0.1	106	0.05	5.1	0.003	0.06	0.4	50	<0.05	119
T18-07D	28845	TH0863	42.3	44.2	1	waste	SLST	2.28	6.8	1.2	<20	286	0.3	0.38	0.07	19.4	52.6	43.8	3.99	6.8	0.061	0.28	6.2	1.05	317	0.67	0.302	67.5	0.039	13.7	0.94	0.04	7.9	<0.1	86.2	0.04	4.6	0.003	0.06	0.4	49	<0.05	118
T18-07D	28846	TH0865	44.2	49.8	1	waste	SST	1.97	6	0.2	<20	295	0.18	1.09	0.07	16.7	57.3	20	3.6	5.3	0.091	0.25	7	0.97	379	0.29	0.28	51.7	0.045	11.6	0.7	0.08	8	<0.1	105	<0.02	3.8	0.003	0.08	0.4	43	<0.05	109
T18-07D	28847	TH0866	49.8	52.8	1	waste	SLST	2.13	5.8	<0.2	<20	302	0.23	1.06	0.09	16.8	54.9	27.2	3.69	5.8	0.08	0.26	7.3	1.02	346	0.27	0.309	54.2	0.062	12.2	0.68	0.06	8.1	<0.1	112	<0.02	4	0.003	0.05	0.4	45	<0.05	112
T18-07D	28848	TH0867	52.8	57.15	1	waste	SLST	2.34	7.5	0.5	<20	310	0.32	0.35	0.11	20.9	55	44.4	3.6	6.4	0.087	0.27	6.3	1.05	297	0.43	0.335	68.2	0.039	15.8	0.55	0.05	8.8	<0.1	95.9	0.03	4.4	0.002	0.06	0.4	50	<0.05	133
T18-07D	28849	TH0868	57.15	61.5	1	waste	SLST	2.27	8.7	0.9	<20	282	0.35	0.5	0.09	19.9	48.3	47.4	3.85	5.9	0.081	0.26	5.2	1.03	340	0.6	0.32	65	0.049	15.2	0.87	0.06	8.5	0.1	94.6	0.07	4.6	0.002	0.07	0.3	49	<0.05	122
T18-07D	28850	TH0869	61.5	63.4	1	waste	FLT	1.66	14.2	0.3	<20	345	0.12	7.02	0.14	14.4	35.8	25.7	3.12	3.6	0.106	0.32	10.8	0.7	879	1.19	0.378	42.1	0.033	13.7	1.01	0.03	8.3	0.2	190	<0.02	2.3	<0.001	0.11	0.4	31	<0.05	103
T18-07D	29501	TH0870	63.4	66.8	1	waste	MDST	1.98	8.6	1.3	<20	307	0.21	0.67	0.1	15.1	46.3	37.5	3.81	5.4	0.084	0.28	4.9	0.92	392	0.64	0.327	42.4	0.04	9.98	0.83	0.03	9.3	0.2	110	<0.02	3.5	0.002	0.07	0.5	43	<0.05	119
T18-07D	29502	TH0871	66.8	69.6	1	waste	SLST	2	13.1	0.3	<20	193	0.19	3.89	0.11	18.5	60.4	41.1	4.78	6.3	0.1	0.21	5.6	1.12	1070	0.99	0.197	61.4	0.068	13.5	1.6	0.09	9.5	<0.1	141	0.07	4.7	0.004	0.04	0.4	58	<0.05	89.1
T18-07D	29503	TH0872	69.6	72.4	1	waste	SLST	2	14.3	1.1	<20	210	0.27	1.03	0.09	21.6	63.6	54.3	4.34	7	0.154	0.23	4.8	0.94	703	1.03	0.219	75.5	0.06	16.1	1.83	0.14	9.2	0.1	85.2	0.06	5.3	0.005	0.07	0.4	58	<0.05	113
T18-07D	29504	TH0873	72.4	75.6	1	waste	SST	1.69	14.8	<0.2	<20	200	0.29	3.92	0.12	19.8	54.7	45	4.04	5.9	0.138	0.21	5.3	0.93	985	1.23	0.199	66.3	0.069	15.2	1.85	0.16	8.3	<0.1	144	0.05	4.7	0.004	0.06	0.4	50	<0.05	94.9
T18-07D	28786	TH0874	75.6	78.8	1	waste	SST	1.61	9.7	0.5	<20	213	0.18	6.77	0.08	17	51.5	35.2	4.17	5.7	0.071	0.2	5.2	0.99	829	0.54	0.172	55.1	0.054	10.6	1.12	0.08	8.2	0.2	129	0.09	3.8	0.004	0.06	0.4	49	<0.05	89.1
T18-07D	29505	TH0876	78.8	84	1	waste	SLST	2.06	9.4	1.2	<20	254	0.25	0.77	0.1	23.6	62.6	50.6	4.43	7.1	0.111	0.24	5	1.09	554	0.55	0.213	75.8	0.043	19.4	0.57	0.05	9.8	<0.1	82.5	0.04	4.2	0.004	0.05	0.4	60	<0.05	119
T18-07D	29506	TH0877	84	86.9	1	waste	SLST	1.59	9.5	0.8	<20	219	0.19	6.61	0.08	20.1	52.9	36	3.82	5.5	0.143	0.22	4.6	0.95	640	0.61	0.183	68.1	0.054	13.5	1.12	0.1	8.4	<0.1	151	<0.02	3.5	0.004	0.07	0.4	48	<0.05	93.6
T18-07D	29507	TH0878	86.9	92.2	1	waste	SLST	1.47	8.7	<0.2	<20	206	0.18	9.35	0.06	19.3	45.8	34	3.69	5.3	0.108	0.19	5.6	0.87	714	0.59	0.177	62.5	0.053	11.8	0.67	0.08	8.2	<0.1	153	0.05	3.6	0.003	0.05	0.4	47	<0.05	86.4
T18-07D	29508	TH0879	92.2	96.3	1	waste	SLST	1.76	10.3	0.2	<20	235	0.21	1.07	0.06	22	61.4	41.8	3.7	6.5	0.105	0.23	4.8	0.88	438	0.72	0.193	70.5	0.056	12.8	0.58	0.09	9.6	<0.1	85.7	<0.02	4.6	0.004	0.06	0.4	57	<0.05	123
T18-07D	29509	TH0880	96.3	104.7	1	waste	SLST	1.76	12.3	0.4	<20	221	0.24	0.71	0.1	21.7	58.2	52.8	3.83	6.3	0.095	0.21	4.7	0.89	634	0.68	0.203	75.3	0.05	14	0.27	0.09	10.1	0.2	80.5	0.1	4.2	0.003	0.05	0.4	56	<0.05	122
T18-07D	29510	TH0881	104.7	107.8	1	waste	MDST	1.65	16.8	<0.2	<20	222	0.26	1.12	0.11	25.4	56.1	59.4	3.94	5.8	0.239	0.21	4.7	0.87	1010	0.89	0.194	92.9	0.053	16.8	0.65	0.19	10.2	<0.1	89.7	0.04	4.4	0.004	0.15	0.3	54	<0.05	126
T18-07D	29511	TH0882	107.8	111.1	1	waste	MDST	1.66	12.1	0.7	<20	221	0.25	1.37	0.1	22	56.4	56.1	4.8	6	0.084	0.2	5.9	0.98	822	0.7	0.19	79.7	0.059	14.3	0.19	0.08	11.5	<0.1	93.6	0.03	4.5	0.004	0.03	0.4	63	<0.05	121
T18-07D	29512	TH0883	111.1	114.2	1	waste	MDST	1.73	13.5	1	<20	250	0.3	0.74	0.11	23.1	55.3	61.7	3.89	6	0.087	0.21	5.8	0.81	593	0.81	0.202	78.4	0.057	15.2	0.35	0.11	10.5	<0.1	88	0.08	5.3	0.003	0.04	0.4	59	<0.05	128
T18-07D	29513	TH0884	114.2	117.4	1	waste	MDST	1.64	12	0.4	<20	243	0.26	1.46	0.09	20.1	45.3	53.8	4.08	5.3	0.064	0.22	5.3	0.8	618	0.67	0.235	59.5	0.049	13.3	0.43	0.05	11	<0.1	107	0.05	3.8	0.002	0.04	0.4	56	<0.05	117
T18-07D	29514	TH0885	117.4	120.6	1	waste	MDST	1.26	13	<0.2	<20	305	0.1	0.87	0.08	11.3	21.2	28.7	5.08	2.8	0.07	0.24	3.1	0.73	390	0.78	0.345	23.7	0.023	9.08	1.29	<0.02	11.1	<0.1	129	0.03	1.4	<0.001	0.06	0.4	41	<0.05	92.9
T18-07D	29515	TH0887	120.6	123.8	1	waste	MDST	1.32	15.6	0.3	<20	310	0.14	0.78	0.08	12.9	17.3	37.4	4.73	3.4	0.061	0.22	2.9	0.63	307	0.3	0.343	19.4	0.026	10.1	1.33	<0.02	13.3	<0.1	133	0.09	1.5	<0.001	0.05	0.3	47	<0.05	92.3
T18-07D	29516	TH0888	123.8	127.5	6	waste	MDST	1.15	12.8	0.2	<20	199	0.12	0.7	0.08	16.5	25.2	28	3.42	2.8	0.217	0.21	2.6	0.38	242	0.97	0.274	25.1	0.017	12	2.15	0.02	9.4	<0.1	111	<0.02	1.4	<0.001	0.09	0.3	29	<0.05	78.9
T18-07D	29517	TH0889	127.5	129.3	6	waste	SLST	1.02	5	<0.2	<20	319	0.11	0.64	0.06	14.4	20.5	22.3	4.65	2.3	0.035	0.21	2.6	0.71	572	0.29	0.324	16.3	0.019	7.68	0.18	<0.02	9.5	<0.1	128	0.02	1	<0.001	<0.02	0.1	26	<0.05	92.4
T18-07D	29518	TH0890	129.3	132.4	6	waste	SST	1.13	12.6	0.6	<20	296	0.09	0.59	0.07	21.7	29.5	21.6	3.07	2.5	0.153	0.18	1.7	0.4	600	0.41	0.315	29.5	0.018	14.8	1.16	0.02	8.7	<0.1	122	0.03	0.8	<0.001	0.1	0.2	25	<0.05	108
T18-07D	29519	TH0891	132.4	133.8	6	waste	MDST	1.23	11.3	<0.2	<20	288	0.18	0.25	0.07	19	24.5	38.7	2.29	3.2	0.088	0.21	1.9	0.33	228	0.6	0.287	28.6	0.018	12.8	1.25	<0.02	9	<0.1	109	0.02	1.5	<0.001	0.05	0.2	27	<0.05	100
T18-07D	29520	TH0892	133.8	134	6	coal	C	1.21	7.3	0.7	<20	298	0.19	0.23	0.06	17.9	22.6	40.3	1.97	3.1	0.06	0.21	2.3	0.32	115	0.21	0.29	25.7	0.017	9.25	0.88	<0.02	9.3	<0.1	114	0.04	1.5	<0.001	0.05	0.2	27	<0.05	138
T18-07D	29521	TH0893	134	134.6	6	coal	C	0.53	5	1.6	<20	117	0.27	0.28	0.52	14.7	13.4	51	1.98	1.8	0.18	0.08	4.1	0.13	44	1.91	0.108	17.5	0.003	22.6	2.2	0.19	6.3	0.3	47.5	0.07	1.6	0.003	0.05	0.4	71	<0.05	120
*Screening Criteria								800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000	20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

Notes:

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Hole-ID	Sample ID	Maxxam Sample ID	Sample Depth (m)		ABA Zone	Sample Type	Lithology	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
			From	To				%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
19-09D	1146024	BAJ890	4.45	5.9	4	waste		1.2	8.5	3	<20	189	0.12	4.06	0.06	12.4	49	49.7	10.7	3.5	0.031	0.18	4	1.06	5270	2.85	0.026	24.3	0.083	11.1	0.36	0.15	13.6	<0.1	94.8	0.06	1	0.003	0.03	0.4	56	9.3	75
19-09D	1146025	BAJ891	5.9	8	4	waste	MDST	1.33	12.7	1.9	<20	254	0.18	1.31	0.06	20.5	47.5	36.6	3.43	3.4	0.056	0.21	2.4	0.69	814	1.15	0.01	37.1	0.012	13	0.87	0.18	16	<0.1	90.4	0.06	0.8	0.001	0.06	0.4	65	<0.1	112
19-09D	1146026	BAJ892	8	10.75	5	waste	SLST	1.51	16.7	0.7	<20	214	0.19	0.9	0.06	19.3	57.6	32.5	3.01	4	0.094	0.24	1.8	0.62	230	1.64	0.007	38.4	0.003	12.6	1.45	0.12	13.7	0.2	56.6	0.05	0.8	0.001	0.05	0.6	57	<0.1	108
19-09D	1146030	BAJ893	13.25	14.75	55	waste	MDST	1.25	12.9	0.4	<20	217	0.2	1.1	0.28	20	37.7	37.5	1.84	3.4	0.048	0.15	1.8	0.55	92	1.09	0.006	35.9	0.001	22	0.33	0.12	15.5	<0.1	77.5	0.07	1.4	<0.001	0.09	0.4	52	<0.1	146
19-09D	1146034	BAJ894	18.85	20.2	6	waste	MDST	0.59	23.1	<0.2	<20	91.2	0.11	1.26	0.11	9.8	30.7	23.4	1.95	2	0.088	0.08	2.2	0.4	47	1.62	0.004	14.3	<0.001	12.3	1.36	0.14	12.2	<0.1	87.2	0.04	1.6	0.002	0.09	0.4	31	<0.1	61.3
19-09D	1146035	BAJ895	20.2	21.9	6	waste	SLST	1.05	9.7	0.3	<20	163	0.09	3.84	0.04	14.6	37.2	25.2	4.6	2.8	0.038	0.16	2.3	0.85	821	0.5	0.02	19	0.039	9.44	0.39	0.07	14.7	0.2	149	0.02	1.1	0.001	0.05	0.3	56	<0.1	90.3
19-09D	1146036	BAJ896	21.9	23.4	6	waste	SLST	1.14	15	<0.2	<20	197	0.09	1.42	0.09	18	42	30.3	9.65	3.2	0.035	0.16	2.8	0.92	2930	0.65	0.038	20.8	0.053	11.1	0.43	0.11	16	<0.1	128	0.04	0.7	0.001	0.07	0.3	68	<0.1	107
19-09D	1146037	BAJ897	23.4	24.9	6	waste	SLST	1.26	14.7	0.9	<20	197	0.16	0.64	0.37	18.5	50.6	47.2	2.04	3.4	0.081	0.23	1.2	0.36	278	1	0.067	34.7	0.002	28.4	0.93	0.16	16.2	0.3	96.6	0.1	0.5	<0.001	0.13	0.3	52	<0.1	152
19-09D	1146038	BAJ898	24.9	26.4	6	waste	SLST	1.09	11.9	<0.2	<20	214	0.13	1.72	0.06	19.2	40.9	30	6.69	3	0.049	0.22	2.5	1.02	1510	0.69	0.086	31.6	0.047	12.6	0.47	0.13	15.8	0.1	148	0.05	0.8	<0.001	0.08	0.3	53	<0.1	111
19-09D	1146039	BAJ899	26.8	27.75	6	waste	SLST	1.16	2.6	<0.2	<20	155	0.13	0.43	0.54	14.8	60.2	68.4	2.4	2.5	0.027	0.19	1.8	0.48	450	0.55	0.099	23.9	0.007	45.4	0.17	0.17	16.2	<0.1	73.8	0.05	0.4	<0.001	0.07	0.2	63	<0.1	200
19-09D	1146040	BAJ900	27.9	28.7	6	Coal	C	0.7	4.9	<0.2	<20	130	0.15	0.78	0.52	23.7	34.5	51.1	2.47	2	0.084	0.12	1.8	0.57	795	1.52	0.084	27.8	0.006	29.7	0.5	0.26	13.7	<0.1	88.9	0.06	0.5	0.001	0.18	0.4	59	<0.1	154
19-09D	1146041	BAJ901	28.85	30.7	7	waste	SST	1.34	10.1	<0.2	<20	196	0.05	7.69	0.36	22.9	43.4	48.3	7.57	3.1	0.032	0.14	4.6	0.87	1700	0.97	0.082	34.3	0.181	20.7	0.21	0.16	15.9	<0.1	207	0.05	0.7	0.003	0.18	0.4	97	<0.1	99.2
19-09D	1146042	BAJ902	30.7	32.7	7	waste	SLST	1.13	2.6	<0.2	<20	153	0.12	0.28	0.28	16.8	24.1	52.6	3.46	2.6	0.022	0.14	3.1	0.17	479	0.32	0.136	23.1	0.021	18.3	0.06	0.19	11.4	<0.1	88.3	0.04	0.5	0.001	0.07	0.2	50	<0.1	102
19-09D	1146043	BAJ903	32.7	34	7	waste	SST	0.89	2	<0.2	<20	106	0.1	1.26	0.38	14.7	48.8	47.6	4.99	1.9	0.007	0.14	3.3	0.65	1090	0.62	0.096	16.3	0.026	19.4	<0.02	0.09	13.4	<0.1	82.3	0.05	0.4	0.001	0.04	0.2	53	<0.1	110
19-09D	1146044	BAJ904	34	35.4	8	waste	SST	1.67	2	<0.2	<20	132	0.09	0.48	0.39	18.4	53.2	57.1	3.43	3.7	0.008	0.22	2.2	0.31	1130	0.38	0.129	20.4	0.013	17.5	0.03	0.11	17.1	<0.1	75.2	0.06	0.4	0.001	0.06	0.2	57	<0.1	159
19-09D	1146045	BAJ905	35.4	35.9	8	waste	SHC	1.36	1.6	<0.2	<20	108	0.09	0.88	0.34	17.1	66.1	50.6	1.33	3.3	0.017	0.18	1.2	0.38	481	0.56	0.11	20.9	0.003	14.9	0.06	0.1	13.9	<0.1	71.8	0.03	0.3	0.002	0.02	0.2	51	<0.1	119
19-16D	1146051	BAJ906	6.4	8	1	waste	SLST	1.49	11.3	<0.2	<20	144	0.15	2.26	0.09	19.6	75.6	38.4	4.82	4.5	0.077	0.29	5.3	1.32	1030	0.74	0.023	65.3	0.07	12.3	0.23	0.16	12.7	<0.1	81.5	0.06	4.2	0.001	0.09	0.4	48	<0.1	106
19-16D	1146052	BAJ907	8	9.4	1	waste	SLST	1.43	10.3	<0.2	<20	144	0.18	1.7	0.09	21.7	70.4	42.4	4.15	4.2	0.072	0.3	4.7	1.11	992	0.79	0.02	72.5	0.057	12.4	0.17	0.15	12.4	0.2	77.8	0.05	4.3	0.001	0.05	0.4	44	<0.1	115
19-16D	1146053	BAJ908	9.4	11.7	1	waste	MDST	1.35	13.3	0.3	<20	156	0.2	1.44	0.09	21.4	62.2	48.5	4.64	3.9	0.061	0.3	4.4	1.1	1100	0.83	0.019	68.3	0.059	13.4	0.17	0.16	13.2	0.2	81.1	0.06	4.5	0.001	0.05	0.4	46	<0.1	111
19-16D	1146054	BAJ909	11.7	14.7	1	waste	MDST	1.26	14.1	0.6	<20	163	0.24	1.09	0.09	22.9	53.6	51.7	4.28	3.3	0.066	0.28	3.9	0.94	894	0.8	0.022	72.2	0.063	13.5	0.25	0.16	13.1	0.3	74.6	0.05	4.9	<0.001	0.05	0.4	47	<0.1	124
19-16D	1146055	BAJ910	14.7	17.7	1	waste	MDST	1.28	14.4	<0.2	<20	157	0.26	1.38	0.09	23	53.6	55.6	4.72	3.4	0.08	0.29	5	1.04	874	1.09	0.047	73	0.076	15.1	0.32	0.19	13.9	0.1	87.4	0.07	5.5	<0.001	0.06	0.5	52	<0.1	121
19-16D	1146056	BAJ911	17.7	20.9	1	waste	MDST	1.15	12	<0.2	<20	195	0.2	1.22	0.11	18.8	47.7	43.2	4.37	2.9	0.067	0.27	3.6	0.89	531	0.96	0.133	55.9	0.056	12.5	0.43	0.18	13.7	0.4	78.3	0.05	4	<0.001	0.06	0.4	47	<0.1	110
19-16D	1146057	BAJ912	20.9	22.1	1	waste	SST	1.41	12.1	<0.2	<20	249	0.07	1.59	0.08	11	44.4	25.5	5.1	3.6	0.053	0.31	3.4	1.03	392	0.34	0.195	19.7	0.032	7.95	0.79	0.08	15.4	0.3	102	0.04	1.9	<0.001	0.05	0.4	51	<0.1	92
19-16D	1146058	BAJ913	22.1	24.7	1	waste	MDST	1.57	18.8	<0.2	<20	394	0.1	1.66	0.07	12.8	34.4	31.6	5.38	3.9	0.06	0.27	2.7	0.97	403	0.92	0.159	23.3	0.071	9.07	1.09	0.08	17.4	0.3	113	0.05	1.6	<0.001	0.08	0.4	61	<0.1	89.5
19-16D	1146059	BAJ914	24.7	26.3	1	waste	SST	1.43	17.6	<0.2	<20	206	0.06	1.47	0.09	11.8	81.8	17.5	5.13	3.8	0.058	0.48	2.9	0.94	336	1.07	0.152	19.5	0.026	6.22	1.11	0.06	14.7	0.3	104	0.03	1.4	0.001	0.11	0.4	50	<0.1	61.1
19-16D	1146060	BAJ915	26.3	28.3	1	waste	SLST	1.21	19.8	<0.2	<20	139	0.11	1.34	0.12	22.9	69.3	24.7	4.47	3.3	0.221	0.24	1.7	0.64	541	2.26	0.061	36.5	0.014	11.9	3.17	0.12	13.3	0.1	78.9	0.03	1.1	0.001	0.22	0.3	43	<0.1	111
19-16D	1146061	BAJ916	28.3	30.2	2	waste	SST	1.08	11.4	<0.2	<20	143	0.19	0.64	0.07	22.2	60.4	33.4	3.98	3.3	0.214	0.22	1.3	0.53	252	1.28	0.018	51.1	0.01	15.3	3.03	0.11	13.5	<0.1	68.1	0.05	0.8	0.001	0.11	0.3	33	<0.1	96
19-16D	1146062	BAJ917	30.2	32.2	2	waste	SST	1.32	10.7	<0.2	<20	157	0.18	1.52	0.07	20.7	61.7	33.7	3.82	3.6	0.09	0.23	2.3	0.91	352	1.93	0.013	39.5	0.012	13.9	1.7	0.09	14.7	<0.1	108	0.05	0.9	0.001	0.07	0.6	44	<0.1	102
19-16D	1146063	BAJ918	32.2	34	3	waste	SLST	1	11.4	<0.2	<20	133	0.18	0.78	0.05	15.9	42.3	32.4	3.1	2.7	0.184	0.18	1.4	0.53	142	2.12	0.008	33.5	0.029	14.5	2.45	0.12	12.5	0.2	93.1	0.05	0.9	0.001	0.1	0.5	36	<0.1	81.4
19-16D	1146064	BAJ919	34	34.45	3	waste	MDST	0.23	6.1	<0.2	<20	68.8	0.11	0.83	0.07	8.2	18.2	26.2	2.59	1.2	0.205	0.07	0.7	0.34	80	2.61	0.003	21.4	0.005	7.76	3.26	0.09	7	0.3	70.3	0.04	0.4	0.003	0.11	0.6	32	<0.1	34.7
19-16D	1146069	BAJ920	38.7	40.4	4	waste	SST	0.65	9.2	<0.2	<20	192	0.17	2.96	0.06	17.8	28.4	28.9	3.45	1.5	0.037	0.16	1.9	0.67	1160	0.51	0.017	31.1	0.034	9.02	0.55	0.05	12.9	0.2	260	0.05	1.5	<0.001	<0.02	0.3	40	<0.1	91.6
19-16D	1146070	BAJ921	40.4	43.2	4	waste	SLST	0.66	10.2	<0.2	<20	226	0.19	1.26	0.03	21.9	25	35.7	4.52	1.6	0.053	0.15	2.1	0.73	1600	0.68	0.024	32.1	0.032	10.4	0.78	0.05	14.2	0.3	109	0.04	1.3	<0.001	0.03	0.3	47	<0.1	101
19-16D	1146071	BAJ922	43.2	45.6	4	waste	SLST	0.62	9.7	<0.2	<20	237	0.19	1.22	0.04	18.8	27.4	33.3	5.38	1.4	0.046	0.14	2.7	0.8	1760	0.65	0.023	31.1	0.024	10.7	0.43	0.06	15.1	0.3	107	0.05	1.1	<0.001	0.02	0.3	56	<0.1	97.5
19-16D	1146072	BAJ923	45.6	49.2	5	waste	SLST	0.61	13	0.3	<20	234	0.19	1.06	0.07	19.7	32.4	27.5	4.26	1.6	0.117	0.16	1.5	0.66	838	0.68	0.019	42.7	0.016	12.3	1.5	0.07	12.6	0.4	84.5	0.04	0.8	<0.001	0.03	0.2	43	<0.1	114
19-16D	1146073	BAJ924	49.2	50.05	5	waste	SLST	0.61	13.5	<0.2	<20	115	0.19	0.65	0.08	22.4	26.2	33.5	3.03	1.7	0.181	0.15	0.7	0.5	287	1.9	0.01	54	0.003	15.3	2.02	0.07	12.7	0.7	63	0.08	0.4	<0.001	0.05	0.3	38	<0.1	122
19-16D	1146079	BAJ925	56.55	58.75	55	waste	SLST	0.83	12.3	<0.2	<20	250	0.27	0.54	0.1	25.8	33	54.6	2.4	2.6	0.11	0.21	1	0.59	179	1.69	0.007	71.9	0.006	16	0.88	0.11	13	0.5	61.4	0.09	0.6	<0.001	0.04	0.4	43	<0.1	128
19-16D	1146080	BAJ926	58.9	61	6	Coal	C	0.52	9.3	<0.2	<20	75.2	0.12	1.06	0.1	10.7	31.9	23.4	2.91	1.8	0.274	0.09	1.3	0.37	59	1.97	0.005	20.9	0.017	10.9	2.84	0.1	8.7	0.5	69.4	0.05	0.7	0.001	0.02	0.3	23	<0.1	64.4
19-16D	1146081	BAJ927	61.15	61.85	7	waste	SLST	0.81	8	<0.2	<20	187	0.12	1.9	0.07	16.8	30.6	28.5	5.12	2.2	0.08	0.15	2.3	1.02	278	0.63	0.008	22.9	0.005	10	1.27	0.04	15.7	0.6	140	0.06	0.8	<0.001	<0.02	0.3	51	<0.1	95.9
19-16D	1146082	BAJ928	62	63.9	7	Coal	C	0.73	6.4	<0.2	<20	156	0.14	0.84	0.11	13.1	29.8	28.5	2.72	1.9	0.142	0.13	0.6	0.43	76	1.55	0.008	17.3	0.001	11.8	2.03	0.04	11.5	0.4	75.7	0.06	0.6	<0.001	<0.02	0.4	38	<0.1	72.2
19-16D	1146083	BAJ929	64.05	67.6	7	waste	SLST	0.67	7.1	<0.2	<20	156	0.13	1.34	0.06	16.1	25.4	28.6	5.07	1.8	0.045	0.14	1.7	0.81	1230	0.58	0.021	25.8	0.023	9.49	0.61	0.04	13.7	0.3	105	0.04	0.7	<0.001	0.02	0.2	43	<0.1	93.9
19-16D	1146084	BAJ930	67.6	70	8	waste	SLST	0.71	3.6	<0.2	<20	123	0.1	1.27	0.34	15	33.1	43.5	6.77	1.8	0.027	0.1	2	0.72	1830	1.01	0.027	17.7	0.054	26.2	0.13	0.11	11.3	0.4	81.5	0.03	1	0.001	<0.02	0.5	62	<0.1	130
19-17D	1146085	BAJ931	8.4	8.7	1	Coal	C	0.22	46.3	<0.2	<20	31.9	0.06	1.28	0.25	7.6	17.5	12.9	3.98	0.9	0.307	0.07	0.6	0.46	154	17.4	0.007	15.6	<0.001	5.6	4.47	0.19	5.6	0.5	47.2	0.02	0.4	0.002	0.06	0.9	20	<0.1	33.3
19-17D	1146086	BAJ932	8.85	11.45	2	waste	MDST	0.7	9.8	<0.2	<20	116	0.19	0.4	0.06	20.3	34.8	33.5	3.71	1.8	0.211	0.16	0.6	0.53	334	1.32	0.046	46.1	0.002	16	2.67	0.04	10.4	0.3	48.3	0.05	0.4	<0.001	0.09	0.3	34	<0.1	101
19-17D	1146087	BAJ933	11.6	12	2	Coal	C	0.34	4.2	<0.2	<20	83	0.16	0.17	0.07	7.5	16.1	24.1	1.94	1.4	0.15	0.09	1.3	0.16	64	0.94	0.045	20.9	0.015	13.8	2.12	0.07	5.2	0.2	49.5	0.04	1	0.002	0.02	0.4	22	<0.1	47.6
19-17D	1146088	BAJ934	12.15	14.5	3	waste	MDST	0.66	8.7	<0.2	<20	174	0.19	0.41	0.03	17.5	36.3	31.3	3.33	1.8	0.087	0.19	1.1	0.55	521	1.09	0.153	35.1	0.002	11.2	1.28	0.03	12.8	0.3	50.8	0.05	0.5	<0.001	0.03	0.3	38	<0.1	102
19-17D	1146089	BAJ935	14.5	17.45	3	waste	MDST	0.57	11.7	<0.2	<20	152	0.18	0.85	0.05	18.2	32.4	30.9	3.16	1.6	0.09	0.15	1.4	0.63	719	1.49	0.126	38.1	0.008	11.8	1.05	0.04	12.9	0.5	66.2	0.07	0.5	<0.001	0.03	0.4	45	<0.1	90.7
19-17D	1146090	BAJ936	19.6	22	4	waste	MDST	0.76	9	<0.2	<20	217	0.15	1.61	0.04	18	24.6	39.8	5.53	1.9	0.025	0.17	2.7	0.76	3450	0.57	0.14	28.8	0.034	9.73	0.26	0.03	17.2	0.2	83.4	0.04	1	<0.001	<0.02	0.3	53	<0.1	96.3
19-17D	1146091	BAJ937	22	25	4	waste	MDST	1.01	10.5	<0.2	<20	207	0.15	1.71	0.03	20.1	38.5	33.1	5.52	2.8	0.034	0.22	2.8	0.83	1910	0.9	0.127	34.3	0.034	9.51	0.33	0.03	16.4	0.2	104	0.04	1.2	<0.001	0.02	0.3	61	<0.1	99
19-17D	1146092	BAJ938	25	26.4	4	waste	MDST	0.71	8.8	<0.2	<20	168	0.15	0.79	0.04	17	29.4	32.3	2.87	2	0.055	0.16	1.9	0.49	901	1.6	0.12	25	0.022	7.39	0.59	<0.02	13.1	0.2	87.8	0.04	0.6	<0.001	<0.02	0.4	48	<0.1	95.6
19-17D	1146093	BAJ939	26.4	29.5	5	waste	MDST	0.76	10.9	<0.2	<20	159	0.17	1.47	0.05	19.9	39.1	28	5.5	2.2	0.098	0.16	2.2	0.86	1160	0.74	0.077	42.6	0.034	11.4	1.28	0.03	13.2	0.4	68.9	0.04	1	<0.001	0.02	0.3	49	<0.1	121
19-17D	1146095	BAJ940	29.5	31.05	5	waste	MDST	0.69	9.4	<0.2	<20	133	0.18	0.83	0.06	20.3	35.3	29.8	2.68	1.9	0.097	0.15	1.2	0.56	231	1.15	0.069	40.1	0.002	12	1.24	0.03	13.6	0.3	59.9	0.05	0.5	<0.001	<0.02	0.4	49	<0.1	104
19-17D	1146098	BAJ941	37.05	38.8	6	waste	MDST	0.93	11.8	<0.2	<20	183	0.23	1.54	0.05	24.7	41.2	42.1	3.95	2.8	0.056	0.19	3.2	0.73	1400	2.03	0.05	72.3	0.01	14.2	0.72	0.12	13.1	0.4	125	0.07	1.3	<0.001	0.04	0.6	58	<0.1	96.3
19-17D	1146099	BAJ942	38.8	41.5		waste		0.72	6.7	<0.2	<20	164	0.11	1	0.04	17.8	23.7	28	3.41	2	0.051	0.14	1.8	0.6	1060	0.68	0.08	19.1	0.005	10.3	0.67	0.03	15.4	0.3	119	0.04	0.9	<0.001	0.03	0.2	49	<0.1	80.2
19-17D	1146100	BAJ943	41.5	42.75	6	waste	SLST	0.69	3.8	<0.2	<20	189	0.11	0.38	0.06	17.8	21.1	33.5	1.07	1.9	0.014	0.16	0.7	0.25	186	0.24	0.095	22.9	0.001	8.87	0.09	0.03	14.3	0.2	82.8	0.03	0.5	<0.001	<0.02	0.1	38	<0.1	95.6
19-17D	1146401	BAJ944	42.75	45.75	6	waste	SLST	1.29	2	<0.2	<20	214	0.06	5	0.15	18.5	59.1	29.9	6.79	3.5	<0.005	0.21	3	0.85	2410	0.42	0.091	17.7	0.061	11.5	0.04	<0.02	14.2	<0.1	217	0.03	0.9	0.001	<0.02	0.3	66	<0.1	111
19-17D	1146402	BAJ945	45.75	47.5	7	waste	MDST	2.02	7.6	<0.2	<20	206	0.11	0.91	0.06	16.7	77.8	27.8	3.46	4.7	0.053	0.34	1.2	0.61	989	0.42	0.122	22.3	0.006	9.07	0.83	<0.02	14.9	0.2	129	<0.02	0.4	<0.001	<0.02	0.2	48	<0.1	97.3
19-17D	1146403	BAJ946	47.5	48.7	7	waste	MDST	0.55	8.6	<0.2	<20	150	0.12	0.39	0.08	14.8	19.7	36.3	3.66	1.4	0.076	0.15	0.6	0.48	291	1.22	0.124	17.9	0.001	8.96	2.11	<0.02	11.7	0.4	84	0.05	0.3	<0.001	0.05	0.2	33	<0.1	116
19-17D	1146404	BAJ947	48.7	50.5	7	waste	MDST	1.43	4.8	<0.2	<20	159	0.14	0.66	0.09	15.5	57.8	30.9	3.17	3.5	0.158	0.25	0.6	0.45	121	1.18	0.107	26.4	<0.001	10.8	2.49	<0.02	13.8	0.3	96.9	0.04	0.4	0.001	0.03	0.3	42	<0.1	81.3
19-17D	1146405	BAJ948	50.5	53.5	7	waste	MDST	0.7	5.9	<0.2	<20	169	0.17	0.51	0.22	18.9	23	44.7	2.56	1.9	0.078	0.18	0.8	0.47	304	0.55	0.134	33.2	0.002	18.6	0.86	0.05	13.7	0.2	90.3	0.07	0.3	<0.001	0.04	0.2	39	<0.1	128
19-17D	1146406	BAJ949	53.5	54.95	7	waste	SLST	0.59	1.8	<0.2	<20	114	0.05	1.27	0.31	13.7	36.8	38.6	4.68	1.5	0.02	0.12	2.3	0.72	1130	0.56	0.087	16.1	0.038	20.5	0.05	0.03	11.6	0.1	99	0.03	0.7	<0.001	0.03	0.2	49	<0.1	150
19-17D	1146407	BAJ950	55.1	55.6	7	Coal	C	0.54	7.7	<0.2	<20	80.9	0.16	0.63	0.31	16.5	8.7	33	0.68	1.3	0.155	0.06	4.1	0.14	51	1.47	0.052	19.5	0.085	18.9	0.67	0.16	5.7	0.4	134	0.05	2.3	0.003	0.03	1.2	84	<0.1	61.3
19-17D	1146408	BAJ951	55.75	56.75	8	waste	MDST	0.69	5	0.4	<20	143	0.11	0.6	0.35	23.6	31.5	59.6	5.64	1.6	0.026	0.14	2.8	0.45	1860	0.58	0.108	32.1	0.013	24.3	0.05	0.04	14.3	0.2	70.8	0.05	0.5	<0.001	0.04	0.2	58	<0.1	147
19-17D	1146409	BAJ952	56.75	58.25	8	waste	MDST	1.54	7	<0.2	<20	340	0.12	0.75	0.36	28.9	23.8	65.8	2.36	3.6	0.033	0.14	5.7	0.2	502	0.78	0.127	40.2	0.216	14.1	0.11	0.06	14.5	0.3	228	0.04	0.9	0.002	0.03	0.3	58	<0.1	130
19-17D	1146410	BAJ953	58.25	59.2	8	waste	MDST	0.81	3	<0.2	<20	153	0.14	0.19	0.37	21.1	11.4	61	2.18	2.1	0.026	0.11	1.1	0.13	398	0.29	0.135	23.6	0.006	28	0.09	0.05	9.3	0.6	69.5	0.04	0.4	<0.001	0.02	0.2	32	<0.1	137
19-18D	1146416	BAJ954	10	13	4	waste	MDST	1.01	10.4	<0.2	<20	262	0.17	1.44	0.04	18.4	30.8	37.9	3.2	2.9	0.047	0.19	1.9	0.69	994	0.68	0.012	35.3	0.016	10	0.71	<0.02	15.6	0.2	104	0.06	0.9	<0.001	0.03	0.3	49	<0.1	114
19-18D	1146417	BAJ955	13	15.2	4	waste	MDST	1.07	12.5	<0.2	<20	290	0.16	1.16	0.03	19	34.1	34	4.9	3.2	0.033	0.18	2.9	0.74	1850	1.08	0.015	29.3	0.024	10.4	0.29	0.04	15.9	0.3	109	0.04	0.9	<0.001	<0.02	0.4	56	<0.1	90.4
19-18D	1146418	BAJ956	15.2	17.75	5	waste	MDST	0.83	12.2	1.2	<20	193	0.33	1.02	0.07	17.5	34.4	26.4	2.82	2.6	0.093	0.15	1.8	0.62	254	1.44	0.007	40.1	0.005	11.6	1.47	0.11	14	0.4	81.1	0.06	1.2	<0.001	0.07	0.4	43	<0.1	109
19-18D	1146421	BAJ957	19.85	20.15	55	waste	SLST	1.9	0.3	1.6	<20	115	0.36	1.14	0.52	5.6	74.5	48	0.95	4	0.016	0.19	2.2	0.45	120	0.41	0.01	7.5	0.002	28.8	0.06	<0.02	10.3	0.2	51.7	0.1	0.8	0.001	0.06	0.4	41	<0.1	157
19-18D	1146422	BAJ958	23.55	23.5	6	waste	MDST	0.74	2.8	0.4	<20	153	0.27	0.7	0.08	17.4	29.8	41.4	1.08	2.4	0.047	0.14	1.6	0.38	58	1.45	0.006	35.8	0.001	5.75	0.19	0.05	10.6	0.1	41	0.04	0.8	0.001	<0.02	0.3	40	<0.1	106
19-18D	1146423	BAJ959	23.5	25.8	6	waste	MDST	0.92	16.3	0.3	<20	187	0.27	1.97	0.13	20.5	41.7	43.8	3.06	2.7	0.224	0.15	3.3	0.89	204	1.34	0.009	63	0.003	16.4	1.59	0.13	13.6	0.6	112	0.05	1.5	0.001	0.12	0.4	51	<0.1	111
19-18D	1146424	BAJ960	25.8	28.7	6	waste	MDST	0.84	4.6	0.9	<20	211	0.15	0.9	0.1	16.4	22.4	28.9	3.79	2.2	0.022	0.13	2.2	0.58	1000	0.32	0.018	18.1	0.005	13.5	0.29	0.08	16	0.2	67	<0.02	1	<0.001	0.05	0.2	51	<0.1	94.2
19-18D	1146425	BAJ961	28.7	31.3	6	waste	SST	1.37	3	1.4	<20	160	0.14	2.99	0.15	16.7	103	23.8	5.13	3.1	<0.005	0.17	2.9	0.98	2000	0.64	0.022	16.6	0.046	18	0.04	<0.02	10.7	<0.1	139	<0.02	1.5	0.001	0.03	0.3	51	<0.1	133
19-18D	1146426	BAJ962	31.3	33.3	6	waste	MDST	0.93	8.9	0.3	<20	279	0.15	1.85	0.1	19	28.6	26	4.59	2.6	0.016	0.2	2.2	0.9	1300	0.41	0.05	23.2	0.027	9.72	0.19	0.05	15	0.2	143	0.05	0.8	<0.001	0.03	0.2	41	<0.1	99
19-18D	1146427	BAJ963	33.3	35.5	6	waste	MDST	1.04	9.8	1.1	<20	315	0.18	0.92	0.08	18.4	33.5	31.5	4.27	2.8	0.082	0.22	1.8	0.61	988	0.89	0.065	25.3	0.015	12.7	0.47	0.06	15.9	0.3	99.8	0.05	0.8	<0.001	0.09	0.4	45	<0.1	105
*Screening Criteria								800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000	20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

Notes:

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Appendix E – Field Barrel Test Work Memo

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FINAL

Memo

To	Dan Farmer, Project and Development Manager	**Client**	Telkwa Mining Ltd.
From	Carlos Paulo, Laura Volden, Michael Herrell	**Project**	CAPR002933
		Date	April 22, 2024

Subject Geochemical Field Barrel Results Interpretation – Tenas Project

File name: TCL Task 100 Field barrels analysis MEMO CAPR002933 FINAL 20240422.docx

1 Introduction

Telkwa Mining Ltd (TCL) submitted an Environmental Assessment Certificate (EAC), application for the Tenas Project, located at the Telkwa Property, near the town of Telkwa, British Columbia in May of 2022. In support of the EA application, SRK Consulting (Canada) Inc. (SRK) conducted a comprehensive geochemical program to evaluate the risk of ML/ARD from mine materials that will be produced by the Project. The program included static geochemical characterization, kinetic testing through humidity cell tests (HCTs) and the development of source terms (SRK 2022a, SRK 2022b).

The kinetic testing program was expanded in 2019 to include field barrel tests and is currently on-going. The barrel tests were initiated to advance the understanding of ML/ARD rates from select stratigraphic zones under field conditions and to modify scaling factors used to adjust release rates based on laboratory testing (HCTs) to the field scale, which were used in the development of geochemical source terms. This memo provides a review and interpretation of existing field barrel data.

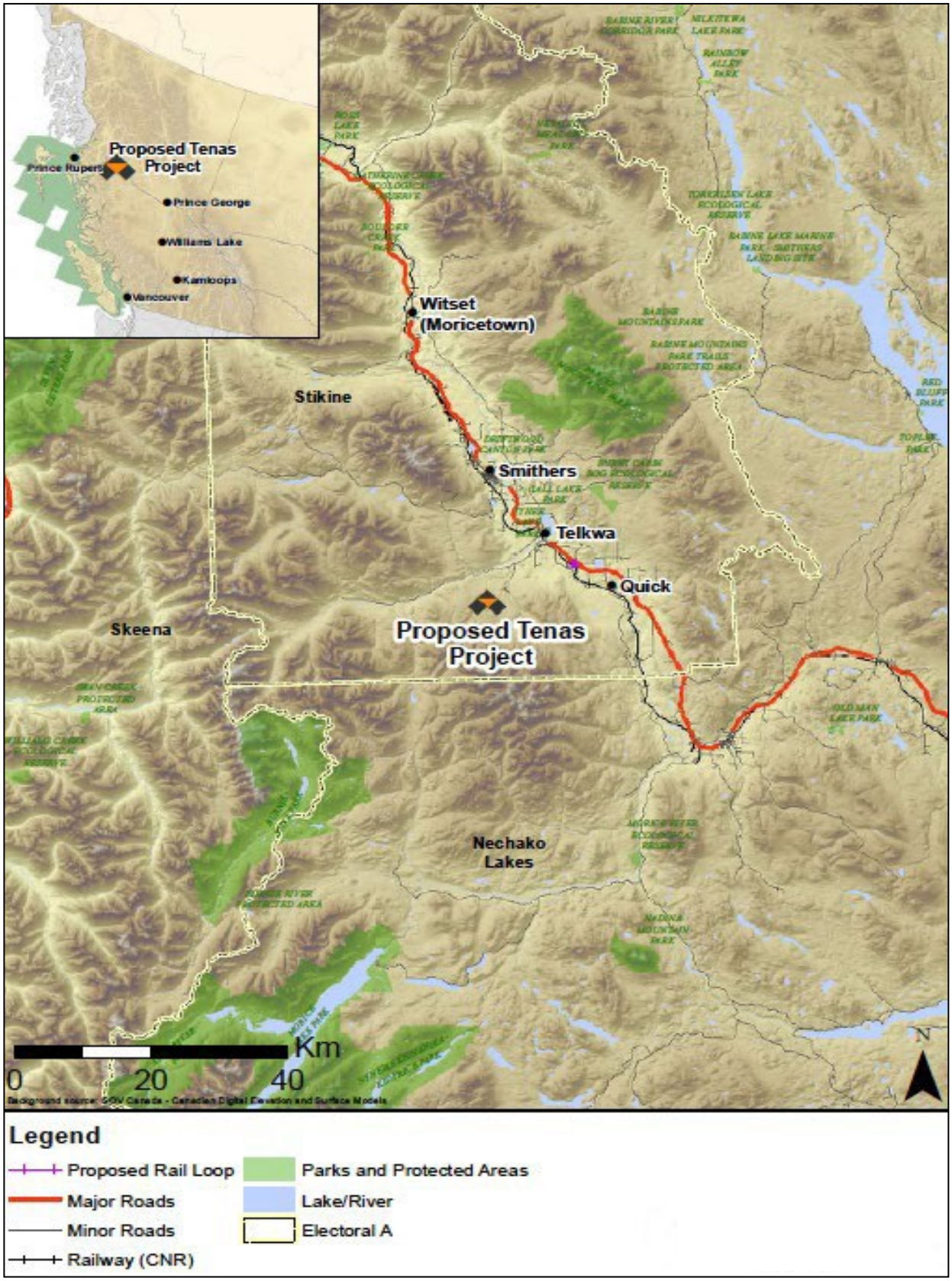
2 Background

2.1 Site Overview

The Tenas Project is in the Regional District of Bulkley-Nechako in northwestern British Columbia (BC), approximately 25 kilometers (km) south of Smithers and 7 km southwest of Telkwa, within the Wet'suwet'en's traditional territory, which includes the majority of the Bulkley River drainage Figure 2-1). Coal was reportedly discovered in the Telkwa area around 1900. Small-scale underground and surface mining began in 1918 and continued sporadically until 1985, resulting in the recovery of over 400,000 tonnes of coal. Modern exploration of the Project to delineate further exploitable coal reserves started in 1978, and with recent exploration programs, over 800 exploration drillholes, three bulk samples, trenching, geological mapping, and surface geophysics are available. The Project will extract run-of-mine (ROM) coal from a surface open pit through conventional shovel and truck methods (TCL 2018). Mining and processing of ROM coal will produce overburden, mine rock and processed rock that will need to be managed as appropriately to minimize long term environmental effects and geotechnical risks.

2.2 Bedrock Geology

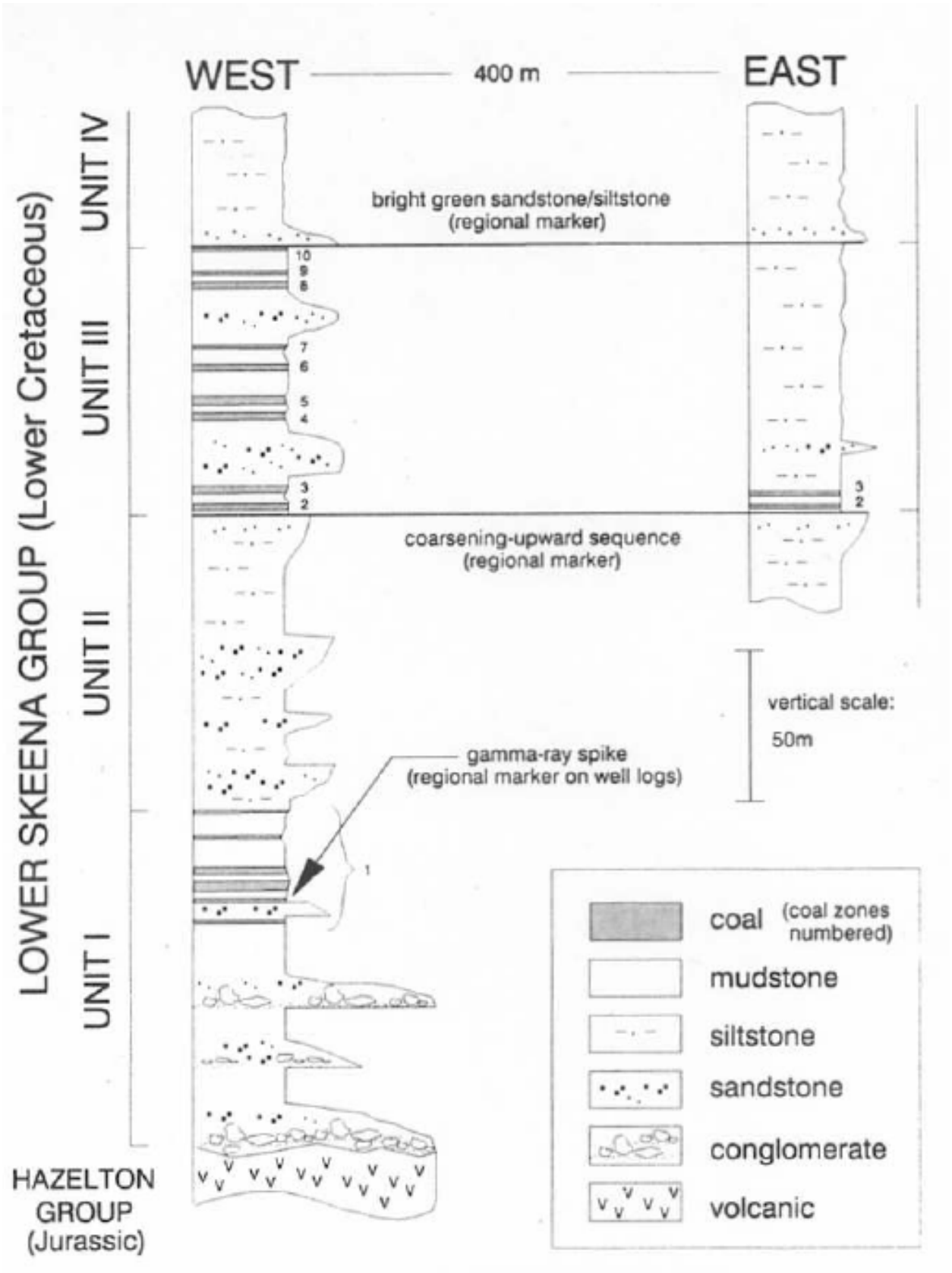
The Tenas Project is located within the northeast/southwest trending Skeena Arch, which separates Jurassic-age sedimentary rocks of the Bowser Basin in the north from the Jurassic to Cretaceous-age sedimentary rocks of the Nechako Basin to the south. The coal-bearing sedimentary rock sequence of the Project is associated with the Lower Cretaceous age Skeena Group, and unconformably overlies the Jurassic-age Hazelton volcanic group. A simplified stratigraphic column of the Tenas deposit is presented in Figure 2-2.



Adapted from Telkwa Mining Ltd.

Source: C:\Users\lvolden\SRK Consulting\NA CAPR002933 Telkwa Mining Project 2023 Geochemistry Support - Figures

srk consulting	TELKWA MINING LIMITED	Geochemical Field Barrel Testing
		Project Location
Job No: CAPR2933 Filename: CAPR002933_TelkwaFieldBarrel_Figures_Portrat_rev00_lv.pptx	Tenas Project	Date: March 2024 / Approved: LV / Figure: **2.1**



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srk consulting	TELKWA MINING LIMITED	Geochemical Field Barrel Testing
		Stratigraphic Sequence
Job No: CAPR2933 Filename: CAPR002933_TelkwaFieldBarrel_Figures_Portrat_rev00_lv.pptx	Tenas Project	Date: March 2024 / Approved: LV / Figure: **2.2**

2.2.1 Jurassic Hazelton Volcanic Group

The volcanic rocks include andesite, trachyte, and basalt with associated tuffs and breccias.

2.2.2 Lower Cretaceous Skeena Group

The Lower Cretaceous Skeena Group includes marine and continental sediments interbedded with coal seams, often correlated over long lateral distances. It is subdivided into four units (Units I through IV) and a unit of undivided sediments overlying the four units.

The economic coal seams in the Tenas Deposit are located in Coal Zone 1 of Unit I and includes two seams: C seam and 1 seam (upper and lower). Coal Zones 2 through 10, located in Unit III are absent from the Tenas area. Units I through IV are summarized below.

Unit I (modified after Ledda, 1998)

The basal unit, Unit I, was deposited in a fluvial environment and, in the Telkwa Property, rests unconformably over the eroded Hazelton volcanic basement of Jurassic age. Because it was deposited over an undulating surface, the Unit l stratigraphy has been observed to display variability in thickness, often over short lateral distances. This variability is most evident in the lower sedimentary assemblage, between the basement contact and the lowermost Unit l coals. As such, Unit l can be more than 100 m in thickness and consists mainly of conglomerate, sandstone, mudstone, and coal.

Coals within this unit, collectively referred to as Coal Zone 1, formed in poorly drained backswamps and are characterized by lateral variation throughout the study area. The Unit l coals can consist of up to 12 individual coal seams that collectively contribute up to 11.9 m of coal to the unit's overall thickness. Sands and gravels were typically deposited in braided channels and bars while mudstones accumulated in floodplains. Indications are that there was periodic marine influence during deposition of the unit. Deposition of Unit I ended with a marine transgression and deposition of Unit II.

Unit II (Ledda, 1998)

Unit II was deposited within a deltaic / shallow marine environment and consists of up to 140 m of sandstone, silty mudstone and occasional thin coaly mudstone. Sands were deposited in distributary channels and mouth-bars while mudstones and silty mudstones accumulated in interdistributary bays. Thin discontinuous peat beds, none of which are of economic significance, accumulated in local salt marshes.

Unit III (modified after Ledda, 1998)

Unit III is indicative of the second regressive episode for the area and represents the deposition of the second main coal-bearing stratigraphic sequence. The unit averages 85 m in thickness and is comprised of sandstone, siltstone, carbonaceous mudstone, and thick, laterally extensive coal seams. Restricted nearshore marine, tidal flat and coastal swamp environments persisted throughout much of the deposition of Unit III. Sandstone units were deposited within tidal channels while interbedded sandstones and siltstones were deposited nearshore within intertidal environments. Mudstones are representative of tidal flat deposits. Significant marine influence during deposition of the entire unit is indicated.

Coal Zones 2 through 11 are represented in Unit III, collectively contributing to up to 17 coal seams of economic significance. The coal zones were likely formed in freshwater peat swamps, located landward of the tidal flat, somewhat isolated from influxes of brackish water. The presence of sulphur in some of the coal seams suggests, however, that the peat was infiltrated periodically by marine water. Thus, the major coal seams are interpreted to have formed from peat accumulated in a freshwater marsh that was proximal to a brackish environment. The Snuggedy Swamp of South Carolina is considered a modern analogue for the paleoenvironment in which Unit III was deposited.

2.2.3 Intrusions

Tertiary and Cretaceous-age porphyritic dykes and sills commonly intrude this sequence, the most notable of which includes a Tertiary granodiorite intrusion located on the north side of the Telkwa River. These intrusions are not present in the Tenas area.

2.2.4 Geological Structures

The sedimentary sequence in the Tenas area is folded into a syncline in which the gently (typically 10 to 20°) northeast-dipping western limb of the syncline subcrops on the western side of the pit area, while the moderately (40 to 45°) southwest-dipping eastern limb subcrops on the eastern side of the pit. Faulting is generally near-vertical, and can be subdivided into two main groups, one which strikes approximately northwest/southeast and the other which strikes approximately northeast/southwest.

2.3 Surficial Geology

The surficial geology in the Project area consists primarily of two types of deposits, glacial clay- or silt-rich till, and sand and glaciofluvial sand and gravel outwash. At upper elevations and south of the proposed pit, the terrain is mapped as having bedrock outcrops to a limited extent or thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick. North of the proposed pit and towards Tenas Creek and Goathorn Creek, drillholes report thin mantles of clay- and silt-rich tills deposits, between 3 m and 10 m thick underlain by a thick sand and gravel outwash deposit that can exceed 100 m.

Other types of deposits are present locally. Patches of glaciolacustrine deposits are scattered throughout the morainal landscape in low ridges and in depressions; the sediments comprise bedded and laminated mud, and minor sand and gravel (Clague 1984). Recent fluvial deposits form the narrow floodplains of Goathorn Creek and Tenas Creek, which are 40 m to 80 m deep incised into the subdued morainal landscape, and the wide floodplains of the Telkwa and Bulkley Rivers. The fluvial deposits range from extremely coarse, poorly sorted gravel on steep alluvial fans to moderately to well-sorted sand and mud on low-gradient floodplains (Clague 1984).

2.4 Material Zone Designations

Geochemical properties are stratigraphically constrained in coal deposits versus lithologically constrained. For example, the deposition environment of the Tenas Deposit includes marine and deltaic sedimentary sequences and rocks formed in these two different environments will be compositionally different. The deposit was demarcated into stratigraphic zones of sedimentary sequences between the mineable coal seams. The stratigraphic zones were further divided into additional zones if they had different distinct geochemical properties (e.g., Zone 1 and Zone 1a) or grouped if geochemical properties were similar between zones identified between coal seams (e.g., Zone 2 and Zone 3). The stratigraphic zones and classification of PAG and non-PAG based on an NPR of 2.0 identified for the Project are presented in Figure 2-3.

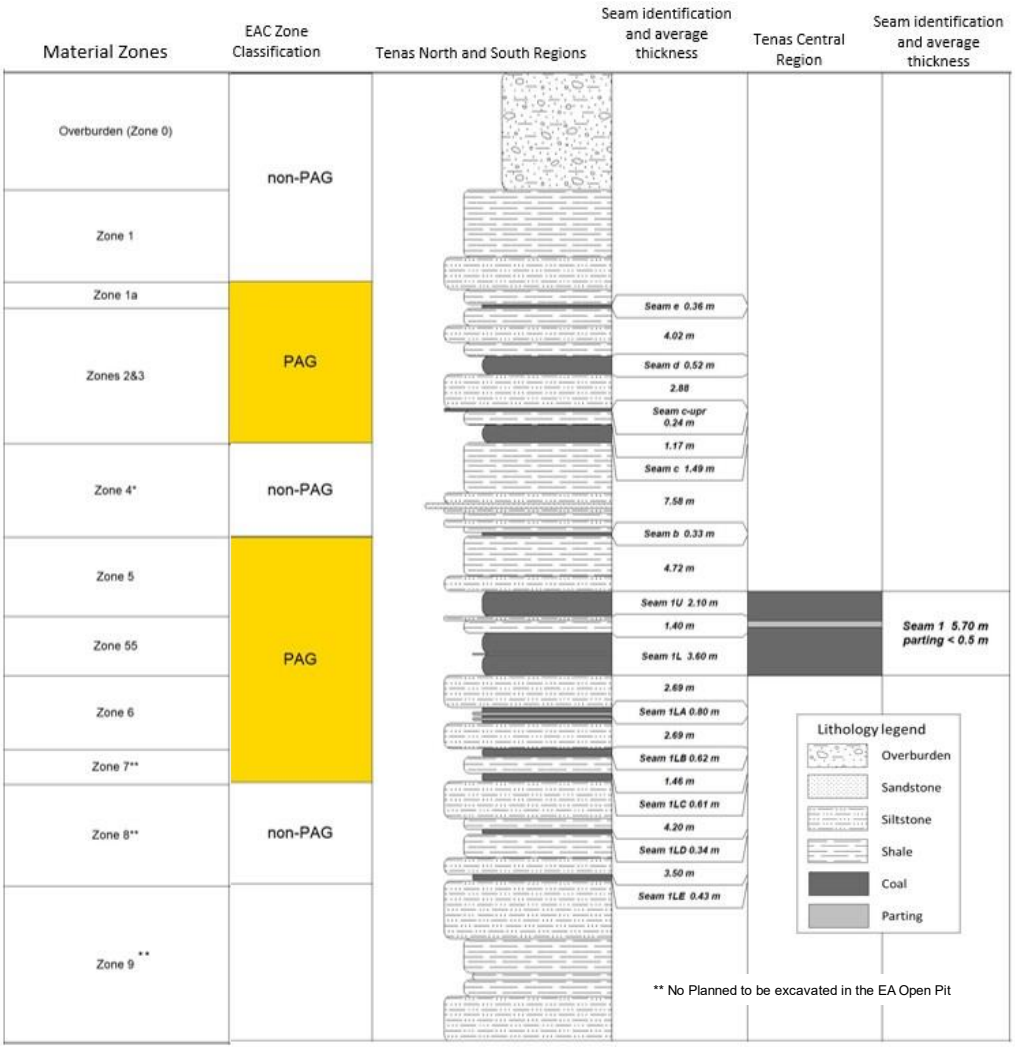


Figure 2-3. Tenas Deposit Stratigraphic Zones

2.5 Summary of Previous Geochemical Characterization Studies

Two geochemical studies have been completed to characterize the acid generating and metal leaching potential of the Tenas deposit:

- Norecol Dames and Moore (1999). Draft Report. Assessment of ARD Potential and Water Quality Predictions. Telkwa Coal Project.
- SRK (2022a). Telkwa Coal – Tenas Project Supplemental Geochemical Characterization.

The Norecol Dames and Moore (1999) study included the collection and analysis of over 700 samples. An additional 173 samples were collected as part of the supplemental geochemical characterization study (SRK 2022a). The supplemental samples were used to confirm the results of the 1999 study and calibrate the test results to more up-to-date testing methods. For example, samples collected as part of the Norecol Dames and Moore (1999) study were analyzed for total sulfur only and neutralization potential was determined using the Sobek-NP (1978) method. Results from both studies were combined to form a robust geochemical characterization that is documented in SRK (2022a). The reader is referred to SRK (2022a) for additional detail on the geochemical characterization program including sample selection, collection, geochemical testing methods and results.

The outcomes of these studies indicated that a large volume of the mine rock to be mined from the Tenas deposit is potentially acid generating (PAG) and that acid generating potential is stratigraphically constrained in zones generally separated by the coal seams (Figure 2-3). The geochemical testing results indicate that all zones contain some PAG rock; however, there are units that are predominantly PAG versus non-PAG. Based on a neutralization potential ratio (NPR) (SRK 2022a) of 2, the following zones were characterized as PAG and non- PAG based on their average bulk properties:

- Non-PAG: Zone 1, portions of Zone 4, overburden, construction materials, and topsoil;
- PAG: Zone 1a, Zone 2/3, portions of Zone 4, Zone 5, Zone 55, Zone 6, processed rock, processed coal and ROM coal

All zones contain both PAG and non-PAG materials with the exception of overburden, construction materials, and topsoil. The above zones were classified as non-PAG or PAG were based on an neutralization potential ratio (NPR) cutoff of 2. This cutoff was used to initially classify zones as non-PAG or PAG. PAG and non-PAG rock volume estimates based on this criterion were used to inform the waste management strategy (e.g., sizing of the management ponds).

SRK subsequently developed a site-specific NPR of 1.2 for mine rock based on carbonate molar ratios (CMRs) observed in humidity cell tests. Application of the site-specific NPR results in the following zones being classified as non-PAG and PAG based on their average bulk properties:

- Non-PAG: Zone 1, portions of Zone 4, Zone 5, Zone 55 and Zone 6;
- PAG: Zone 1a, Zone 2/3 and portions of Zone 4

The site-specific NPR of 1.2 is specific to mine rock does not apply to other mine materials (i.e., overburden, construction materials, topsoil, processed rock, processed coal and ROM coal). An NPR of 2 is used to characterize these materials as PAG or non-PAG and their classification (see above) does not change. The NPR of 2 is used for planning purposes and TML is proposing the site-specific

NPR of 1.2 be used as an operational segregation criterion, pending approval by the British Columbia Ministry of Energy Mines and Lower Carbon Innovation.

2.6 Overview of Field Barrel Testing Program

Nine field barrels were constructed at the Project site and have been monitored intermittently since October 2019. Details of each barrel, including material zone, ARD classification, and data availability are summarized by Table 2-1.

Composite samples for each barrel were prepared from sample rejects stored at Bureau Veritas Laboratories in Burnaby, British Columbia. Sample rejects, varying in mass from one to 110 kg were selected for use in the barrels until a minimum mass of 200 kg was achieved. Zones with insufficient mass (e.g., Zone 4 PAG and Zone 4 non-PAG) were supplemented with sample rejects from other zones with similar geochemical properties (Table 2-1). Individual waste rock samples were homogenized using cone and quartering methods prior to placing the samples in the barrels. A barrel consisting of overburden collected at site was also constructed. As part of the QA/QC program, a duplicate barrel was constructed from Zone 1 rock and a blank barrel, containing no materials, was also constructed at site to identify any systematic laboratory testing errors.

The PAG management strategy for the Project is to place PAG rock underwater in the management ponds prior to the rock becoming acidic. A key objective of the barrel testing program was to confirm the lag time to onset of acid generation estimates derived using lab based kinetic tests (SRK 2022a) that have been used to inform the PAG management strategy. With this objective in mind, conservatism was included in the evaluation by selecting sample rejects for some barrels which resulted in weighted sulfide concentrations greater than the bulk sulfide content of the zone and a weighted NPR lower than the bulk properties of each zone (Table 2-1). Samples used in the construction of each barrel are provided in Appendix A.

Leachate sampling has been conducted intermittently from October 2019 until November 2023. Seven to nine samples have been collected from each barrel during this period. The volume of leachate collected in each barrel between sampling periods was calculated from the water column height at the time of collection. Table 2-2 presents the calculated volume of each barrel for the sampling date, as well as the dates when volumes were not recorded but leachate samples were collected for analytical chemistry.

During sample collection the following field parameters were measured and recorded: pH, temperature, oxidation reduction potential (ORP), dissolved oxygen and electrical conductivity (EC). Olfactory and other visual (e.g., colour) observations were made during sampling. Laboratory analysis was conducted at Bureau Veritas Laboratories in Richmond, BC, using standard analytical methodologies. The following parameters were measured:

- General parameters: electrical conductivity (EC), pH, hardness, acidity, alkalinity
- major anions (chloride, fluoride, sulfate, phosphate) and nitrogen species (nitrate, nitrite, ammonia),
- total and dissolved major and trace elements concentrations.

Before data analysis and interpretation, SRK screened the analytical results against internal QA/QC procedures to validate that data quality is acceptable for the purpose of the Project.

Table 2-1. Field Barrel Attributes

Barrel	Description	ID	Mass (kg)	Zone Classification	Starting Date	Weeks of Data	No. Leachate Samples	Barrel Geochemical Attributes		Zone Average Geochemical Properties	
								S^{2-} (w.t.%)	NPR	S^{2-} (w.t.%)	NPR
Barrel 1	Zone 1	B1	193.5	Non-PAG	8/7/2019	158	9	0.55	2.7	0.43	3.2
Barrel 2	Zone 1 (duplicate)	B2	193.5	Non-PAG	8/7/2019	158	8	0.55	2.7	0.43	3.2
Barrel 30.32	Zone 1a	B3	234.3	PAG	8/7/2019	158	8	1.46	0.47	1.6	0.7
Barrel 4	Zone 2/3	B4	190.7	PAG	8/7/2019	158	9	1.40	0.82	0.88	0.80
Barrel 5	Zone 4 PAG + Zone 5	B5	146.1	PAG/ Non-PAG	8/20/2019	156	8	1.23	1.01	1.75 (Zone 4 PAG) 1.13 (Zone 5)	0.6 (Zone 4 PAG) 1.5 (Zone 5)
Barrel 6	Zone 6 + Zone 7	B6	138.7	Non-PAG	8/20/2019	156	8	1.66	0.51	0.97 (Zone 6) 0.86 (Zone 7)	1.6 (Zone 6) 1.4 (Zone 7)
Barrel 7	Zone 4 non-PAG + Zone 8	B7	183.8	Non-PAG	8/20/2019	156	9	0.32	5.6	0.5 (Zone 4 non-PAG) 0.3 (Zone 8)	3.5 (Zone 4 non-PAG) 4.7 (Zone 8)
Barrel 8	Overburden	B8	167	Non-PAG	10/18/2019	147	9	N/A	N/A	N/A	N/A
Barrel 9	Blank	B9	0		8/20/2019	156	7	N/A	N/A	N/A	N/A

Source**:** compiled in the text.

Table 2-2. Sampling Events and Leachate Volumes

Volume (L)	Barrel 1: Zone 1	Barrel 2: Zone 1 (duplicate)	Barrel 3: Zone 1a	Barrel 4: Zone 2-3	Barrel 5: Zone 4PAG + Zone 5	Barrel 6: Zone 6 + Zone 7	Barrel 7: Zone 4 NPAG + Zone 8	Barrel 8: Overburden	Barrel 9: Blank
12/31/2019	10.7	10.9	20.4	6.4	5.1	6.9	6.4	n.r.	n.r.
4/29/2020	13.4	8.1	11.5	7.8	10.9	6.4	4.7	16.8	n.r.
9/23/2020	13.4	8.1	11.5	7.8	10.9	6.4	4.7	16.8	n.r.
11/29/2020	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
4/5/2021	12.8	11.3	11.8	10.4	9.3	10.2	6.9	15.7	n.r.
7/15/2021	21.2	9.9	17.1	15.7	14.5	18.5	18.2	9.0	n.r.
12/20/2021	3.9	n. r.	15.1	18.1	17.5	6.3	19.3	8.1	n.r.
5/24/2022	4.0	5.5	n.r.	2.5	n.r.	2.5	7.0	8.5	n.r.
8/15/2022	n.r.	12.5	5.1	8.1	14.5	9.2	n.r.	n.r.	n.r.
8/16/2022	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	19.8	6.9	n.r.

n.r. - volume not recorded during sampling,

Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx

3 Field Barrel Results

Barrel release rates for select parameters are presented on Figure 3-1 and a complete summary of results is provided in Appendix B. Select parameters are defined as those that provide insight to acid generation potential (pH, alkalinity, acidity and sulfate), were screened to be greater than 10 times the average crustal abundances during static geochemical characterization (arsenic, phosphorus and selenium) or had increasing concentrations during the testing period in at least one barrel (cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, nickel, tin, thallium, uranium, vanadium and zinc).

Release rates were calculated using the following formula:

$$L_j = C_j * \frac{V}{m} / t$$

Where: L_j is the load of parameter j expressed in mg/kg/week

C_j is the concentration of parameter j in the leachate sample in mg/L

V is the volume of the sample in L

m is the total mass in the barrel in kg

t is the time between sample events in weeks

Trends in release rates were relatively consistent, or decreasing, in all barrels until the most recent sampling event (October 2023), where acidity increased in B4 (Zone 2/3) and B6 (Zone 6/7) along with several other parameters (Figure 3-1). Sulfate, as well as calcium and magnesium loadings were higher in barrels containing PAG rock (i.e., B3, B4, B5 and B6) in comparison to non-PAG barrels (i.e., B1, B2 and B7). Higher sulfate production rates are expected in the PAG barrels because they have higher sulfide concentrations (Table 2-1). The higher calcium and magnesium loading rates are indicative of carbonate mineral dissolution in response to acid production from sulfide oxidation.

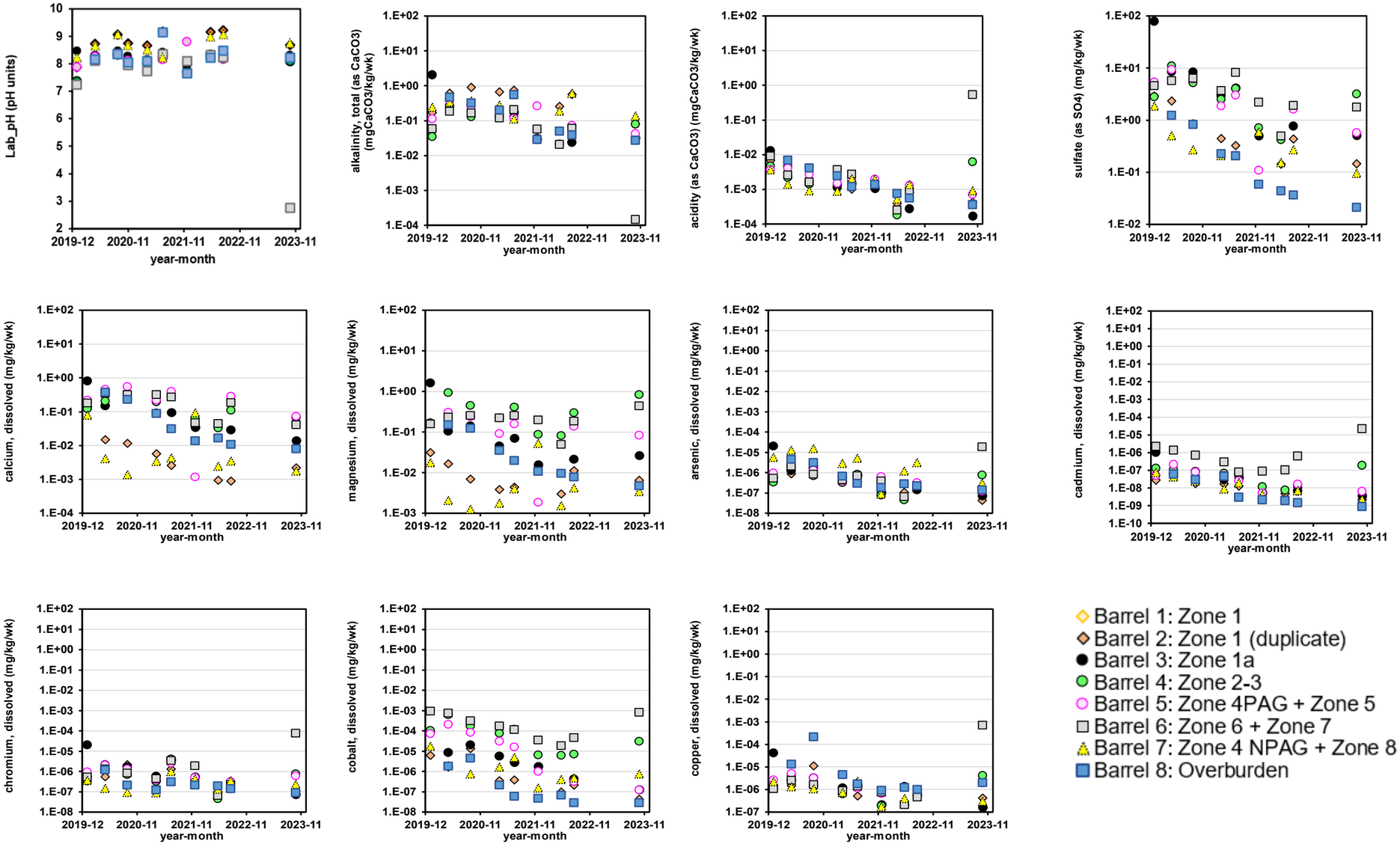
The pH in B6 decreased from 8.2 in August 2022 to 2.8 in October 2023. B6 represents a composite of waste rock Zones 6 and 7, which were classified as non-PAG based on static data and is currently the only barrel with an acidic pH. The NPR of the barrel containing waste rock reject samples from these zones was 0.5 (Table 2-1), which is lower than the bulk average NPR for Zone 6 (1.6) and Zone 7 (1.4). Although the Zone 6 and 7 composite barrel went acidic this does not change the overall PAG classification for Zone 6 and Zone 7 since the barrel NPR is closer to the 5th percentile NPRs in these two zones based on static properties (SRK 2022a).

Decreasing pH in B6 coincided with an increase in several constituent loadings including cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, phosphorus, nickel, tin, thallium, uranium, vanadium and zinc (Figure 3-1). Increases in some of these parameters were also observed at lower magnitudes in B4. The results suggest that if acidic drainage occurs from mine rock prior to placement in the management ponds, concentrations of these parameters will increase. The current interpretation is only based on one monitoring point with an acidic pH, and continued monitoring is required to confirm the trends.

Increasing acidity and sulfate loads in B4, along with several other parameters indicates B4 may go acidic in the near future. B4 represents waste Zone 2/3 which is classified as PAG based on static data. In all other barrels, alkalinity loadings remained generally consistent during the testing period with a slight decrease over time. Loadings of other constituents have generally maintained a slight decreasing trend throughout the testing period. This generally occurs when the pH remains stable and the mass inventory is depleted through time.

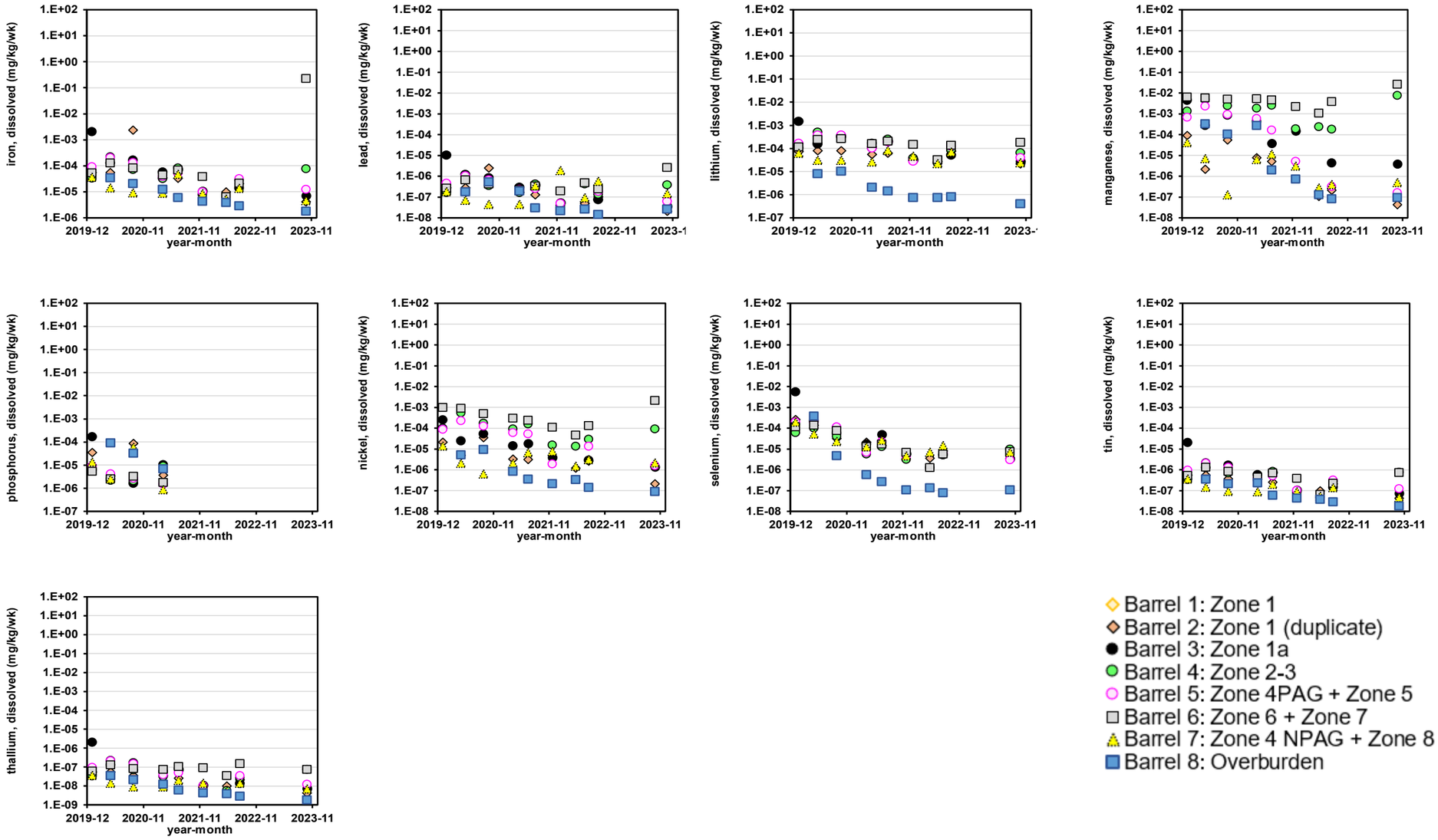
As discussed in Section 2.5, SRK (2022a) developed a site-specific NPR criterion based on kinetic testing results. CMRs calculated using the methods described in SRK (2022a) are presented in Figure 0-1. The HCT CMRs are also presented.

The field barrels had low sulfate production rates in comparison to the HCTs (Figure 0-1). The non-PAG barrels (1, 2 and 7) had sulfate release rates less than 1 mg/kg/week and PAG barrels (3, 4, 5 and 6) had sulfate release rates ranging from 3.5 to 13 mg/kg/week. The lower barrel production rates occur because of much lower water to rock ratios and water yields in the barrel tests compared to the HCTs. The CMRs of the PAG barrels were approximately 1.0 mol/mol for all barrels. The non-PAG CMRs were higher as a result of the lower sulfate production rates. The empirical sulfate production and carbonate dissolution rates converge on a CMR of 1.0 indicating the site-specific NPR of 1.2 estimated based on the HCTs is reasonable.



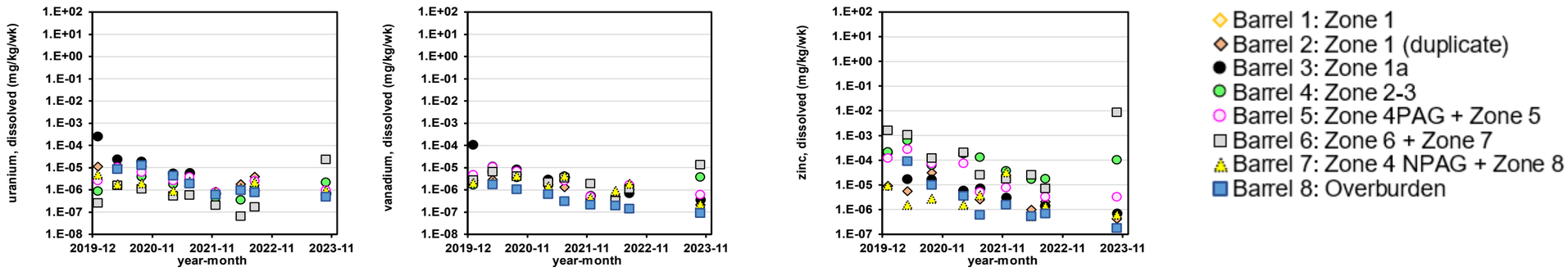
Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx]Load_S

Figure 3-1. Loading Results from Barrel Tests for Select Parameters



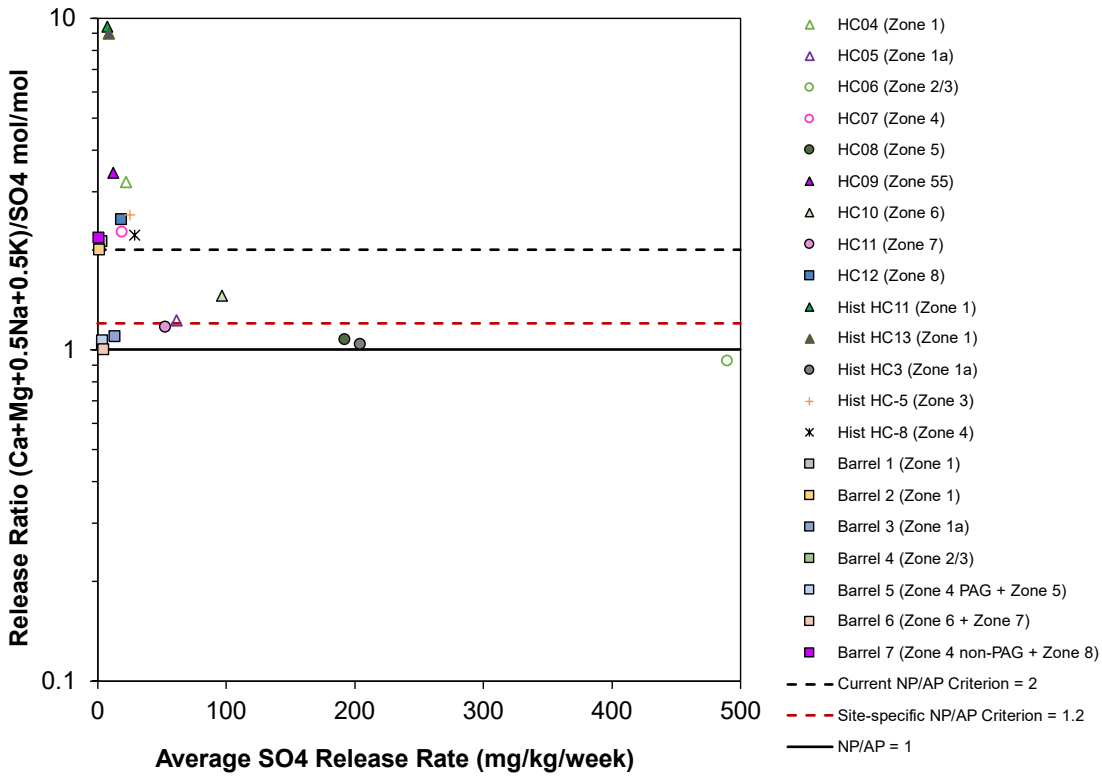
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Figure 3-1 (cont.) Loading Results from Barrel Tests for Select Parameters



Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx]Load_S

Figure 3-1 (cont.) Loading Results from Barrel Tests for Select Parameters



Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[NPR_Crit_1CT027.002_JED_MKH_r01.xlsx]

Figure 0-1. Comparison of CMR Estimates from HCTs and Field Barrels

4 Comparison to Source Term Loadings

SRK (2022b) developed geochemical source terms using humidity cell testing (HCT) results that were scaled to account for the differences between lab and site conditions (e.g., temperature and grain size). The reader is referred to SRK (2022b) for additional details on the source term derivation methods, including the scaling approach that was used. The barrel release rates provide insight into parameter release rates under ambient conditions. These were compared to the scaled HCT results to determine if the scaling approach used in the source term derivation was accurate. Prior to the comparison, a grain size scaling factor (0.2) was applied to the barrel release rates since the barrels were constructed using HCT rock rejects (i.e., <1/4”). The barrels are much smaller than a full scale rock pile and will not exhibit the same internal heating that occurs in full scale piles containing pyritic rock. The field temperature of the barrels was approximately 10ºC and the release rates were not adjusted for temperature differences since this is the expected temperature of the full scale pile.

Figures comparing the scaled barrel and HCT release rates for non-PAG zones (Zones 1 and 4) is included in Appendix C. A release rate higher in the barrel in comparison to the HCT indicates the lab rates were over scaled. The following list the parameters that were similar, lower or higher in the barrels compared to the HCT.

- Higher: sulfate, arsenic, cobalt, lead, molybdenum, nickel, selenium and uranium,
- Lower: calcium, magnesium, potassium, barium, boron, cadmium, iron, lithium, manganese, mercury, phosphorus, silicon, strontium, tin and thallium.
- Similar: sodium, chloride, antimony, chromium, copper, silver, vanadium and zinc.

The comparison indicated several constituents were either over or under scaled in the HCTs. SRK has updated the geochemical source terms using the barrel release rates to be used in the Project water quality model to evaluate changes to water quality (SRK 2022c).

5 Summary

A field barrel testing program was initiated to evaluate release rates and acidic lag times from Project Materials under ambient conditions. The results were used for several purposes, including:

- Advance the understanding of ML/ARD from stratigraphic zones under field conditions.
- Provide additional empirical evidence to support lag times lag times to the onset of acid generation.
- Constrain scaling factors that were used in the geochemical source terms that were used as the basis of the EA water quality predictions.

With the exception of barrel 6 (Zone 6/7), all barrels remained alkaline during the four-year data collection period. Sulfate loadings were higher in barrels that are characterized as PAG based on the weighted NPRs (Table 2-1) in comparison to non-PAG barrels. In addition, the calcium and magnesium release rates were also higher in PAG barrels relative to non-PAG barrels. Release rates of these constituents as well as the alkaline pH of the leachates and alkalinity production rates indicate carbonate mineral dissolution is buffering acid production from sulfide oxidation. Acidity and sulfate release rates increased during the last sampling round (October 2023) in barrel 4 (Zone 2/3) indicating this barrel may go acidic in the near future.

The PAG management strategy for the project is to place all PAG rock underwater in the management ponds within a period of 12 months. Barrel 6 became acid generating in October 2023, four years after the barrel testing program was constructed and all other barrels maintained alkaline pH values. The barrel results support the proposed period for inundation of PAG rock is reasonable.

SRK (2022a) developed a site-specific NPR of 1.2 based on HCT results. CMRs on the steady state rates in the barrel tests converged on a value of 1. The similarities between the barrel and the HCT CMRs support that the site-specific NPR estimated based on the HCT results of 1.2 is reasonable.

A comparison of the scaled barrel and HCT release rates indicate the scaling factors applied in the source terms (SRK 2022b) were too high for some constituents and too low for others. SRK has updated the geochemical source terms and site-wide water quality predictions using the scaled barrel release rates. The results of these updates will be reported under separate cover.

6 Closing

We trust this memo satisfies your current requirements. Should you have any questions or require any additional information please do not hesitate to contact the undersigned.

Regards,
SRK Consulting (Canada) Inc.

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Attachments:

Appendix A	Barrel Attribute Data
Appendix B	Summary of Barrel release rates
Appendix C	Comparison of Scaled HCT Loads to Barrel Load Figures

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References

Norecol Dames and Moore, 1999. Draft Report. Assessment of ARD Potential and Water Quality Predictions. Telkwa Coal Project. Prepared for Luscar Coal Ltd. Project No. 25373-004-310. March 19, 1999.

SRK 2022a. Telkwa Coal – Tenas Project Supplemental Geochemical Characterization. Prepared for Telkwa Coal Ltd. By SRK Consulting (Canada) Inc. February 2022.

SRK 2022b. Telkwa Coal – Tenas Project Water Quality Model Source Term Derivation Methods. Prepared for Telkwa Coal Ltd. By SRK Consulting (Canada) Inc. February 2022.

SRK 2023c. Tenas Project – Water and Load Balance Modeling Report. FINAL. Prepared for Telkwa Coal Limited: Vancouver BC. Project Number 1CT027.003. Issued July 29, 2022.

Appendix A Barrel Attribute Data

Barrel #	Description	Sample IDs	Sample Mass (kg)	Total Mass (kg)
1 and 2	Zone 1 and duplicate	T18-02D-A-005	34.0	633.96725 (2 barrels for 316.983625 kg each) *247kg total or 123.5kg each barrel was disposed of and did not fit into barrels. ***28657 + 28669 samples were not on pallet*.**
		T18-02D-A-006	37.1	
		28651	97.6	
		28653	82.5	
		28655	49.8	
		28657	40.0	
		28658	47.7	
		28659	41.2	
		28660	17.9	
		28669	40.9	
		29502	33.8	
		29509	111.6	
3	Zone 1a	28841	51.6	332.2785 *98.0kgs total was disposed of and did not fit into barrel.
		28842	43.3	
		28843	52.3	
		28844	40.7	
		T18-02D-A-011	33.7	
		28672	35.4	
		29514	41.8	
		29515	33.6	
4	Zone 2-3	T18-01D-A-001	11.1	282.249875 *91.5kgs total was disposed of and did not fit into barrel.
		T18-01D-A-002	0.9	
		T18-02D-A-012	29.5	
		T18-02D-A-013	14.9	
		28673	26.6	
		28674	4.9	
		T18-01D-A-003	5.1	
		T18-01D-A-004	14.0	
		T18-01D-A-005	23.4	
		T18-01D-A-006	10.6	
		T18-01D-A-007	1.2	
		T18-02D-A-014	43.5	
		T18-02D-A-015	33.2	
		T18-02D-A-016	3.3	
		28675	30.1	
		28676	27.6	
		28677	2.3	
5	Zone 4PAG + Zone 5	T18-01D-A-009	24.9	282.11575 *136.0kgs total was disposed of and did not fit into barrel.
		T18-02D-A-020	47.2	
		28681	32.1	
		28682	2.7	
		28683	5.2	
		T18-01D-A-010	44.0	
		T18-01D-A-011	29.7	
		T18-02D-A-022	34.8	
		T18-02D-A-024	14.6	
		T18-02D-A-025	6.7	
		T18-03D-A-005	14.3	
		28684	6.3	
		28686	14.9	
		28687	4.8	
6	Zone 6 + Zone 7	T18-01D-A-012	7.1	335.677875 *197.0kgs was disposed of and did not fit into barrel.
		T18-02D-A-027	3.7	
		T18-02D-A-029	11.5	
		T18-03D-A-009	10.9	
		T18-03D-A-021	15.0	
		T18-03D-A-022	3.7	
		28688	2.2	
		28690	24.3	
		28691	1.8	
		28704	6.5	
		28692	2.8	
		28693	5.6	
		28696	1.9	
		28697	5.4	
		29516	41.3	
		29518	38.6	
		29519	15.2	
		29520	3.4	
		29521	4.9	
		T18-02D-A-030	13.4	
		T18-02D-A-031	18.9	
		T18-02D-A-032	16.3	
		T18-02D-A-033	11.3	
		T18-02D-A-034	9.4	
		T18-03D-A-023	2.1	
		T18-03D-A-024	11.6	
		28698	38.8	
		28699	2.4	
		28700	5.7	
7	Zone 4 NPAG + Zone 8	T18-01D-A-008	35.1	224.280125 *40.5kgs was disposed of and did not fit into the barrel.
		T18-02D-A-017	0.8	
		T18-02D-A-018	28.2	
		T18-02D-A-019	14.8	
		28678	3.0	
		28679	56.2	
		28680	30.9	
		T18-02D-A-035	17.8	
		T18-02D-A-036	5.6	
		T18-02D-A-037	12.0	
		28708	4.1	
		28709	15.7	
8	Overburden	B945450	167.4	167.367kgs- All overburden pail samples fit into barrel.
9	Blank	0	0.0	0

Appendix B Summary of Barrel release rates

Appendix B: Summary of Barrel release rates (mg/kg/week)

Table B1: Element release rates for non-PAG zones estimated from field kinetics testing

Parameter	Units	non-PAG Zones											
		Barrel 1: Zone 1			Barrel 2: Zone 1 (duplicate)			Barrel 6: Zone 6 + Zone 7			Barrel 7: Zone 4 NPAG + Zone 8		
		min	Average	Max	min	Average	Max	min	Average	Max	min	Average	Max
Conventional													
pH	s.u.	8.0	8.7	9.5	7.9	8.6	9.2	2.8	7.9	8.4	7.6	8.3	9.1
EC	mS/cm	2790	4706	6350	2160	3953	5190	1020	7893	11200	511	2095	3050
Alkalinity	mg$CaCO_3$/Kg/week	0.18	3.6	9.4	0.08	0.55	0.88	0.00014	0.11	0.20	0.032	0.27	0.61
Major Ions													
Calcium	mg/kg/week	0.0019	0.033	0.117	0.00089	0.025	0.14	0.041	0.21	0.34	0.0014	0.024	0.093
Magnesium	mg/kg/week	0.010	0.028	0.13	0.0029	0.011	0.031	0.049	0.19	0.44	0.0012	0.011	0.053
Potassium	mg/kg/week	0.008	0.023	0.043	0.0014	0.0051	0.0083	0.00052	0.010	0.016	0.0011	0.0028	0.0048
Sodium	mg/kg/week	1.1	3.1	5.3	0.11	0.72	1.3	0.06	1.1	2.4	0.11	0.37	0.81
Chloride	mg/kg/week	0.010	0.042	0.083	0.0019	0.0085	0.027	0.0031	0.018	0.034	0.00077	0.0044	0.0087
Sulfate	mg/kg/week	0.91	3.1	7.6	0.14	1.1	2.9	0.49	4.1	8.2	0.09	0.51	1.9
Nitrate	mg/kg/week	0.00024	0.015	0.046	0.000021	0.0075	0.024	0.000031	0.00018	0.00034	0.000024	0.0013	0.0031
Nitrite	mg/kg/week	0.000023	0.0014	0.0042	0.0000042	0.00023	0.00066	0.0000062	0.000039	0.000067	0.0000023	0.000076	0.00026
Ammonia	mg/kg/week	0.000007	0.0010	0.0035	0.0000010	0.00034	0.0011	0.0000019	0.00037	0.0014	0.0000013	0.000083	0.00044
Dissolved Elements													
Aluminum	mg/kg/week	0.0000053	0.00062	0.0041	0.00000048	0.00017	0.0011	0.00000062	0.0000063	0.022	0.00000045	0.000025	0.00011
Antimony	mg/kg/week	0.00000069	0.0000054	0.000011	0.000000042	0.0000014	0.0000029	0.0000001	0.0000005	0.0000013	0.000000086	0.00000091	0.0000018
Arsenic	mg/kg/week	0.00000074	0.0000054	0.000014	0.000000042	0.000001	0.000002	0.000000062	0.00000064	0.000018	0.000000086	0.0000057	0.000015
Barium	mg/kg/week	0.0000010	0.000065	0.00025	0.00000016	0.00001	0.00002	0.0000010	0.0000056	0.000010	0.0000010	0.000011	0.000025
Boron	mg/kg/week	0.00008	0.00085	0.0019	0.000011	0.000094	0.00018	0.0000116	0.0000738	0.00013	0.000022	0.00010	0.00026
Cadmium	mg/kg/week	0.000000025	0.00000015	0.00000030	0.0000000021	0.000000019	0.000000044	0.000000077	0.00000067	0.000022	0.0000000023	0.000000023	0.000000073
Chromium	mg/kg/week	0.0000005	0.0000034	0.000013	0.00000010	0.0000007	0.0000021	0.000000062	0.0000011	0.000074	0.00000009	0.00000032	0.0000010
Cobalt	mg/kg/week	0.0000012	0.000021	0.00012	0.000000042	0.0000032	0.000013	0.000018	0.00029	0.00093	0.00000015	0.00000342	0.000017
Copper	mg/kg/week	0.0000023	0.000015	0.00007	0.00000021	0.0000023	0.000011	0.00000021	0.0000011	0.00069	0.00000017	0.00000115	0.0000024
Iron	mg/kg/week	0.000049	0.00092	0.00577	0.0000042	0.00036	0.0023	0.0000062	0.000055	0.22354	0.00000454	0.00001802	0.000048
Lead	mg/kg/week	0.00000026	0.0000095	0.00005	0.000000021	0.00000049	0.0000024	0.00000019	0.00000035	0.0000025	0.00000004	0.00000040	0.0000019
Lithium	mg/kg/week	0.000078	0.00025	0.00053	0.000022	0.000064	0.000080	0.000031	0.00016	0.00026	0.000022	0.000046	0.000083
Manganese	mg/kg/week	0.0000012	0.000064	0.00031	0.000000042	0.000022	0.000089	0.0011	0.0042	0.025	0.00000013	0.0000089	0.000042
Mercury	mg/kg/week	0.0000000049	0.000000014	0.000000026	0.0000000010	0.0000000045	0.000000013	0.00000000062	0.0000000049	0.000000013	0.0000000013	0.0000000064	0.000000022
Phosphorus	mg/kg/week	0.0000066	0.0000	0.0000	0.0000034	0.000032	0.000087	0.0000017	0.0000032	0.0000052	0.00000088	0.000019	0.0001
Molybdenum	mg/kg/week	0.0000019	0.00031	0.00102	0.00000017	0.000040	0.00011	0.000000031	0.00000071	0.0000027	0.00000043	0.000059	0.00017
Nickel	mg/kg/week	0.0000059	0.00005	0.00023	0.00000021	0.000010	0.000034	0.000046	0.00040	0.0020	0.00000063	0.000005	0.00001
Selenium	mg/kg/week	0.0000005	0.00013	0.00039	0.0000034	0.000067	0.00025	0.0000012	0.000045	0.00013	0.0000047	0.000041	0.00019
Silicon	mg/kg/week	0.0012	0.0055	0.013	0.000094	0.0011	0.0026	0.00018	0.0012	0.0064	0.00026	0.00095	0.0018
Silver	mg/kg/week	0.000000049	0.00000014	0.00000026	0.0000000042	0.000000033	0.000000055	0.0000000062	0.000000055	0.00000013	0.0000000045	0.000000015	0.000000037
Strontium	mg/kg/week	0.00008	0.0011	0.0024	0.000017	0.00068	0.0031	0.00079	0.0032	0.0052	0.000049	0.00038	0.0015
Tin	mg/kg/week	0.00000049	0.0000014	0.0000026	0.000000042	0.00000033	0.00000055	0.000000062	0.00000055	0.0000013	0.000000045	0.00000015	0.00000037
Thallium	mg/kg/week	0.000000049	0.00000014	0.00000026	0.0000000042	0.000000033	0.000000055	0.000000034	0.000000090	0.00000015	0.0000000053	0.000000015	0.000000037
Uranium	mg/kg/week	0.000009	0.000035	0.000092	0.00000075	0.0000073	0.000013	0.000000064	0.00000055	0.000023	0.00000081	0.0000020	0.0000049
Vanadium	mg/kg/week	0.0000025	0.0000068	0.000013	0.00000021	0.0000021	0.0000047	0.00000031	0.0000027	0.000013	0.00000023	0.0000021	0.0000043
Zinc	mg/kg/week	0.0000049	0.000046	0.00025	0.00000042	0.000008	0.000030	0.0000071	0.00038	0.0085	0.00000053	0.0000066	0.000032

Source: https://srk.sharepoint.com/sites/NACAPR002933/Internal/Task 100 Field barrel analysis/Loads_comparison/[Conc_Loadings_Telkwa Tenas_Field Barrel_1CT027.007_rtc_CP_CCM_05.xlsx

Appendix B: Summary of Barrel release rates (mg/kg/week)

Table B2: Element release rates for PAG zones estimated from field kinetics testing

Parameter	Units	PAG Zones								
		Barrel 3: Zone 1a			Barrel 4: Zone 2-3			Barrel 5: Zone 4PAG + Zone 5		
		min	Average	Max	min	Average	Max	min	Average	Max
Conventional										
pH	s.u.	7.9	8.2	8.5	7.4	7.9	8.3	7.9	8.1	8.8
EC	mS/cm	2000	13318	27200	1580	7857	19200	727	5471	8660
Alkalinity	mg $CaCO_3$/L	0.024	0.43	2.0	0.021	0.10	0.27	0.042	0.19	0.35
Major Ions										
Calcium	mg/kg/week	0.014	0.21	0.81	0.032	0.16	0.28	0.0011	0.30	0.55
Magnesium	mg/kg/week	0.016	0.29	1.61	0.081	0.33	0.93	0.0018	0.15	0.30
Potassium	mg/kg/week	0.0019	0.043	0.21	0.0015	0.010	0.025	0.0013	0.016	0.043
Sodium	mg/kg/week	0.140	7.1	38.3	0.017	1.1	4.4	0.034	1.4	3.9
Chloride	mg/kg/week	0.0018	0.049	0.23	0.0019	0.018	0.054	0.00049	0.018	0.051
Sulfate	mg/kg/week	0.49	15	79	0.41	3.5	11	0.11	3.9	9.3
Nitrate	mg/kg/week	0.00032	0.0028	0.0058	0.000057	0.0017	0.0079	0.000024	0.0065	0.023
Nitrite	mg/kg/week	0.0000035	0.0010	0.0059	0.0000038	0.000084	0.00031	0.0000020	0.00026	0.0011
Ammonia	mg/kg/week	0.00000042	0.0061	0.032	0.0000013	0.00039	0.0025	0.0000012	0.00040	0.0020
Dissolved Elements										
Aluminum	mg/kg/week	0.00000070	0.00004	0.00021	0.00000045	0.00001	0.000022	0.0000012	0.000010	0.000021
Antimony	mg/kg/week	0.000000070	0.0000036	0.000021	0.000000045	0.00000059	0.0000022	0.00000012	0.0000008	0.0000021
Arsenic	mg/kg/week	0.000000070	0.0000036	0.000021	0.000000045	0.00000059	0.0000022	0.00000012	0.00000087	0.0000021
Barium	mg/kg/week	0.00000023	0.0000074	0.000032	0.00000065	0.0000035	0.0000071	0.0000019	0.0000082	0.000015
Boron	mg/kg/week	0.000012	0.00042	0.0021	0.000014	0.00010	0.00022	0.000019	0.00013	0.00024
Cadmium	mg/kg/week	0.0000000035	0.00000018	0.0000010	0.0000000072	0.000000054	0.00000018	0.0000000049	0.000000062	0.00000021
Chromium	mg/kg/week	0.00000007	0.0000041	0.000021	0.000000045	0.0000010	0.0000041	0.00000032	0.0000011	0.0000025
Cobalt	mg/kg/week	0.00000012	0.000018	0.00009	0.0000062	0.00013	0.00060	0.00000012	0.000058	0.00021
Copper	mg/kg/week	0.00000016	0.0000073	0.000042	0.00000019	0.0000015	0.0000043	0.00000065	0.0000020	0.0000050
Iron	mg/kg/week	0.0000070	0.00036	0.00208	0.0000045	0.000059	0.00022	0.000010	0.000080	0.00021
Lead	mg/kg/week	0.000000035	0.0000019	0.000010	0.000000038	0.00000034	0.0000011	0.000000049	0.00000041	0.0000010
Lithium	mg/kg/week	0.000026	0.00034	0.00151	0.000023	0.00019	0.00051	0.000027	0.00019	0.00038
Manganese	mg/kg/week	0.0000037	0.0009	0.00433	0.00018	0.0017	0.0076	0.0000002	0.00066	0.00231
Mercury	mg/kg/week	0.000000000035	0.0000000059	0.000000021	0.00000000045	0.0000000037	0.0000000080	0.0000000012	0.000000006	0.000000010
Phosphorus	mg/kg/week	0.0000017	0.000045	0.00017	0.0000021	0.0000049	0.0000091	0.0000015	0.0000043	0.0000090
Molybdenum	mg/kg/week	0.000000055	0.000077	0.00046	0.000000061	0.0000023	0.000010	0.00000025	0.000011	0.000036
Nickel	mg/kg/week	0.0000013	0.000053	0.00025	0.000013	0.00014	0.00054	0.0000015	0.000080	0.00022
Selenium	mg/kg/week	0.0000033	0.00086	0.00566	0.0000013	0.000028	0.000099	0.0000029	0.000074	0.00020
Silicon	mg/kg/week	0.000090	0.0023	0.010	0.00016	0.00092	0.0017	0.00020	0.0012	0.0023
Silver	mg/kg/week	0.0000000070	0.00000036	0.0000021	0.0000000045	0.000000059	0.00000022	0.000000010	0.000000080	0.00000021
Strontium	mg/kg/week	0.00037	0.0068	0.032	0.00040	0.0021	0.0044	0.000031	0.0030	0.0052
Tin	mg/kg/week	0.000000070	0.0000036	0.000021	0.000000045	0.00000059	0.0000022	0.00000010	0.00000080	0.0000021
Thallium	mg/kg/week	0.0000000070	0.00000036	0.0000021	0.0000000057	0.000000059	0.00000022	0.000000010	0.000000082	0.00000021
Uranium	mg/kg/week	0.00000066	0.000043	0.00025	0.00000034	0.0000026	0.000010	0.0000008	0.0000041	0.000010
Vanadium	mg/kg/week	0.00000035	0.000018	0.00010	0.00000022	0.0000029	0.000011	0.00000049	0.0000040	0.000010
Zinc	mg/kg/week	0.00000070	0.000037	0.00021	0.000017	0.00016	0.00063	0.0000032	0.000078	0.00027

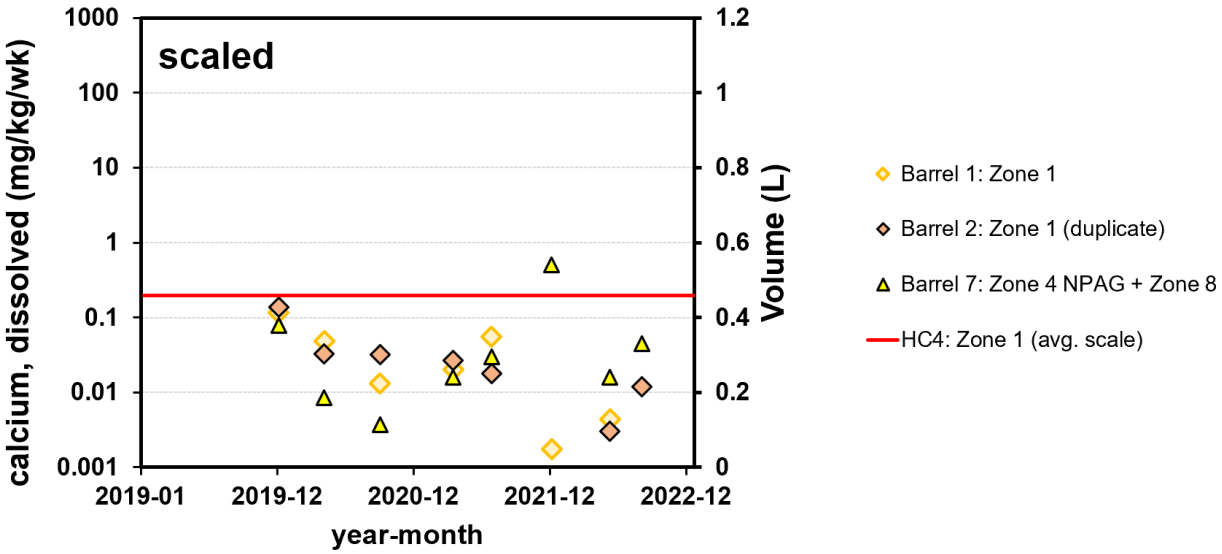
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Appendix B: Summary of Barrel release rates (mg/kg/week)

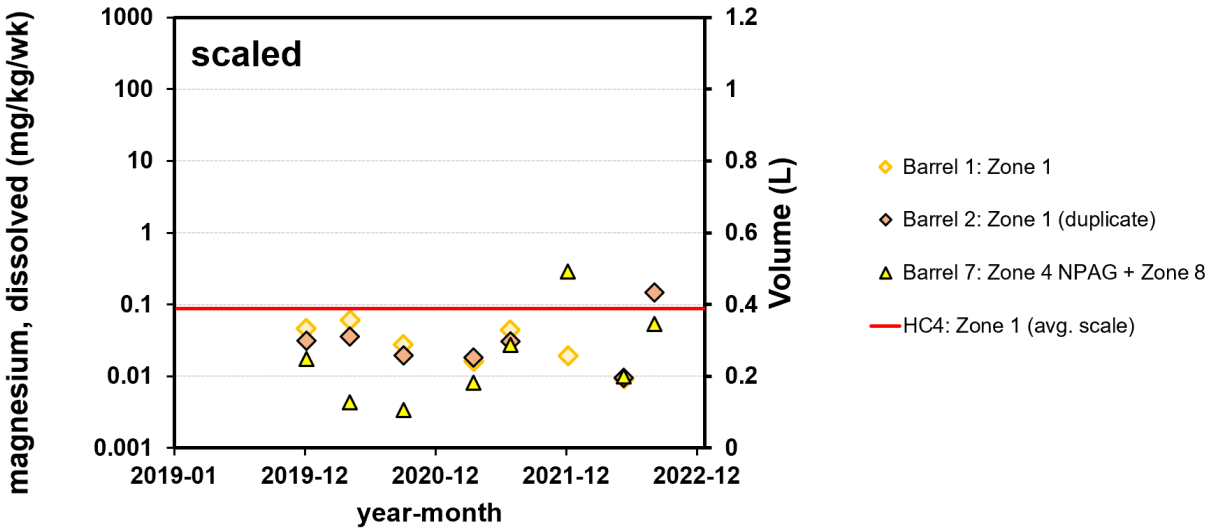
Table B3: Element release rates for overburden estimated from field kinetics testing

Parameter	Units	Overburden		
		Barrel 8: Overburden		
		min	Average	Max
Conventional				
pH	s.u.	7.7	8.1	9.1
EC	mS/cm	29	896	2320
Alkalinity	mg $CaCO_3$/L	0.027	0.23	0.55
Major Ions				
Calcium	mg/kg/week	0.0079	0.11	0.37
Magnesium	mg/kg/week	0.0046	0.051	0.15
Potassium	mg/kg/week	0.00028	0.0041	0.018
Sodium	mg/kg/week	0.0033	0.034	0.10
Chloride	mg/kg/week	0.000089	0.008	0.037
Sulfate	mg/kg/week	0.021	0.37	1.2
Nitrate	mg/kg/week	0.0000014	0.0025	0.012
Nitrite	mg/kg/week	0.00000028	0.00014	0.00061
Ammonia	mg/kg/week	0.0000014	0.000022	0.000080
Dissolved Elements				
Aluminum	mg/kg/week	0.00000018	0.0000023	0.0000059
Antimony	mg/kg/week	0.000000037	0.00000024	0.00000070
Arsenic	mg/kg/week	0.00000014	0.0000013	0.0000044
Barium	mg/kg/week	0.0000027	0.000039	0.00011
Boron	mg/kg/week	0.0000059	0.000034	0.00010
Cadmium	mg/kg/week	0.00000000089	0.000000020	0.000000060
Chromium	mg/kg/week	0.000000089	0.00000033	0.0000012
Cobalt	mg/kg/week	0.000000028	0.00000093	0.0000044
Copper	mg/kg/week	0.00000088	0.000033	0.00021
Iron	mg/kg/week	0.0000018	0.000012	0.000034
Lead	mg/kg/week	0.000000014	0.00000014	0.00000052
Lithium	mg/kg/week	0.00000039	0.0000034	0.000010
Manganese	mg/kg/week	0.000000081	0.00010	0.00032
Mercury	mg/kg/week	0.00000000089	0.0000000060	0.0000000172
Phosphorus	mg/kg/week	0.0000066	0.000042	0.000088
Molybdenum	mg/kg/week	0.00000029	0.0000031	0.0000084
Nickel	mg/kg/week	0.000000089	0.0000023	0.0000092
Selenium	mg/kg/week	0.000000075	0.0000525	0.00036
Silicon	mg/kg/week	0.0011	0.0064	0.016
Silver	mg/kg/week	0.0000000018	0.000000012	0.000000034
Strontium	mg/kg/week	0.000062	0.00055	0.0016
Tin	mg/kg/week	0.000000018	0.00000014	0.00000034
Thallium	mg/kg/week	0.0000000018	0.000000012	0.000000034
Uranium	mg/kg/week	0.00000048	0.0000042	0.000013
Vanadium	mg/kg/week	0.000000089	0.00000060	0.0000017
Zinc	mg/kg/week	0.00000018	0.000015	0.000090

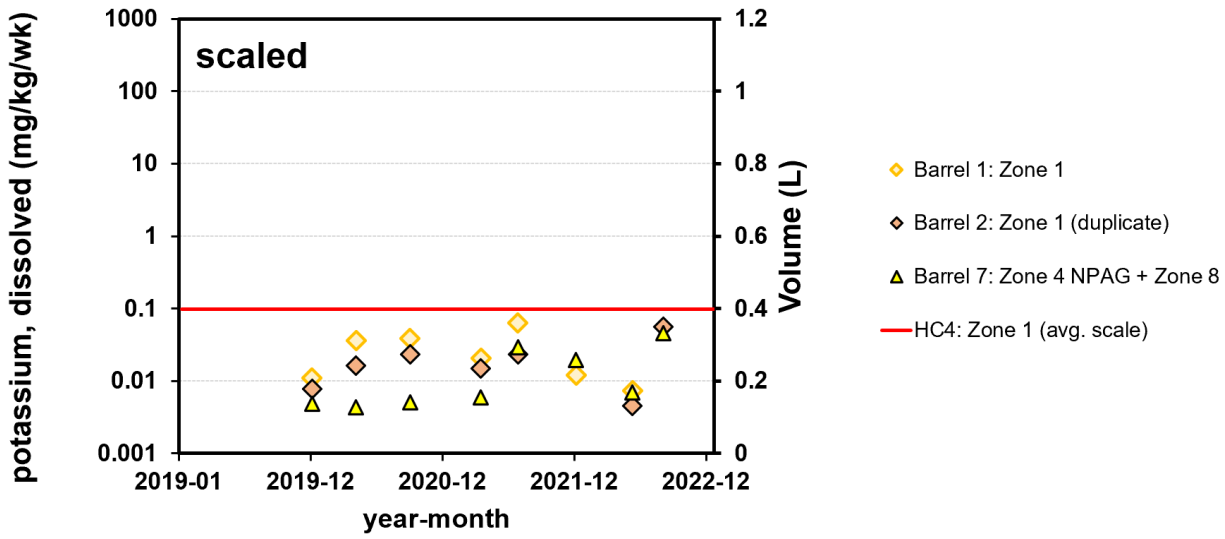
Appendix C Comparison of Scaled HCT Loads to Barrel Load Figures



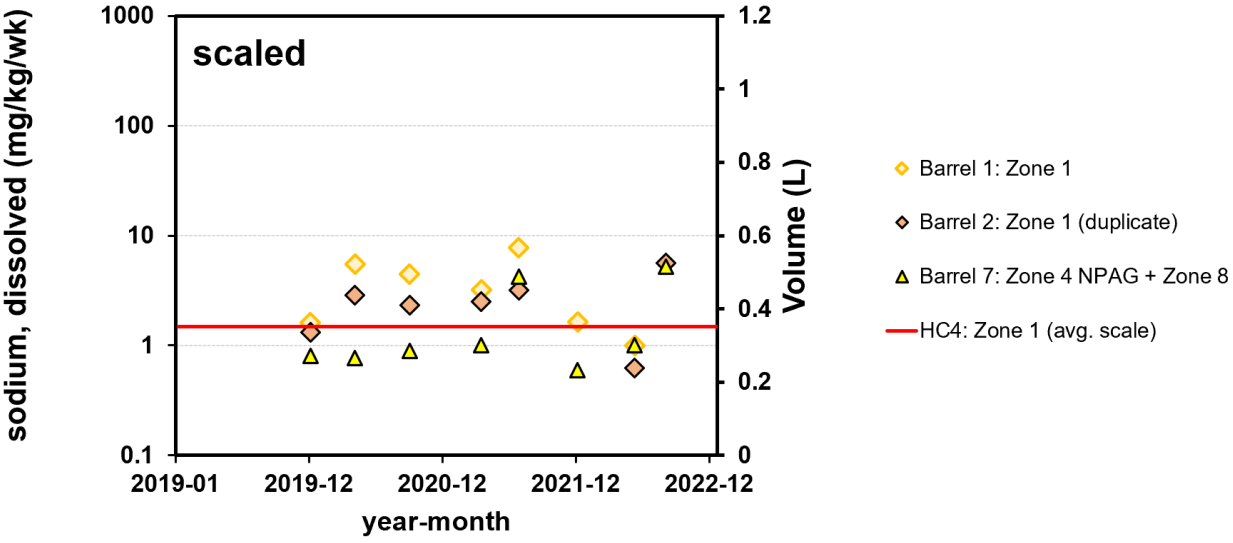
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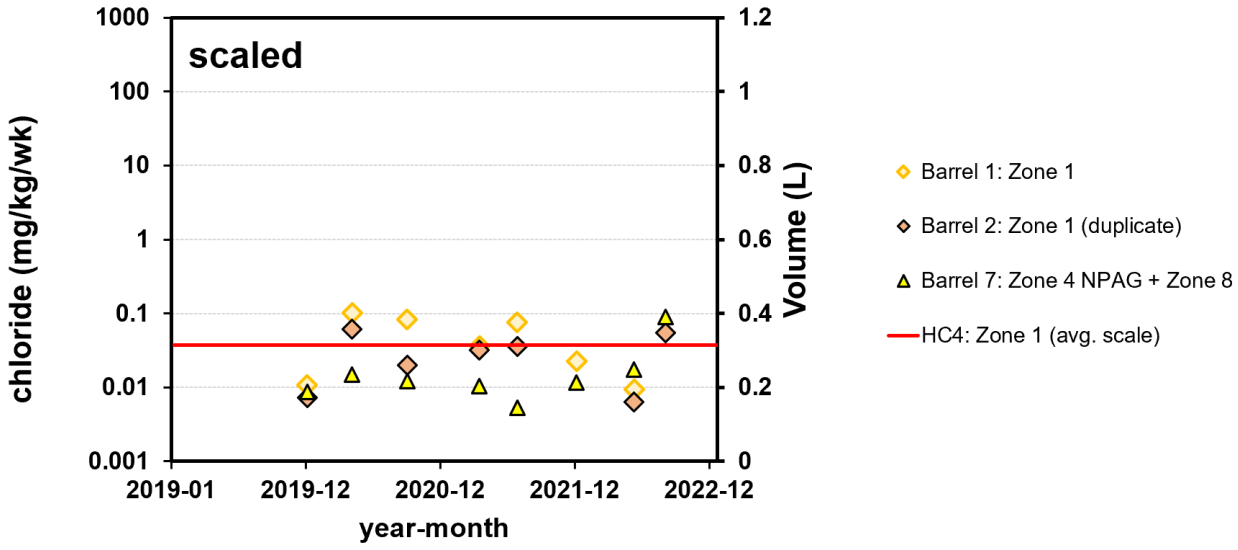
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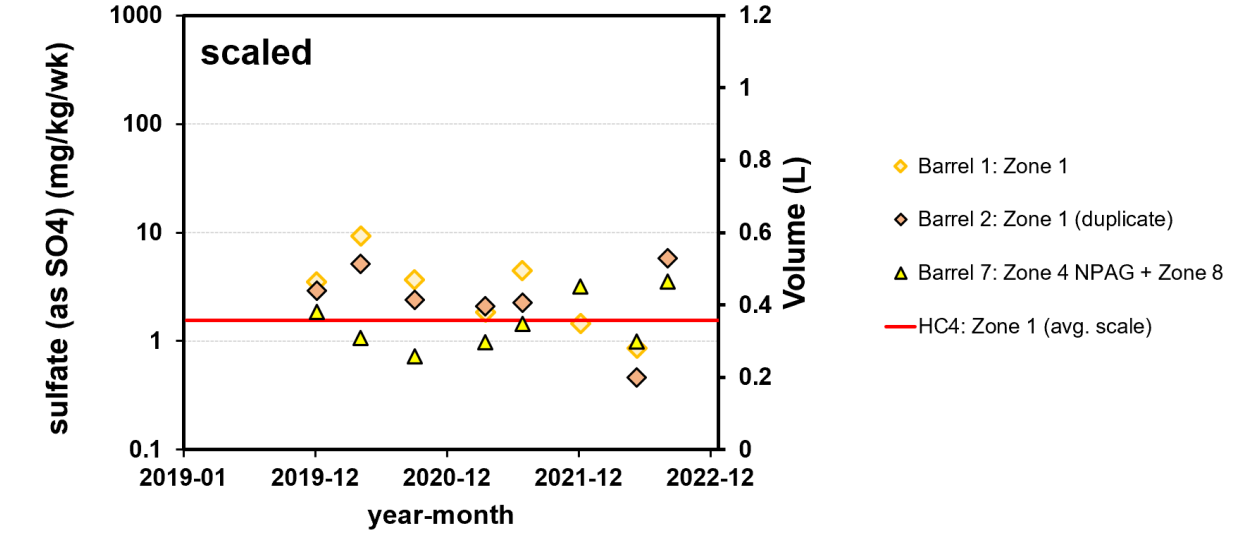
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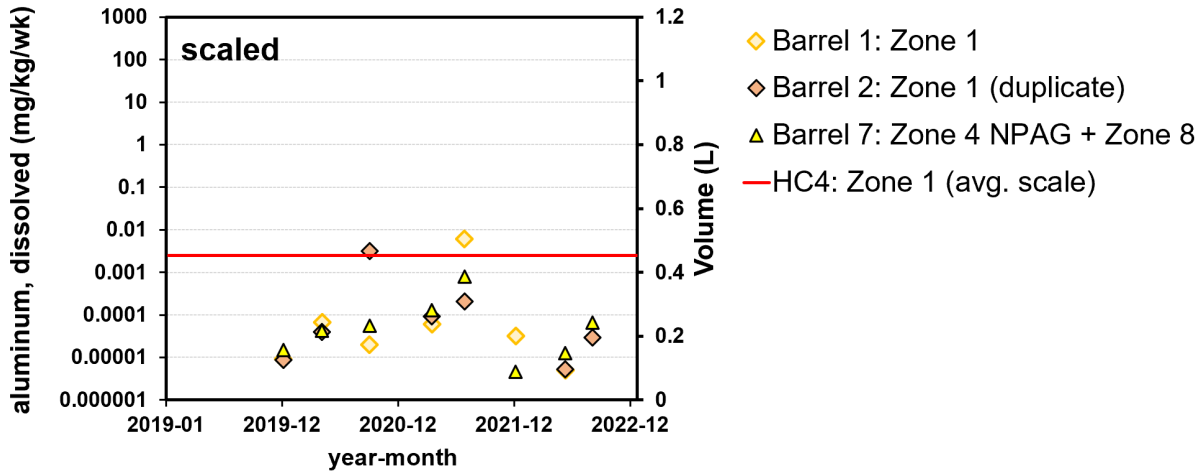


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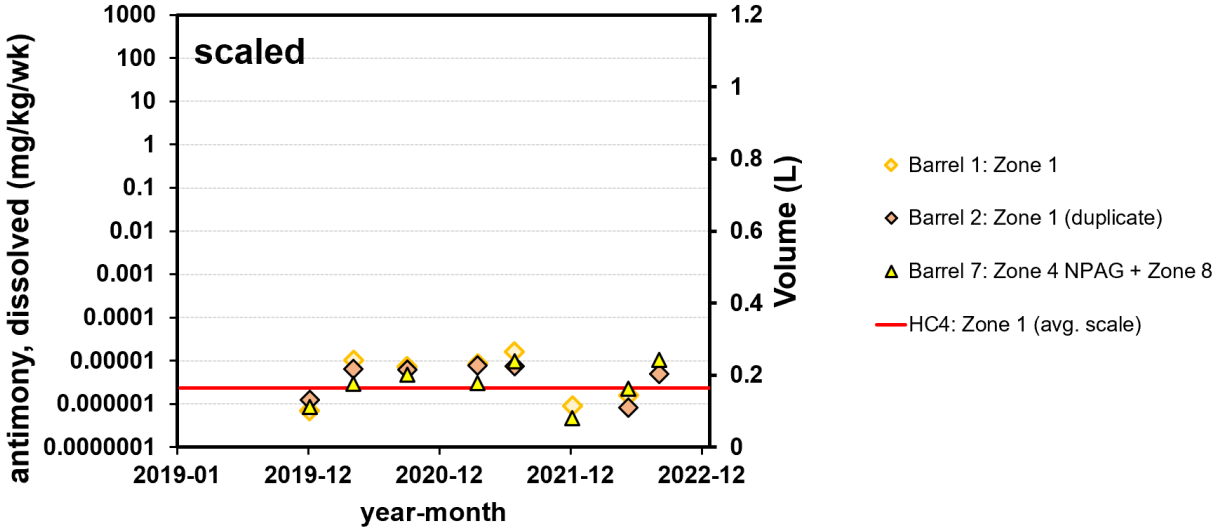


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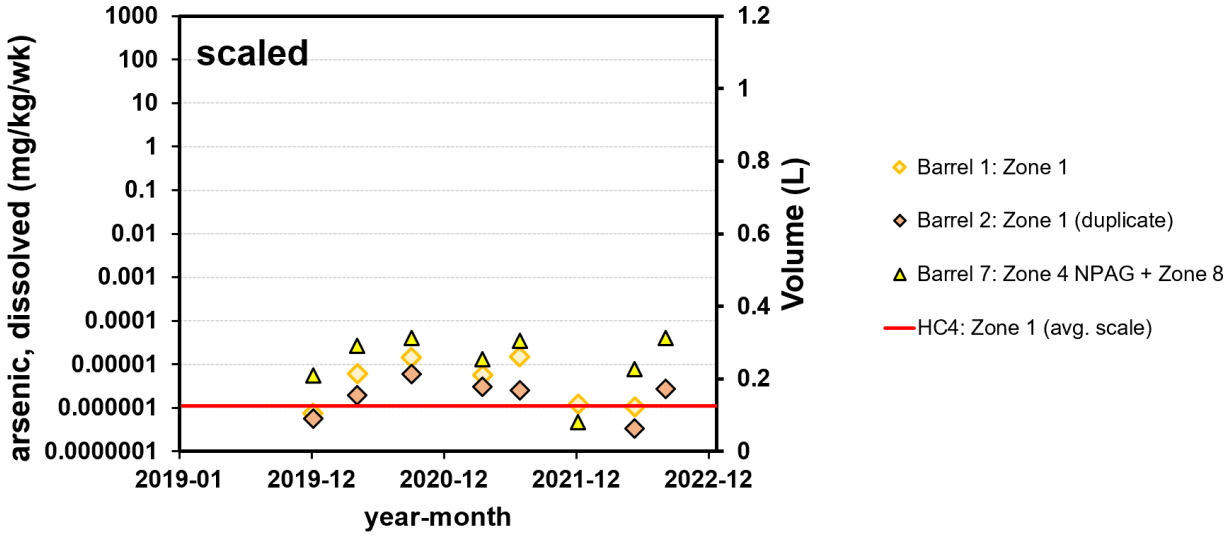
Appendix C Comparison of Scaled HCT Loads to Barrel Load Figures



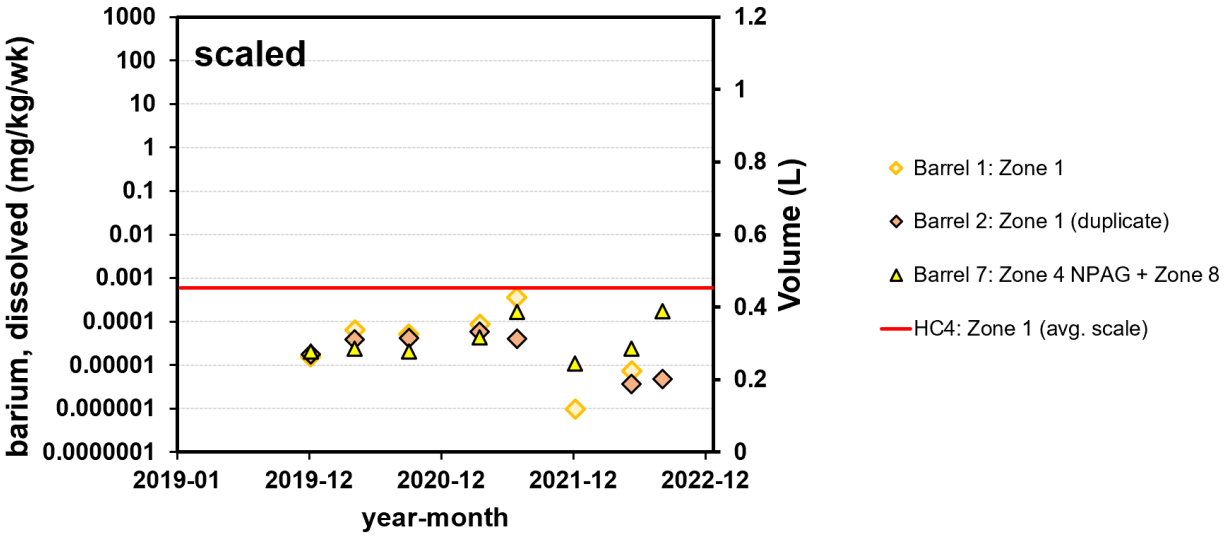
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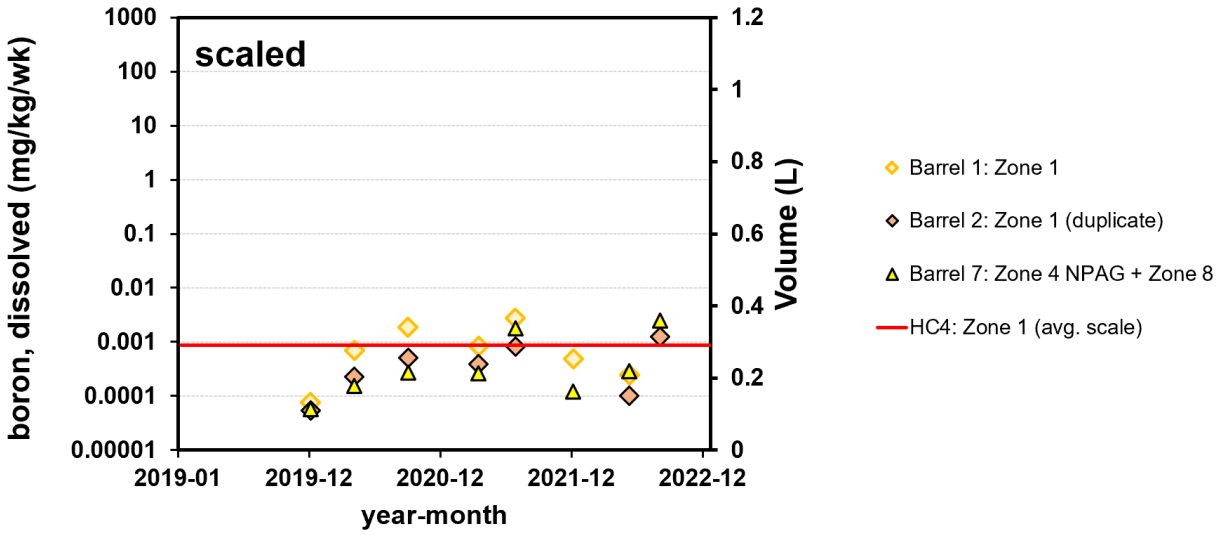
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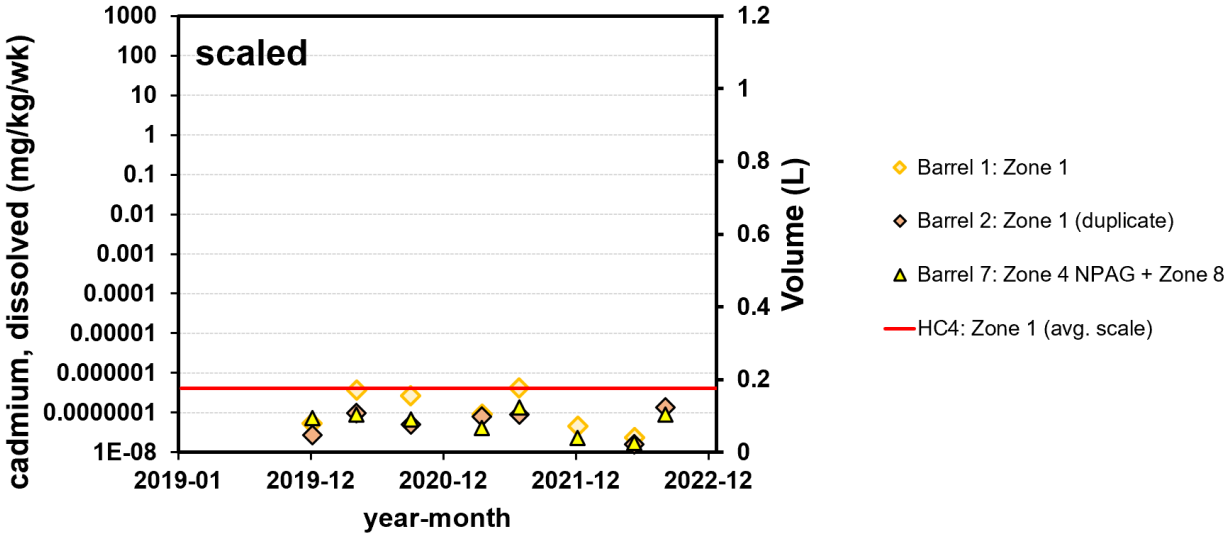
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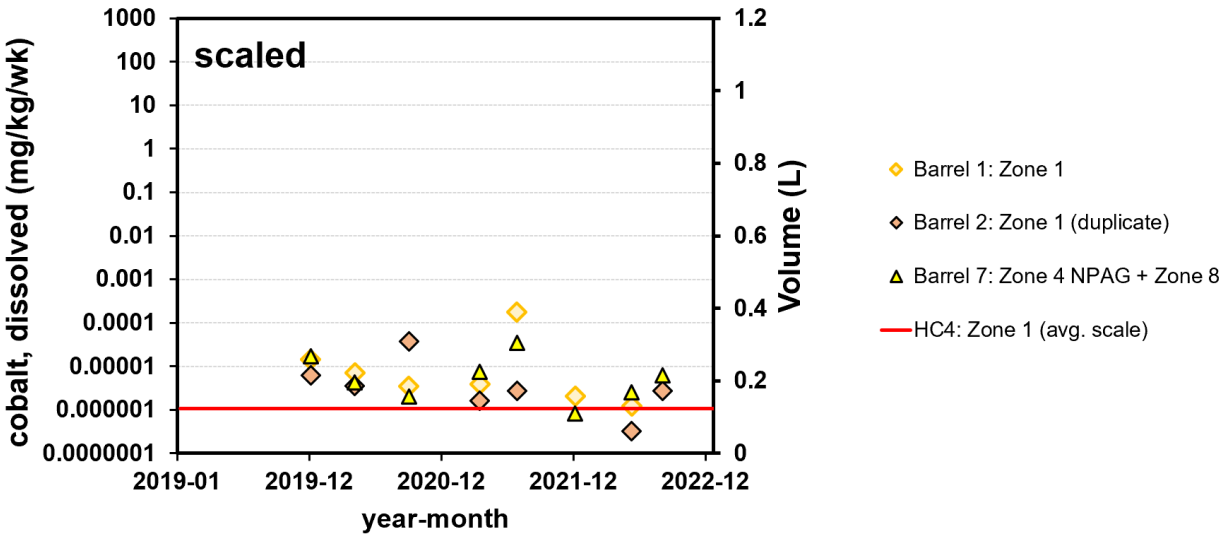
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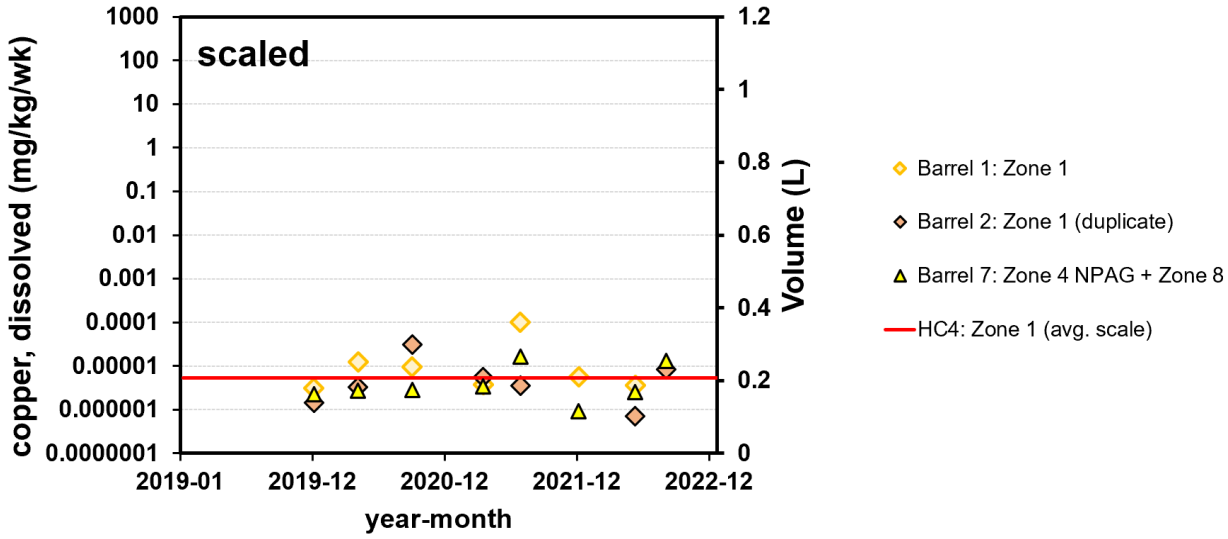
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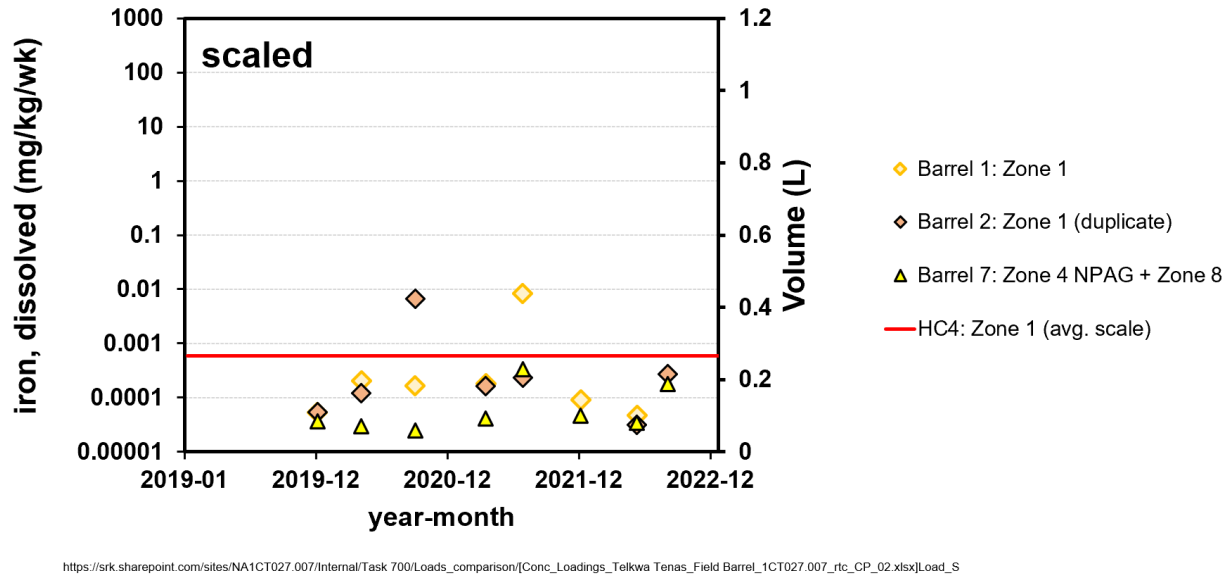
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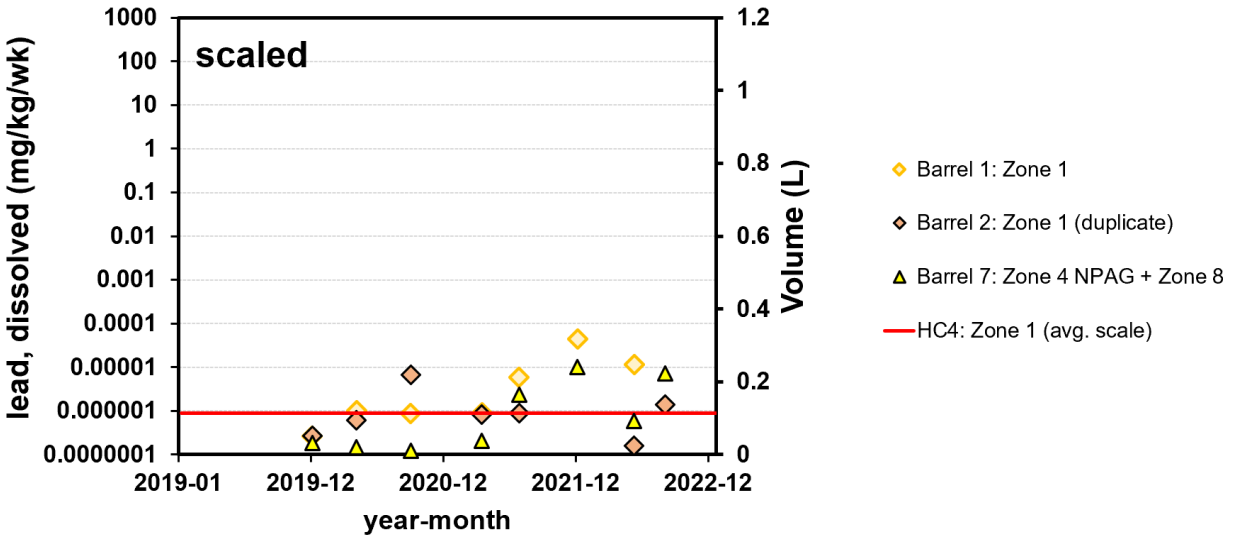
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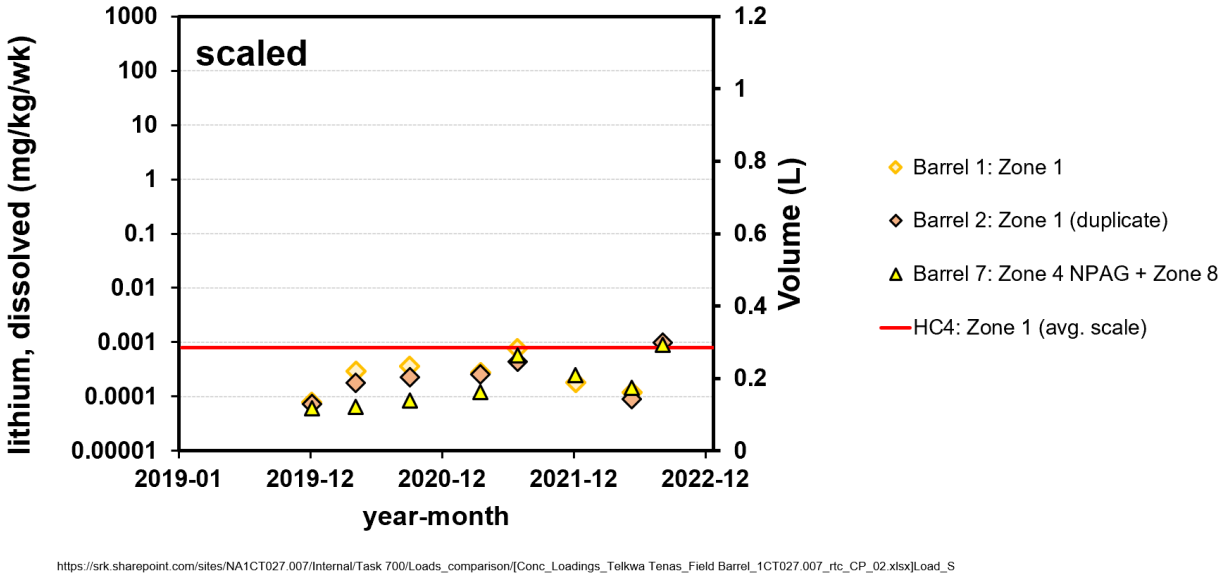
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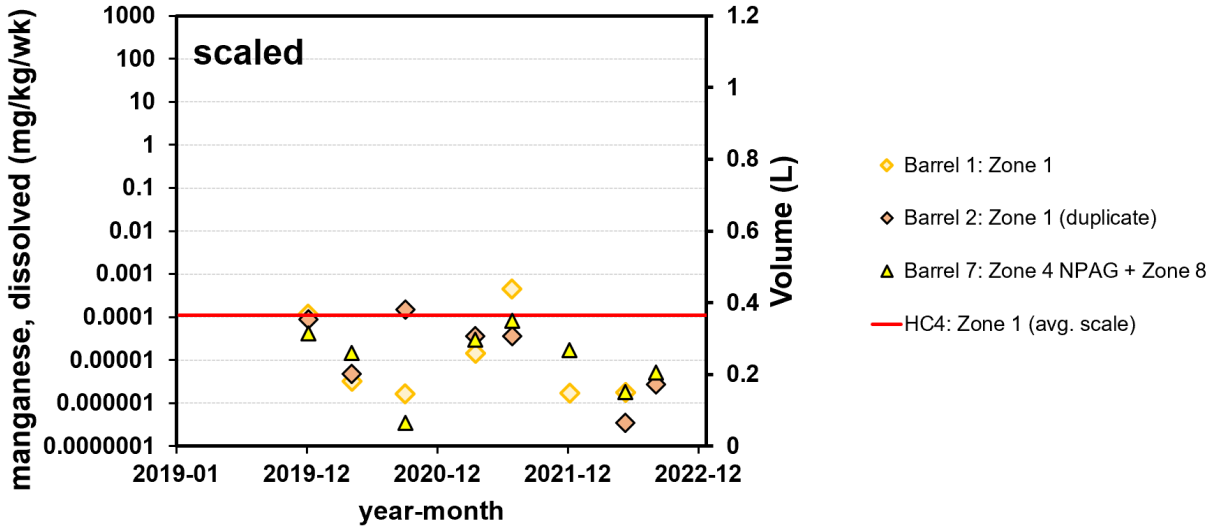
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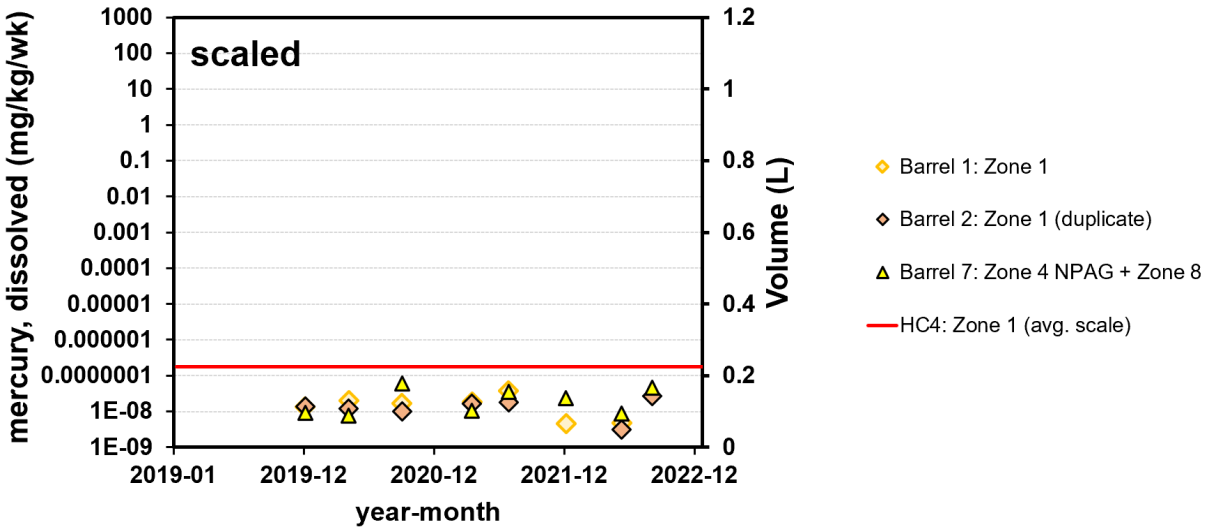


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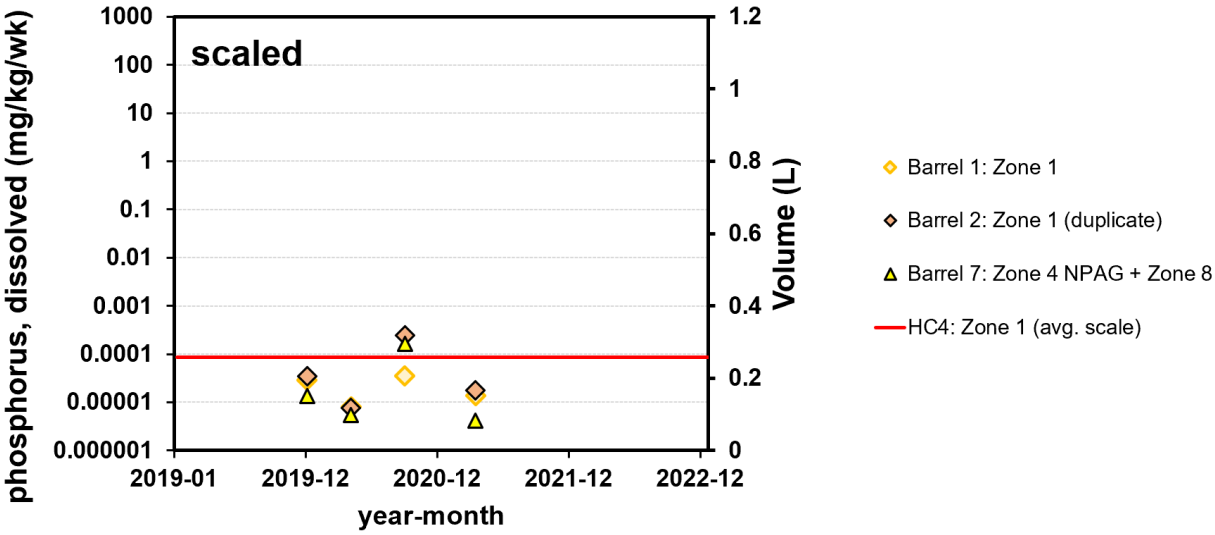


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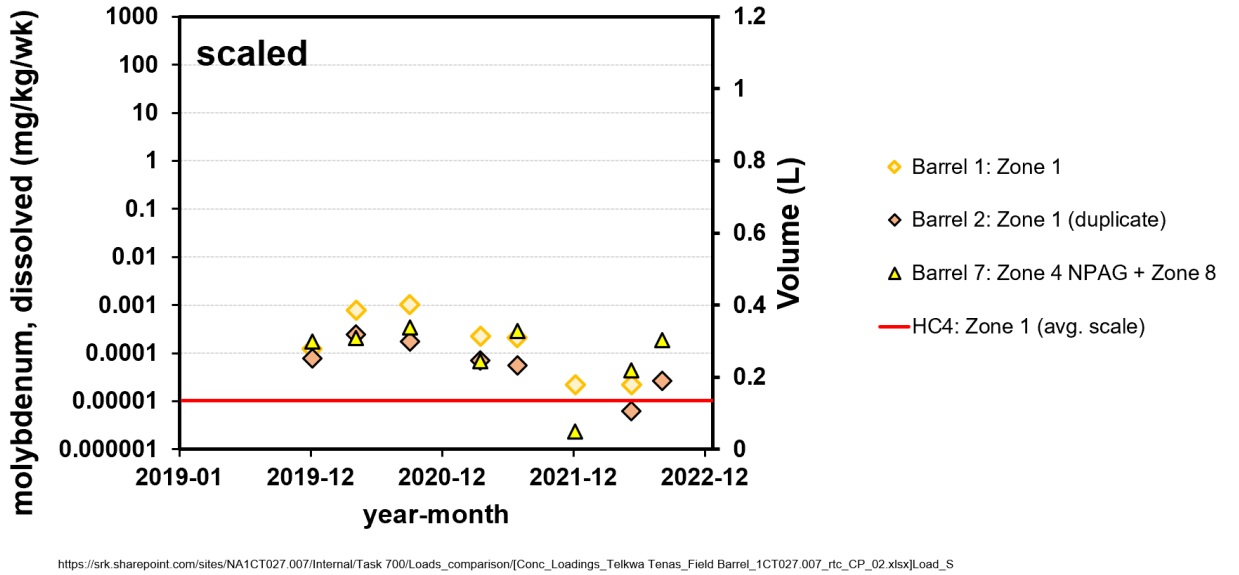
Appendix C Comparison of Scaled HCT Loads to Barrel Load Figures



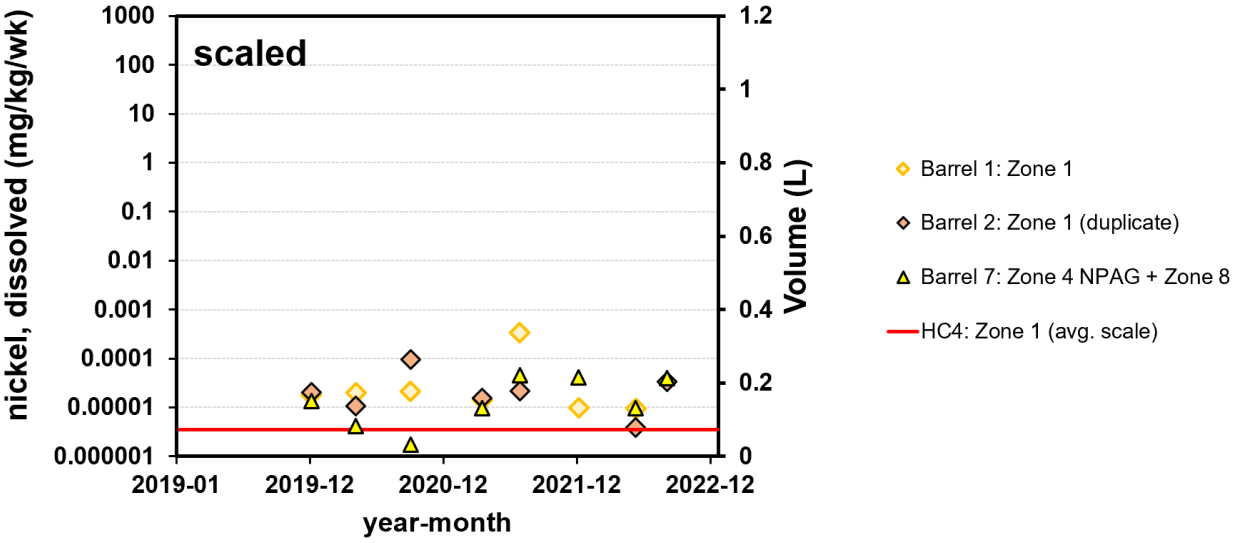
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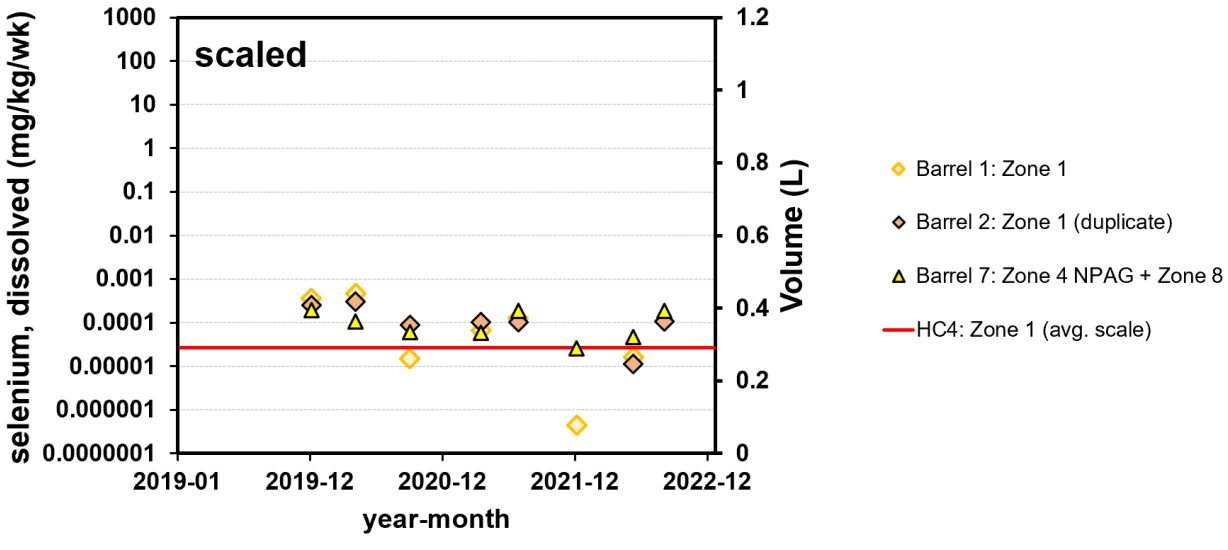
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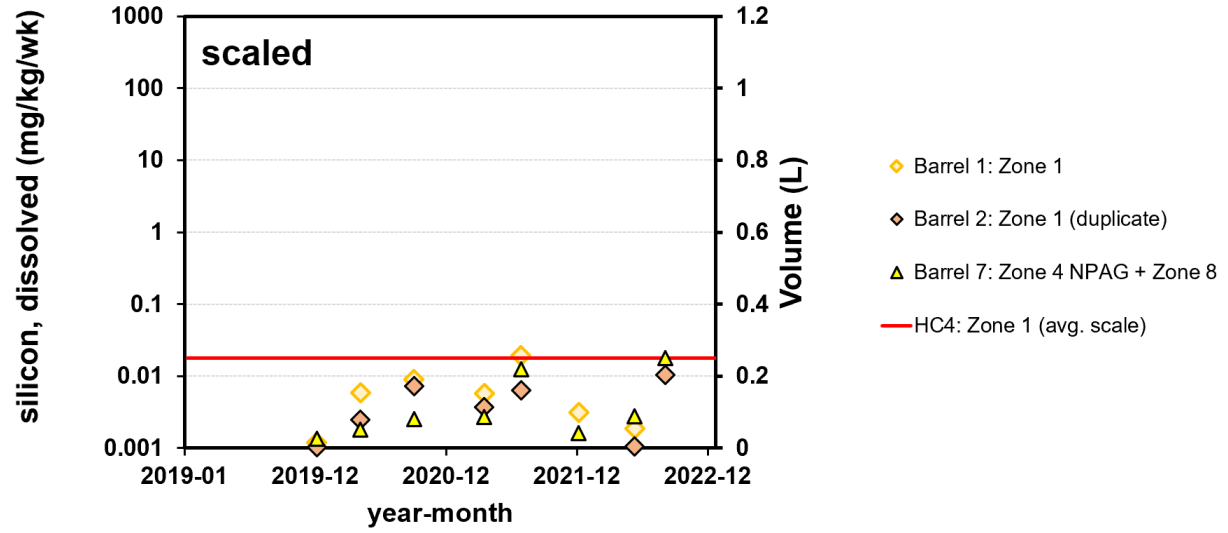
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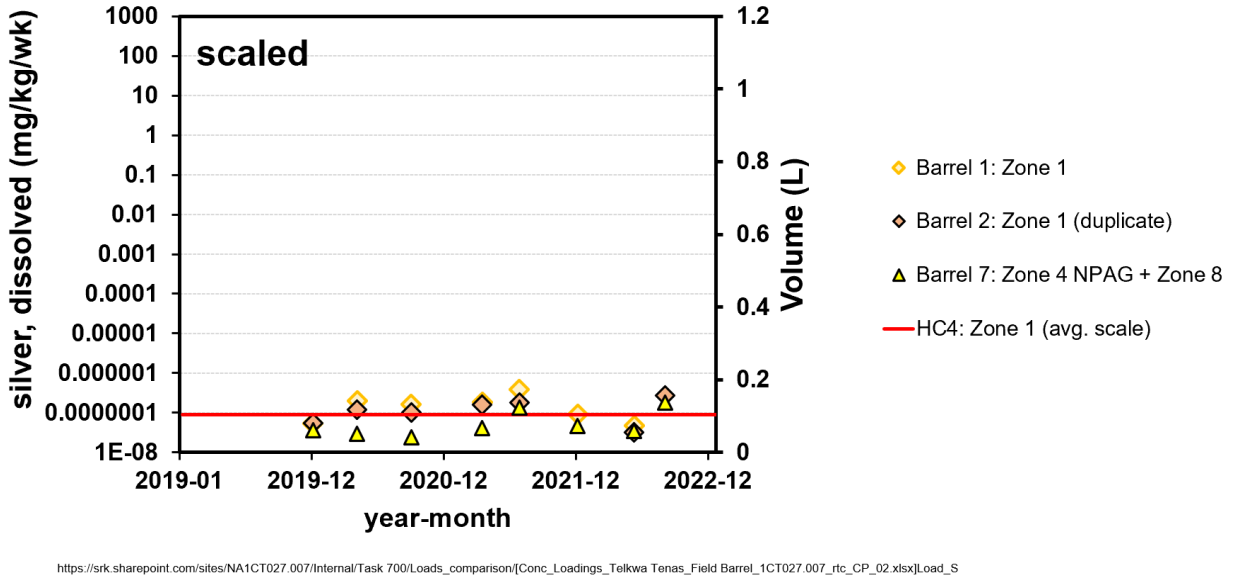
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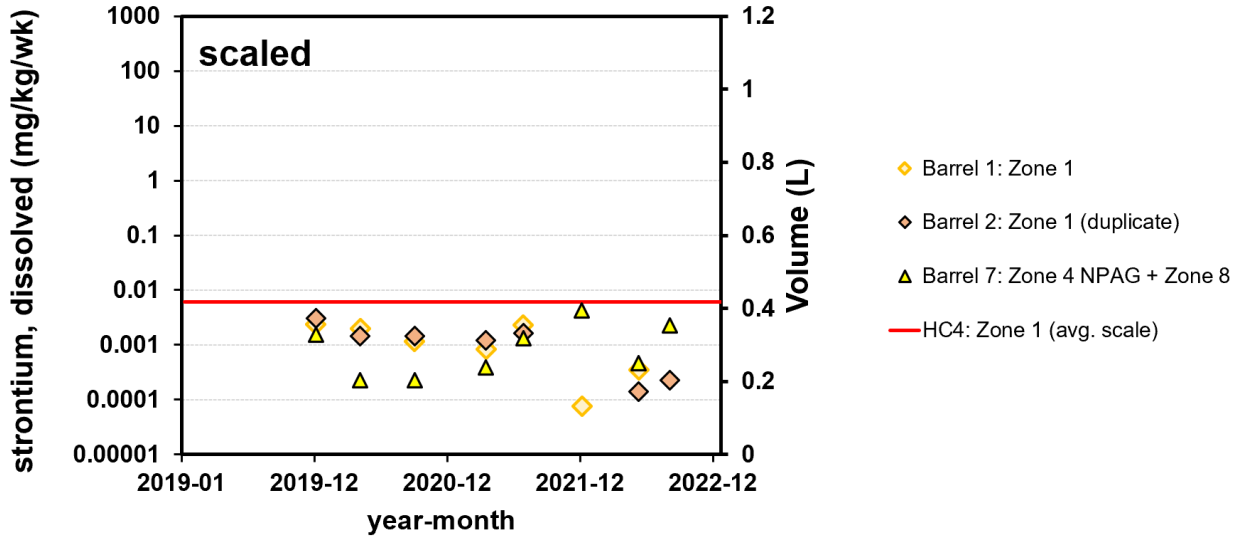
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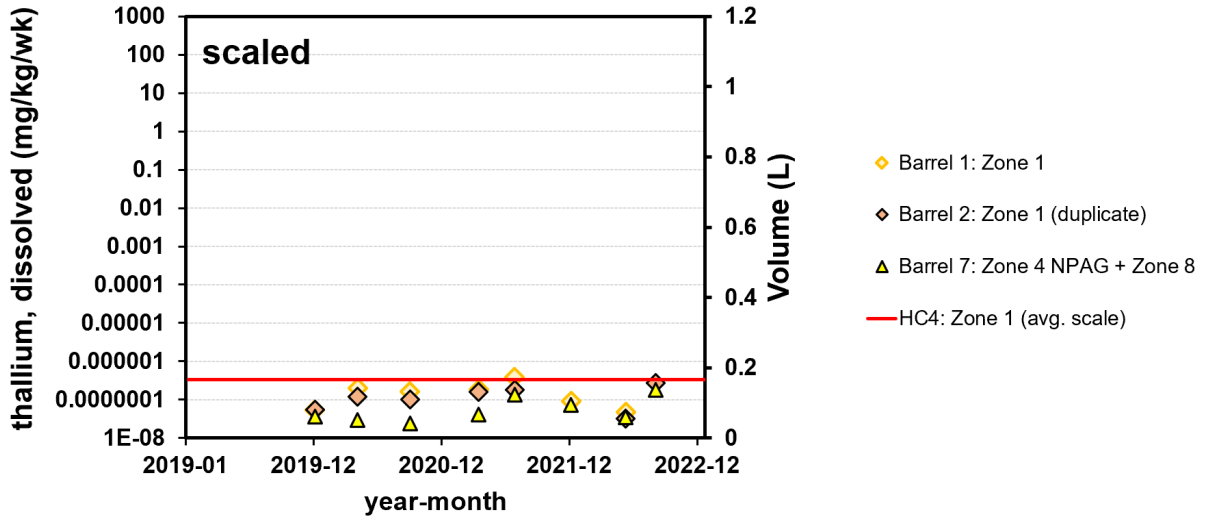
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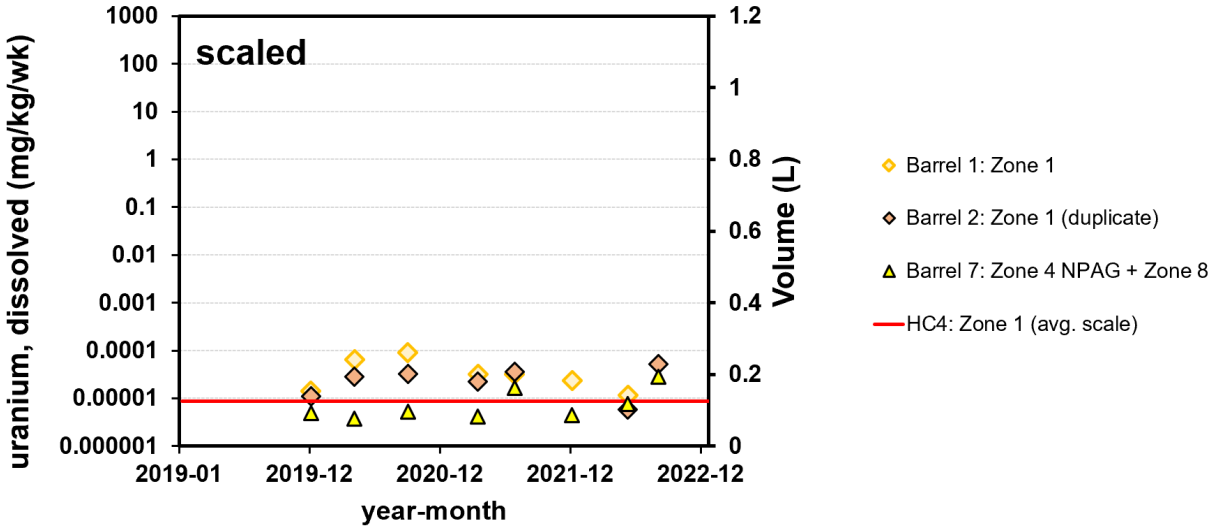
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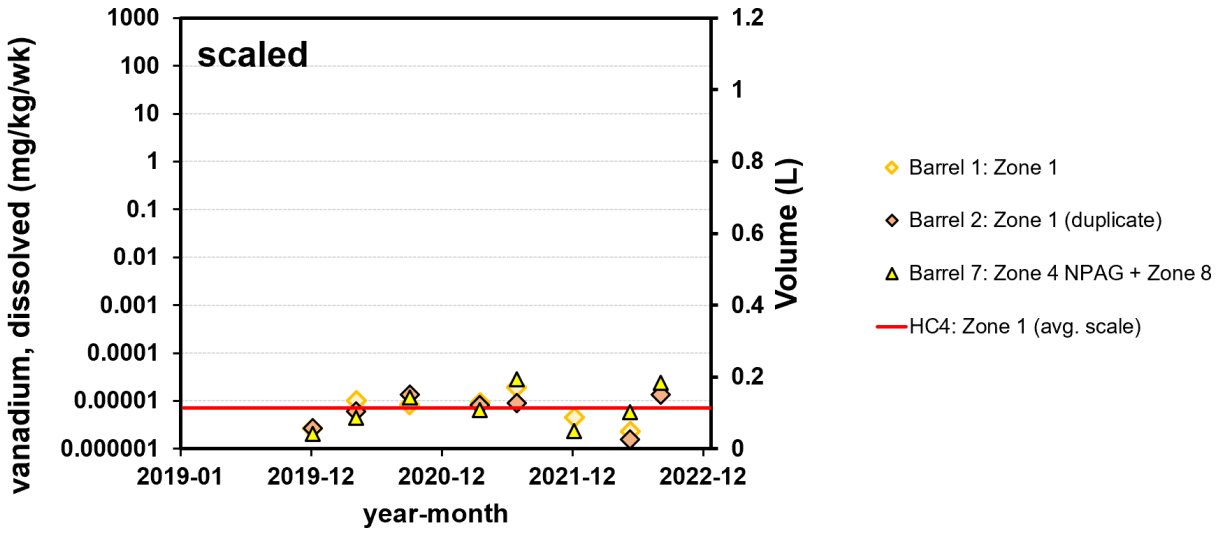
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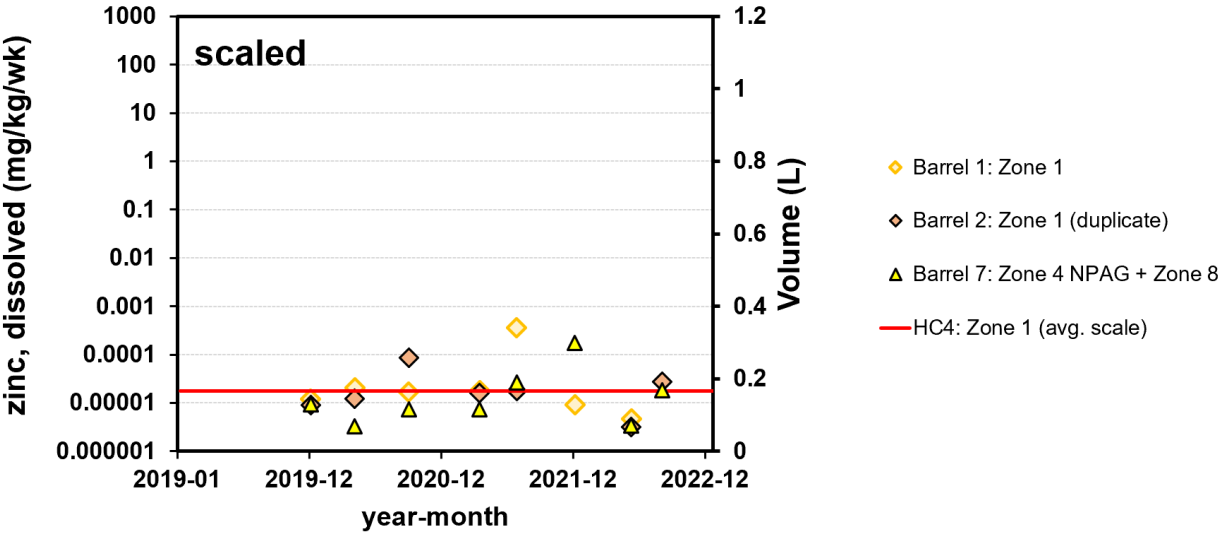
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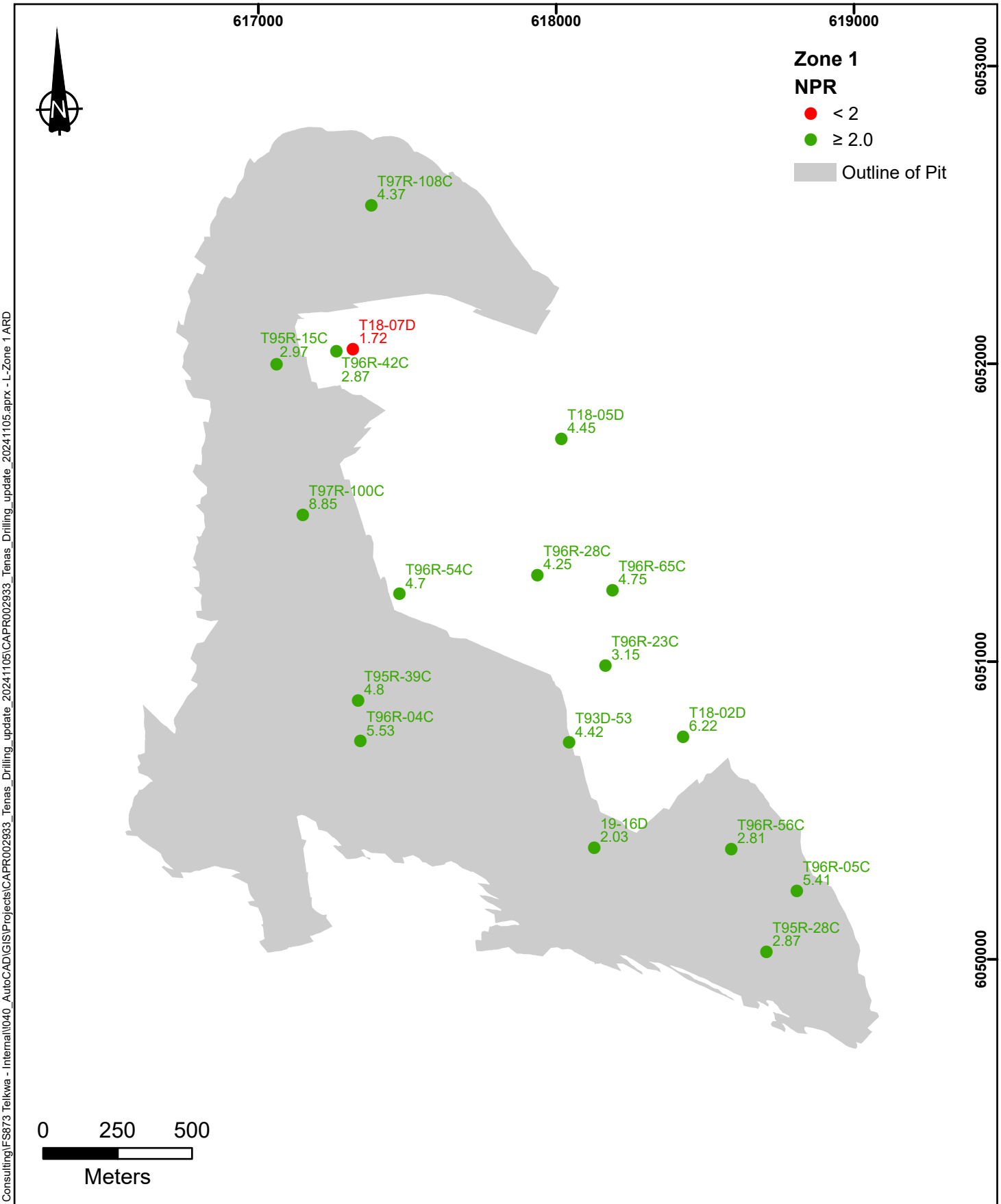


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Appendix F – Mine Rock ARD Maps



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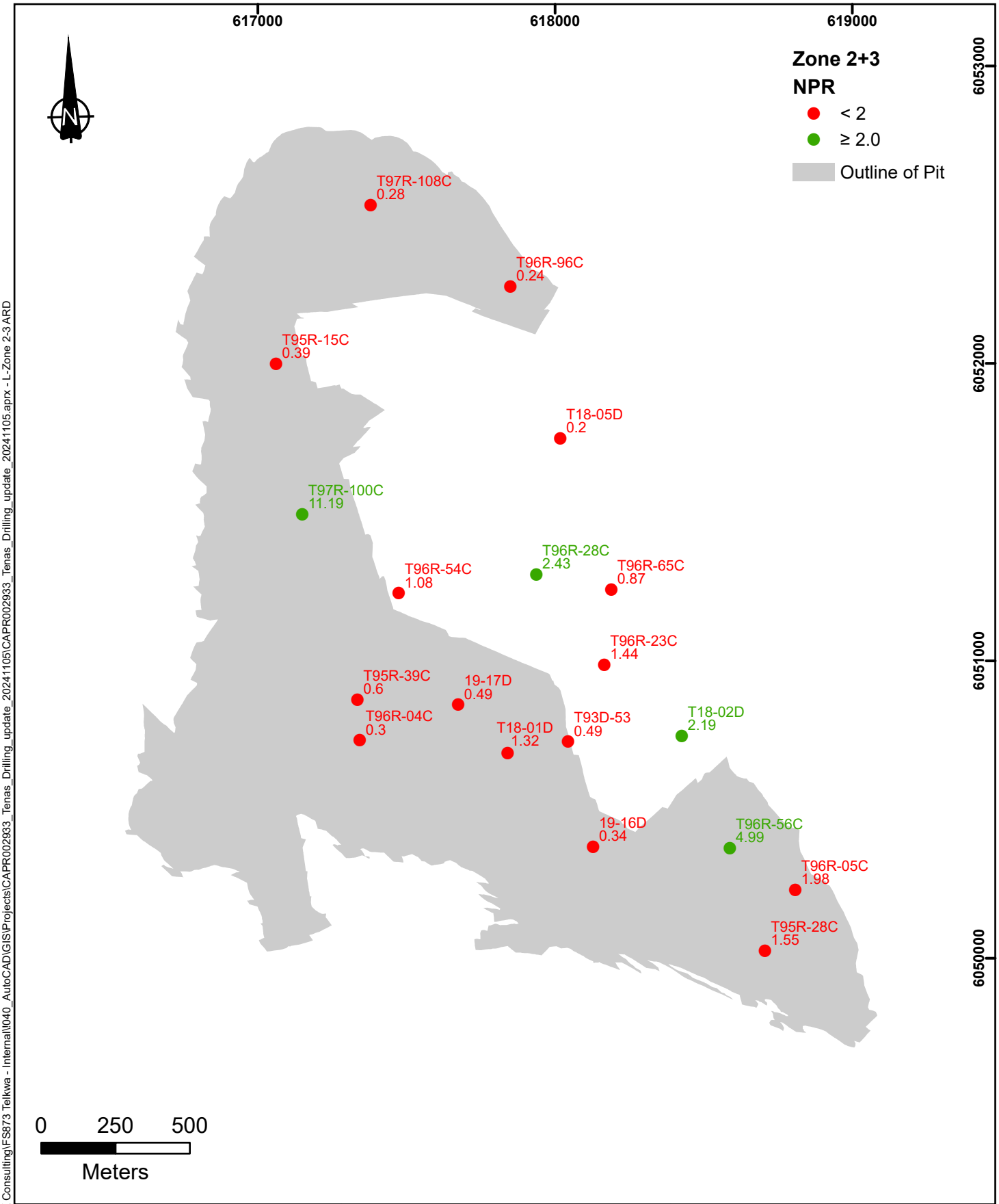
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Job No: CAPR002933

Filename: CAPR002933_Tenas_Drilling_update_20241105

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Date:	Approved:	Figure:
Nov 2024	MKH	F-1



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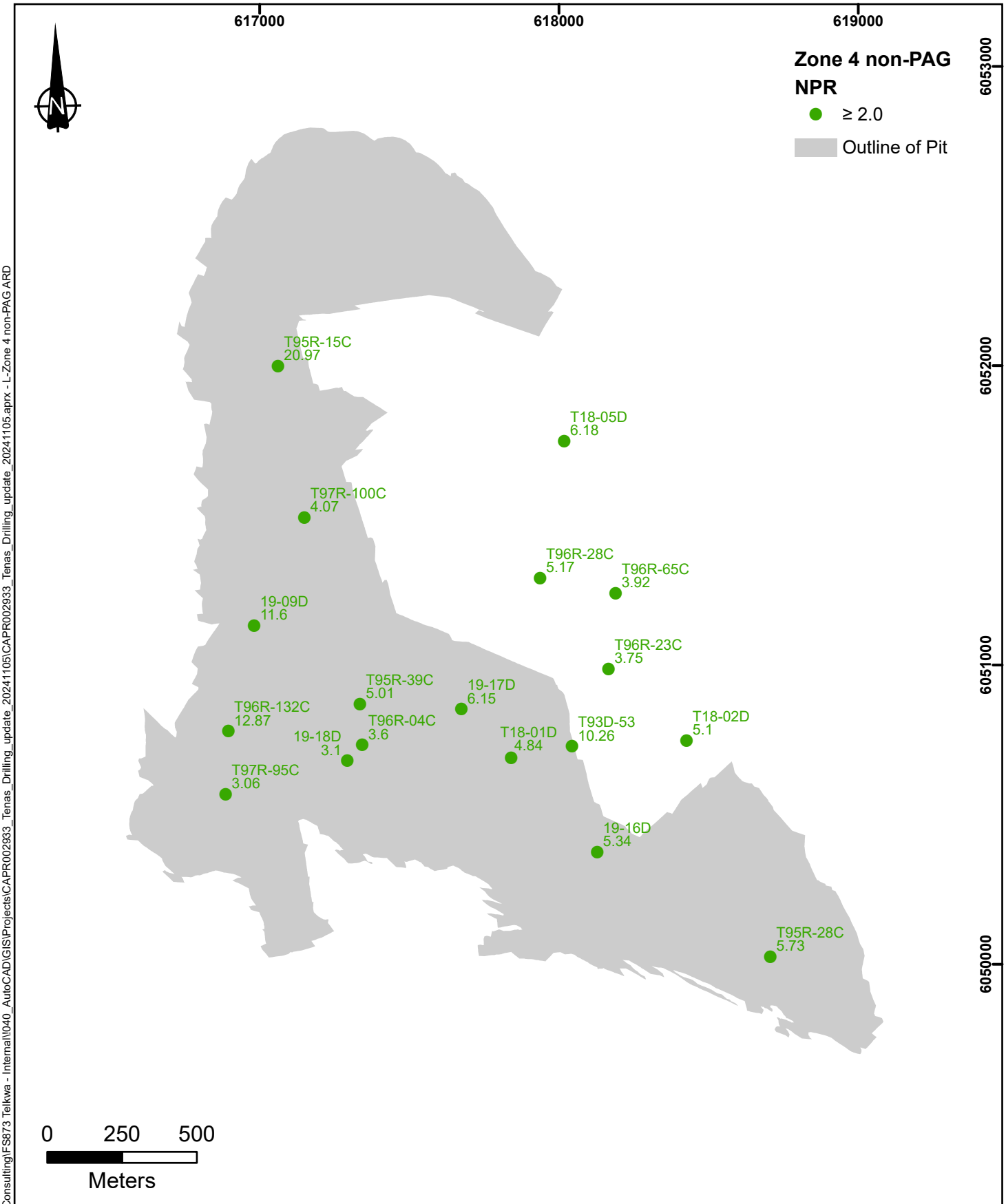
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Nov 2024	MKH	F-2



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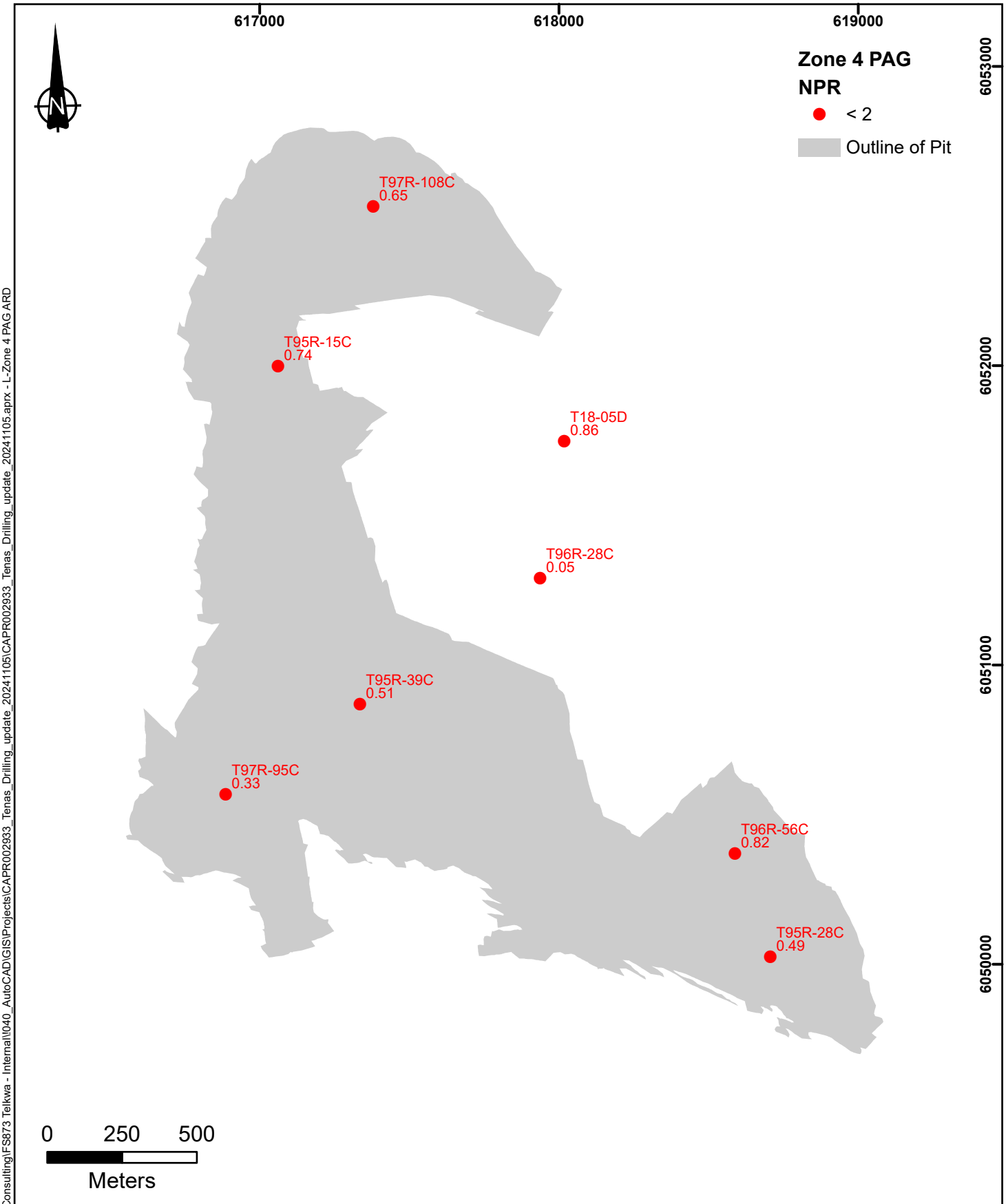
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Supplemental Geochemical Characterization

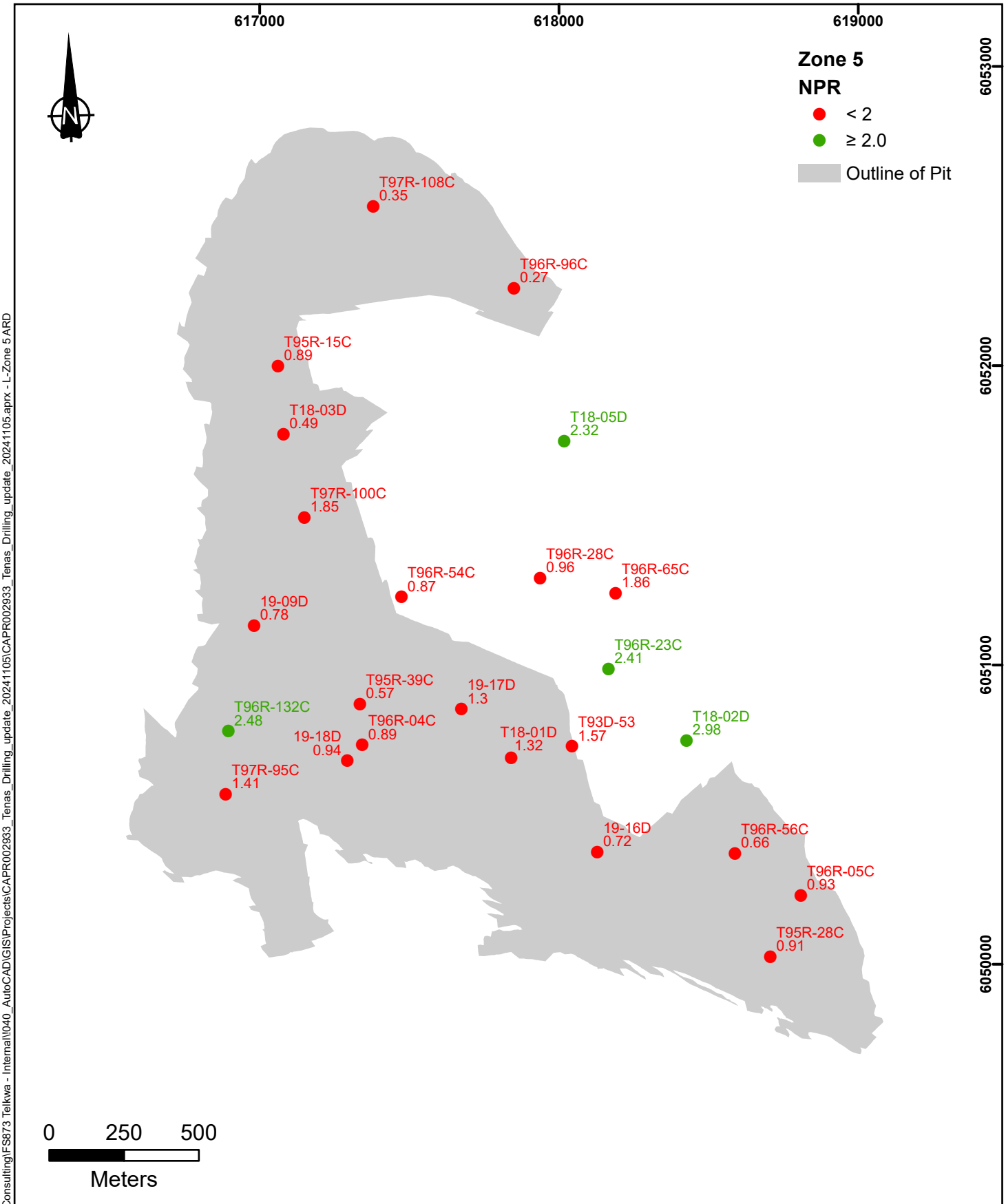
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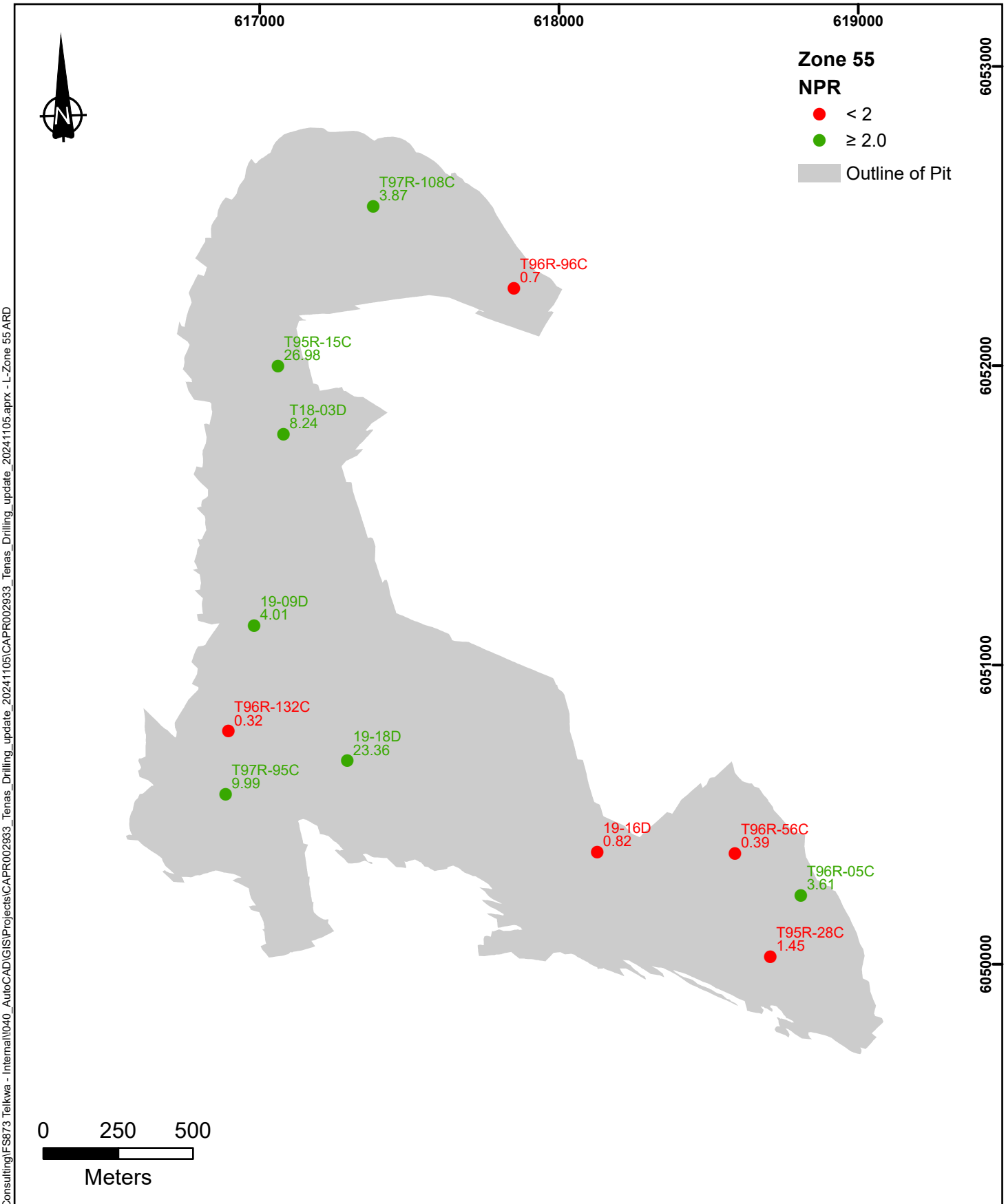
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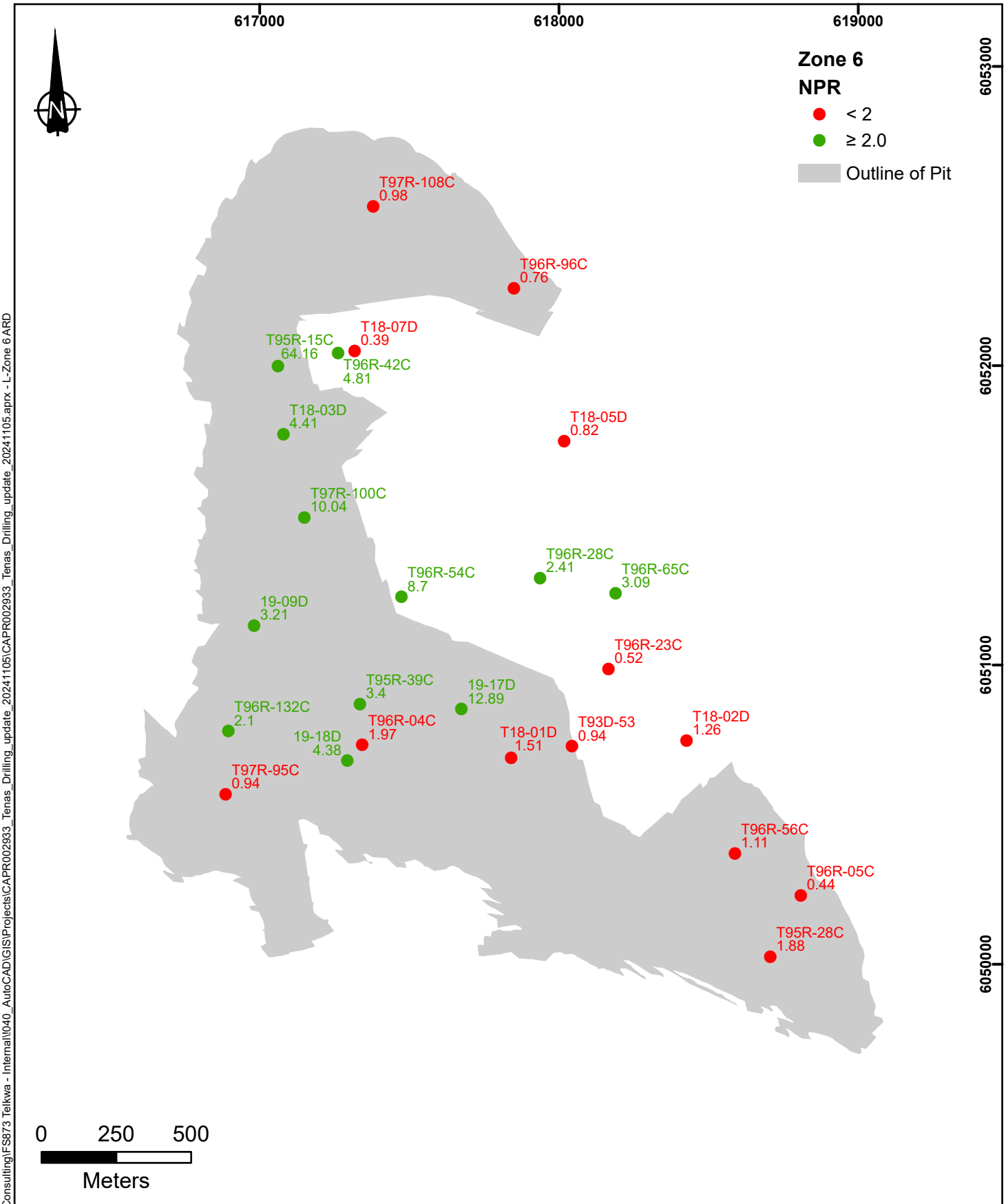
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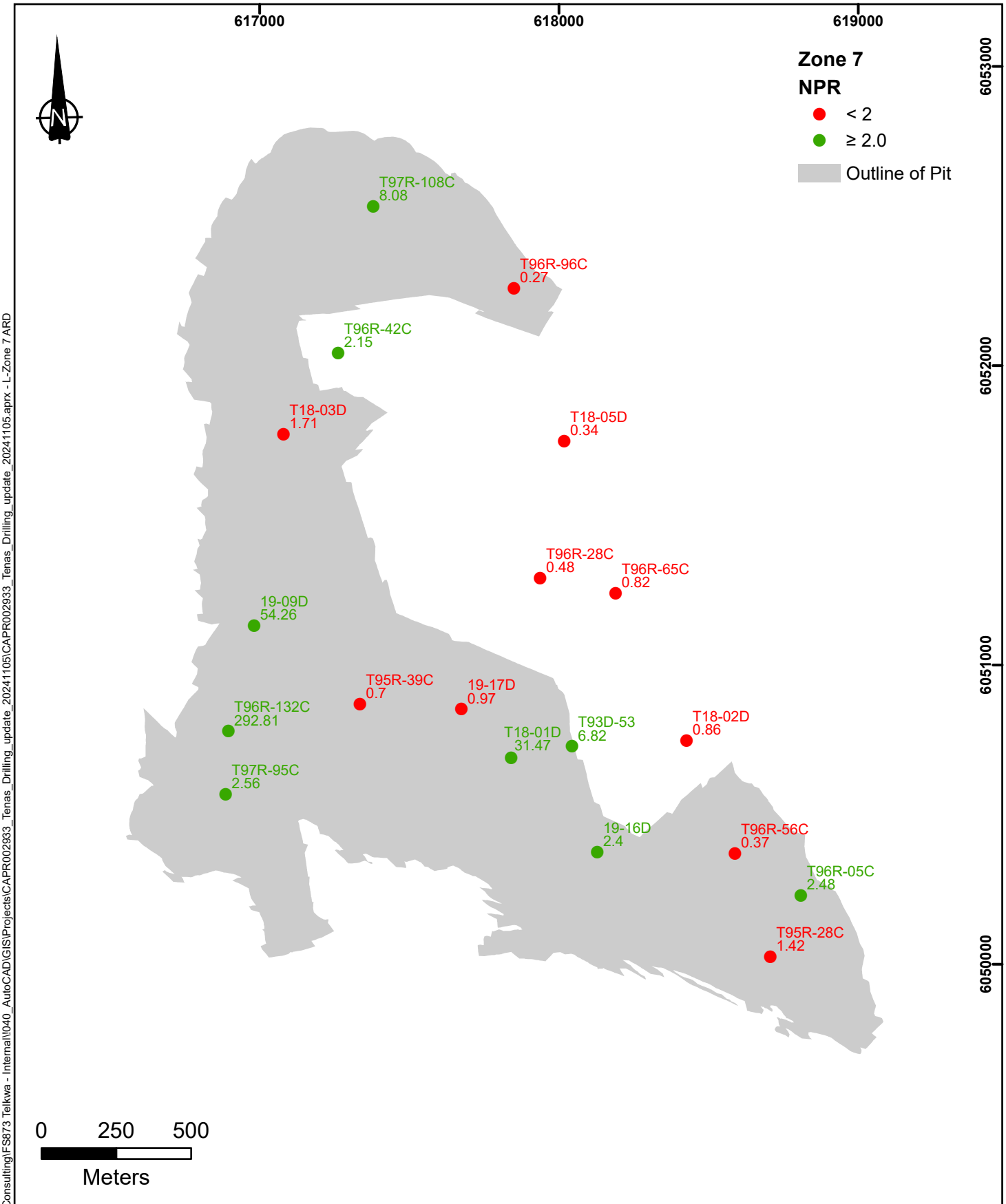
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Date:	Approved:	Figure:
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Supplemental Geochemical Characterization

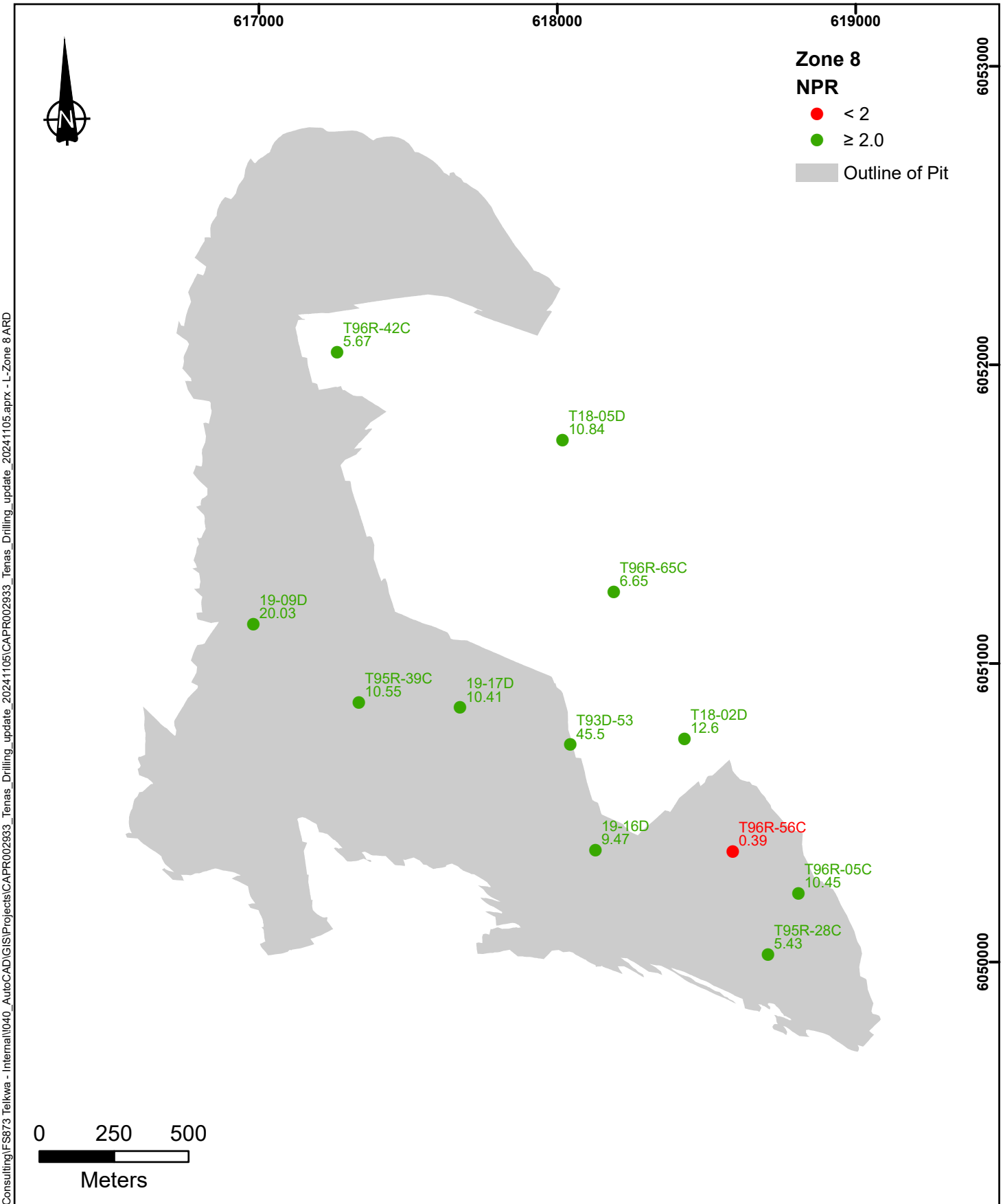
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Date:	Approved:	Figure:
Nov 2024	MKH	F-8



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srk consulting

ALLEGIANCE COAL LIMITED

Tenas Project
Supplemental Geochemical Characterization

Zone 8 ARD

Job No: CAPR002933

Filename: CAPR002933_Tenas_Drilling_update_20241105

ALLEGIANCE COAL

Date:	Approved:	Figure:
Nov 2024	MKH	F-9

Appendix G – Overburden and Construction Rock ABA Results

Overburden and Construction Material Samples: ABA Results

Sample ID	Maxxam Sample ID	Sample Depth (m)			Lithology	Paste pH (s.u.)	Paste EC (µS/cm)	Carbon Species (w.t.%)			Sulphur Species (w.t.%)								Potentials (kg $CaCO_3$/tonne)					Neutralization Potential Ratios				
		From	To	Thickness				Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulphate	S_{ICP}	Total-S (DL)	Sulphate (DL)	S_{ICP} (DL)	Sulphide (Total - SO_4)	Sulphide (S_{ICP} - SO_4)	AP (Total Sulphur)	AP (Sulphide)	CO_3-NP	Sobek-NP	Modified Sobek-NP	CO_3-NPR	Sobek-NPR (Total Sulphur)	Modified Sobek-NPR (Total Sulphur)	Sobek-NPR (Sulphide)	Modified Sobek-NPR (Sulphide)
2018 Overburden																												
+25mm fraction																												
+25MM - T18-10-S-BLK-02 9.5	UJ3985	9	9.5	0.50	Overburden	8.8	158	---	0.21	0.77	<0.02	0.010	<0.02	0.01	0.01	0.02	0.00	0.010	0.31	0.31	18	40	33	56	128.0	104.0	128.0	104
+2mm-25mm fraction																												
+2MM - T18-03-S-SPT4 6.0-6.45	UJ3987	6	6.45	0.45	Overburden	7.9	816	---	0.23	0.84	0.19	0.020	0.19	0.19	0.020	0.19	0.17	0.17	5.9	5.3	19	37	29	3.6	6.1	4.9	6.9	5.5
+2MM - T18-10-S-SPT2 3.0-3.45	UJ3988	3	3.45	0.45	Overburden	8.1	376	---	0.20	0.74	0.030	0.010	0.020	0.030	0.010	0.020	0.020	0.010	0.94	0.31	17	33	28	54	35	30	106	89
+2MM - T18-13-S-SPT2 4.5-4.95	UJ3989	4.5	4.95	0.45	Overburden	8.2	693	---	0.31	1.1	0.040	0.010	0.040	0.040	0.010	0.040	0.030	0.030	1.3	0.94	26	45	39	27	36	31	48	41
+2MM - T18-13-S-SPT5 12.0-12.45	UJ3990	12	12.45	0.45	Overburden	8.3	532	---	0.21	0.78	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.005	0.015	0.31	0.47	18	40	34	38	127	107	85	71
+2MM - T18-10-S-BLK-02 9.0-9.5	UJ3991	9	9.5	0.50	Overburden	8.5	398	---	0.13	0.49	0.04	<0.01	0.040	0.040	0.005	0.040	0.035	0.035	1.3	1.1	11	34	30	10	27	24	31	27
+2MM - T18-02-S SPT-14 6.0-6.45m	UJ3993	6	6.45	0.45	Overburden	8.3	437	---	0.52	1.9	0.05	<0.01	0.050	0.050	0.005	0.050	0.045	0.045	1.6	1.4	43	67	66	31	43	42	48	47
-2mm fraction																												
-2MM - T18-03-S-SPT4 6.0-6.45	TO9565	6	6.45	0.45	Overburden	8.0	747	0.75	0.26	0.95	0.070	0.020	0.070	0.070	0.020	0.07	0.050	0.050	2.2	1.6	22	39	28	14	18	13	25	18
-2MM - T18-10-S-SPT2 3.0-3.45	TO9566	3	3.45	0.45	Overburden	8.3	383	0.87	0.25	0.90	0.020	0.010	<0.02	0.020	0.010	0.020	0.010	0.010	0.6	0.31	20	36	26	65	58	42	115	83
-2MM - T18-13-S-SPT2 4.5-4.95	TO9567	4.5	4.95	0.45	Overburden	8.0	2010	0.62	0.32	1.2	0.080	0.050	0.10	0.080	0.050	0.10	0.030	0.050	2.5	1.6	26	43	32	17	17	13	27	21
-2MM - T18-13-S-SPT5 12.0-12.45	TO9568	12	12.45	0.45	Overburden	8.3	580	0.43	0.22	0.79	<0.02	0.010	<0.02	0.010	0.010	0.020	0	0.010	0.31	0.31	18	39	27	57	123	86	123	86
-2MM - T18-10-S-BLK-02 9.0-9.5	TO9570	9	9.5	0.50	Overburden	8.2	717	0.73	0.27	1.0	0.040	0.020	0.050	0.040	0.020	0.050	0.020	0.030	1.3	0.94	23	41	28	24	32	22	43	30
-2MM - T18-02-S SPT-14 6.0-6.45m	TO9571	6	6.45	0.45	Overburden	8.1	875	0.89	0.28	1.0	0.060	0.020	0.070	0.060	0.020	0.070	0.040	0.050	1.9	1.6	24	41	28	15	22	15	26	18
Bulk Samples																												
ORIGINAL - T18-03-5-SPT2	TV0022	3	3.45	0.45	Overburden	8.2	276	0.63	0.19	0.70	<0.02	0.010	<0.02	0.010	0.010	0.020	0	0.010	0.31	0.31	16	53	23	51	168	75	168	75
ORIGINAL - T18-03-5-SPT6	TV0175	10.5	10.95	0.45	Overburden	8.4	336	1.0	0.43	1.6	0.10	0.010	0.10	0.10	0.010	0.10	0.090	0.090	3.1	2.8	36	32	37	13	10	12	11	13
ORIGINAL - T18-03-5-SPT5	TV0176	7.5	7.95	0.45	Overburden	8.4	483	0.75	0.38	1.4	0.090	0.010	0.090	0.090	0.010	0.090	0.080	0.080	2.8	2.5	32	48	38	13	17	13	19	15
Duplicates																												
+25MM - T18-10-S-BLK-02 9.5 Split Dup	UJ3986	9	9.5	0.50	Overburden	8.9	161	---	0.19	0.70	<0.02	0.010	<0.02	0.010	0.010	0.020	0	0.010	0.31	0.31	16	38	33	51	121	105	121	105
+2MM - T18-10-S-BLK-02 9.0-9.5 Split Dup	UJ3992	9	9.5	0.50	Overburden	8.5	436	---	0.14	0.51	0.050	<0.01	0.050	0.050	0.0050	0.050	0.045	0.045	1.6	1.4	12	35	29	8.2	22	18	25	20
-2MM - T18-13-S-SPT5 12.0-12.45 SPLIT DUP	TO9569	12	12.45	0.45	Overburden	8.2	771	0.40	0.21	0.76	<0.02	0.010	<0.02	0.010	0.010	0.02	0	0.010	0.31	0.31	17	38	27	55	123	86	123	86
2019 Overburden																												
29632	VW1525	---	---	---	Overburden	7.9	---	0.49	0.0082	0.030	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	0.68	12	7.7	1.5	38	25	26	16
29633	VW1526	---	---	---	Overburden	8.4	---	0.48	0.13	0.46	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	10	27	19	22	87	59	58	39
29634	VW1527	---	---	---	Overburden	8.3	---	0.67	0.20	0.73	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	17	28	18	35	90	56	60	37
29635	VW1528	---	---	---	Overburden	8.4	---	0.50	0.15	0.54	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	12	30	21	26	95	68	63	45
29636	VW1529	---	---	---	Overburden	8.4	---	0.68	0.25	0.90	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	20	32	27	44	103	85	69	57
29637	VW1530	---	---	---	Overburden	8.5	---	0.72	0.23	0.86	0.040	<0.01	0.050	0.040	0.005	0.050	0.035	0.045	1.3	1.4	20	35	28	14	28	22	25	20
29638	VW1531	---	---	---	Overburden	8.4	---	0.77	0.29	1.1	0.040	<0.01	0.050	0.040	0.005	0.050	0.035	0.045	1.3	1.4	24	38	30	17	30	24	27	21
35029	VW1532	---	---	---	Overburden	8.2	---	0.47	0.08	0.28	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	6.4	20	14	14	65	45	44	30
35030	VW1533	---	---	---	Overburden	8.3	---	0.77	0.24	0.88	0.060	0.01	0.070	0.060	0.010	0.070	0.050	0.060	1.9	1.9	20	29	25	11	16	13	16	13
35031	VW1534	---	---	---	Overburden	8.4	---	0.74	0.27	0.98	0.070	0.01	0.070	0.070	0.010	0.070	0.060	0.060	2.2	1.9	22	36	28	12	16	13	19	15
29655	VW1535	---	---	---	Overburden	8.3	---	0.50	0.068	0.25	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	5.7	20	13	12	64	41	43	27
29656	VW1536	---	---	---	Overburden	8.4	---	0.78	0.20	0.72	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	16	31	29	35	100	91	67	61
29657	VW1537	---	---	---	Overburden	8.4	---	0.79	0.29	1.1	0.030	<0.01	0.040	0.030	0.005	0.040	0.025	0.035	0.94	1.1	25	37	30	22	39	32	34	28
29658	VW1538	---	---	---	Overburden	8.3	---	0.83	0.31	1.1	0.040	0.01	0.070	0.040	0.010	0.070	0.030	0.060	1.3	1.9	25	36	28	14	28	22	19	15
29659	VW1539	---	---	---	Overburden	8.3	---	0.82	0.27	0.98	0.040	<0.01	0.050	0.040	0.005	0.050	0.035	0.045	1.3	1.4	22	35	27	16	28	22	25	19
29660	VW1540	---	---	---	Overburden	8.4	---	0.73	0.26	0.96	0.040	<0.01	0.030	0.040	0.005	0.030	0.035	0.025	1.3	0.78	22	31	29	28	25	24	39	38
35021	VW1541	---	---	---	Overburden	8.0	---	0.52	0.035	0.13	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	3.0	17	12	6	54	37	36	25
35022	VW1542	---	---	---	Overburden	8.5	---	0.51	0.27	0.99	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	23	37	31	48	118	98	79	65
35024	VW1543	---	---	---	Overburden	8.6	---	0.59	0.30	1.1	<0.02	<0.01	<0.02	0.010	0.005	0.020	0.0050	0.015	0.31	0.47	25	41	35	53	131	111	87	74
2023 Overburden																												
Overburden Composite Sample from Sonic Drilling Program in 2021 for Management Ponds	BEF361	---	---	---	Overburden	8.4	---	0.94	0.24	0.88	0.060	<0.01	0.070	0.060	0.005	0.070	0.055	0.065	1.9	2.0	20	---	31	10	---	17	---	15
Construction Material																												
Quarry Sample																												
ROCK ROAD CONSTRUCTION	UU1350	---	---	---	Overburden	8.8	---	0.19	0.1	0.36	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.005	0.005	0.31	0.16	8	17	15	53	54	46	109	93
ROCK MATERIAL FOR ROADS	ZB0881	---	---	---	Overburden	8.7	---	0.78	0.6	2.3	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.005	0.005	0.31	0.16	50	---	45	320	---	145	---	289
Road Samples																												
T18-29	VH0513	---	---	---	Overburden	8.1	---	0.97	0.35	1.3	0.030	<0.01	0.020	0.030	0.005	0.010	0.0250	0.005	0.94	0.16	29	45	40	187	48	43	287	257
T18-32	VH0514	---	---	---	Overburden	7.9	---	1.0	0.30	1.2	0.040	0.01	0.040	0.040	0.010	0.020	0.0300	0.010	1.25	0.31	25	44	39	80	35	31	141	124
T18-35	VH0515	---	---	---	Overburden	7.5	---	0.66	0.01	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.83	11	8	5.3	34	25	67	49
T18-36	VH0516	---	---	---	Overburden	7.7	---	0.44	0.01	<0.08	0.020	<0.01	0.020	0.020	0.005	0.010	0.0150	0.005	0.63	0.16	0.83	11	6	5.3	17	10	67	38
T18-39	VH0517	---	---	---	Overburden	7.6	---	0.17	0.01	<0.08	0.040	<0.01	0.030	0.040	0.005	0.015	0.0350	0.010	1.25	0.31	0.83	9	7	2.7	7	6	30	23
Rail Loop Samples																												
TP18-23, 1.3-1.4	VH0584	1.3	1.4	0.10	Overburden	8.3	---	0.08	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	9.8	8.7	5.9	31	28	63	56
TP18-23, 2.6-2.7	VH0585	2.6	2.7	0.10	Overburden	8.3	---	0.07	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	10	6.2	5.9	32	20	65	40
TP18-24 1.9-2.1	VH0586	1.9	2.1	0.20	Overburden	8.5	---	0.07	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	11	7.0	5.9	34	22	67	45
TP18-24 1-1.2	VH0587	1	1.2	0.20	Overburden	8.5	---	0.06	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	10	6.7	5.9	32	21	64	43
T18-25, 2.1-2.3	VH0588	2.1	2.3	0.20	Overburden	8.5	---	0.06	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	12	8.9	5.9	38	28	76	57
T18-25 3.2-3.4	VH0589	3.2	3.4	0.20	Overburden	8.7	---	0.05	0.011	<0.08	0.050	<0.01	<0.02	0.050	0.005	0.010	0.0450	0.005	1.6	0.16	0.92	10	7.5	5.9	6	5	64	48
TP18-20 0.3-0.4	VH0590	0.3	0.4	0.10	Overburden	7.1	---	0.38	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	9.8	7.2	5.9	31	23	63	46
TP18-20 0.7-0.8	VH0591	0.7	0.8	0.10	Overburden	6.9	---	0.39	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	9.9	6.3	5.9	32	20	63	40
TP18-20 1.8-2.0	VH0592	1.8	2	0.20	Overburden	8.3	---	0.07	0.011	<0.08	<0.02	<0.01	<0.02	0.010	0.005	0.010	0.0050	0.005	0.31	0.16	0.92	6.8	5.2	5.9	22	17	44	33

Appendix H – Overburden and Construction Rock Elemental Analysis Results

Overburden and Construction Material Samples: Elemental Analysis Results

Sample ID	Maxxam Sample ID	Sample Depth (m)		Lithology	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
		From	To		%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppb	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
2018 Overburden																																								
+25mm fraction																																								
+25MM - T18-10-S-BLK-02 9.5	UJ3985	9	9.5	Overburden	2.62	15.3	0.3	<20	128	0.38	2.2	0.35	24.3	49	15.8	4.48	5.5	7	0.05	8.7	1.76	1470	0.39	0.166	48.1	0.074	10.2	<0.02	0.25	7	<0.1	79	<0.02	1.6	0.179	0.03	1	111	<0.1	78.7
+2mm-25mm fraction																																								
+2MM - T18-03-S-SPT4 6.0-6.45	UJ3987	6	6.45	Overburden	1.92	300	0.6	<20	245	6.15	1.42	3.05	14.5	41	73.5	3.89	5.3	38	0.12	8.4	0.95	971	0.87	0.054	28.3	0.076	16.2	0.19	1.11	8.1	0.4	90.7	0.04	1.8	0.061	0.06	0.5	71	<0.1	336
+2MM - T18-10-S-SPT2 3.0-3.45	UJ3988	3	3.45	Overburden	2.07	35.3	0.5	<20	270	0.9	1.34	0.65	16.6	52.4	46.4	4.32	6.1	52	0.13	9.5	1	1040	0.85	0.032	39.3	0.084	15.9	0.02	0.57	10.1	<0.1	83.5	<0.02	1.7	0.049	0.06	0.5	71	<0.1	143
+2MM - T18-13-S-SPT2 4.5-4.95	UJ3989	4.5	4.95	Overburden	1.92	22.1	<0.2	<20	253	0.46	1.85	0.38	15.4	42.2	41.9	3.72	5.6	49	0.11	9	1.03	966	0.59	0.052	29.1	0.078	13.2	0.04	0.51	9.3	<0.1	115	<0.02	1.5	0.078	0.06	0.5	75	<0.1	108
+2MM - T18-13-S-SPT5 12.0-12.45	UJ3990	12	12.45	Overburden	2.19	15.7	1.7	<20	241	0.37	1.79	0.37	16	37.7	43.6	3.94	6.1	30	0.14	9.3	1.01	965	0.44	0.054	28.3	0.07	11.8	<0.02	0.52	10.3	0.2	112	<0.02	1.8	0.067	0.06	0.5	77	<0.1	98.6
+2MM - T18-10-S-BLK-02 9.0-9.5	UJ3991	9	9.5	Overburden	1.81	12.6	0.3	<20	181	0.2	1.42	0.22	17	45.8	36.9	3.8	5.3	30	0.09	12.9	1.13	834	0.6	0.081	40.7	0.104	8.42	0.04	0.44	7.1	<0.1	86.4	<0.02	1.6	0.09	0.06	0.5	82	<0.1	82
+2MM - T18-02-S SPT-14 6.0-6.45m	UJ3993	6	6.45	Overburden	1.74	22.9	<0.2	<20	227	0.46	2.77	0.59	13.9	43.6	39.4	3.31	4.8	38	0.1	8	0.84	2490	0.65	0.055	27	0.064	14.4	0.05	0.5	8	<0.1	99.9	0.04	1.5	0.064	0.05	0.5	63	<0.1	96.1
-2mm fraction																																								
-2MM - T18-03-S-SPT4 6.0-6.45	TO9565	6	6.45	Overburden	1.88	13.4	<0.2	<20	193	0.29	1.5	0.3	14.5	48.4	44.2	3.61	4.9	52	0.13	8.2	0.86	865	0.7	0.048	30.2	0.072	31.8	0.07	0.39	8.5	<0.1	94.9	0.03	1.7	0.066	0.08	0.5	67	<0.05	105
-2MM - T18-10-S-SPT2 3.0-3.45	TO9566	3	3.45	Overburden	1.96	14	0.3	<20	225	0.17	1.31	0.27	14.9	48.1	43.7	3.79	5.2	55	0.16	8.3	0.9	843	0.89	0.04	32.3	0.074	15.8	<0.02	0.35	8.8	<0.1	79.2	0.04	1.8	0.053	0.06	0.5	68	<0.05	109
-2MM - T18-13-S-SPT2 4.5-4.95	TO9567	4.5	4.95	Overburden	2.06	14.3	0.6	<20	259	0.15	1.73	0.39	14.7	38.6	48.8	3.7	5.2	36	0.14	8.5	0.99	851	0.56	0.092	27.1	0.07	26	0.1	0.51	9.9	<0.1	109	0.04	1.6	0.084	0.06	0.5	75	<0.05	110
-2MM - T18-13-S-SPT5 12.0-12.45	TO9568	12	12.45	Overburden	2.32	13.2	0.6	<20	233	0.16	1.62	0.28	16.9	39.5	46.3	3.86	5.7	31	0.15	8.8	0.98	837	0.47	0.06	28.2	0.063	29.5	<0.02	0.44	10.7	<0.1	110	0.04	1.7	0.075	0.07	0.5	82	<0.05	103
-2MM - T18-10-S-BLK-02 9.0-9.5	TO9570	9	9.5	Overburden	2.02	10.2	<0.2	<20	193	0.14	1.5	0.23	15.1	36.1	43.2	3.66	5.3	41	0.14	8.7	0.94	1040	0.65	0.055	27.9	0.065	10.6	0.05	0.27	9.8	<0.1	96.7	<0.02	1.7	0.063	0.06	0.6	70	<0.05	88.9
-2MM - T18-02-S SPT-14 6.0-6.45m	TO9571	6	6.45	Overburden	1.98	41.4	273	<20	227	0.15	1.47	0.3	16.2	45.3	48.2	3.7	5.3	53	0.16	8.8	0.92	1020	0.71	0.048	33.5	0.069	12.7	0.07	0.31	10.2	<0.1	93.8	0.05	1.8	0.06	0.06	0.5	69	<0.05	100
Bulk Samples																																								
ORIGINAL - T18-03-5-SPT2	TV0022	3	3.45	Overburden	1.92	12.1	<0.2	<20	219	0.13	1.27	0.4	15.3	43.9	39.4	3.82	6	25	0.13	8.3	0.89	957	0.65	0.03	28.9	0.075	10.5	<0.02	0.3	9.6	<0.1	67.8	0.02	1.7	0.058	0.06	0.4	68	<0.05	110
ORIGINAL - T18-03-5-SPT6	TV0175	10.5	10.95	Overburden	1.61	12.2	1.2	<20	198	0.11	1.71	0.36	14.3	37.7	31.6	3.45	5.1	74	0.13	8.9	0.73	869	0.95	0.044	27.3	0.066	12	0.1	0.39	9.6	<0.1	89.4	0.02	1.9	0.027	0.07	0.7	54	<0.05	92.4
ORIGINAL - T18-03-5-SPT5	TV0176	7.5	7.95	Overburden	1.7	10.5	0.2	<20	234	0.11	1.94	0.22	13.9	35.3	38.2	3.38	5	42	0.13	10.4	0.79	889	0.76	0.061	19.4	0.067	9.3	0.09	0.31	9.7	<0.1	120	0.03	2.1	0.095	0.06	0.7	70	<0.05	88
Duplicates																																								
+25MM - T18-10-S-BLK-02 9.5 Split Dup	UJ3986	9	9.5	Overburden	2.67	17	1.1	<20	124	0.39	2.19	0.3	24.3	48.3	16	4.45	5.5	<5	0.05	8.9	1.79	1490	0.39	0.164	50.2	0.076	10.5	<0.02	0.28	7	<0.1	80.8	<0.02	1.6	0.18	0.03	0.9	112	<0.1	78.7
+2MM - T18-10-S-BLK-02 9.0-9.5 Split Dup	UJ3992	9	9.5	Overburden	1.94	15	<0.2	<20	216	0.26	1.48	0.29	15.9	48.5	44.8	3.84	5.7	52	0.13	8.7	1.02	1060	0.67	0.07	30.7	0.07	10	0.05	0.52	9.9	<0.1	101	0.03	1.6	0.078	0.06	0.5	76	<0.1	94.2
-2MM - T18-13-S-SPT5 12.0-12.45 SPLIT DUP	TO9569	12	12.45	Overburden	2.41	14.1	1.6	<20	228	0.15	1.65	0.26	16.4	43	48.1	3.97	6.1	38	0.17	8.9	1	858	0.43	0.068	29	0.063	25	<0.02	0.4	11.3	<0.1	109	0.03	1.7	0.077	0.07	0.5	82	<0.05	106
2019 Overburden																																								
29632	VW1525	---	---	Overburden	1.8	10.7	4	<20	219	0.12	0.64	0.21	11.7	37.8	32.3	3.26	4.8	35	0.13	8.4	0.67	852	0.58	0.042	25.3	0.062	7.5	<0.02	0.57	9	<0.1	59.8	0.03	2	0.061	0.07	0.4	70	<0.1	71.3
29633	VW1526	---	---	Overburden	1.98	13	5.1	<20	212	0.17	1.08	0.38	13.4	46.8	35.8	3.48	5.5	36	0.15	7.8	0.8	955	0.63	0.042	30.1	0.067	9.67	<0.02	0.57	8.9	<0.1	62.7	0.05	1.9	0.059	0.08	0.5	70	<0.1	91.5
29634	VW1527	---	---	Overburden	1.95	13.1	2.4	<20	225	0.13	1.26	0.29	13.5	39.8	33.5	3.7	5.3	42	0.15	8.3	0.81	890	0.64	0.04	28.7	0.066	8.67	<0.02	0.43	9.5	<0.1	66	0.03	1.7	0.055	0.08	0.4	72	<0.1	87.8
29635	VW1528	---	---	Overburden	2.21	12.3	1.9	<20	253	0.11	1.42	0.25	14.7	42.7	36.6	3.81	5.7	63	0.15	8.4	0.9	937	0.67	0.095	29.9	0.071	7.94	<0.02	0.55	9.8	<0.1	129	0.03	1.7	0.069	0.07	0.4	84	<0.1	85.2
29636	VW1529	---	---	Overburden	1.99	12.8	1	<20	224	0.12	1.48	0.26	13.9	38.9	35.5	3.72	5.6	43	0.17	8.6	0.89	1020	0.74	0.049	28.6	0.077	7.93	<0.02	0.54	9	<0.1	77.7	0.04	1.8	0.063	0.07	0.4	74	<0.1	87.4
29637	VW1530	---	---	Overburden	1.97	11.7	3.6	<20	198	0.11	1.38	0.25	13.7	40.6	35.1	3.64	5.5	39	0.15	8	0.92	1040	0.66	0.046	29	0.072	9.32	0.05	0.52	9	<0.1	82.1	0.04	1.6	0.066	0.07	0.4	74	<0.1	83.2
29638	VW1531	---	---	Overburden	1.99	12.3	0.9	<20	201	0.11	1.57	0.34	13.8	40.5	32.9	3.63	5.5	32	0.17	8.1	0.87	894	0.73	0.051	27.1	0.072	8.18	0.05	0.61	8.9	<0.1	85	0.04	1.6	0.056	0.07	0.5	73	<0.1	91.1
35029	VW1532	---	---	Overburden	1.65	12.4	1.6	<20	235	0.09	0.79	0.22	13.4	38.2	28.3	3.65	5.2	34	0.11	8	0.74	990	0.65	0.038	22.5	0.068	8.09	<0.02	0.52	9	<0.1	48.4	0.03	1.5	0.067	0.06	0.4	71	<0.1	93
35030	VW1533	---	---	Overburden	1.83	12.8	3.5	<20	186	0.14	1.19	0.24	13.7	39.2	35.5	3.44	5.7	37	0.15	7.6	0.88	868	0.85	0.037	31.3	0.071	7.81	0.07	0.59	7.9	<0.1	74.3	0.04	1.6	0.052	0.07	0.4	64	<0.1	81.8
35031	VW1534	---	---	Overburden	2.05	11.9	1.8	<20	300	0.12	1.39	0.23	13.9	38.2	34.1	3.59	5.6	34	0.16	7.7	0.99	875	0.69	0.058	28.8	0.079	7.19	0.07	0.74	8.1	<0.1	95.9	0.04	1.8	0.073	0.07	0.5	72	<0.1	77.4
29655	VW1535	---	---	Overburden	1.73	17.3	0.9	<20	320	0.09	0.78	0.27	14.4	35	31.2	3.93	5.6	38	0.15	7.5	0.78	1010	0.83	0.032	22	0.071	9.46	<0.02	0.63	9.1	<0.1	39.8	0.03	1.6	0.064	0.08	0.3	89	<0.1	121
29656	VW1536	---	---	Overburden	1.83	15.4	1.3	<20	270	0.1	1.18	0.28	15	46	31.7	3.76	5.6	32	0.15	7.5	0.87	964	0.7	0.034	28	0.069	8.97	<0.02	0.45	9.7	<0.1	56.3	0.03	1.7	0.039	0.08	0.4	77	<0.1	110
29657	VW1537	---	---	Overburden	2.02	13.9	1	<20	266	0.12	1.54	0.32	14.6	43.2	35.3	3.75	5.9	40	0.17	7.8	0.9	970	0.72	0.043	29	0.071	9.25	0.04	0.51	9.7	<0.1	74.3	0.03	1.7	0.051	0.09	0.4	74	<0.1	101
29658	VW1538	---	---	Overburden	2	16.7	1.6	<20	268	0.14	1.49	0.4	15.1	39	36.6	3.89	5.9	46	0.17	8.3	0.95	960	0.78	0.046	29.2	0.072	10.5	0.07	0.53	9.7	<0.1	92.8	0.04	1.7	0.055	0.08	0.5	79	<0.1	106
29659	VW1539	---	---	Overburden	1.98	14.8	2.5	<20	252	0.14	1.33	0.31	15	39	38.1	3.74	5.7	41	0.17	8.2	0.92	999	0.7	0.035	30	0.07	9.13	0.05	0.52	9.3	<0.1	74.7	0.04	1.8	0.055	0.08	0.4	74	<0.1	99.1
29660	VW1540	---	---	Overburden	1.96	12.2	1.5	<20	228	0.12	1.49	0.28	13.9	39.5	34.1	3.74	5.5	43	0.15	8.5	0.92	968	0.73	0.063	29.4	0.075	7.88	0.03	0.6	9.1	<0.1	84.7	0.04	1.7	0.064	0.07	0.4	73	<0.1	87.6
35021	VW1541	---	---	Overburden	2.17	12.6	0.9	<20	252	0.12	0.87	0.15	14.9	44.6	35.7	3.75	5.7	41	0.14	8.5	0.86	938	0.7	0.075	30.3	0.071	7.7	<0.02	0.52	10	<0.1	90.1	0.04	1.6	0.057	0.08	0.4	80	<0.1	80.1
35022	VW1542	---	---	Overburden	2.11	10.3	0.8	<20	198	0.12	1.65	0.23	13.8	38.7	37.7	3.62	5.6	31	0.15	7.7	0.93	844	0.59	0.051	28.8	0.072	7.12	<0.02	0.64	9.3	<0.1	94.7	0.05	1.5	0.071	0.06	0.4	74	<0.1	76.2
35024	VW1543	---	---	Overburden	2.15	11.4	0.3	<20	205	0.12	1.79	0.22	14.3	37.9	36.9	3.78	5.9	47	0.16	8.8	0.96	900	0.59	0.055	28.2	0.076	7.68	<0.02	0.52	9.8	<0.1	104	0.04	1.7	0.074	0.07	0.5	79	<0.1	81.2
2023 Overburden																																								
Overburden Composite Sample from Sonic Drilling Program in 2021 for Management Ponds	BEF361	-	-	Overburden	1.94	10.4	1.2	<20	189	0.12	1.43	0.24	13.6	75.6	34.1	3.55	5.4	40	0.18	7.6	0.86	930	0.89	0.061	28.8	0.069	7.44	0.07	0.47	9	0.3	89.3	0.04	1.5	0.066	0.07	0.4	72	<0.1	91.5
Construction Material																																								
Quarry Sample																																								
ROCK ROAD CONSTRUCTION	UU1350	---	---	Overburden	0.33	3.1	0.5	<20	129	0.04	0.54	0.09	5.6	85.8	13.6	1.65	1.4	111	0.17	15.5	0.1	486	0.93	0.035	10.6	0.044	3.33	<0.02	0.12	4.8	<0.1	21	<0.02	8	0.022	0.06	1	28	<0.1	49.7
ROCK MATERIAL FOR ROADS	ZB0881	---	---	Overburden	0.27	5.9	0.3	<20	219	<0.02	1.45	0.03	5.6	77.3	9.59	1.62	1.1	9	0.14	14.7	0.44	523	0.71	0.028	9.8	0.04	4.11	<0.02	0.12	5.1	<0.1	106	<0.02	7.1	0.017	0.05	1.3	27	0.2	33
Road Samples																																								
T18-29	VH0513	---	---	Overburden	1.72	10.2	1.6	<20	217	0.12	1.74	0.3	11.7	37.8	30.3	3.63	4.6	37	0.12	6.7	0.75	834	0.73	0.054	24.5	0.061	7.63	0.02	0.42	9.1	<0.1	106	0.02	2	0.041	0.07	0.4	66	<0.1	76.4
T18-32	VH0514	---	---	Overburden	2.45	9	0.8	<20	213	0.12	1.78	0.2	14.3	37.1	37.6	4.45	5.6	38	0.15	6.5	1.09	742	0.57	0.087	34.7	0.068	7.27	0.04	0.27	9.1	<0.1	128	0.02	1.7	0.032	0.06	0.4	74	<0.1	82.6
T18-35	VH0515	---	---	Overburden	1.78	8.7	0.3	<20	225	0.16	0.53	0.21	12	45.2	30.5	3.89	6.1	23	0.2	6	0.82	953	1.2	0.059	18.4	0.042	7.26	<0.02	0.52	8.5	0.1	36.6	0.04	1.4	0.069	0.19	0.3	71	0.2	81.6
T18-36	VH0516	---	---	Overburden	1.7	8.4	0.9	<20	248	0.19	0.52	0.35	15.1	45.3	32.5	4.78	5.6	16	0.16	5.6	1.01	1100	0.95	0.06	19.3	0.065	6.84	0.02	0.76	9.5	<0.1	29	<0.02	1.4	0.094	0.12	0.4	93	0.2	98.2
T18-39	VH0517	---	---	Overburden	1.74	9	1.2	<20	210	0.13	0.52	0.7	13.6	48.1	37.9	4.13	5.5	19	0.16	6.8	0.96	992	1.06	0.06	23	0.068	7.32	0.03	0.65	8.9	<0.1	27.9	<0.02	1.5	0.089	0.11	0.4	86	0.1	98.7
Rail Loop Samples																																								
TP18-23, 1.3-1.4	VH0584	1.3	1.4	Overburden	1.84	4.1	0.8	<20	110	0.05	0.8	0.13	13.8	56.5	31	3.98	6.5	9	0.08	5.2	1.23	944	0.43	0.06	15.9	0.073	3.83	<0.02	0.3	7	<0.1	23.6	<0.02	1	0.127	0.03	0.4	89	<0.1	101
TP18-23, 2.6-2.7	VH0585	2.6	2.7	Overburden	1.68	4.6	3.5	<20	85.8	0.04	0.55	0.1	9.6	53	23.9	3.91	5.6	9	0.08	5.2	0.95	874	0.43	0.049	12	0.063	4.38	<0.02	0.43	7.5	<0.1	24.3	<0.02	0.9	0.116	0.04	0.3	82	<0.1	91.7
TP18-24 1.9-2.1	VH0586	1.9	2.1	Overburden	1.39	5.9	2	<20	224	0.04	0.51	0.14	9.9	60.8	20	3.64	5.5	10	0.2	5.7	0.86	820	0.5	0.06	13.8	0.072	4.34	<0.02	0.36	7.4	<0.1	26.9	0.02	1.1	0.109	0.08	0.4	72	<0.1	100
TP18-24 1-1.2	VH0587	1	1.2	Overburden	1.47	5.2	2.1	<20	121	0.06	0.56	0.14	9.7	54.7	18.3	3.49	6.1	14	0.11	6.4	0.88	827	0.4	0.077	13	0.066	4.25	<0.02	0.31	7.3	<0.1	24.7	<0.02	1.2	0.099	0.04	0.4	74	<0.1	92.7
T18-25, 2.1-2.3	VH0588	2.1	2.3	Overburden	1.4	6.4	0.9	<20	151	0.06	0.68	0.13	11.8	66.3	21.9	3.85	6.2	7	0.12	6.8	0.88	904	0.62	0.071	13.3	0.122	4.89	<0.02	0.54	8.9	<0.1	26.8	0.05	1.3	0.121	0.05	0.4	86	<0.1	103
T18-25 3.2-3.4	VH0589	3.2	3.4	Overburden	1.4	5.9	0.5	<20	148	0.06	0.51	0.14	11.4	48.2	28.7	3.5	6.1	13	0.09	7.2	0.86	879	0.45	0.077	13.7	0.078	5.14	<0.02	0.36	7.1	<0.1	27.4	0.03	1.3	0.102	0.06	0.3	72	<0.1	92.5
TP18-20 0.3-0.4	VH0590	0.3	0.4	Overburden	1.55	8	0.3	<20	180	0.08	0.56	0.14	11.6	39.8	29.1	3.31	5	31	0.09	8.9	0.67	913	0.51	0.04	21.5	0.057	7.19	<0.02	0.37	7.8	<0.1	42.8	0.02	1.5	0.084	0.06	0.6	76	<0.1	67.6
TP18-20 0.7-0.8	VH0591	0.7	0.8	Overburden	1.58	7.5	1	<20	185	0.09	0.55	0.13	11.7	30.5	26	3.26	4.9	23	0.08	8.8	0.7	524	0.54	0.035	19.3	0.062	7.56	<0.02	0.38	7.4	<0.1	40.2	0.03	1.5	0.079	0.06	0.6	78	<0.1	67.9
TP18-20 1.8-2.0	VH0592	1.8	2	Overburden	1.15	5.5	0.8	<20	168	0.04	0.42	0.07	9.1	42	14.5	3.18	4.9	9	0.07	6.2	0.73	587	0.48	0.037	11.1	0.068	4.44	<0.02	0.4	6.3	<0.1	21	0.02	1.1	0.085	0.03	0.4	65	<0.1	78.1
***Screening Criteria**					**800**	**20**	**40**	**100**	**4300**	**2**	**300**	**1.8**	**250**	**2000**	**600**	**500**	**170**	**800**	**260**	**65**	**210**	**9000**	**20**	**240**	**800**	**1**	**160**	**0.5**	**1.5**	**50**	**0.9**	**3500**	**0.01**	**100**	**5**	**10**	**30**	**1500**	**10**	**700**

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

Appendix I – Processed Rock ABA Analysis Results

Processed Rock and Processed Coal ABA Results

Sample ID	Maxxam /Bureau Veritas Sample ID	Description	Paste pH (s.u.)	Carbon Species (w.t.%)			Sulphur Species (w.t.%)				Potentials (kg $CaCO_3$/tonne)			Neutralization Potential Ratios	
				Total-C	Total Inorganic Carbon	CO_2	Total-S	Sulphate	S_{ICP}	Sulphide (S_{ICP} - SO_4)	AP (Sulphide)	CO_3-NP	Modified Sobek-NP	CO_3-NPR	Modified Sobek NPR (Sulphide)
Fine Processed Rock															
183104	UI3972	Fine processed rock	7.8	26	2.3	8.6	1.9	0.02	1.8	1.8	57	196	192	3.4	3.4
182962	UI3973	Fine processed rock	7.6	16	1.8	6.7	2.7	0.02	2.7	2.7	84	151	157	1.8	1.9
TELKWA TAILINGS COMPOSITE	WT7431	Fine processed rock	7.6	22	2.3	8.6	3.9	0.07	3.5	3.4	109	194	158	1.8	1.4
TAILINGS	WP0672	Fine processed rock	6.2	43	0.8	3.1	3.0	0.05	3.1	3.0	95	71	61	0.74	0.64
Coarse Processed Rock															
183104	UI3970	Coarse processed rock	6.2	34	0.7	2.5	3.8	0.05	3.71	3.7	116	56	111	0.49	0.96
182962	UI3971	Coarse processed rock	6.8	33	0.4	1.4	2.8	0.03	3.1	3.0	96	32	36	0.34	0.37
JIG CCR	WP0671	Coarse processed rock	3.7	47	0.5	1.9	4.1	0.16	3.8	3.6	119	43	30	0.36	0.25

Appendix J – Processed Rock Elemental Analysis Results

Processed Rock and Processed Coal Elemental Analysis Results

Sample ID	Maxxam Sample	Description	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn
			%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm
Fine Processed Rock																				
183104	UI3972	Fine processed rock	0.47	39	1.1	<20	115	0.10	6.1	0.20	2.8	14	78	2.6	1.0	0.19	0.040	5.0	1.3	251
182962	UI3973	Fine processed rock	0.54	102	0.70	<20	119	0.20	5.6	0.30	2.7	16	96	3.0	1.0	0.41	0.030	3.0	0.65	205
TELKWA TAILINGS COMPOSITE	WT7431	Fine processed rock	0.52	22	<0.2	<20	183	0.21	7.1	0.29	7.9	21	75	4.3	1.3	0.26	0.060	3.6	0.84	257
TAILINGS	WP0672	Fine processed rock	0.32	12	<0.2	<20	70	0.16	2.4	0.30	6.7	13	44	3.2	1.1	0.21	0.040	2.5	0.63	231
Coarse Processed Rock																				
183104	UI3970	Coarse processed rock	0.39	71	0.90	<20	68	0.20	2.1	0.20	2.0	5.0	20	3.4	<1	0.37	0.040	3.0	0.48	139
182962	UI3971	Coarse processed rock	0.42	95	<0.5	<20	79	0.20	1.4	0.10	1.6	3.0	15	2.6	<1	0.19	0.030	2.0	0.18	56
JIG CCR	WP0671	Coarse processed rock	0.19	16	<0.2	<20	61	0.20	1.0	0.12	3.7	6.0	18	3.7	0.70	0.34	0.020	1.0	0.38	307
Processed Coal																				
TENAS PROCESSED COAL	CGF546	Processed Coal	0.050	2.4	<0.2	<20	13	0.050	0.10	0.020	3.5	2.1	4.7	0.25	0.70	0.084	<0.01	<0.5	0.030	5.0
****Screening Criteria***			800	20	40	100	4300	2	300	1.8	250	2000	600	500	170	0.8	260	65	210	9000

Sample ID	Maxxam Sample	Description	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Te	Th	Ti	Tl	U	V	W	Zn
			ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Fine Processed Rock																				
183104	UI3972	Fine processed rock	5.1	0.0080	10	0.17	21	1.8	0.30	17	1.7	176	<0.2	2.1	0.0010	<0.1	0.80	23	0.60	74
182962	UI3973	Fine processed rock	6.0	0.0060	10	0.17	14	2.7	0.50	19	1.7	198	<0.2	1.8	0.0010	0.10	0.70	20	2.3	71
TELKWA TAILINGS COMPOSITE	WT7431	Fine processed rock	4.8	0.011	22	0.12	18	3.5	0.37	26	1.2	270	0.090	2.3	<0.001	0.38	1.1	26	0.60	101
TAILINGS	WP0672	Fine processed rock	4.1	0.0090	13	0.093	22	3.1	0.34	20	1.1	86	0.080	1.5	<0.001	0.040	0.70	19	0.20	57
Coarse Processed Rock																				
183104	UI3970	Coarse processed rock	3.8	0.024	5.2	0.048	16	3.7	0.40	6.6	1.0	70	<0.2	4.5	<0.001	0.10	0.90	12	<0.1	31
182962	UI3971	Coarse processed rock	3.1	0.035	5.8	0.038	14	3.1	0.20	4.5	1.2	60	<0.2	2.4	<0.001	0.10	0.60	11	<0.1	26
JIG CCR	WP0671	Coarse processed rock	3.4	0.0040	7.1	0.0070	16	3.8	0.25	5.9	0.80	37	0.080	1.7	<0.001	0.060	0.40	9.0	<0.1	19
****Screening Criteria***			20	240	800	1	160	0.5	1.5	50	0.9	3500	0.01	100	5	10	30	1500	10	700

*Screening criteria corresponds to 10 times the average crustal abundance from (Smith and Huyck, 1999)

APPENDIX 18: TENAS PROJECT INFORMATION REQUEST RESPONSES RELATED TO GEOTECHNICAL ASPECTS, SRK

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FINAL

Geotechnical IR Responses

To	Dan Farmer	**Client**	Telkwa Mining Ltd.
From	Santiago Pastine, Calvin Boese	**Project**	CAPR002055
Cc	Nicolas Alscher	**Date**	June 14, 2024

Subject Tenas Project Information Request Responses Related to Geotechnical Aspects

File name: 04-A Tenas Project_Geotechnical IR Responses_Memo_CAPR002055_20240614_FNL.docx

1 Introduction

The following memorandum presents SRK's responses to Information Requests (IRs) from the Environmental Assessment Office (Environmental Assessment Office, 2022) related to the Tenas Project Geotechnical Aspects. These include comments associated with mine materials management, and dam safety and analysis.

To address these IRs, SRK has performed a series of revisions and updates related to the site characterization, slope stability analyses and mine materials management, including the following:

1. Conducting a Potentially-Acid Generating (PAG) material storage alternatives assessment for the Tenas Project following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC, 2013) (Attachment 1).
2. Conducting a site-specific seismic hazard assessment at the Tenas Project area (Attachment 2).
3. Reviewing and updating the slope stability analyses of the Management Ponds and Tenas Control Pond of the Tenas Project for the EAC Submitted Option, based on the outcomes of the site-specific seismic hazard assessment (Attachment 3).
4. Revisiting the Dam Consequence Rating for the Management and Control Ponds.

2 Responses to Information Requests

The following sections present SRK's responses to IRs associated with the Geotechnical Aspects of the Tenas Project.

2.1 EMLI Geotechnical – General Comments

2.1.1 Comment

1. *Completion of an alternative means of undertaking the proposed project with respect to options for tailings management that considers technology, siting, and water balance has not been demonstrated.*
2. *The proponent does not identify the processed rock waste as tailings and does not identify the North, East, and West Management Ponds as tailings storage facilities (TSFs). As per the Health, Safety and Reclamation Code for Mines in British Columbia (the Code), the definition of "tailings" is: "the residue remaining from the preparation of a concentrate of minerals or coal,"; and a "tailings storage facility" (TSF) is: "a facility that stores tailings". As per these definitions, the "processed rock" described in the Application is considered tailings and the North, East and West Management Ponds are TSFs.*
    a. *TSFs have different minimum requirements than water dams in BC, including, but not limited to, minimum factors of safety, minimum design requirements for larger flood (return event and duration) and seismic events, downstream slopes, and many other requirements related to water management, performance, monitoring and surveillance, governance, etc.*
    b. *Results of the Dam Breach Analysis (DBA) does not clearly support the selected Consequence Classification Ratings for Dams or the seismic design criteria required by the Code given that the DBA reports that over 100 people could be impacted or at risk in the event of a breach of one of more of the management pond embankments. The Consequence Classification and seismic design criteria are lower than what is anticipated from the results of the Dam Breach Analysis, which could result in use of design criteria that are not consistent with regulatory requirements or accepted industry practice.*

2.1.2 Response

1. A detailed review of the PAG material storage alternatives assessed to support the mine plan and management and control ponds provided in the Environmental Assessment Certificate Application (EACA) was conducted by SRK in 2024 (refer to Attachment 1). Rationale is presented in Response to Item #178 (refer to Section 2.3).
2. For the Tenas Project, Telkwa Mining did not identify the processed rock as tailings based on the definition stated in (Vick, 1983):

    '*The term tailings is sometimes used in a generic sense to refer to any mine or mill waste in solid form, including rock-sized stripping waste, underground mine muck, and finely ground mill waste.*

However, because of the divergent characteristics of these various materials (…) tailings are defined as crushed rock particles that are either produced or deposited in slurry form'.

The Tenas project will store a mixture of Potential Acid Generating (PAG) rock and processed rock which are a mix of fine and coarse rock and coal removed from Run-of-Mine Coal via the coal washing process, rather than a traditionally processed slurry tailings one would see from a conventional mining and milling process. However despite this difference, the design of the Management and Control Ponds were conducted following the (CDA, 2019) and GISTM (ICMM, 2020) guidelines, applicable for tailings storage facilities. This includes the definition of the Consequence Category for the Management and Control Ponds, definition of earthquake and flood design criteria based on the Dam Consequence Category, and definition of operation, maintenance, and surveillance procedures to safely manage the different mine materials (e.g., considering an exclusion zone of ~75 m from the upstream dam face where processed rock cannot be stored to reduce the risk of this material becoming mobilized due to a potential failure).

Though the management and control ponds were not classified as tailings storage facilities, due to the size of the management and control ponds, closeness to population centers such as the Village of Telkwa, and fish habitat SRK utilized the guidelines for design requirements that matched the tailings pond design guidelines under CDA (2019) and GISTM (2020). Telkwa Mining has adopted a more conservative approach to the design of the management ponds than is required for even some of the parameters for a Tailings Storage Facility (TSF). For example, embankment slope stability purposes, a more stringent design criteria of 1.60 and a downstream slope no steeper than 3H to 1V than presented in (CDA, 2019) guidelines was adopted. More detail is provided in Response to Item #181 (refer to Section 2.4) and the slope stability assessment presented in Attachment 3.

To provide explanation of the initial selection of a "Very High" consequence rating given in the EAC application the following is provided which was based on CDA (2019) and GISTM (2020) guidelines, which provide definitions distinguishing Population at Risk and Loss of Life for the dam classifications.

Population at Risk was determined as the number of persons within incremental inundation zones of the breach scenarios, which was estimated to be between 150 to 200.

- CDA classifies Population at Risk into 'None', 'Temporary', or 'Permanent'. Dam classifications based on Loss of Life are provided for 'Permanent' populations at risk.
- GISTM classification of 'Very High' is applied where 100 to 1,000 persons are at risk.

Loss of Life was determined as the number of individuals within zones categorized as Danger to Some, Danger to Most, or Danger to All (as opposed to Very Low Hazard) based on flood hazard ratings calculated using water depth, flow velocity, and presence of debris (APEGBC 2017). Loss of Life was estimated to be less than 100 for the breach scenarios.

- CDA classification of 'Very High' is applied where Loss of Life is estimated to be 100 or fewer.
- GISTM classification of 'Very High' is applied where Loss of Life is estimated to be 10 to 100.

The Consequence Category of the Management and Tenas Control Ponds of the Tenas Project were upgraded to “Extreme” according to Requirement 4.2 of GISTM guidelines (ICMM, 2020) and based on feedback obtained from the public comment period in 2022.

Despite the Consequence Category being defined as ‘Very High’, a higher Consequence Category (i.e., 'Extreme') should be adopted in design to demonstrate the feasibility of the design to accommodate an ‘Extreme’ classification criteria throughout the tailings’ facility total lifecycle.

This change from ‘Very High’ to ‘Extreme’ does not indicate a change in design or higher risk of downstream impacts, but rather an implementation of a more conservative level of design and guidelines applied to the Project.

The facilities design criteria were consistent with the consequence of failure classification selected as ‘Extreme’. More detail is provided in Response to Item #181 (refer to Section 2.4).

2.2 #171 – EMLI Geotechnical – Tailings Management

2.2.1 Comment

The report FINAL Tenas Project Dam Breach Assessment Report dated April 2021, by SRK (Canada) Ltd., included as Appendix 1.0-AA of the Application, has not been appropriately sealed in accordance with Engineers and Geoscientists BC requirements.

1. *Provide appropriately sealed documents, as required, including the Dam Breach Analysis included as Appendix 1.0-AA of the Application.*

2.2.2 Response

The above mentioned report has been appropriately sealed and further documents accompanying this IR request will are also sealed according to EGBC requirements.

2.3 #178 – EMLI Geotechnical – Tailings Management

2.3.1 Comment

Applications must include an alternatives assessment for the Management Ponds/Tailings Storage Facilities as per the Application Information Requirements Template – Tailings Management Requirements for Mining Projects Undergoing an Environmental Assessment and the alternatives assessment completed should be consistent with the Guidelines for the Assessment of Alternative for Mine Waste Disposal.

2. *Provide a detailed review of the tailings storage alternatives assessed to support the proposed mine plan.*

2.3.2 Response

A detailed review of the PAG material storage alternatives assessed to support the mine plan and management ponds provided in the Environmental Assessment Certificate Application (EACA) was conducted by SRK in 2024 (Attachment 1). An executive summary of this review is presented below.

The PAG material storage alternatives assessment was conducted in terms of a Multiple Account Analysis (MAA), following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC) (ECCC, 2013). The seven steps presented in the guidelines (ECCC, 2013) were conducted.

In the first step, a set of threshold criteria was defined to establish the regional boundaries for selecting candidate alternatives for storing the mine materials including PAG rock. Pre-screening criteria were then set to establish 'fatal flaws' for eliminating the candidate alternatives that do not meet minimum specifications developed for the Project. Based on this, the 'EAC Submitted Option' and two alternative configurations (configurations 2 and 4) were selected for the next stages of the Alternatives Assessment.

To ensure a robust process, a multi-disciplinary workshop was organized by Telkwa Mining and was virtually held on February 28th, 2024, which had representatives from SRK, Telkwa Mining, Fisheries, Wildlife, and Public groups.

During the workshop, a summary of the identified candidate alternatives and pre-screening assessment was presented to all participants. It was agreed to include an additional alternative configuration (configuration 5) in the next stages of the Alternatives Assessment to account for a completely different alternative (i.e., dams vs no dams). Figure 2-1 presents the general arrangement of the four alternatives considered for the MAA that were evaluated during the multi-disciplinary workshop.

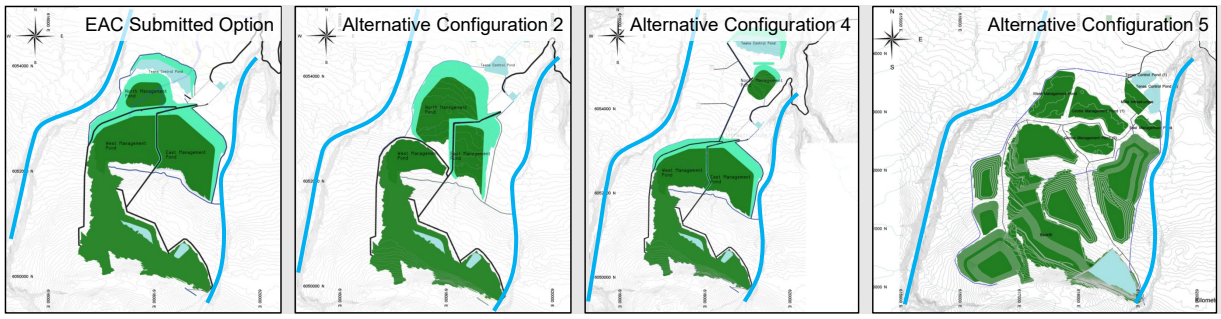


Figure 2-1: Candidate Alternatives selected for the MAA.

Scoring for each Indicator, and Weighting for each Account and Sub-Account were revised and agreed with all participants during the multi-disciplinary workshop. Final Scoring and Weighting were provided to the participants for a final review after the workshop.

The results of the MAA showed that the 'EAC Submitted Option' is the preferred alternative for storing PAG materials as it had the highest score as illustrated by Figure 2-2.

Sensitivity analyses were also conducted to better assess if bias and subjectivity during the process could impact in the decision making. Results showed that independently of the weightings, the 'EAC Submitted Option' was still the highest rated alternative as illustrated by Figure 2-3.

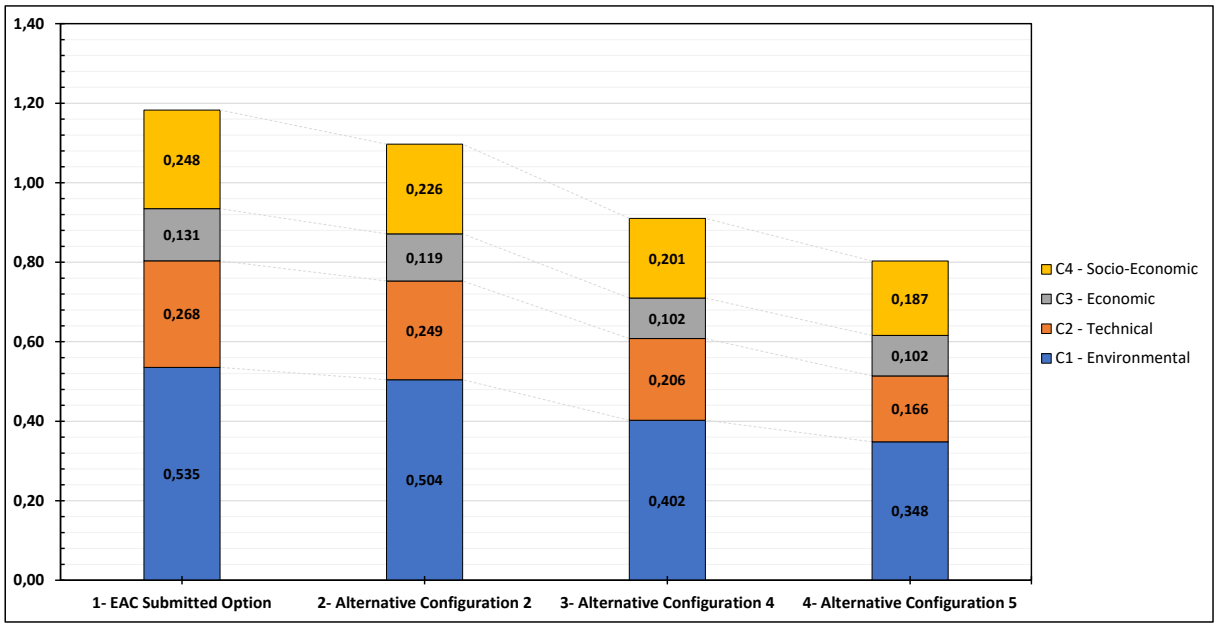


Figure 2-2: Results of the Value-Based Decision Process.

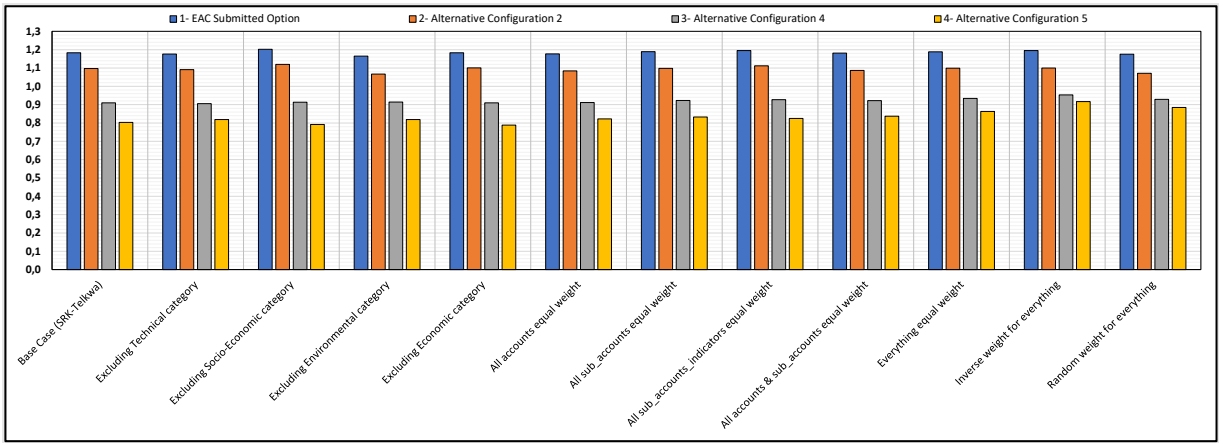


Figure 2-3: Results of the Sensitivity Analyses.

Based on the outcomes of the Value-Based Decision Process and the Sensitivity Analyses performed, SRK and Telkwa Mining consider that the 'EAC Submitted Option' as the preferred alternative for storing PAG materials for this Project.

2.4 #181 – EMLI Geotechnical – Dam Safety and Analysis

2.4.1 Comments

1. *Provide justification for the selection of the failure scenarios considered, including descriptions of the findings of all cascading failure modes/scenarios assessed.*
2. *Provide justification for selection of a "Very High" Consequence Classification given the findings of the Dam Breach Analysis that over 100 people could be impacted or at risk in the event of potential failure or breach of one or more of the management pond embankments.*
    a. *Include the relevant TSF regulations and guidelines that support this determination.*
    b. *Indicate what evaluation of possible environmental impacts due to the release of the contents of the North, West or East Management Ponds was used as a basis for selection of Consequence Classification. The environmental impacts should be consistent with the current understanding of the project (PAG tailings, etc.) and include appropriate references to the sources of information considered.*
3. *Provide justification for selection of the TSF design flood events (Inflow Design Flood and Environmental Design Flood). Include the relevant TSF regulations and guidelines that support this design event selection.*
4. *Provide justification for selection of an earthquake with a return period of 1 in 2,475 years for the Management Ponds/TSFs stability assessment. Include the relevant TSF regulations and guidelines that support this design event selection.*

2.4.2 Responses

1. The selection of potential failure scenarios for the dam breach analysis was based on a preliminary evaluation of the likelihood of occurrence and potential consequences, considering dam configuration and geometry, mine plan and construction sequences, and site water management strategies.

    Critical scenarios with the highest consequence to populations, environment and infrastructure were then selected. Since the coarser PAG rock and the finer processed rock are designed to be co-disposed, higher consequences are associated with the runout of water rather than of solids, which are expected to be subject to limited runout in the event of a hypothetical dam breach. The composition of the contained material within the facilities will comprise predominantly PAG rock and a smaller proportion of processed rock (approximately 11.25:1 by volume), with the latter placed at least 75 meters from the upstream face of the embankments. Rock flow following a dam breach is expected to be further inhibited by the relatively flat topography immediately downstream of the embankments.

    The volume of sediment from overburden/non-PAG rock used in dam construction is negligible compared to the volume of water stored behind the dams. For the West, East, and North Management Ponds, incremental PAG rock placement and dam raises are planned such that the maximum possible water storage when the facilities are active would coincide with the period

immediately following the ultimate dam raise prior to further PAG rock or cover placement. The Tenas Control Pond is the only major facility for which the entire stored volume behind the dam will be water.

Cascading failures were deemed to be of higher consequence than individual embankment failures, as they compound the incremental effects of each failure on the downstream receptors. These failures start at the East and West Management Pond embankments (i.e., the upstream-most dams). The critical scenario of a failure of the West Management Pond embankment would occur when the combined volume for free water in the West and North Management Ponds is highest given their construction and waste rock placement schedules. Failures of the embankments resulting in release of water are not expected to reach below the elevation of waste rock placed directly against the dam faces. The cascade failure would then extend to Tenas Control Pond, assumed to be at maximum capacity in an event of a potential failure.

The management pond configurations make failure of the East Management Pond's embankment into the West Management Pond far less likely than a failure towards Four Creek. The scenario with the highest potential consequences includes effects to the Mine Infrastructure Complex (MIC) prior to reaching Four Creek whereas a failure towards the West Management Pond would not affect the MIC. A failure regarding the embankment separating the East and West Management Ponds was deemed highly unlikely or non-credible due to the stability provided by material at the same elevation on either side of the dam.

2.

a. The Consequence Category of the Management Ponds and Tenas Control Pond of the Tenas Project were upgraded to "Extreme" according to the CDA Guidelines (CDA, 2019) and the Global Industry Standard on Tailings Management (ICMM, 2020). As stated in GISTM Guideline Requirement 4.2, despite the Consequence Category is defined as 'Very High', a higher Consequence Category (i.e., 'Extreme') should be adopted in the design in order to demonstrate the feasibility of the design to accommodate an 'Extreme' classification criteria throughout the tailings facility lifecycle. This change from 'Very High' to 'Extreme' does not indicate a change in design or higher risk to downstream impacts, but rather an implementation of a more conservative level of design applied to the project. The facilities design criteria were consistent with the consequence of failure classification selected as 'Extreme'.

b. The assessment of environmental impacts references the Canadian Dam Association (CDA) (CDA, 2013) and the Global International Standards on Tailings Management (GISTM) (ICMM, 2020) for the classification criteria. The impacts were evaluated qualitatively considering the incremental volume, depth, and velocity of water released during a potential breach, the release of PAG rock and other process-affected water, and the release of processed rock and other sediments to downstream environments.

   Terrestrial inundation from the cascade failures are suggests moderate loss or deterioration of habitat in the approximately 10 km^2 forested area downstream of the Tenas Control Pond and/or the approximately 5 km^2 area downstream of the East Management Pond embankment. These areas are within the habitat range for caribou, a species of concern (BC CDC, 2024).

The Telkwa River, Bulkley River, and affected tributaries are not home to at-risk aquatic fauna but contain some plant and fish species of special concern (BC CDC, 2024). Sudden high flows in these streams during a sunny day breach may temporarily damage fish habitat, but incremental effects from a rainy-day breach would be minimal compared to the concurrent PMF or Q200 conditions in the streams.

The East and West Management Pond facilities may contain process water with a potential for very low to low concentrations of Parameters of Concern due to the presence of PAG and processed rock. A mitigating factor in the North Management Pond will be the planned non-PAG cover, which should minimize the release of potential ML/ARD material in the event of a breach. Due to the strategic placement of processed rock away from the dam faces, the release of processed material from the East and West Management Ponds is also expected to be somewhat mitigated. The Tenas Control Pond may release sediment accumulated during the operational period, which could comprise overburden, non-PAG, or PAG solids. However, water in the Tenas Control Pond is anticipated to have lower concentrations of ML/ARD species than that of the co-disposal facilities, owing to the dilution effect from incoming water sources that have not been in contact with ML/ARD substances.

The qualitative assessment of the potential environmental impacts is most consistent with a 'High' classification for the North Management Pond and Tenas Control Pond embankments, due to the potential for loss of 10 to 20 km^2 of the habitat for terrestrial and aquatic species of special interest (CDA, 2013), and the transport of water with the potential to be acutely lethal or sediments with the potential for ML/ARD. Mitigation of health effects due to potential contamination of wildlife/fauna habitat and water supply is possible due to dilution from other inflows reporting to the Tenas Control Pond, and the NPAG cover placed over PAG material in the North Management Pond. Restoration may take up to five years but is deemed feasible due to the localized area of contamination and the moderate water quality, which reduces the requirement for intensive rehabilitation measures.

c. A 'Very High' classification is considered more appropriate for the East and West Management Pond embankments from an environmental perspective, due to the potential for loss of terrestrial and fish habitat up to 20 km^2 (CDA, 2013) affecting species of concern (though not rare and endangered species). Process water could have moderate concentrations of Parameters of Concern, especially during a sunny day breach with minimal dilution, with potential for ML/ARD effects from processed rock and PAG. The selected breach scenarios assume that there will not yet be non-PAG or overburden cover placed over PAG to reduce the transport of ML/ARD material in the event of a breach. Contaminated areas are kept localized due to the co-disposal strategy, but restoration may be more difficult with poorer water quality and require more than 5 years (ICMM, 2020).

3. To provide explanation of the initial selection of a "Very High" consequence rating given in the EAC application the following is provided which was based on CDA (2013/2019) and GISTM (2020) guidelines, which provide definitions distinguishing Population at Risk and Loss of Life for the dam classifications.

   Population at Risk was determined as the number of persons within incremental inundation zones of the breach scenarios, which was estimated to be between 150 to 200.

- CDA classifies Population at Risk into 'None', 'Temporary', or 'Permanent'. Dam classifications based on Loss of Life are provided for 'Permanent' populations at risk.
- GISTM classification of 'Very High' is applied where 100 to 1,000 persons are at risk.

  Loss of Life was determined as the number of individuals within zones categorized as Danger to Some, Danger to Most, or Danger to All (as opposed to Very Low Hazard) based on flood hazard ratings calculated using water depth, flow velocity, and presence of debris (APEGBC, 2017). Loss of Life was estimated to be less than 100 for the breach scenarios.
- CDA classification of 'Very High' is applied where Loss of Life is estimated to be 100 or fewer.
- GISTM classification of 'Very High' is applied where Loss of Life is estimated to be 10 to 100.

  The selection of the Inflow Design Flood (IDF) for the PAG rock and processed rock co-disposal facilities was guided by the CDA guidelines (CDA, 2013), which specifies 2/3 between 1-in-1000 year and Probably Maximum Flood (PMF) events for dams with a "Very High" classification provided in the EAC application and described above.

  Re-rating the dams as "Extreme" as described in '2.a' above will require design upgrades to the PMF event for the IDF in accordance with CDA guidelines (CDA, 2019) and the Health, Safety and Reclamation Code for Mines in British Columbia (MEMLCI, 2022), which will be submitted during the permitting phase of the Project.

  An EDF is not required for the Management Ponds. Management Ponds all discharge to the Tenas pond prior to discharge to the environment, and so are not at risk of discharge to the environment. The Tenas Pond provides water supply volume to maintain a minimum 1.0 m water cover in the Management Ponds to prevent ML/ARD as part of the PAG management plan, and water levels are required to be actively managed. Water quality projections for the project indicate that water quality in the Tenas Pond will be acceptable for discharge even under conservative modelling scenarios (this is discussed further in the Water and Load Balance reporting). It is acknowledged that the WLBM does not simulate TSS which can be expected to result from placement of rockfill materials in the upstream Management Ponds. To mitigate TSS release to the environment in the event of a discharge from the Tenas Pond, a minimum retention time has been applied to allow settlement of suspended solids prior to discharge using the BC guidance document for mining sediment ponds. Additionally, a "contingency storage" associated with the 1:10 year inflow has also been applied to the Tenas Pond to provide operational flexibility to control the rate of discharge to Goathorn Creek. However, this storage volume is not directly linked to water quality or aquatic environmental impacts.

4. For the EAC Application, there was no site-specific hazard assessment (SHA). The available seismic information was the 2015 National Building Code Seismic Hazard Map (NCR, 2015) which indicates that the Telkwa Coal project site is located in a relatively stable seismic area, and provides design seismic coefficients for an annual exceedance probability of 1-in-2,475 years. The seismic event adopted for the Management and Control Ponds stability assessment provided in the EAC application was aligned with the CDA guidelines (CDA, 2013), which specifies 1/2 between 1-in-2,475 year and 1-in-10,000 or the Maximum Credible Earthquake (MCE) seismic events for dams with a "Very High" classification.

The Consequence Category of the Management Ponds (MP) and Tenas Control Pond (TCP) of the Tenas Project were afterwards upgraded to “Extreme” as described in ‘2.a’ above.

A site-specific seismic hazard assessment was conducted (Attachment 2) to estimate the Peak Ground Acceleration (PGA) and the horizontal seismic coefficients to be used in the slope stability analyses. Considering an “Extreme” Consequence Category, a seismic design event with a 1:10,000 Annual Exceedance Probability (AEP) was adopted for the MP and TCP slope stability assessment as it is more conservative than a Maximum Credible Earthquake option provided in the guideline.

The review of the MP and TCP slope stability analyses at a feasibility study level considering the site-specific seismic hazard assessment for the Tenas Project showed that in all the analysed scenarios, the obtained factor of safety (FoS) was acceptable and in accordance with the design standards specified in the relevant guidelines. Based on the stability results developed by SRK, the proposed ponds design provided by Telkwa (v.7 20210304) do meet the requirements of the design standards for an “Extreme” Consequence Category provided in the CDA and GISTM guidelines. The complete slope stability assessment is presented in Attachment 3.

3 Closing

The above memorandum presented SRK's responses to Information Requests (IRs) from the Environmental Assessment Office related to the Tenas Project Geotechnical Aspects. These include comments associated with mine materials management, and dam safety and analysis. Telkwa Mining Limited and SRK feel these IRs have been adequately addressed by documents provided.

Regards,
SRK Consulting (Canada) Inc.



JUNE 14, 2024

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Principal Consultant

Attachments:

Attachment 1 Potential Acid Generating Material Storage Alternatives Assessment
Attachment 2 Site-Specific Probabilistic Seismic Hazard Assessment
Attachment 3: Management and Control Ponds Stability Assessment Review

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Attachment 1 Tenas Project, Potential Acid Generating Material Storage Alternatives Assessment, SRK

FINAL

Tenas Project Potential Acid Generating Material Storage Alternatives Assessment

Tenas Project, British Columbia, Canada

Telkwa Mining Limited



SRK Consulting (Canada) Inc. ▪ CAPR002055 ▪ June 2024

srk consulting

FINAL

Tenas Project Potential Acid Generating Material Storage Alternatives Assessment

Tenas Project, British Columbia, Canada

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File Name:
03-B Tenas Project_PAG Material Storage Alternatives Assessment_Report_CAPR002055_20240614_FNL

Suggested Citation:
SRK Consulting (Canada) Inc. 2024. Tenas Project Potential Acid Generating Material Storage Alternatives Assessment. Final report. Prepared for Telkwa Mining Ltd.: Telkwa, British Columbia. Project number: CAPR002055. Issued June 2024.

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Appendix G Multi-Disciplinary Workshop Minutes

Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

ABA	Acid Base Accounting
ALR	Agriculture Land Reserve
AP	Acid Potential
ARD	Acid Rock Drainage
BAP	Best Available Practices
BAT	Best Available Technologies
CPP	Coal Processing Plant
DMC	Dense Medium Cyclone
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
ECCC	Environment and Climate Change Canada
EMP	East Management Pond
GHG	Greenhouse Gases
MAA	Multiple Account Analysis
MBCM	Million Banked Cubic Metres
ML	Metal Leaching
MP	Management Ponds
NMP	North Management Pond
Non-PAG	Non Potentially-Acid Generating
NP	Neutralization Potential
NPR	Neutralization Potential Ratio
PAG	Potentially-Acid Generating
PGA	Peak Ground Acceleration
SHA	Seismic Hazard Assessment
SRK	SRK Consulting (Canada) Inc.
TCP	Tenas Control Pond
Telkwa	Telkwa Mining Ltd.
WMP	West Management Pond
XRD	X-Ray Diffraction

Executive Summary

The Tenas Project is a Telkwa Mining Limited (Telkwa) owned steelmaking surface coal project located in central British Columbia, approximately 25 km south of Smithers and 7 km southwest of Telkwa. The Project site is located south of the Tenas River and the boundaries of the Project encompass the lower reaches of the Telkwa River, Goathorn Creek, and Tenas Creek. The Tenas Project's total mine life is anticipated to be 22.5 years, including one and half years of mine development and construction followed by 21 years of production.

The mine plan was designed and scheduled in a manner that allows potentially-acid generating (PAG) rock including processed rock (tailings) to be deposited into Management Ponds (MP), including the East Management Pond (EMP), West Management Pond (WMP), and North Management Pond (NMP).

In 2022, Telkwa prepared the Environmental Assessment Certificate Application (EACA) and submitted this to the Environmental Assessment Office (EAO). In response, the EAO submitted a letter to Telkwa with a list of information requests (IRs) related to first nation aspects, water quality, pond liner design, water and load balance, ARD/ML, and MP management and design. Among others, the EAO requested Telkwa to provide a detailed review of the PAG material storage alternatives assessed to support the mine plan and management ponds provided in the EACA.

This document presents the PAG material storage alternatives assessment conducted for the Tenas Project in response to the list of information requests (IRs) requested by the EAO in response to the Project provided by Telkwa Mining in the EACA. The PAG material storage alternatives assessment was conducted in terms of a Multiple Account Analysis (MAA), following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC) (ECCC, 2013). The seven steps of the MAA presented in (ECCC, 2013) were conducted.

A set of threshold criteria was set to establish the regional boundaries for selecting candidate alternatives for storing the mine materials and pre-screening criteria were set to establish the 'fatal flaws' for eliminating the candidate alternatives that do not meet minimum specifications developed for the Project. Based on this, the candidate alternatives of the 'EAC Submitted Option' and two alternative configurations were selected for the next steps of the Alternatives Assessment.

To ensure a robust process a multi-disciplinary workshop was organized by Telkwa Mining and held on February 28th, 2024, which had representatives from SRK, Telkwa Mining, Fisheries, Wildlife, and Public groups. The multi-disciplinary workshop was held on February 28th, 2024. A summary presentation of this report will be presented and reviewed with Participating Indigenous Nations such as the Office of the Wet'suwet'en and Witset First Nation for questions, input, and understanding and will be incorporated as an amendment to this document if required. Furthermore, as part of the EAO process a presentation will also be made to the EAO Technical Advisory Committee/Working Group for input and clarifications which will be incorporated as an amendment to this document inf required.

During the multi-disciplinary workshop, a summary of the candidate alternatives and pre-screening assessment was presented to participants. It was agreed to include 'an additional alternative

configuration in the next steps of the Alternatives Assessment to account for a completely different alternative (i.e., dams vs no dams). Scoring for each Indicator, and Weighting for each Account and Sub-Account were revised and agreed with participants during the multi-disciplinary workshop.

Final Scoring and Weighting were provided to the participants for a final review after the workshop with any further edits incorporated into this document's results. The results of the MAA showed that the 'EAC Submitted Option' is the preferred alternative for storing PAG materials, as presented in Figure E-1. Sensitivity analyses were conducted to better assess if bias and subjectivity during the process could impact in the decision making. Results showed that independently of the weightings, the 'EAC Submitted Option' was the highest rated alternative (see Figure E-2).

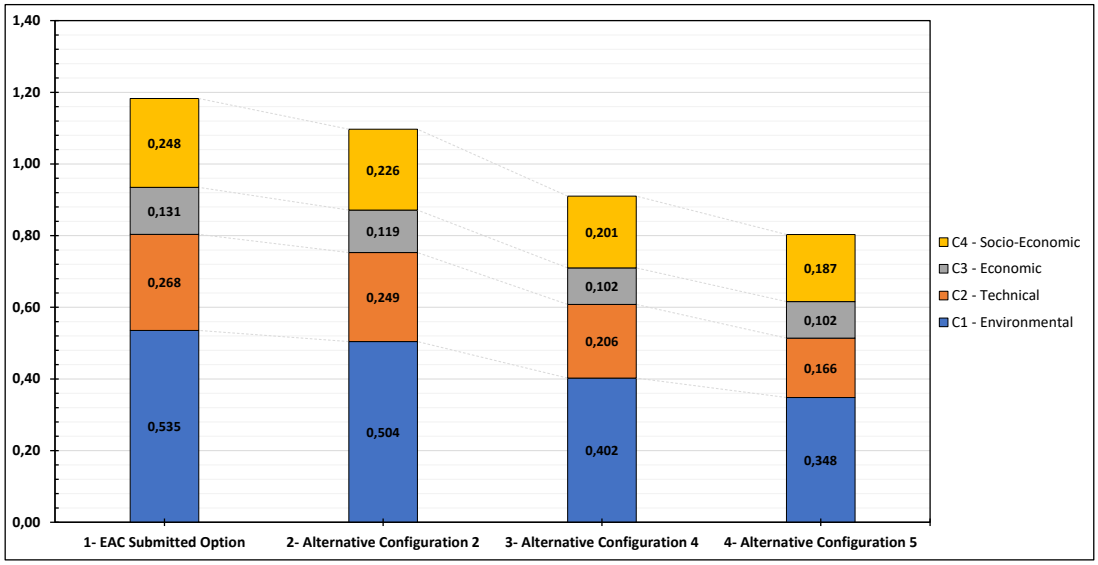


Figure E-1: Results of the Value-Based Decision Process.

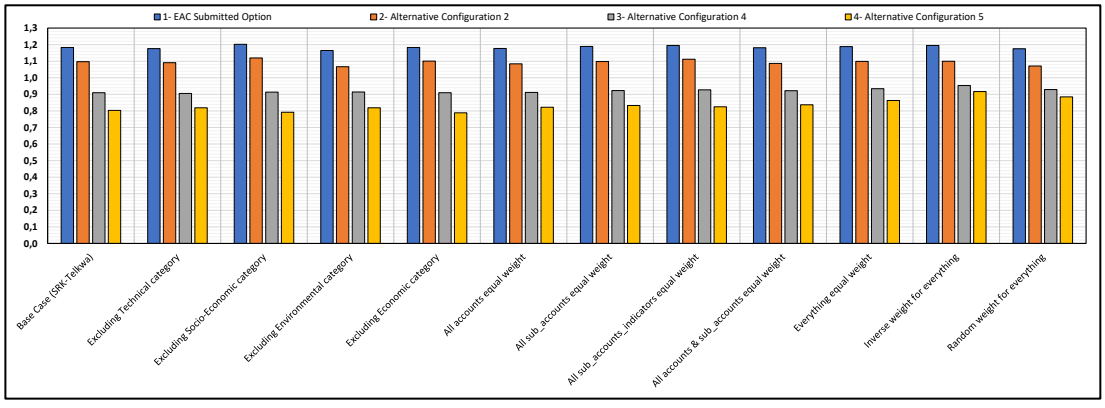


Figure E-2: Results of the Sensitivity Analyses.

Based on the outcomes of the Value-Based Decision Process and the Sensitivity Analyses, SRK and Telkwa Mining considers that the ‘EAC Submitted Option’ as the preferred alternative for storing PAG materials for this Project. It is recommended to advance with the field work and detailed design process for this configuration.

1 Introduction

1.1 Project description

The Tenas Project (Project) is a Telkwa Mining Ltd. (Telkwa) owned coal project located in central British Columbia, approximately 25 km south of Smithers and 7 km southwest of Telkwa. The Project site is located south of the Tenas River and the boundaries of the Project encompass the lower reaches of the Telkwa River, Goathorn Creek, and Tenas Creek. The Tenas Project's total mine life is anticipated to be 22.5 years, including one and half years of mine development and construction followed by 21 years of production.

The mine plan was designed and scheduled in a manner that allows potentially-acid generating (PAG) rock including processed rock (tailings)to be deposited into Management Ponds (MP), including the East Management Pond (EMP), West Management Pond (WMP), and North Management Pond (NMP).

These MPs will be constructed ahead of time, in sequence as per the mine plan developed by Telkwa, and allowed to flood with water to a level that maintains a minimum 1 m water cover above the PAG material placed in the MP at the end of a 12-month period. This PAG management plan is intended to reduce oxygen levels so that the oxidization of rock will be minimized with the goal of preventing Acid Rock Drainage and the associated implications to water quality from occurring. Once a particular management pond is completed the water cover will be increased to 2 m for permanent storage of PAG material below this level.

The mine plan also includes the construction of the Tenas Control Pond (TCP) to aid with onsite water management, provide a central sedimentation pond for the Project, and provide additional water for submerging PAG materials. The TCP will be constructed north of the NMP, and adjacent to the Coal Processing Plant and Mine Infrastructure Complex Pad.

1.2 Project background

During 2018 and 2019, SRK Consulting (Canada) Inc. (SRK) conducted field programs to investigate the foundation characteristics for previous versions of the MP design, and rock geotechnical investigations for the open pit slopes.

During 2021, a geotechnical assessment of the Management Ponds (MP) and the Tenas Control Pond (TCP) was completed by SRK (SRK, 2024b), at a feasibility study level, based on the proposed ponds design provided by Telkwa (v.7 20210304) and the field investigation results from 2018 and 2019.

To support the Environmental Assessment (EA) level design for the geotechnical components of the TCP, and the proposed management pond MP structures to store PAG material, a field investigation was performed in 2021, involving the completion sonic drillholes, test pits, and installation of standpipe and vibrating wire piezometers. Field and laboratory testing was undertaken as part of this field program to reduce uncertainties related to the foundation conditions below the proposed MP and TCP and inform material strength and hydraulic parameters, with focus on determining the presence,

extension, depth, and thickness of weak layers. An interpretation of the obtained results was then completed by SRK issued in 2022 (SRK, 2022). The results were mostly consistent with the previous campaign findings and with the regional interpretation by Levson (Levson et al, 1997).

Based on this, among others, Telkwa prepared the Environmental Assessment Certificate Application (EACA) and submitted this to the Environmental Assessment Office (EAO) in February 2022.

In response to this application, the EAO submitted a letter to Telkwa with a list of information requests (IRs) related to first nation aspects, water quality, water and load balance, ARD/ML and MP management and design. Among others, the EAO requested Telkwa to provide a detailed review of the PAG material storage alternatives assessed to support the mine plan and management ponds provided in the EACA.

1.3 Objective and scope

The objective of this document is to provide a comprehensive review of the different PAG material storage alternatives and definition of the preferred alternative to support the mine plan provided in the EACA. The scope of work includes:

- review of background information;
- methodology description;
- alternatives assessment;
- conclusions and recommendations.

1.4 Exclusions

The results presented herein are intended for the EACA for the Tenas Project and should not be extended beyond this specific scope. The following items are excluded from the alternatives assessment scope of work:

- stability assessment of the PAG material storage alternatives;
- detailed cost model for PAG material storage alternatives,
- reclamation plan for PAG material storage alternatives,
- dam breach assessment of PAG material storage alternatives, and
- water and load balance assessments of PAG material storage alternatives.

2 Background Information

This section presents the background information used as a basis for the PAG Material Storage Alternatives Assessment (refer to Section 4). The objective of this section is to provide a summary of the 'Project-specific framework', including site-specific conditions, mine plan, mine material streams, characterization of each mine material streams as potential acid generating (PAG) versus non-potential acid generating(non-PAG), potential borrow/construction source materials and the foundation terrain. Additional detail on these aspects is included in the '*PAG Management Alternatives Assessment*' memorandum Appendix A, the '*Tenas Project – Management and Control Ponds Stability Assessment Review*' report (SRK, 2024b) and the '*Tenas Project - Site-Specific Probabilistic Seismic Hazard Assessment*' report (SRK, 2024a).

2.1 Site Conditions

2.1.1 Location

The Tenas Project is in central British Columbia approximately 15 km south of Smithers and 7 km southwest of Telkwa as illustrated by Figure 2-1. The project site is located south of the Telkwa River.

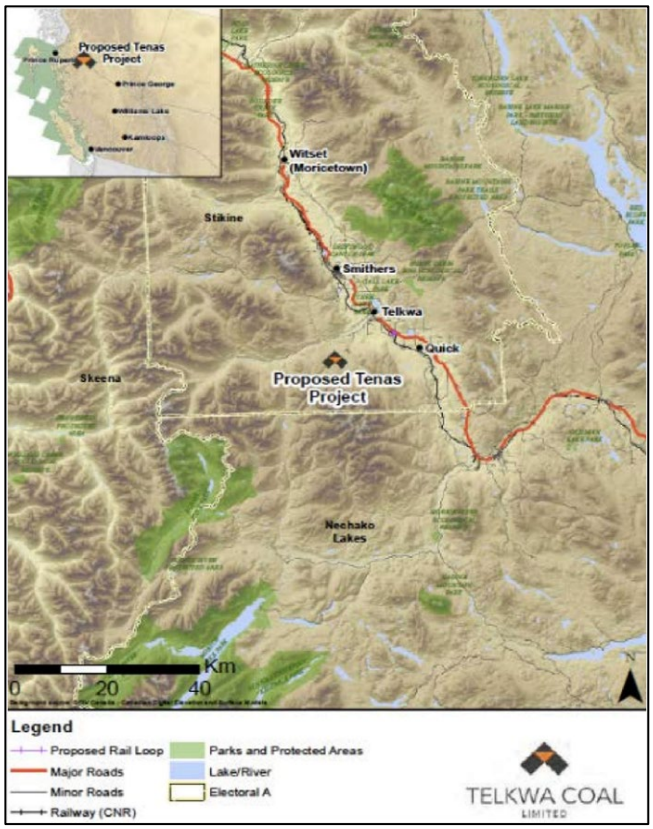


Figure 2-1: Tenas Project Location Plan (SRK, 2024b).

2.1.2 Geomorphology and Surficial Soils

The site is located within the foothills of British Columbia, between the Bulkley Mountain Range to the north and west, and the low-lying gently sloping relief of the Nechako Plateau.

Bedrock is typically covered by Quaternary soils, except for rocky outcrops along deeply eroded sections in adjacent river and creek valleys. Elevation across the site ranges generally from 600 to 900 m, with maximum elevations along the east side of the property (Levson et al, 1997).

The regional surficial soils have been studied by Levson (Levson et al, 1997). Two soil units are characterized regionally, and include:

- A widespread, massive unit, interpreted as a till, is located at or near the ground surface elevation. The till is described as diamicton, with particle sizes ranging from clay to boulders within a fine grained or sandy matrix. No thickness information was provided by (Levson et al, 1997).
- In some areas, the till is underlain by both glaciofluvial stratified sands and gravels, and horizontally bedded sand, silt and clay sequences interpreted to be advanced-phase glacio-lacustrine sediments.

In the 2018 investigations, the surficial soils intercepted were mostly sandy lean clay. The 2019 investigations intercepted finer grained till, more commonly described as a sandy lean clay, as well as coarser-grained soils within the paleo-channel described as a clayey silty sands or gravels. At greater depths within the paleo-channel (i.e., below 30 m) these two broader material types are interfingered. Both materials are comparable to the till units described by Levson (Levson et al, 1997). Results indicate that the silts and clays are commonly stiff to hard in consistency, and the sands and gravels are dense to very dense.

The surficial soil materials encountered in the sonic drillholes during the 2021 campaign (SRK, 2022) indicated the presence of a wide-spread diamicton till material. This was mostly consistent with the previous campaign findings and with the regional interpretation by Levson (Levson et al, 1997). Particle size analyses led to the interpretation of lithology zones, including Upper Till, Lower Till, High Fines, Sand (Silty Sand), and Mixed Sand & Gravel. The results of the index testing show that the majority of the clays are of low to medium plasticity, with only two samples being categorized as high plasticity.

2.1.3 Bedrock Geology

The coal that is to be mined from the Tenas EA Open Pit is located within the sedimentary sequences of the early Cretaceous-aged Skeena Group. The Skeena Group consists of mudstones, siltstones, sandstones, and conglomerates with inter-bedded, bituminous coal seams. The Skeena Group has been historically divided into four units (Palsgrove, 1991), of which two units are economically coal-bearing (Figure 2-2).

Of relevance to this study at Tenas is Unit 1 described by (Palsgrove, 1991). A geological map of the Tenas EA Open Pit with the Unit 1 outcrops is shown by Figure 2-2. Unit 1 comprises a 50 to 120 m thick sedimentary sequence interbedded with Coal Seam 1 (Seams 1A to 1F). The individual coal

seams vary from less than 1 m to 3 m in thickness and can be laterally discontinuous (Palsgrove, 1991).

The Skeena Group unconformably overlies the Hazelton Volcanic Group rocks. Additionally, the project geology map indicates the intrusive unit is in contact with the Skeena Group in directions outside of the Tenas Deposit footprint in white as shown by Figure 2-3. However, the Hazelton Volcanic Group was not intercepted in vertical diamond drillholes that extended below the lower-most coal plys at Tenas or the inclined diamond drillholes that were drilled though the east-limb of the Tenas syncline (i.e., proposed east wall) along the east side of the deposit.

As discussed, the Skeena Group rocks have been folded into a syncline at Tenas. On the west side the rocks are shallow, west dipping and gently folded along a west-limb. Toward the east, the bedding dips increase at the axis of the fold, and the rocks are moderately dipping to the east along the east-limb.

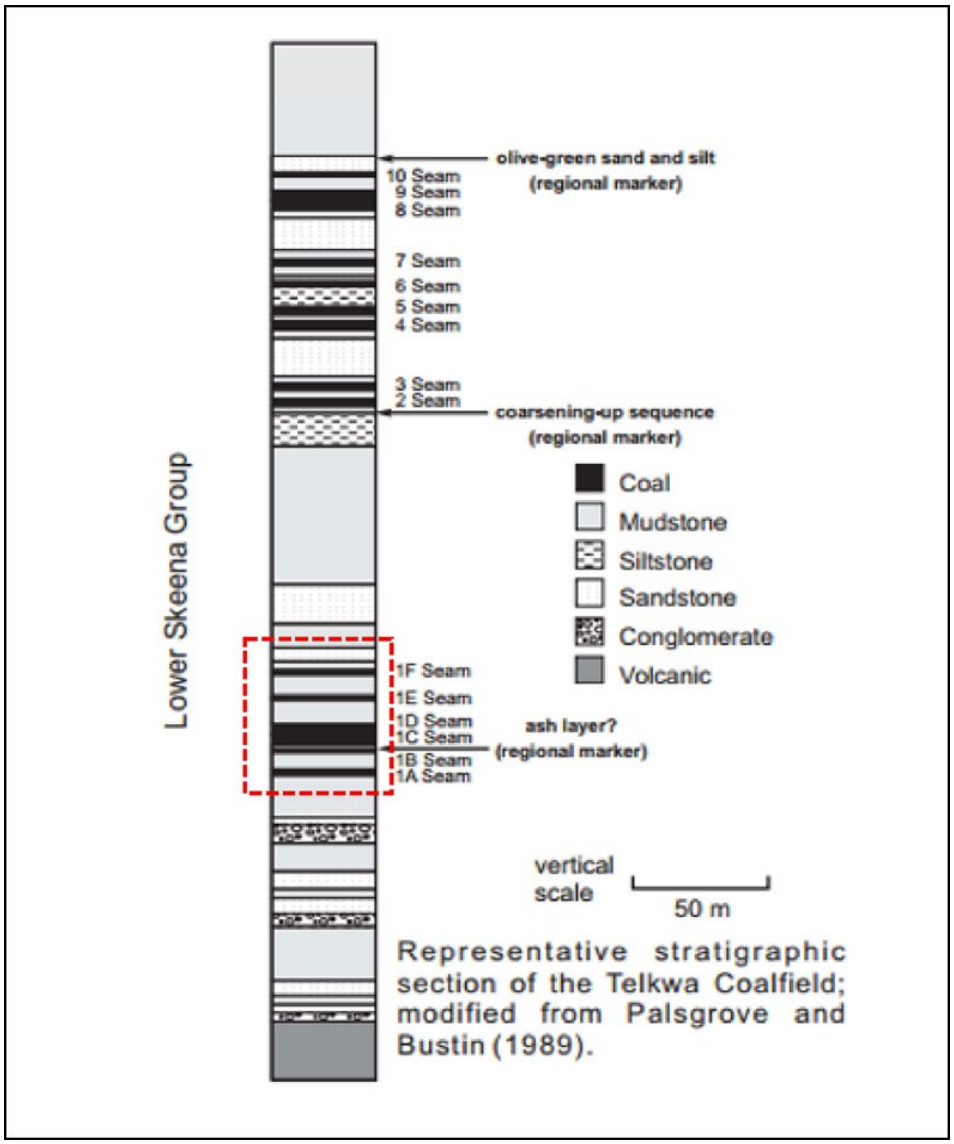


Figure 2-2: Representative Stratigraphy of the Skeena Group (Palsgrove, 1991). Unit 1 shown in Red Dashed Box (SRK, 2024b).

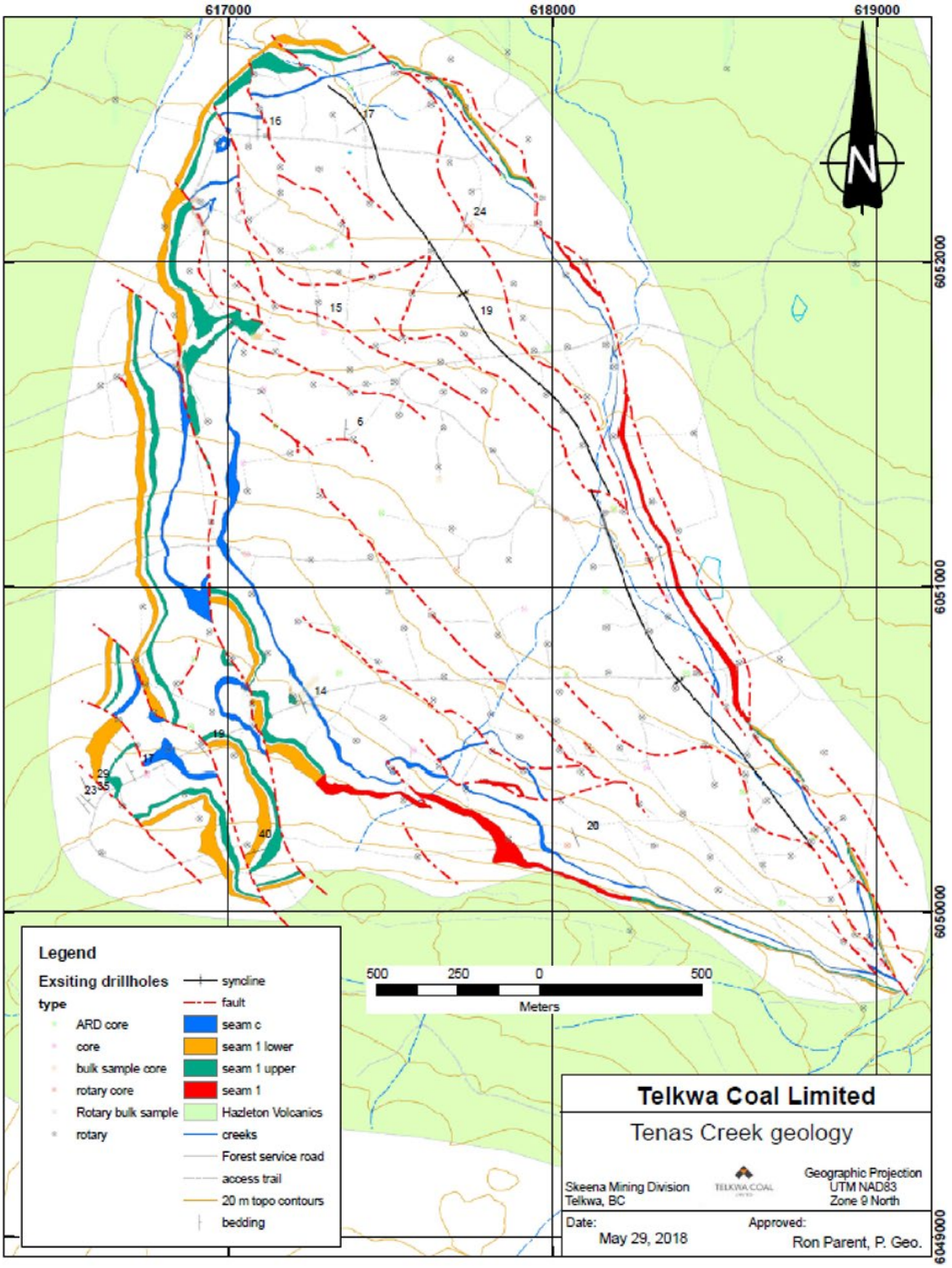


Figure 2-3: Tenas Geology Map (SRK, 2024b).

2.1.4 Seismicity

The 2015 National Building Code Seismic Hazard Map (NCR, 2015) indicates that the Tenas Project is in a relatively stable seismic area. The peak ground acceleration (PGA) for a two percent probability of exceedance in a 50-year period, i.e., 1 in 2,475 years, is 0.049 times the force of gravity of 9.81 m/s^2 (g).

A site-specific seismic hazard assessment (SHA) was conducted in 2023 (SRK, 2024a). The study provides an estimation of the seismic hazard for the Project site for a representative site condition and presents seismic design criteria and design guidance in terms of ground acceleration, spectral accelerations, and horizontal seismic coefficients for use in stability analysis.

The SHA showed that for Project's rock site conditions, the maximum design earthquake (MDE) will have a PGA of 0.10 g (mean) and 0.129 g (84% percentile) with a target AEP of 1:10,000 years. For C site class (site class for Tenas Project) and Extreme Dam Consequence Category, the maximum design earthquake MDE for passive-care stages will have a PGA of 0.11 g (mean) and 0.142 g (84%), according to GISTM and the CDA.

Finally, a range of seismic coefficients (pseudo-static) had been calibrated for different dam heights for the Extreme Dam Consequence Category. The obtained values are approximately between 0.032g and 0.044g. For the purposes of this analysis, a maximum horizontal seismic acceleration (0.045g) was conservatively adopted for the pseudo-static stability assessment.

2.2 Mine Plan and Mine Material Streams

The proposed project will produce metallurgical coal at a planned annual production rate of between 775,000 and 825,000 processed coal tonnes over a life of mine of about 21 years at a maximum production rate of 2,500 tonnes of processed coal per day. The mining of the Run-of-Mine (ROM) coal will require the excavation of surface soils (topsoil), overburden, non-PAG rock, PAG rock, and non-recoverable coal seams. Run-of-Mine coal is processed by a dense medium cyclone (DMC)/flotation coal processing plant with a 145 rom-of-mine tonnes per hour (tph) capacity, with fine processed rock (fine processed rock, defined as materials smaller than 0.5 mm) dewatered to 40% solids content by a belt filter press, before being combined with the coarse processed rock at a 20 to 25% moisture content and stockpiled for disposal by placing it underwater in the management ponds. A schematic of the Coal Processing Plant (CPP) is shown in Figure 2-4. In summary the following are the Porject's material streams that need to be stored on a permanent basis:

- Overburden: this material is either backfilled into the EA Open Pit or used for the construction of the management and control ponds;
- Non-Pag Rock: this material is either backfilled into the EA Open Pit or used for the construction of the management and control ponds;
- PAG Rock: this material is placed underwater in the management ponds;
- Surface Soils (topsoil): this material is temporarily stockpiled or direct placed for reclamation requirements;

- Processed Rock: this material is placed underwater in the management ponds;
- Run-of-Mine Coal: this material is temporarily placed in stockpiles for processing; and
- Processed Coal: this material is temporarily placed in stockpiles for shipment to the overseas markets.

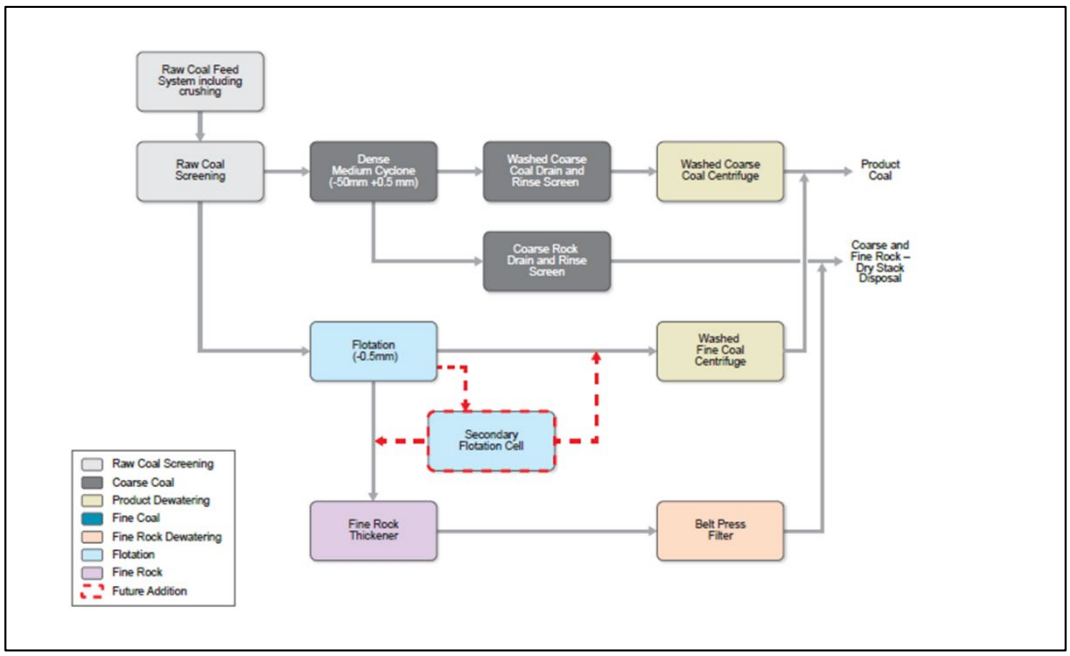


Figure 2-4: DMC/ Flotation CPP schematic flow diagram (SRK, 2021b).

The Tenas EA Open Pit contains both PAG and non-potentially acid generating (non-PAG) materials (see Section 2.4). The mine plan involves separating mine rock based on its potential to generate acid, as it is extracted. A zone model has been developed for the rock units within the EA Open Pit, and supplemental geochemical testing will be conducted during the Operation Phase to confirm mine rock properties as per the ML/ARD Management Plan. Non-economic materials from the Project are expected to include:

- Non-PAG Reclamation materials (surface soils/topsoil) and overburden from EA Open Pit mining (24.22 million banked cubic meters (MBCM)).
- PAG[1] mine rock from EA Open Pit mining (31.83 MBCM).
- Non-PAG mine rock from EA Open Pit mining (29.52 MBCM).

[1] PAG defined as materials with an NPR less than 2.0 (SRK, 2021b) for the EACA and planning purposes, however materials will be subject to the verification testing during the Construction and Operation phases provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials using an NPR cutoff of 1.20 which still requires approval from regulatory agencies.

- Coarse and fine processed rock (tailings) from the Coal Processing Plant. These materials are also expected to be PAG (total 3.28 MBCM):
  - Coarse processed rock which is comprised of material >0.5 millimeters (mm), and is roughly 75% of the processed rock materials produced;
  - Fine processed rock which is comprised of material <0.5 mm and is the remaining 25% of the processed rock materials produced.

2.3 Processed Rock Dewatering

Processed rock produced by the Project can be produced at several different moistures as follows:

- Wet processed rock (conventional slurry): Coarse and Fine Processed Rock are combined together to produce a material with a moisture level of roughly 75% to 85% which can then be pumped to a final disposal area;
- Paste processed rock: Some dewatering occurs for the Fine Processed Rock and then combined with Coarse Processed rock to produce a material with a moisture level of 50% which can then be pumped to a final disposal area; and
- Dry processed rock: Dewatering processes are completed for both Coarse and Fine Processed Rock to produce a final product with a moisture level of roughly 25% which can then be hauled to a final disposal area.

As part of the EACA, Telkwa Mining conducted an alternative means analysis for carrying out the Project with processed rock dewatering being one of the topics reviewed. Based on the analysis and information available when this analysis was conducted a dry processed rock product was selected mainly due to this option's low use of water from the surrounding environment.

2.4 Mine Materials

2.4.1 Mine Material Characterization

A comprehensive historical geochemical characterization program was completed for the Telkwa Project (Norecole, Dames & Moore, 1999) which included geochemical testing of over 700 samples. Supplemental geochemical characterization programs were conducted in 2018 and 2019 (SRK, 2019) which included additional testing of 173 selected samples from these programs, as well as collection and testing of 19 additional samples of processed rock, overburden, and construction rockfill.

Based on these characterizations, mine rock for the Project is characterized as non-PAG or PAG by acid base accounting (ABA), which measures the ratio of the Neutralization Potential (NP) to the Acid Potential (AP) of the material (i.e., the Neutralization Potential Ratio (NPR)). When the mineralogical contributors to NP and AP are well understood (i.e., NP is like that provided by calcite, AP is from oxidation of pyrite and these minerals have the same availability), regulatory guidance allows that NPR of 2.0 can be used to define PAG versus non-PAG (Price, 2009). The results of the supplemental mine rock geochemical characterization for the Project showed a strong positive relationship between

modified-NP and presence of calcium plus magnesium, which provides confidence in the ABA calculations (SRK, 2019).

In addition, there was a strong correlation based on modified-NP and NP calculated based on minerology NP-XRD (SRK, 2021a). Based on this relationship, an NPR of 2.0 was selected to identify rock as PAG or non-PAG for planning and the EAC application, consistent with the guidelines. However, materials will be subject to verification testing as provided for in the ML/ARD management plan during the Construction and Operation phases for final determination of PAG and non-PAG materials where a lower NPR might be approved by regulatory agencies.

In Table 2-1, the results of the geochemical characterization are summarized for the different mine rock types and described in the following sections.

Table 2-1: Non-Economic Material Geochemical Characterization (SRK, 2021b).

Material Type	Geochemical Characterization
Mine Rock	**Eleven (11) zones: 3 non-PAG(portions of Zones 1, 4, and 8) 1 of which is not mined by the EA Open Pit (zone 7), 8 PAG (Portions of Zones 1, Zone 1a, Portions of Zones 2, 3, 4, 5, 55, 6, and 7), 2 of which are not mined by the EA Open Pit (zones 7 and 8)**
Processed rock/tailings (coarse and fine)	**PAG**
Reclamation materials (surface soils/topsoils) and Overburden	**Non-PAG**
Construction Materials	**Non-PAG**
Open Pit EA Walls	**9 zones: 2 non-PAG, 7 PAG**

Sources: Compiled in text.

Notes: PAG distinction based on NPR ≤2 for the EACA and planning purposes, please note these materials will be subject to verification testing during the Operation Phase for the final determination of PAG and non-PAG materials using an NPR cut-off of 1.20 if approved by regulatory agencies.

2.4.2 Mine Material Management

A PAG Management Alternatives Assessment was conducted by SRK in 2021 (SRK, 2021b). The assessment presented and compared best available practices (BAP) and best available technologies (BAT) for processed rock (tailings) and PAG rock management for the specific conditions of the Project. It took into consideration safety (including dam safety), technical and financial aspects, and implications for environmental, health, social, heritage and economic values.

Based on the outcomes of the analysis, ARD/ML mitigation strategies for PAG and non-PAG mine rock, including processed rock and open pit walls, and their rationale are as follows. The detailed methodology and assessment are included in the "*PAG Management Alternatives Assessment*" memorandum (SRK, 2021b) presented in Appendix A.

- Processed rock (tailings): Dewatered fine processed rock (tailings) blended with coarse processed rock, for co-disposal with PAG mine rock:
  - Increased process water recycling leading to lower freshwater makeup requirements.
  - Reduced operational complexity and risk of managing a single PAG facility.
- Open Pit walls: progressively backfilled with non-PAG mine rock/overburden, then covered with overburden, shaped to desired landform, and portions are submerged to form an end pit lake during the Post-closure phase with any remaining areas above water covered with surface soils (topsoil) and revegetated. Any remaining exposed open pit wall areas will be covered with overburden and surface soils during the Decommissioning and Reclamation Phase to meet post-closure land use objectives:
  - Prevention of ARD during Operation and Post-closure phases by reducing oxygen ingress and providing excess neutralizing potential material for the EA Open Pit wall PAG zones.
  - Reduction of ML during Operation and Post-closure phases by reducing oxygen and water ingress into the EA Open Pit wall zones.
  - Amenable to Post-closure restoration of pre-mining landforms.
- Non-PAG mine rock: progressively covered with glacial till and overburden and surface soils(topsoil):
  - Reduced infiltration and seepage to the receiving environment.
  - Promote vegetation and meet post-closure land use objectives.
- PAG mine and processed rocks: impounded, with a water cover:
  - Demonstrated effectiveness of the method in managing ML/ARD in the long-term.
  - Ability to incorporate design contingencies to mitigate risks of system failure.
  - Relatively low operational and maintenance requirements, post-closure.

2.5 Construction Materials

In the event that the selected alternative requires the construction of containment embankments to store PAG material, it is expected that the containment embankments will be constructed with site materials found within the EA Open Pit with the appropriate compaction requirements (e.g., potential for softening under seismic loading, or strength reduction under undrained loads is not expected) (SRK, 2024b).

Independently of the selected alternative, an impermeabilization of the impoundment areas will be required to ensure a positive water balance is maintained to have a water cap on PAG materials for a variety of situations including drought conditions. A liner seepage assessment was conducted to determine the liner composition along the bottom of the management ponds (SRK, 2021c). The liner will be composed of a 0.30 m thick low permeability soil-bentonite material, constructed in two 0.15 m lifts. The soil-bentonite liner system will require a hydraulic conductivity of 1E-10 m/s to reduce total

seepage below 2,800 m3/day which is the maximum seepage below which a positive water balance is maintained even in drought conditions. A laboratory study was performed to determine the optimal proportion of bentonite-soil blend to achieve a hydraulic conductivity $\leq$ 1E-10 m/s. For this EACA study, the geotechnical strength parameters were conservatively adopted equal to those of the High Plasticity Clay (CH) layer.

3 Alternatives Assessment Methodology

The PAG material storage alternatives assessment was conducted following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC) (ECCC, 2013).

The (ECCC, 2013) guidelines present the Multiple Account Analysis (MAA) as the preferred tool to facilitate the decision-making process for allowing '*technical specialists to communicate essential technical considerations while allowing stakeholders to establish valued judgements for the decision*'.

The MAA process is composed of seven steps. A summary of each step is presented below. The flow diagram of the MAA process is shown in Figure 3-1:

- Step 1 – Identify Candidate Alternatives:
  - Define a basic threshold criteria to establish the regional boundaries for selecting candidate alternatives.
  - Develop a list of possible candidate alternatives for mine material disposal. Mine material deposition technologies and storage options should be considered.
  - As an outcome, provide a summary table of candidate alternatives complemented by maps and/or figures and a well-documented threshold criteria to demonstrate to an external reviewer that reasonable mine material disposal alternatives have been considered.
- Step 2 – Pre-Screening Assessment:
  - Define a pre-screening criteria such that 'Yes/No' responses to whether the alternative complies with the set criteria can be provided.
  - As an outcome, provide a summary table presenting each alternative against the pre-screening criteria and associated rationale for the project.
- Step 3 – Alternative Characterization:
  - Develop site specific characterization criteria for the project. These criteria should be categorized in the following four 'accounts' for the purpose of the MAA: 'Environmental characterization', 'Technical characterization', 'Project economic characterization' and 'Socio-economic characterization'. Selection and documentation of the characterization criteria should be done by a multidisciplinary team with representatives from four accounts.
  - As an outcome, provide a series of summary tables that list the selected characterization criteria and rationale for each four accounts.
- Step 4 – Multiple Accounts Ledger:
  - Develop a multiple accounts ledger to identify the elements that differentiate each alternative and provide the basis for the scoring and weighting (refer to Step 5).
  - Define sub-accounts (also known as 'evaluation criteria') that truly differentiate mine material disposal alternatives. As an outcome, provide a summary table presenting the list of sub-accounts and associated rationale, referencing the supporting documentation.

  - Define indicator (also known as ‘measurement criteria’) that allow measurability of each sub-account. These indicators may be different for the different life-cycle stages of the project. As an outcome, provide an expansion of the sub-accounts summary table including the set of indicators, indicator parameter, unit, and quantity.

- Step 5 – Value-Based Decision Process:
  - Assess the combined impacts for each alternative by scoring and weighting the list of accounts, sub-accounts and indicators and quantitatively determine the merit ratings for each alternative.
  - Scoring is done by developing qualitative value scales for every indicator.
  - Weighting should be defined with the input from stakeholders to prevent value bias. The guidelines present a ‘Base Case’ weighting for accounts, prioritizing the Environmental’ aspects.
  - Conduct the quantitative analysis by assessing the combined impacts of scoring and weighting for each indicator and obtain a sub-account merit score.
  - To allow comparison of these values against values for other sub-accounts, normalize to the same scale used to score each indicator value. By this process, a sub-account merit rating is obtained.
  - Repeat the same procedure of weighting and normalization to determine the account merit scores and account merit ratings.
  - Repeat the same procedure one final time to determine the alternative merit score and alternative merit rating.
  - As an outcome, provide justification for scoring and weighting factors and summary tables presenting of each indicator, sub-accounts, accounts and alternative merit scores and merit ratings.
- Step 6 – Sensitivity analyses:
  - Conduct sensitivity analyses to better assess if bias and subjectivity during the process could impact in the decision making. Test the sensitivity of the value-based decision-making process by assigning different weightings to each indicators, sub-accounts, and account according to a range of value systems that represent the perceived disparity between the stakeholders.
  - As an outcome, provide a well-documented summary of the sensitivity analyses. A summary table showing the different sensitivity scenarios and merit ratings for each alternative should be provided.
- Step 7 – Document Results:
  - Complete a comprehensive technical report including the process and outcomes of each step, results and supporting documentation including a recommended option to carry forward into subsequent design and construction.

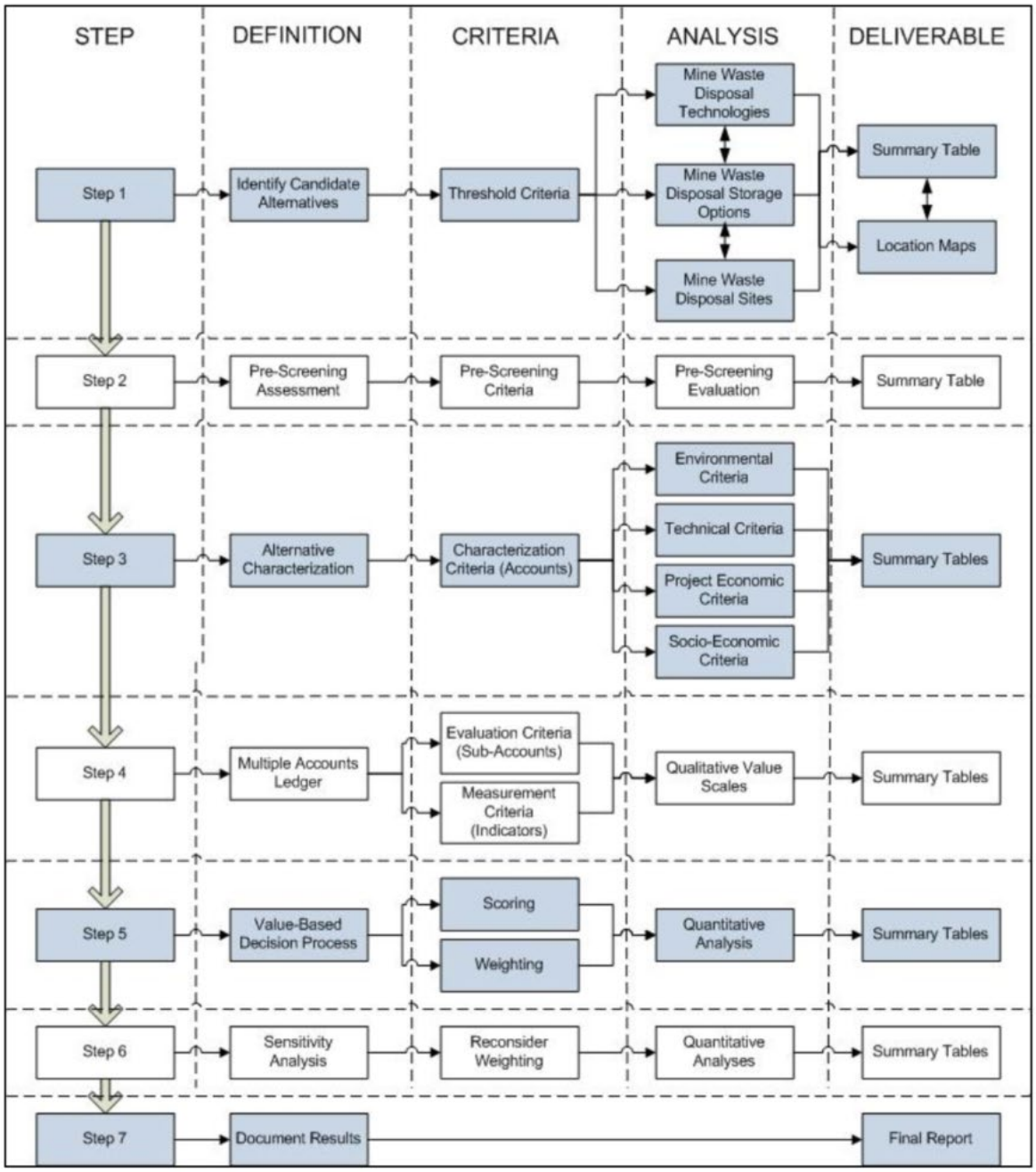


Figure 3-1: Flow diagram of the process of assessing alternatives for mine material disposal (ECCC, 2013).

4 Alternatives Assessment

4.1 Step 1: Candidate Alternatives

Figure 4-1 presents a plan view of the mine property limits and regional boundaries and 'unsuitable areas including riparian areas, waterbodies, watercourses, powerlines, rail lines, provincial roads, municipal boundaries, federal lands, private lands, mineral lease, and forest service roads.

The following threshold criteria was set to establish the regional boundaries for selecting candidate alternatives for storing the mine materials; areas that do not meet these threshold criteria are excluded from the identification of candidate alternatives or the PAG material storage alternatives assessment:

1. Protected areas: Protected areas include First Nation Reserves, Agriculture Land Reserve (ALR) areas, provincial and federal parks and protected areas, recreation areas, known archaeology and heritage sites, high elevation caribou habitat, and fish and fish habitat. In addition, the following watercourses are also considered protected areas from material placement:
    a. Goathorn Creek.
    b. Tenas Creek.
    c. Telkwa River.
    d. Four Creek.
    e. Bulkley River.
2. Topographic constraints: Areas with overall slope angles equal or higher than 4H:1V (14% grade) to avoid construction issues (especially for the installation of the impermeabilization system/liner) and reduce overall stability issues through the foundation for the embankment and/or pile.
3. Existing infrastructure: This includes provincial/municipal/federal infrastructure, hydrological infrastructure, PNG infrastructure, powerlines, rail lines, bridges, and provincial transportation roads.
4. Telkwa Mining owned property or coal license boundaries: Areas outside of TCL property and/or coal license limits are excluded due to uncertainties related to property acquisition and permitting.
5. Infrastructure constraints: Avoid crossings of named watercourses of Goathorn, Four, and Tenas Creeks and the Telkwa and Bulkley Rivers by mining equipment.
6. Distance to the CPP: A maximum distance of 10 km between the CPP and the PAG material storage facilities was set to avoid excessive coarse and fine processed rock transport costs and minimize dust, noise, and greenhouse gases (GHG) emissions.
7. Distance to EA Open Pit: A maximum distance of 10 km between open pit and permanent storage areas was set to avoid excessive material transport costs, and minimize dust, noise and GHG emissions.

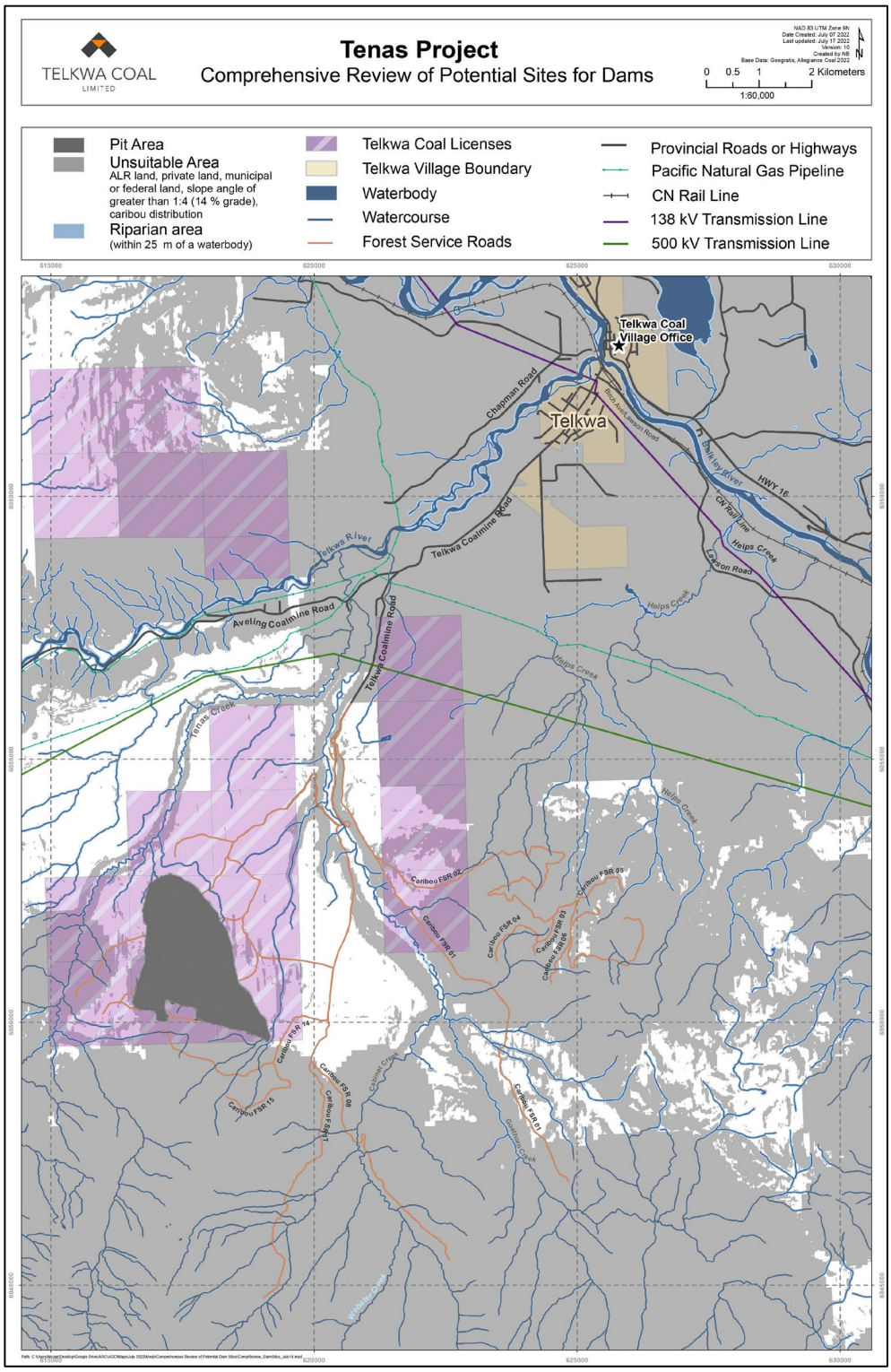
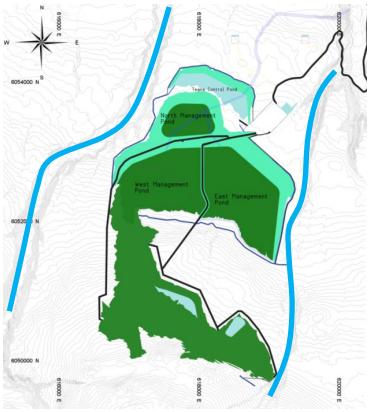
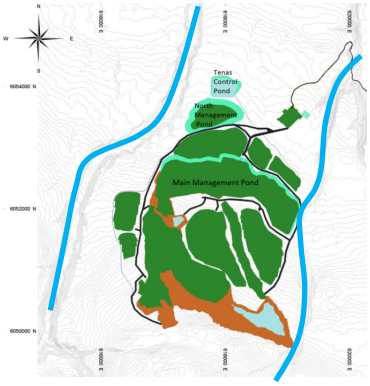


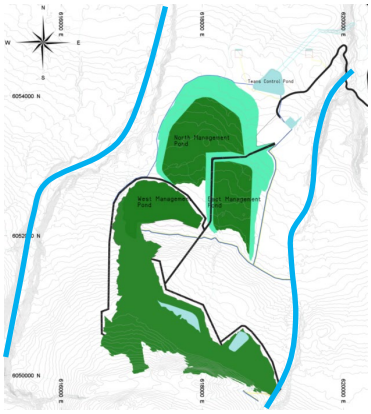
Figure 4-1: Tenas Project – Regional boundaries and property limits.

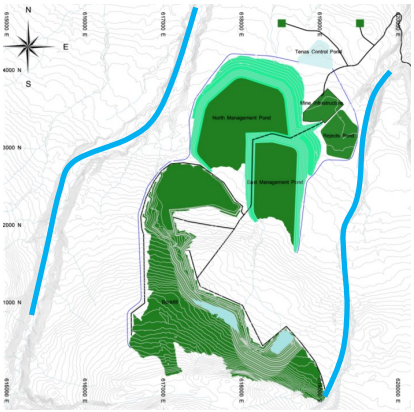
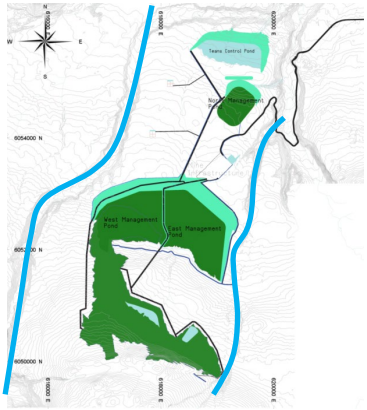
Based on the threshold criteria stated above, the resource open pit area and 'white areas' shown on Figure 4-1 that are within the TML coal licenses in pink and comply with the maximum distance constraints could be used to store materials including PAG. Due to the area required to store materials, the TML coal licenses located north of the EA Open Pit are the only areas that complies with threshold criteria and storage requirements.

Within this area several different alternative configurations were identified. Table 4-1 presents a summary description of each candidate alternative.

Table 4-1: Candidate Alternatives Summary Table.

Candidate Alternative	Description	General Arrangement
EAC Submitted Option	This configuration only uses dams for the MP and to develop the TCP for the Project which is also the main sedimentation and water storage facility. As part of the material placement strategy, no processed rock materials (tailings) will be placed within exclusion zones that are designated as the immediate 75 m in front of the face of any downstream embankment. The reason for this is to ensure that if a potential failure was to occur that there is sufficient coarse PAG rock between the area of a potential failure and processed rock to prevent this material from potentially flowing out into the environment. The TCP is to be constructed at the north of the NMP, and adjacent to the Coal Processing Plant and Run-of-Mine coal stockpile areas. This configuration has the potential for a cascading failure with the WMP failing into the NMP and then the TCP. The MP and TCP have an 'Extreme' dam consequence classification given the potential for a failure affecting the Village of Telkwa and disturbing identified fish habitat in Tenas and Goathorn creeks. This configuration preserves resources in the centre of the deposit for future generations.	
Alternative Configuration 1	This configuration uses a combination of dams and excavated impoundments to contain the PAG material in two MP (the NMP and Main MP) and to develop the TCP for the Project which is the main sedimentation and water storage facility. This configuration would have a potential for the NMP to fail into the TCP as a cascading failure. However, the main MP likely cannot fail into either of these facilities as they are both protected by overburden storage piles. This configuration has approximately 150 ha more disturbance than the current EAC submitted option. The Main MP would have an 'Extreme' dam consequence classification given that a failure would affect the village of Telkwa and identified fish habitat within Tenas and Goathorn Creeks while the NMP and TCP together or	

Candidate Alternative	Description	General Arrangement
	separately would also have a similar dam consequence classification due to the reasons above. This configuration has both coarse and fine processed rock stored in separate above ground unsaturated facilities which was requested during further discussions to be placed underwater by regulatory personnel and the public during open house discussions due to these materials being classified as PAG. This configuration would capture more water from both the Four and Tenas Creek watersheds due to having a larger surface disturbance footprint and required contact water collection systems. This configuration places a permanent material storage pile over potential resources which sterilizes these for future generations.	
Alternative Configuration 2	This configuration is based on the option of removing the WMP dam completely. This configuration also has the TCP as a 100% excavated impoundment that requires no dam. This option has approximately 100 ha more disturbance than the current EAC submitted option. Both the revised EMP and NMP would have at least an 'Extreme' dam consequence rating and there is still the possibility of the EMP failing into the NMP as a cascading failure which would affect the village of Telkwa and identified fish habitat within Tenas Creek This configuration has both coarse and fine processed rock comingled with other PAG rock within the three MP. As part of the material placement strategy, no processed rock materials (tailings) will be placed within exclusion zones that are designated as the immediate 75 m in front of the face of any downstream embankment. The reason for this is to ensure that if a potential failure was to occur that there is sufficient coarse PAG rock between the area of a potential failure and processed rock to prevent this material from potentially flowing out into the environment. This configuration will likely need the explosive facility and magazines to be moved to meet minimum legislated quantity distance requirements. This configuration would require more water than the EAC case from the Tenas Creek watershed due to the increased size of the NMP and location of the TCP. This configuration preserves resources in the center of the deposit for future generations.	

Candidate Alternative	Description	General Arrangement
Alternative Configuration 3	This configuration is based on the option of removing the WMP dam structure completely while keeping the NMP and EMP as fully above ground structures. This configuration also has the TCP as a 100% excavated impoundment that requires no dam. This configuration has both coarse and fine processed rock stored within an independent separate facility that is 100% excavated into the ground to avoid comingling with other PAG materials. This configuration has approximately 150 ha more disturbance than the current EAC submitted option. Both the revised EMP and NMP would have at least an 'Extreme' dam consequence rating and there is still the possibility of the EMP failing into the NMP as a cascading failure which would affect the village of Telkwa and identified fish habitat within Tenas and Goathorn Creeks. This configuration will likely also need the explosive facility and magazines to be moved to an alternate location on the east side of Goathorn Creek to meet minimum legislated quantity distance requirements. This change will require explosive agents to be transported daily over Goathorn Creek which is an additional risk versus the current EAC Project Case. This configuration would require more water than the EAC case from the Tenas and Four Creek watersheds due to the increased size of the NMP, location of the TCP, and the introduction of processed rock storage ponds respectively. This configuration preserves resources in the center of the deposit for future generations.	
Alternative Configuration 4	This configuration is based on the option of avoiding any potential cascading failures between ponds by placing them in locations where they do not have direct flow paths into one other. This involves moving the TCP to the very northeast end of the plateau which would potentially fail into Tenas Creek. The revised NMP is also moved to the east side of the plateau but above a height of land that would have this structure potentially fail into a tributary that leads into the Goathorn Creek versus going north towards the TCP. The EMP is revised so that any potential failure path leads into Four Creek like the EAC application. The WMP would fail to the west into Tenas Creek like the current EAC application. This option has approximately 200 ha more disturbance than the current EAC submitted option. As part of the material placement strategy, no processed rock materials (tailings) will be placed within exclusion zones that are designated as the immediate 75 m in front of	

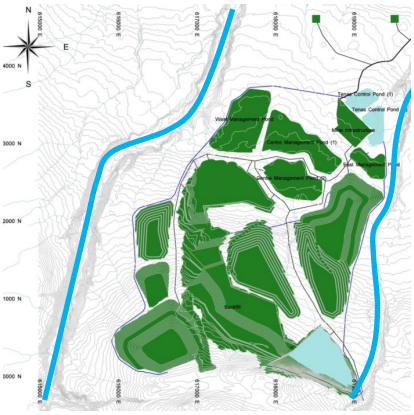
Candidate Alternative	Description	General Arrangement
	the face of any downstream embankment. The reason for this is to ensure that if a potential failure was to occur that there is sufficient coarse PAG rock between the area of a potential failure and processed rock to prevent this material from potentially flowing out into the environment. Water capture increases significantly above the EAC submission due to the revised EMP and NMP locations which would create additional contact water within the Tenas Creek Watershed. These dams would still have an 'Extreme' dam consequence rating due to potential impacts to the village of Telkwa and identified fish habitat within Tenas Creek even without potential cascading failure paths which was demonstrated by the Dam Breach Report for the EMP. This configuration has both coarse and fine processed rock comingled within the other PAG materials within the Management Pond impoundments. This configuration preserves resources in the center of the deposit for future generations.	
Alternative Configuration 5	This configuration is based on the option of avoiding any potential cascading failures between the MP and TCP by removing dams by having no water being held above the existing topography surface. This is addressed by having water held below existing ground elevations which eliminates the possibility of a dam failure. This configuration involves excavating several management pits into the overburden layer for the deposit to hold PAG material and a control pond to act as the main sedimentation pond for the site and water storage. This configuration has approximately 400 ha more disturbance than the current EAC submitted option due to the additional overburden material being placed into permanent piles. Water capture increases significantly above the EAC submission due to the extra material required to develop ponds without dams as pits and creates the most contact water within the Tenas Creek watershed. This configuration has both coarse and fine processed rock comingled within the other PAG materials within the MP excavations. This configuration places a permanent storage pile over potential resources which sterilizes these for future generations.	

Table 4-2 presents a summary of the main aspects for each candidate alternative. This includes the containment strategy (dams vs excavated), potential for cascading failure, Consequence Dam

Category of the facility, deposition strategy, additional infrastructure requirements, water capture area and water management requirements vs the EAC Submitted Option and potential impact to resources.

Table 4-2: Summary of main aspects for each candidate alternative

Item	EAC	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Containment	Dams	Dams + Excavated	Dams + Excavated	Dams + Excavated	Dams	Excavated
Potential for cascading failure	YES	YES	YES	YES	NO	NO
Consequence Dam Category	Extreme	Extreme	Extreme	Extreme	TBD but lower than Extreme	TBD but much lower than Extreme
Mine materials management	Comingling. Exclusion zones ~75 m from the dam face	Coarse and fine processed rock stored in separate above ground facilities.	Coarse and fine processed rock comingled with other PAG rock. Comingling. Exclusion zones ~75 m from the dam face	Coarse and fine processed rock stored in separate excavated facilities.	Coarse and fine processed rock comingled with other PAG rock. Comingling. Exclusion zones ~75 m from the dam face	Coarse and fine processed rock comingled with other PAG rock.
Infrastructure requirements	NO	NO	Movement of the proposed explosive facility and magazines.	Movement of the proposed explosive facility and magazines.	NO	NO
Water capture area vs EAC	N/A	+150 ha	+100 ha	+150 ha	+200 ha	+400 ha
Water Management requirements vs EAC	N/A	Captures more water from both the Four and Tenas Creek watersheds.	Require more water from the Tenas Creek watershed.	Require more water from the Tenas and Four Creek watersheds.	Captures more water due to additional contact water within the Tenas Creek Watershed.	Captures more water due to additional contact water within the Tenas Creek Watershed.
Potential impact to coal resources	NO	YES	NO	NO	NO	YES

4.2 Step 2: Pre-Screening Assessment

The following pre-screening criteria and rationale was set to establish the 'fatal flaws' for eliminating the candidate alternatives that do not meet minimum specifications developed for the Project.

The pre-screening criteria is formulated such that 'Yes/No' responses can be provided; candidate alternatives that get a 'Yes' response to at least one of the pre-screening criteria are excluded from the next stages of the Alternatives Assessment:

1. *Is the infrastructure out of the boundaries of Tenas and Four Creek?* A candidate alternative that places its ancillary infrastructure outside the boundaries of Tenas and Four Creek increases the costs and risks associated with materials deposition and materials and water monitoring and surveillance.
2. *Would the candidate alternative preclude future exploitation or mining of a potential resource?* A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.
3. *Does the candidate alternative store coarse and fine processed rock in separate facilities than the PAG rock?* A candidate alternative that stores coarse and fine processed rock in separate facilities than the PAG rock pose a higher impacted area due to the need of different facilities. Comingling allows better prevention and control of ARD/ML.

Table 4-3 presents a summary description of how each candidate alternative compares with the pre-screening criteria and whether each should be excluded from further assessment or not.

Table 4-3: Pre-Screening Assessment Summary Table.

Pre-screening criterion	EAC Submitted Option	Alternative Configuration 1	Alternative Configuration 2	Alternative Configuration 3	Alternative Configuration 4	Alternative Configuration 5
Is the infrastructure out of the boundaries of Tenas and Four Creek?	NO	NO	NO	YES	NO	NO
Would the candidate alternative preclude future exploitation or mining of a potential resource?	NO	YES	NO	NO	NO	YES
Does the candidate alternative store coarse and fine	NO	YES	NO	YES	NO	NO

Pre-screening criterion	EAC Submitted Option	Alternative Configuration 1	Alternative Configuration 2	Alternative Configuration 3	Alternative Configuration 4	Alternative Configuration 5
processed rock in separate facilities than the PAG rock?						
Should candidate alternative be excluded from further assessment?	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**

Based on this, the candidate alternatives selected for the next stages of the Alternatives Assessment were the 'EAC Submitted Option', 'Alternative Configuration 2' and 'Alternative Configuration 4'. However, during the multi-disciplinary workshop held on February 28th, 2024, it was agreed to include 'Alternative Configuration 5' in the next stages of the Alternatives Assessment to account for a completely different alternative (i.e., dams vs no dams). Figure 4-2 presents the four alternatives considered for the next steps of the Alternatives Assessment.

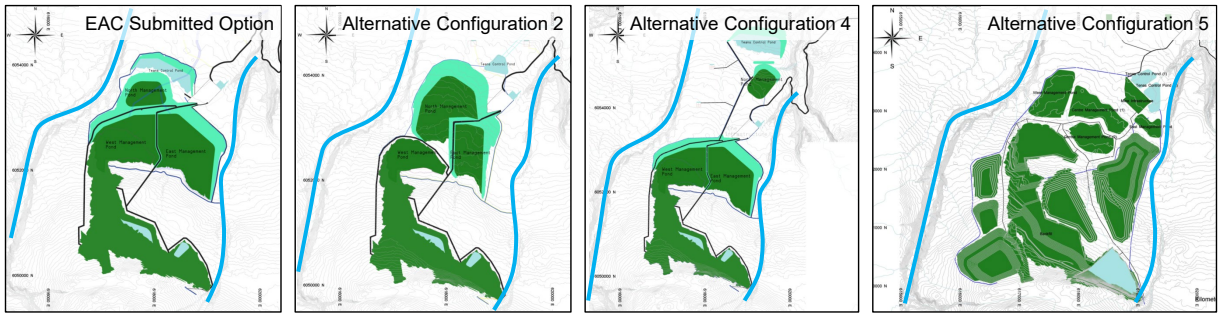


Figure 4-2: Candidate Alternatives selected for the next steps of the Alternatives Assessment.

4.3 Step 3: Alternatives Characterization

This section presents the site-specific characterization criteria for the Project and their rationale, categorized in the following four 'accounts' for the purpose of the MAA:

1. Environmental characterization: Local and regional environment surrounding the different configurations, including climate, geology, hydrology, hydrogeology, water quality, flora, fauna, etc.
2. Technical characterization: Technical aspects of each configuration, including storage capacity, dam size and volume, diversion structures, ancillary infrastructure, haul distances, materials hauling and deposition methods, closure aspects, water management, access roads, etc.
3. Project economic characterization: Aspects that impact the project economics during the LOM, including investigation, design, construction, operation, closure, post-closure, land acquisition, borrow sources development, etc.

4. Socio-economic characterization: Aspects from the different configurations that influence the local and regional land users and community perception, including land use, cultural significance, presence of archaeological sites, employment, training opportunities, etc.

As part of this characterization the criteria were reviewed by SRK and the Project Team to determine if any of the indicators could be removed and new ones added based on the Project Specific characteristics.

Appendix C presents the characterization criteria summary tables; as seen, some elements are 'double-counted' since different goals are followed in each account. This apparent double-counting will be addressed during Step 4. Tables from Appendix C includes indicators defined prior to the multi-disciplinary workshop, clarifying which of them were considered and which of them were ruled out during the multi-disciplinary workshop.

4.4 Step 4: Multiple Accounts Ledger

This section presents the Multiple Accounts Ledger developed to differentiate each alternative and to provide the basis for the scoring and weighting. This includes the sub-accounts (also known as 'evaluation criteria') and indicators (also known as 'measurement criteria').

4.4.1 Sub-Accounts

Sub-Accounts were defined by SRK and reviewed by Telkwa prior to the multi-disciplinary workshop and at the multi-disciplinary workshop. Appendix D.1 presents the list sub-accounts and associated rationale, referring to each Account.

4.4.2 Indicators

Indicators were previously presented in Step 3 (Section 4.3). Appendix D.2 presents an expansion of the sub-accounts summary table including the set of indicators and associated rationale defined during the multi-disciplinary workshop.

4.5 Step 5: Value-Based Decision Process

To ensure a robust process a multi-disciplinary workshop was organized by Telkwa Mining and held on February 28th, 2024, which had representatives from SRK, Telkwa Mining, Fisheries, Wildlife and Public groups. Appendix G holds the multi-disciplinary workshop minutes from February 28th, 2024. A summary presentation of this report will be presented and reviewed with Participating Indigenous Nations such as the Office of the Wet'suwet'en and Witset First Nation for questions, input, and understanding and will be incorporated as an amendment to this document if required. Furthermore, as part of the EAO process a presentation will also be made to the EAO Technical Advisory Committee/Working Group for input and clarifications which will be incorporated as an amendment to this document inf required.

This section presents the Value-Based Decision Process followed to define the preferred alternative for PAG materials storage. Scoring for each Indicator and Weighting for each Indicator, Sub-Account and Account and justification are presented. The final results of the analysis are presented, defining the preferred alternative for PAG materials storage.

4.5.1 Scoring

Scoring for each Indicator were defined by representatives from SRK, Telkwa Mining, Fisheries, Wildlife and Public groups during the multi-disciplinary workshop. Indicators were scored using a qualitative value scale of 1 (Worst) to 6 (Best), following the proposed scale from (ECCC, 2013).

Scorings for each Indicator were provided after the multi-disciplinary workshop to the participants to do a final review and approval. Appendix G.1 presents the final scoring adopted for each Indicator with its justification.

4.5.2 Weighting

Weighting for each Indicator were defined by SRK before the multi-disciplinary workshop. Indicators were weighted using a qualitative value scale of 1 (Worst) to 6 (Best), following the proposed scale from (ECCC, 2013). Appendix E.2 presents the final weighting adopted for each Indicator.

Weighting for Accounts were defined by SRK before the multi-disciplinary workshop using the proposed weighting from (ECCC, 2013):

- Environment – 6.
- Technical – 3.
- Economic – 1.5.
- Socio-Economic – 3.

Weighting for Sub-Accounts were defined by SRK before the multi-disciplinary workshop. Sub-Accounts were weighted using a qualitative value scale of 1 (Worst) to 6 (Best), following the proposed scale from (ECCC, 2013).

Weighting for Accounts and Sub-Accounts were reviewed, revised where required, and agreed during the multi-disciplinary workshop. Weighting for Accounts and Sub-Accounts were provided after the multi-disciplinary workshop to the participants to do a final review and approval. Appendix E.3 presents the final scoring adopted for each Accounts and Sub-Accounts.

4.5.3 Quantitative Analysis

The results of the Value-Based Decision Process are shown in Figure 4-3. Comprehensive tables with the results are included in Appendix E.4. The results show that the ‘EAC Submitted Option’ is the preferred alternative for PAG materials storage.

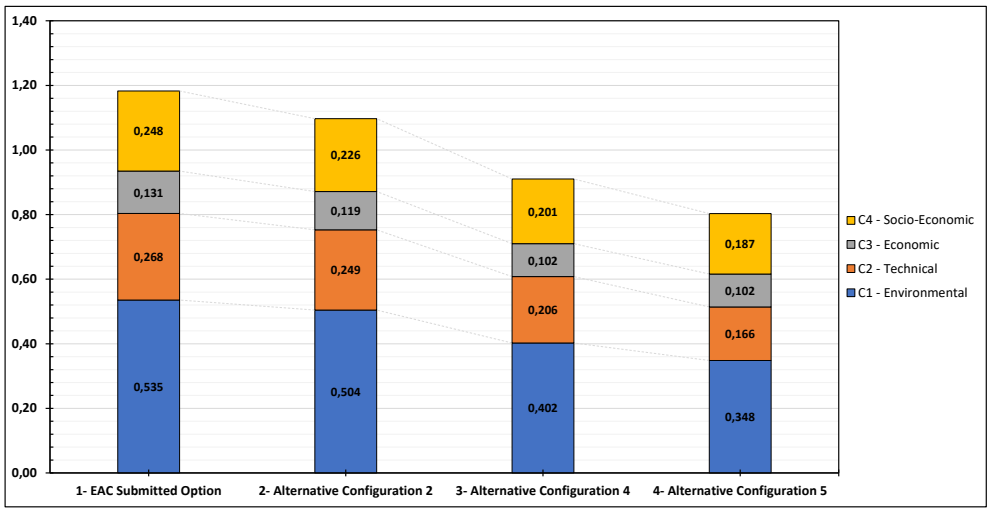


Figure 4-3: Results of the Value-Based Decision Process.

4.6 Step 6: Sensitivity Analysis

Sensitivity analyses were conducted to better assess if bias and subjectivity during the process could impact in the decision making. Different weightings to each Indicator, Sub-account and Account were assessed, as well as excluding the different Accounts.

Table 4-4 presents the modelled scenarios. Figure 4-4 presents the outcomes of the sensitivity analyses. Results show that independently of the weightings, the ‘EAC Submitted Option’ was the highest rated alternative. Comprehensive details of each Sensitivity Analysis are included in Appendix F.

Table 4-4: Sensitivity Analyses.

Sensitivity Analysis	Comments
Equal Weighting for Accounts	A Weighting equal to 1.0 was defined for Accounts.
Equal Weighting for Sub-Accounts	A Weighting equal to 1.0 was defined for Sub-Accounts.
Equal Weighting for Indicators	A Weighting equal to 1.0 was defined for Indicators.
Equal Weighting for Accounts and Sub-Accounts	A Weighting equal to 1.0 was defined for Accounts and Sub-Accounts.
Equal Weighting for Accounts, Sub-Accounts and Indicators	A Weighting equal to 1.0 was defined for Accounts, Sub-Accounts and Indicators.
Inverse Weighting for Accounts, Sub-Accounts and Indicators	Inverse Weighting was defined for Accounts, Sub-Accounts and Indicators. This means that a Weighting of 1.0 was turned to 6.0, a Weighting of 2.0 was turned to a 5.0, a Weighting of 3.0 was turned to a 4.0 and vice versa.
Random Weighting for Accounts, Sub-Accounts and Indicators	Random Weightings were defined for Accounts, Sub-Accounts and Indicators.
Excluding Environmental Account	Environmental Account was excluded form the analysis.
Excluding Technical Account	Technical Account was excluded form the analysis.
Excluding Economic Account	Economic Account was excluded form the analysis.
Excluding Socio-Economic Account	Socio-Economic Account was excluded form the analysis.

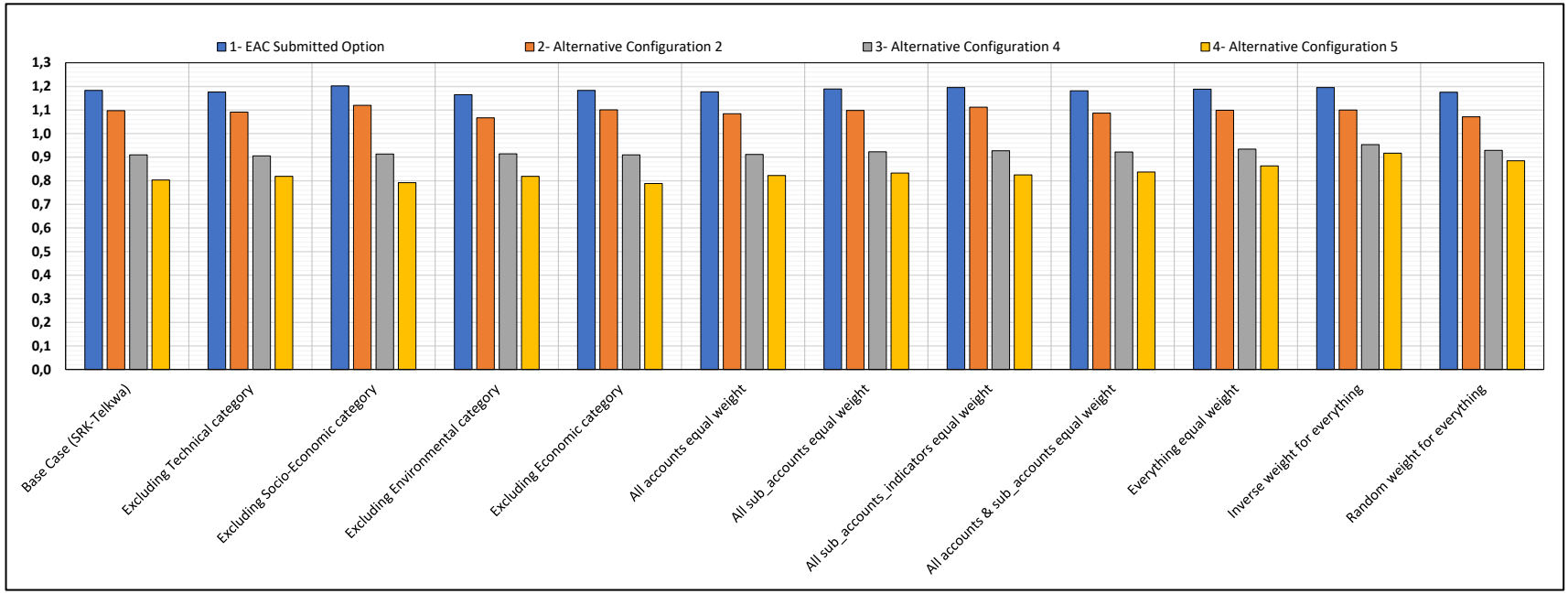


Figure 4-4: Results of the Sensitivity Analyses.

5 Conclusions and Recommendations

This document presented the PAG material storage alternatives assessment conducted for the Tenas Project in response to the list of information requests (IRs) requested by the EAO in relation to the Project provided by Telkwa Mining in the EACA.

The PAG material storage alternatives assessment was conducted in terms of a Multiple Account Analysis (MAA), following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC) (ECCC, 2013).

The seven steps of the MAA presented in (ECCC, 2013) were conducted:

1. A set of threshold criteria was set to establish the regional boundaries for selecting candidate alternatives for storing the mine materials. Based on the threshold criteria and the area required to store materials, the TML coal licenses located north of the open pit were identified as the only areas for PAG materials storage. Within this area, the 'EAC Submitted Option' and five different alternative configurations were identified as candidate alternatives for PAG materials storage.
2. Pre-screening criteria and rationale were set to establish the 'fatal flaws' for eliminating the candidate alternatives that do not meet minimum specifications developed for the project. Location of infrastructure outside the boundaries of Tenas and Four Creek, placement of permanent storage pile over an area with proven indicators of mineralization and storage of the different mine materials in separate facilities were identified as the pre-screening criteria. Based on this, the candidate alternatives selected for the next stages of the Alternatives Assessment were the 'EAC Submitted Option', 'Alternative Configuration 2' and 'Alternative Configuration 4'.
3. Site-specific characterization criteria were developed by SRK, categorized in four 'accounts' (environmental, technical, economic and socio-economic) for the purpose of the MAA. The characterization criteria were reviewed by Telkwa Mining.
4. A Multiple Accounts Ledger was developed by SRK to differentiate each alternative and to provide the basis for the scoring and weighting. A set of Sub-Accounts were defined, associated to each Account. The characterization criteria (Indicators) were assigned to each Sub-Account. Weighting for Sub-Accounts were defined by SRK. The Multiple Accounts Ledger was reviewed by Telkwa Mining.
5. To ensure a robust process a multi-disciplinary workshop was organized by Telkwa Mining and held on February 28th, 2024, which had representatives from SRK, Telkwa Mining, Fisheries, Wildlife and Public groups. The multi-disciplinary workshop was held on February 28th, 2024. A summary presentation of this report will be presented and reviewed with Participating Indigenous Nations such as the Office of the Wet'suwet'en and Witset First Nation for questions, input, and understanding and will be incorporated as an amendment to this document if required. Furthermore, as part of the EAO process a presentation will also be made to the EAO Technical Advisory Committee/Working Group for input and clarifications which will be incorporated as an amendment to this document inf required.

   During the multi-disciplinary workshop, a summary of the candidate alternatives and pre-screening assessment was presented to participants. It was agreed to include 'Alternative Configuration 5' in

the next stages of the Alternatives Assessment to account for a completely different alternative (i.e., dams vs no dams). Hence, the ‘EAC Submitted Option’, ‘Alternative Configuration 2’, ‘Alternative Configuration 4’ and ‘Alternative Configuration 5’ were considered for MAA.

During the multi-disciplinary workshop, Scoring for each Indicator, and Weighting for each Account and Sub-Account were revised and agreed with participants. Final Scoring and Weighting were provided to the participants for a final review after the workshop.

The results of the MAA showed that the ‘EAC Submitted Option’ is the preferred alternative for storing PAG materials.

Sensitivity analyses were conducted to better assess if bias and subjectivity during the process could impact in the decision making. Different weightings to each Indicator, Sub-account and Account were assessed, as well as excluding the different Accounts. Results showed that independently of the weightings, the ‘EAC Submitted Option’ was the best rated alternative.

Based on the outcomes of the Value-Based Decision Process and the Sensitivity Analyses, SRK and Telkwa Mining consider the ‘EAC Submitted Option’ as the preferred alternative for storing PAG materials. It is recommended to advance with the field work and detailed design process for this configuration.

Closure

This report, Tenas Project Potential Acid Generating Material Storage Alternatives Assessment, was prepared by



Nicolás Alscher
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Santiago Pastine
Senior Consultant

and reviewed by



Calvin Boese, MSC, PEng
Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A PAG Management Alternatives Assessment

Appendix 1.0-Q SRK, Tenas Project PAG Management Alternatives Assessment Memo

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Technical Memo

20 April 2022

To	Dan Farmer
From	Michael Dabiri
Cc	Samantha Barnes, Tom Sharp
Subject	PAG Management Alternatives Assessment
Client	Telkwa Coal Ltd
Project	1CT027.003

1 Introduction

This technical memorandum presents the processes and criteria used to select preferred alternatives, and “Alternative Means", for management of Potentially Acid Generating (PAG) materials, as well as potential Metal Leaching (ML) from non-PAG materials, at the Tenas Project (Project).

This alternatives assessment for the Project meets the information requirements as outlined in the British Columbia (BC) Environmental Assessment Office (EAO) Application Information Requirements (AIR) for the Project (EAO 2022). The assessment complies with the BC *Environmental Assessment Act* (GovBC 2002) and the EAO guidance for information requirements for tailings management (EAO 2015), and with the Operational Policy Statement Addressing “Purpose of” and “Alternative Means” under the *Canadian Environmental Assessment Act* (Canadian Environmental Assessment Agency [CEAA] 2012).

“Alternative means” are the various technically and economically feasible ways under consideration by the proponent that would allow the Project to be carried out. The proposed Project reflects the analysis of alternatives throughout the history of the mine site as information on coal resources was supplemented over time. This analysis of the alternative means considers the major decisions for the management of PAG materials.

The assessment presents and compares best practices and best available technologies for processed rock (tailings) and PAG rock management for the specific conditions of the Project. It takes into consideration safety (including dam safety), technical and financial aspects, and implications for environmental, health, social, heritage and economic values.

This memo presents background material on the history of the mine, geochemical material characterizations, the method for the review of alternative means, and an assessment of alternative means to manage mined and processed rock.

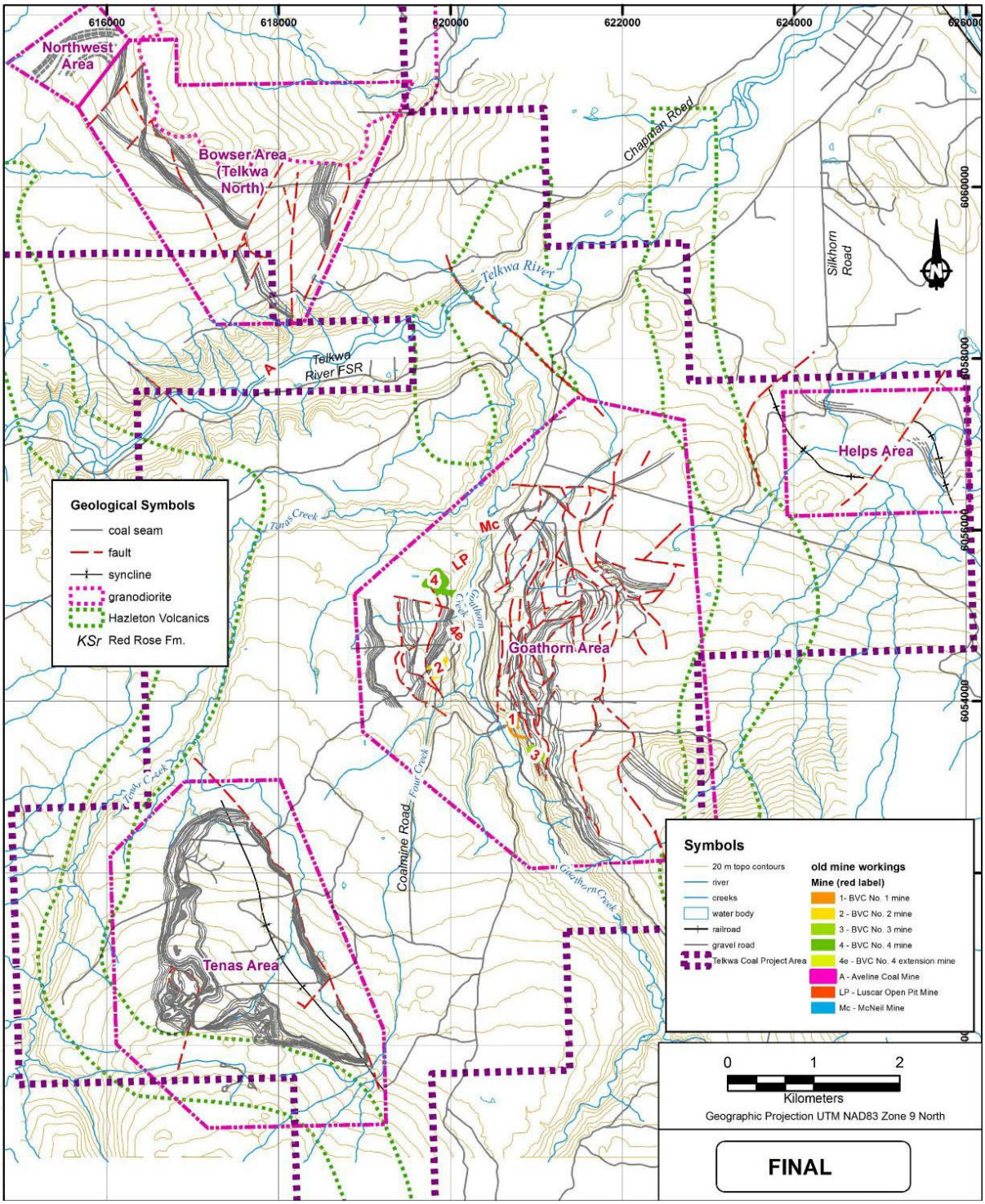
1.1 Background

Coal was discovered in the Telkwa area around the year 1900. Mining is reported to have begun as early as 1918, with small-scale operations supplying thermal coal locally for heating. Approximately 400,000 tonnes of coal were reportedly produced from 1918 to 1985. Through the 1980s and 1990s, the Telkwa property, which includes the Telkwa North, Tenas, and Goathorn Creek deposits (see **Figure 1-1**), changed hands several times with no coal production, before the coal licenses and property were acquired by Telkwa Coal Limited (TCL) in 2017 and 2018.

Geochemical characterization studies performed by previous owners of the project to support economic and environmental assessments in the 1990s showed that Metal Leaching/Acid Rock Drainage (ML/ARD) potential management needed to be considered for the project. The resulting management plans prescribed segregation of highly reactive rock components for subaqueous disposal in backfilled pits and blending of PAG and non-PAG components to create non-PAG mine rock dumps and backfilling of the open pit.

More recently, pre-feasibility studies were completed for large mine designs (encompassing the three (3) deposits, SRK 2017b) and small mine designs (encompassing only the Tenas deposit, SRK 2017a), which included initial expit non-PAG rock piles and in-pit disposal of PAG rock. Due to the requirement for long-term treatment of ARD, this configuration was abandoned for the subsequent Project feasibility study (SRK 2019a) in favour of subaqueous disposal of all PAG materials in purpose-built “PAG cells also known as management ponds”.

Figure 1-1: Telkwa Project Geology and Deposits



***Source**: SRK 2019a*

1.2 Environmental Assessment (EA) Mine Plan

The proposed Project will produce metallurgical coal at a planned annual production rate of between 775,000 and 825,000 tonnes over a life of mine of about 25 years at a maximum production rate of 2,500 tonnes of processed coal per day. Coal is processed by a dense medium cyclone (DMC)/flotation Coal Processing Plant (CPP) with a 145 tonnes per hour (tph) capacity, with fine processed rock (fine processed rock, defined as materials smaller than 0.5 millimetres [mm]) dewatered to 40 percent (%) solids content by a belt filter press, before being combined with the coarse reject and stockpiled for disposal. A schematic of the CPP is shown in **Figure 1-2.**

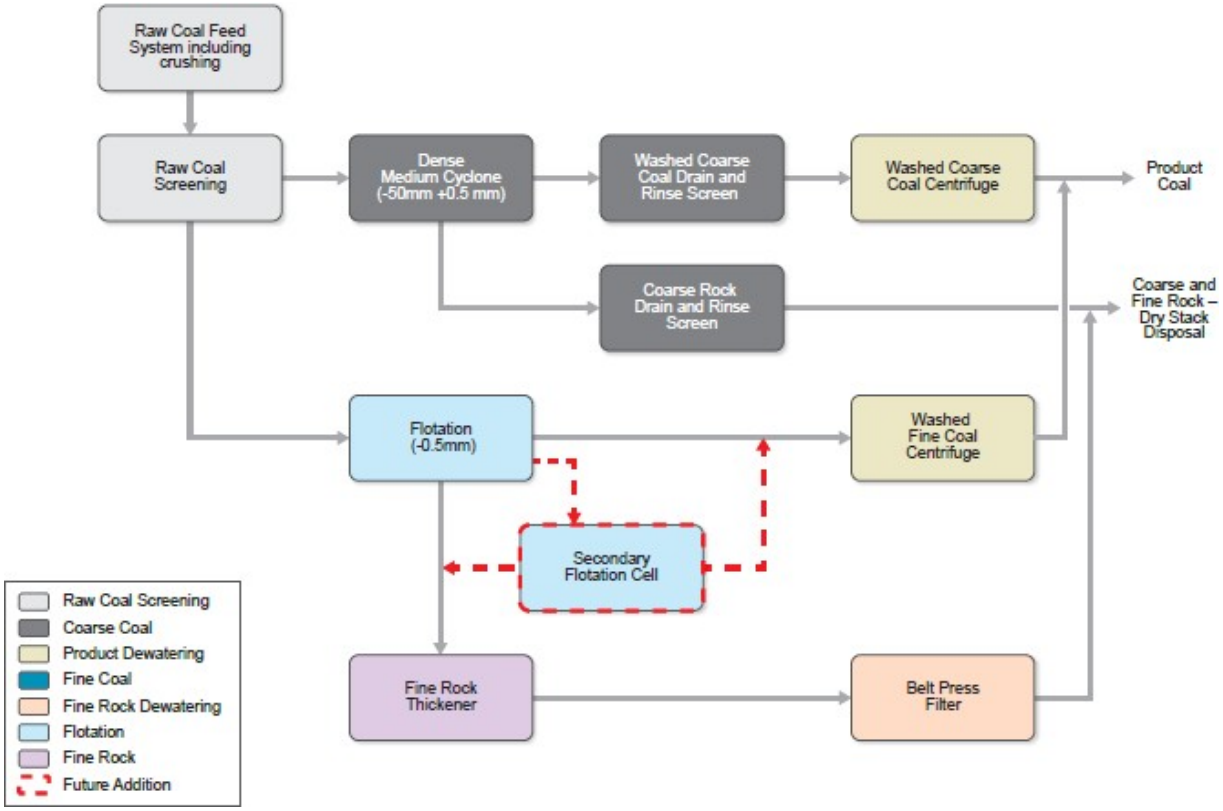
The Tenas Environmental Assessment (EA) Open Pit contains both PAG and non-PAG materials (see **Section 2**). The current mine plan involves separating mine rock based on its potential to generate acid, as it is extracted. A zone model has been developed for rock units within the open pit, and supplemental geochemical testing will be conducted during the Operation Phase to confirm mine rock properties. Non-economic materials from the project are expected to include:

- Non-PAG reclamation materials (surface soils) and overburden from open pit mining and haul road development (24.22 million banked cubic metres [MBCM]);
- PAG[1] mine rock from open pit mining (31.83 MBCM);
- Non-PAG rock from open pit mining including rehandle (29.52 MBCM); and
- Coarse and fine processed rock. These materials are also expected to be PAG (total 3.28 MBCM).

In addition, portions of the open pit walls are expected to be PAG. The mine production schedule is summarized in **Figure 1-3**. The risk of neutral ML from non-PAG rock is also considered in this assessment.

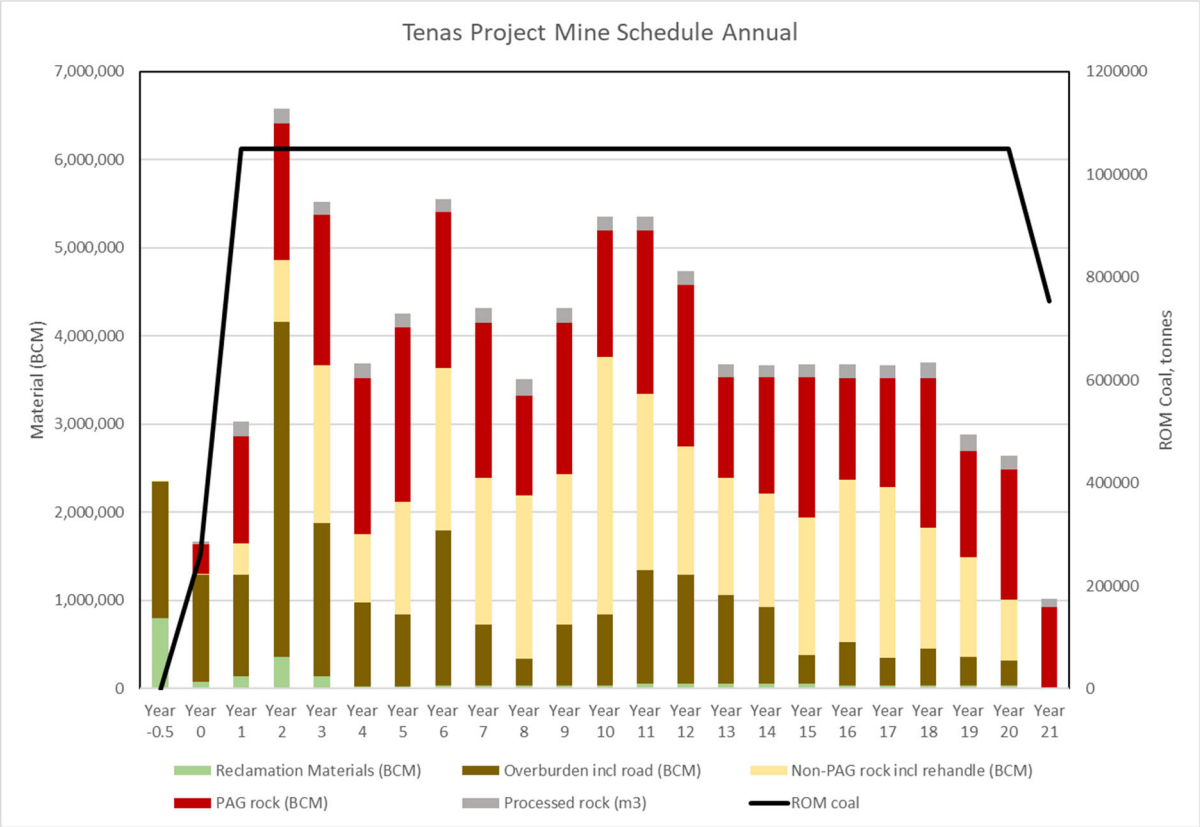
[1] PAG defined as rock with a neutralization potential ratio (NPR) less than 2, see **Section 2.**

Figure 1-2: DMC/Flotation CPP Schematic



***Sources**: SRK 2019a*

Figure 1-3: Tenas Project Annual Production Schedule



2 Geochemical Material Characterization

2.1 Background

A comprehensive historical geochemical characterization program was completed for the Telkwa Project (Norecol Dames and Moore 1999) which included geochemical testing of over 700 samples. A supplemental geochemical characterization program was conducted in 2019 (SRK 2019b) which included additional testing of 173 selected samples from the 1999 program, as well as collection and testing of 19 additional samples of processed rock, overburden, and construction rockfill.

Based on these characterizations, mine rock for the Project is characterized as non-PAG or PAG by acid base accounting (ABA), which measures the ratio of the Neutralization Potential (NP) to the Acid Potential (AP) of the material (i.e., the Neutralization Potential Ratio [NPR]). When the mineralogical contributors to NP and AP are well understood (i.e., NP is like that provided by calcite, AP is from oxidation of pyrite and these minerals have the same availability), regulatory guidance allows that NPR of 2 can be used to define PAG versus non-PAG (MEND 2009). The results of the supplemental mine rock geochemical characterization for the Project showed a strong positive relationship between modified-NP and presence of calcium plus magnesium, which provides confidence in the ABA calculations (SRK 2019b). In addition, there was a strong correlation based on modified-NP and NP calculated based on minerology NP-XRD (SRK 2022). Based on this relationship, an NPR of 2 is selected to identify rock as PAG or non-PAG, consistent with the guidelines.

The results of geochemical characterization are summarized for the different mine rock types in **Table 2-1**, and described in the following sections.

Table 2-1: Non-Economic Material Geochemical Characterization

Material Type	Geochemical Characterization
Mine Rock	Ten (10) zones: 3 non-PAG, 7 PAG, 2 of which are not mined by the EA open pit (zones 7 and 8)
Processed rock (coarse and fine)	PAG
Reclamation materials (surface soils) and Overburden	non-PAG
Open Pit Walls	8 zones: 3 non-PAG, 6 PAG

Sources: *Compiled in text.*

Notes: *EA=environmental assessment; PAG=potentially acid generating; PAG distinction based on NPR ≤2*

2.2 Mine Rock

Seven (7) non-economic rock zones were defined in the 1990s by reference to the coal seams, with four (4) added (0, 1a, 7, and 8) to represent the entire Tenas Deposit and reflecting EA zone geochemical model, as summarized by **Table 2-2** and shown in **Figure 2-1**.

Table 2-2: Acid Rock Drainage (ARD) Management Zone Definitions (Potentially Acid Generating (PAG) Material Highlighted in Yellow)

Zone	Stratigraphic Location	Average Weighted NPR
0	Till and overburden – topography to bedrock surface	17.5
1	Bedrock surface to top of Seam e (minus Zone 1a)	3.5
1a	Select area above Seam e to bottom of Seam e	0.8
2 & 3	Bottom of Seam e to bottom of Seam c	0.9
4	Bottom of Seam c to top of Seam b	2.7
5	Top of Seam b to top of Seam 1U	1.4
55	Top of Seam 1U to bottom of Seam 1L	2.3
6	Bottom of Seam 1L to bottom of Seam 1Lc	1.4
7**	Below Seam 1Lc to the bottom of Seam 1Ld	1.7
8**	Below Seam 1Ld	5.5

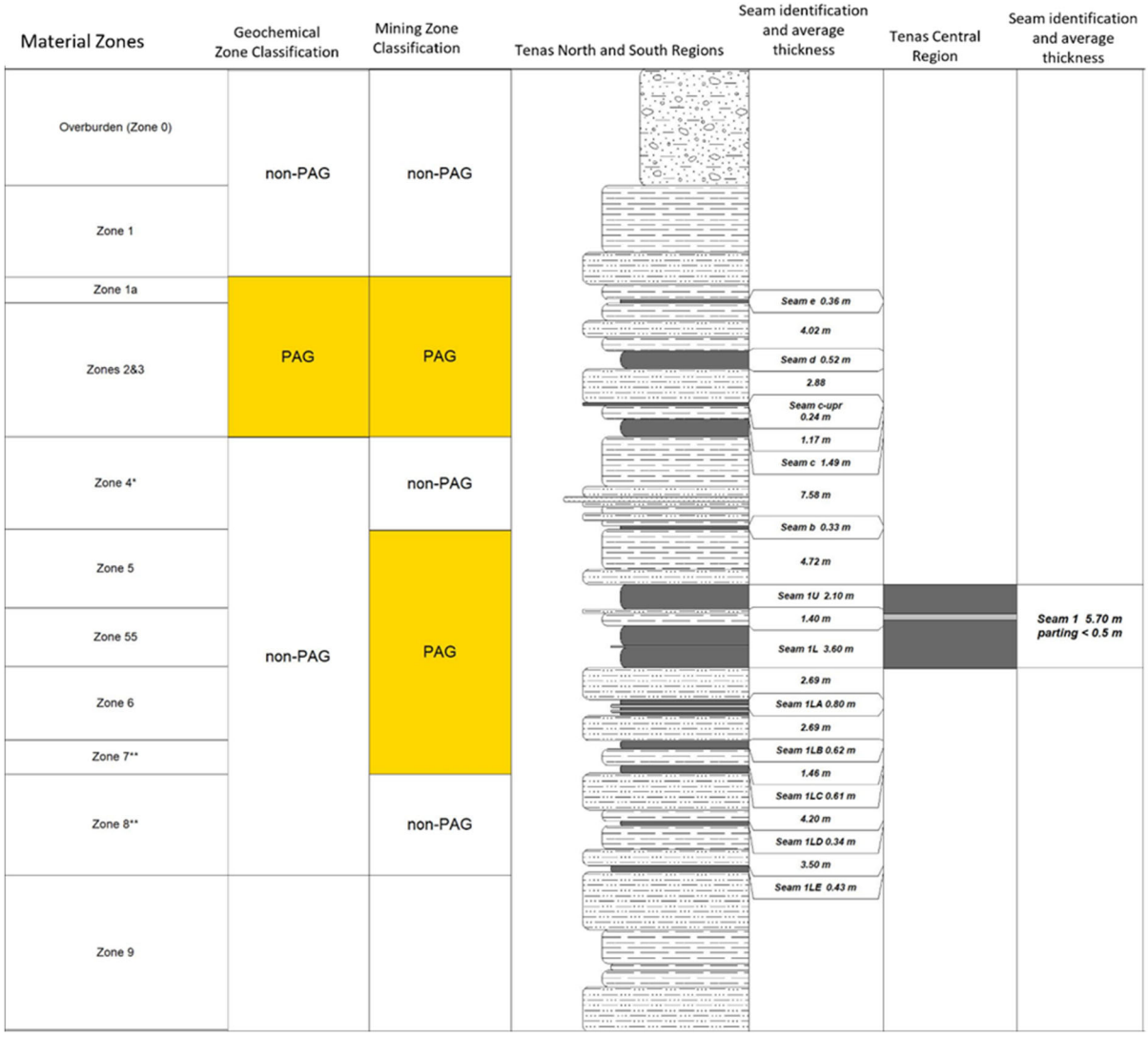
Sources: SRK 2019b)

Notes: *EA=environmental assessment; NPR=neutralization potential ratio; PAG=potentially acid generating*

(1) Zone 4 is spatially segregated as non-PAG and PAG, with the larger portion of the zone (75%) being non-PAG,

***these two zones are currently not being excavated by the EA Open Pit*

Figure 2-1: Tenas Project Lithology



According to SRK (2019b), seven (7) (Zones 1a, 2/3, 5, 55, 6 and 7) out of the 11 zones have average NPRs less than 2 and are classified as PAG, even though all zones, except for Zone 1a, have a component of non-PAG rock (i.e., the non-PAG rock is included in the PAG estimates as part of the mine plan). Zones 1 and 8 are classified as non-PAG. Zone 4 contains quantities of both PAG and non-PAG mine rock but is classified as non-PAG based on the overall weighted average of the Zone, however in mine planning the portions of this zone identified as PAG were managed as other PAG rock zones.

In summary, the following zones were identified to be PAG and non-PAG:

- **Non-PAG** – Zones 0 (includes overburden and reclamation materials/surface soils), 1, 4 and 8 (not excavated in EA mine plan); and
- **PAG** – Zones 1a, 2/3, 5, 55, 6 and 7 (not excavate in the EA mine plan).

The sulfide oxidation rates in the humidity cell samples were used to estimate the lag time for acid generation (SRK 2019b). The evaluation indicated that for the bulk properties of PAG rock, the lag

time varies from 2 to 12 years for the different zones. A minimum lag time of 0.6 years was estimated for PAG rock units with minimum NPRs in Zone 4 under laboratory conditions. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

Geochemical testing has indicated elevated concentrations of aluminum, cadmium, nitrite, cobalt, and selenium may be present in leachate at both acidic and neutral/alkaline pH. Aluminum is projected to have high concentrations in suspended form. Note that sediment control for the project is outside of the scope of this assessment.

2.3 Processed Rock

Processed rock samples tested were generally found to be PAG and contained more sulphur than interburden mine rock. Depletion calculations on the humidity cell tests (SRK 2019b) indicate that NP will be consumed prior to sulfide in all samples, with the NP predicted to be depleted after 1.3 years based on laboratory conditions. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

2.4 Reclamation Materials (Surface Soils) and Overburden

All the overburden and reclamation material (surface soil) samples tested had NPRs greater than 2 and were classified as non-PAG (SRK 2019b).

2.5 Open Pit Walls

At Post-closure, an end-pit lake will form in portions of the backfilled open pit. However, unsubmerged open pit walls (highwall and footwall) will remain above the end-pit lake composed mainly of PAG Zone 6 rock. While loading rates are expected to be lower than those of PAG mine rock or processed rock due to the lower reaction surface areas, these exposed surfaces should be expected to become acid-generating within 2 to 12 years based on laboratory conditions and contribute ML/ARD to the end-pit lakes if not management plan is provided. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

3 Methods

As defined in the AIR (EAO 2022), this framework constitutes an assessment of alternative means for material management, that are technically and economically feasible, of both PAG and non-PAG materials. PAG materials include processed rock (coarse coal rejects, fine coal rejects, and tailings) and mine generated PAG material (EAO 2015).

The following four (4) steps, consistent with CEAA (2012), were adopted to determine the preferred PAG management alternative for the Project:

1. Identify technically and economically feasible alternatives.
2. Characterize the options, including their potential effectiveness at reducing ML/ARD and expected effects on the environment and communities.
3. Select the approach for the analysis of alternatives means.
4. Assess the environmental effects of the preferred alternative, or alternatives if multiple are being carried forward.

Potential alternatives were first screened for cost effectiveness and technical applicability. Alternatives that met the screening criteria are further assessed based on their environmental and community effects. This assessment is carried out qualitatively, at a level sufficient to distinguish the relative merits of the different alternatives based on consideration for the advantages and disadvantages of each.

4 Performance Objectives and Criteria

PAG management alternatives are evaluated with respect to their effectiveness in mitigating long-term project risks and their potential effects on VCs. Feedback obtained from community outreach and consultations were considered in defining the VCs and establishing these objectives. The following criteria are considered for this assessment:

- Cost effectiveness;
- Technically applicability, including system integrity and reliability;
- Effects on the natural environment;
- Community effects and input including human health; and

These criteria are discussed further in the following subsections.

4.1 Cost Effectiveness

The cost effectiveness performance objective compares the relative capital and life cycle (including Post-closure) costs of each alternative, relative to the corresponding long-term benefits. Cost considerations include pre-mining (capital) construction, operating and sustaining costs, closure, and Post-closure operations, maintenance, and surveillance costs, as well as amenability for financing and financial risk.

Preference is given to lower-maintenance alternatives and alternatives that enable deferral of construction costs into cash-flow positive periods of the mine life.

4.2 Technical Applicability, System Integrity, and Reliability

The technical performance objective addresses the following technical risks associated with the alternative:

- Suitability for the proposed mine plan, climate, terrain, and design;
- Precedence of successful implementation in similar conditions;
- Risk of long-term degradation or failure of the system;
- Feasibility and ease of implementing contingency measures should the system degrade or fail; and
- Reliance on long-term operations, surveillance, and maintenance.

4.3 Effects on the Natural Environment

This performance objective describes the expected effectiveness of the alternative in reducing impacts to the natural environment, and primarily refers to water quality in effluent and the receiving environment, and the resulting effects on aquatic life.

However, additional considerations include effects on natural hydrological regimes, footprint area, post-reclamation land use, air quality, and terrestrial fauna and flora.

4.4 Community Effects and Input Including Human Health

This performance objective evaluates the effects of the alternative on the local communities and considers feedback from ongoing engagement activities with the community of Telkwa and the Wet'suwet'en First Nation.

Community effects include aspects of cultural heritage as well as Aboriginal and treaty rights, and includes traditional land use, access to quality resources, community well-being (including access to education, infrastructure, and services), archaeological resources, outdoor recreation, noise and vibration, and human health.

5 Metal Leaching/Acid Rock Drainage (ML/ARD) Alternatives Assessment

This section describes the alternatives assessment for ML/ARD management for the following materials:

- Processed rock (coarse and fine);
- Open pit walls; and
- Mine rock (non-PAG and PAG).

Sulphide oxidation occurs when minerals containing sulphide and elemental sulphur are exposed to the weathering effects of oxygen and water. ARD results from premature depletion of acid neutralizing minerals and results in elevated metal solubility and faster sulphide weathering rates under acidic conditions, however, ML can also occur at circum-neutral pH. “Metal” in this context includes any constituents of potential concern (COPC) and is not limited to elements or parameters classified as metals. Measures to reduce ML/ARD generally require one or more of the following mechanisms shown in **Table 5-1**.

Table 5-1: Metal Leaching/Acid Rock Drainage (ML/ARD) Mitigation Mechanisms

Mechanism	Examples
Limiting oxygen availability	Subaqueous deposition, saturation covers, oxygen diffusion barriers
Limiting water availability[1]	Dry (shedding) covers
Neutralization of PAG materials[2]	PAG/non-PAG blending (“ideal blend”), tailings de-sulphurization
Neutralization of ARD after onset	Active treatment, passive treatment (bioreactors), “non-ideal” PAG/non-PAG blending
Removal of neutral metals after onset	Active treatment, passive treatment (bioreactors, wetlands)

Sources: *Modified from the GARD guide (2010)*

Notes: *ARD=acid rock drainage; PAG=potentially acid generating*

[1] Water is both a reactant and a transport mechanism for ML/ARD

[2] Neutralization of PAG materials may be achieved by removing or isolating sulphide materials, maximizing the availability of alkaline materials or porewater, or controlling bacteria and/or biogeochemical processes.

5.1 Alternative Characterization and Screening

Proposed alternative means for mitigating ML/ARD from PAG materials (processed rock, mine rock, and open pits), as well as non-PAG mine rock, evaluated for the Project are described in the following subsections and summarized in **Table 5-2**. These alternatives were screened for technical applicability and economic feasibility, as summarized in **Table 5-3**. Where more than one (1) alternative was technically feasible, the alternatives were evaluated with the environmental and social criteria to determine a final preferred alternative, as summarized in **Table 5-4**.

5.1.1 Fine Processed Rock (Tailings)

Processed rock storage (both fine and coarse) was discussed in each of the PAG management alternatives above and is discussed in further detail below. Note that total processed rock (coarse and fine) represents 8% of the total PAG materials, and 4% of the total mine rock (excluding overburden and reclamation materials (surface soils)), with fine processed rock making up a small percentage of project materials (2% of total PAG materials and 1% of total mine rock). The following

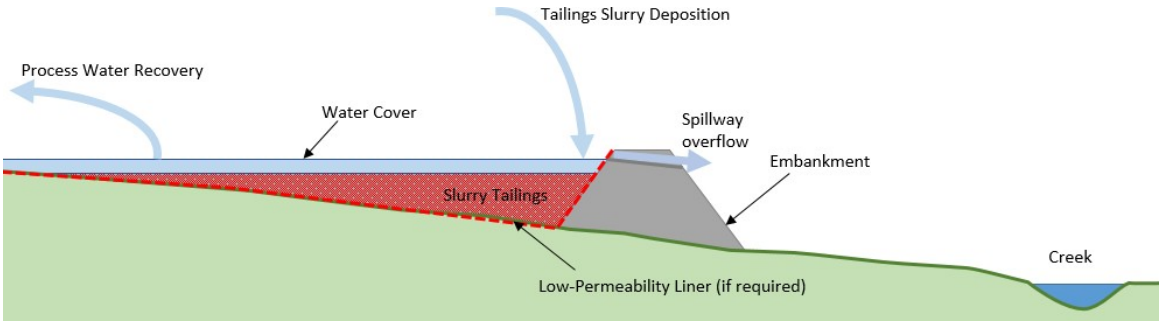
alternatives for fine processed rock are considered:

- Slurry, deposited in a conventional tailings impoundment, or
- Dewatered, and either stacked on-surface or co-disposed with coarse processed rock and/or mine rock (disposal options are discussed further in **Section 5.1.2**)

5.1.2 Conventional Tailings Impoundment

The mine plan described in the Manalta Telkwa Project Environmental Assessment (Manalta 1998) included a separate impoundment to store tailings. In this alternative, tailings are deposited subaqueously in a lined impoundment to prevent the onset of ARD. Water reclaimed from this facility supplies the coal processing plant process. This is shown schematically in **Figure 5-1**.

Figure 5-1: Processed Rock (Tailings) Impoundment Schematic



Notes: *Schematic. Not to scale.*

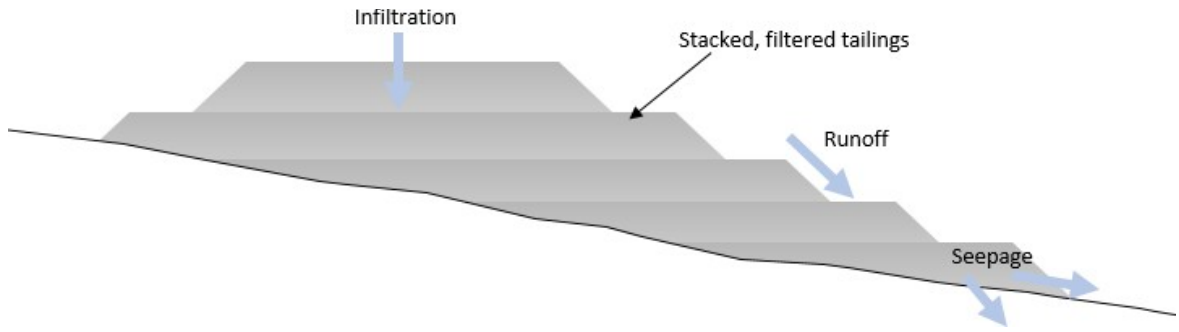
Dewatered Tailings Stack (Filter Press)

A dewatered processed rock (tailings) stack, separate from the PAG rock storage facility, was proposed as part of the Project feasibility study (SRK 2019a). Fine processed rock is dewatered to 40% solids by weight as part of the process, combined with the coarse processed rock, and trucked and placed in compacted lifts in a dedicated storage facility. Dewatering the fine processed rock allows the fine processed rock to be placed and stacked in a compacted pile without the need for an impoundment. It also increases the volume of water recovered, reducing freshwater makeup demands from either onsite or offsite sources.

Oxygen flux in fine materials is more likely to occur by diffusion rather than advection thereby significantly reducing oxygen availability for oxidation of sulphide minerals compared to coarser mine rock. In addition, fine materials can be partially saturated to a level at which the rate of air entry is the same as if the material were fully saturated with water. The moisture content at which this typically occurs is about 60%. Therefore, if the materials are sufficiently fine and well-compacted, the moisture content of the pile may be sufficient to prevent ML/ARD from occurring. Moisture content in the near surface would not be expected to be this high, and as such some ML/ARD should be expected to occur unless additional measures are implemented (e.g., soil cover, blending with neutralizing material).

For filtered tailings, a separate water management facility is typically required for site water management and to provide a source of process water supply.

Figure 5-2: Dry Stack Fine Processed Rock – Schematic



Notes: *Schematic. Not to scale.*

5.1.3 Coarse Processed Rock

The following alternatives were considered for coarse processed rock:

- Surface disposal (stack), in segregated coarse and fine processed rock piles;
- Surface disposal (stack), in blended coarse and fine processed rock piles; and
- Blended coarse and fine processed rock, co-disposed with mine rock underwater.

Segregated Processed Rock Piles

Both coarse processed rock and dewatered fine processed rock generally lend themselves to surface disposal. If dewatering of fine processed rock is selected for other reasons (e.g., water recycling in the process), the lowest effort option may be segregated surface piles. These piles would be placed on surface, likely near the process facility to reduce transportation requirements, and though have favorable geotechnical properties and may be effective in limiting ARD by limiting oxygen advection and seepage to deeper parts of the piles, they are likely to be susceptible to ML/ARD near surface. This alternative also requires drainage management from multiple sources, which increases risk and complexity.

Blended Fine/Coarse Processed Rock Piles

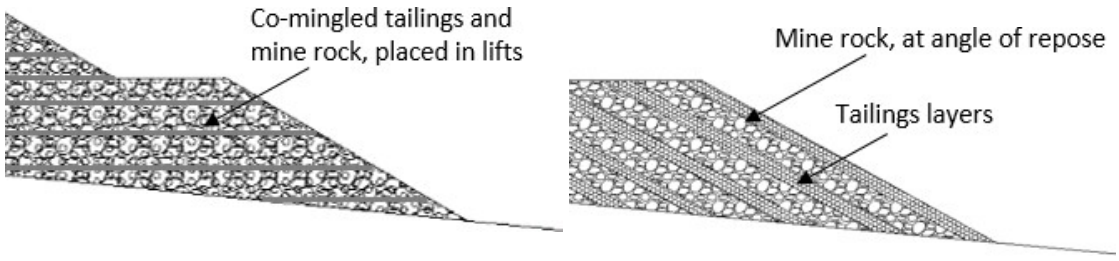
Blending dewatered fine and coarse processed rock can be done at the CPP, prior to transportation, to reduce the footprint and number of drainage management locations. Blending also has the benefit of further reducing oxygen advection and seepage compared to segregated piles.

Blended and Co-Disposal with Mine Rock

In this alternative, processed rock is co-mingled with PAG rock and deposited in the same facility. If the materials are going to be deposited subaqueously, fine processed rock may be dewatered or not, however dewatering simplifies transportation logistics and reduces freshwater demands. If the materials are going to be deposited in a surface pile, fine processed rock should be dewatered for stability and water management purposes, and co-mingled and/or placed in lifts to prevent segregation during placement. If the material will be submerged or disposed with non-PAG mine rock, end-dumping of different materials without specific co-mingling would provide similar results.

The two (2) configurations are shown schematically in **Figure 5-3**, though it is noted that the ratio of processed rock to mine rock is insufficient to allow effective layering for the Project.

Figure 5-3: Co-Disposal of Processed Rock with Mine rock – Schematic Options



(a) Co-mingled and placed in lifts **(b) End-dumped**

Notes: *Schematic. Not to scale.*

5.1.4 Open Pit Walls

Although planned the mine plan involves staging and backfilling of open pits with mine rock, open pit development will result in progressive and sustained exposure of PAG rock walls throughout the life of mine and, without mitigation, post-closure. The following alternatives to mitigate open pit wall ARD were considered:

- Do nothing;
- Partial end-pit lake established based on natural topography and staging;
- Total submergence end-pit lake established via construction of embankments; and
- Open is backfilled with non-PAG rock, overburden, and reclaimed materials.

Do Nothing

In this alternative, open pits are exploited sequentially per the mine plan, but no measures are taken to promote ponding and no material is placed on the exposed open pit walls. Inflows are allowed to drain by gravity and open pit walls remain exposed.

Partial End-Pit Lake

In this alternative, open pits are exploited sequentially per the mine plan and open pit development and sequencing is done to promote ponding within the open pits, resulting in formation of (relatively shallow) end-pit lakes. Inflows are allowed to drain by gravity and pit highwalls remain exposed. No material is placed on the exposed open pit walls.

Total Submergence End-Pit Lake

This alternative promotes total submergence of exposed open pit walls by the construction of embankments to impound water within and outside of the open pits once they are exhausted. No materials is placed on the exposed open pit walls.

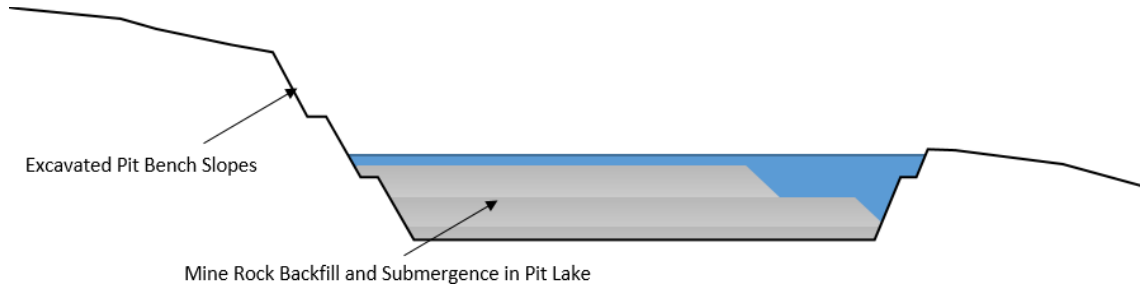
Backfill with Mine Rock and Overburden and Partial End-Pit Lake Submergence

In this alternative, open pit development will be staged in a way that facilitates progressive backfill with mine rock, and partial submergence during the Operation Phase with final end-pit lake elevations reached in the Decommissioning and Reclamation, and Post-closure phases. Upon decommissioning, remaining exposed open pit walls will be covered with excess overburden and non-PAG rock present in the backfill, embankments and buttresses, placed in lifts and reshaped to a final slope of 2.5H:1V. See **Figure 5-4**.

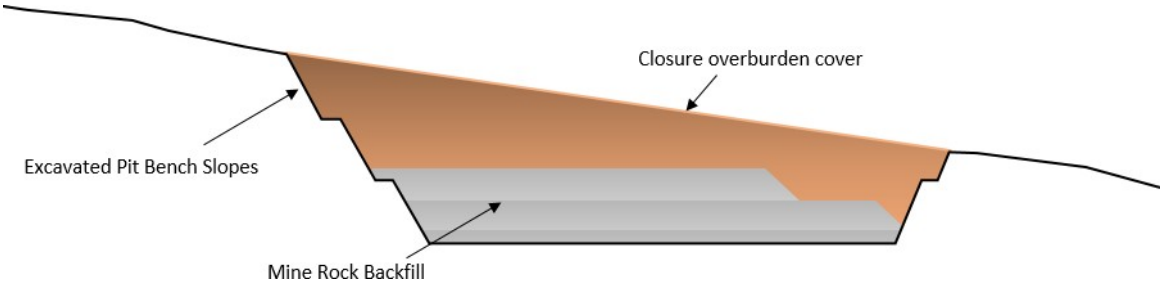
This approach is consistent with the mine development plan, as well as mine rock management objectives and the decommissioning and reclamation plan. The alternative approaches discussed above were not considered in detail in this assessment (see **Table 5-3** for selection rationale).

Figure 5-4: Open Pit Mine Rock Backfill and Submergence – Schematic

(a) Open Pit Backfill During Operation



(b) Open Pit Backfill Decommissioning and Reclamation Cover of Overburden and Reclamation Materials and Partial Submergence of Mine Rock with Water



Notes: *Schematic. Not to scale.*

5.1.5 Mine Rock

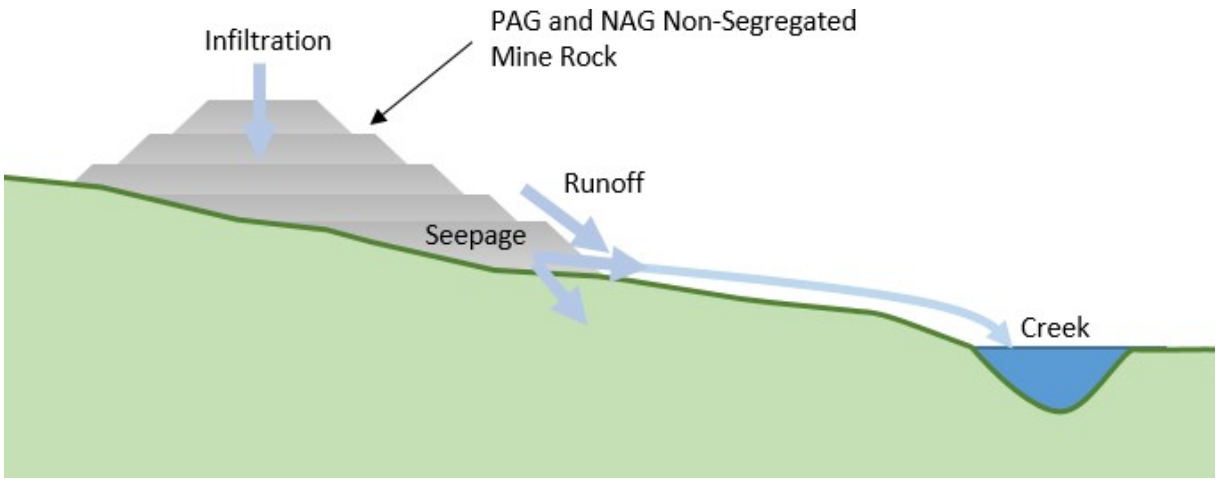
Do Nothing

In the “do nothing” scenario, mine rock generated from the open pit would be placed on surface without management of segregated PAG and non-PAG mine rock. The total mine rock volume is 60 MBMC plus an estimated 30% bulking, of which 52% is expected to be PAG. Depending on the timing and configuration of the mine rock deposition, some natural blending and neutralization may occur, however, pockets of PAG rock should be expected. The onset of acid generation would be expected to occur within 4 to 12 years (see **Section 2**), with some sections (Zone 4 NPR of 0.3) going acid in as little as 0.3 years under laboratory conditions.

Processed rock may be deposited in a separate storage facility (as per the Manalta project [1997]) or dewatered and deposited with the mine rock.

In this alternative, the effects of ML/ARD would be managed by the assimilative capacity of the site and dilution in receiving waterbodies. This alternative is shown schematically in **Figure 5-5**.

Figure 5-5: Do Nothing Option Schematic



Notes: *Schematic. Not to scale.*

Active Water Treatment

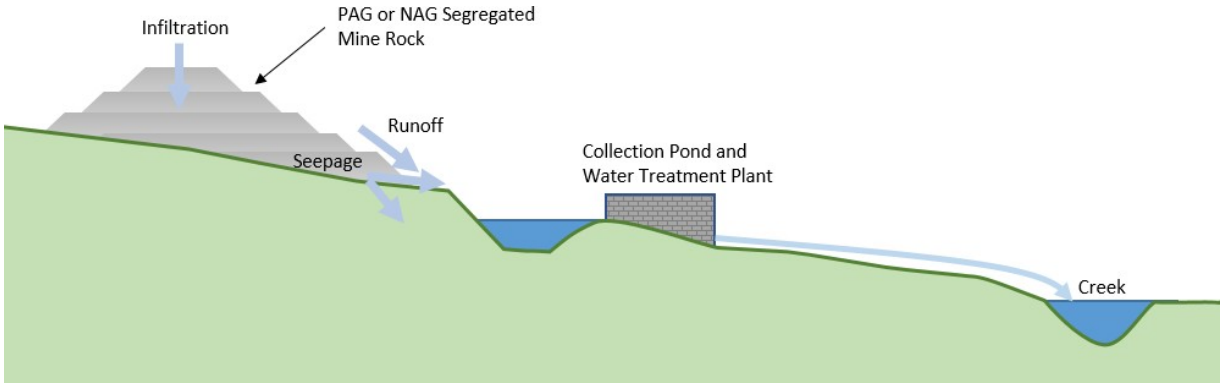
Active water treatment of ARD with lime was considered for the pre-feasibility study (SRK 2017a and 2017b) but was dismissed for the feasibility study (SRK 2019a) due to the risks associated with long-term operation of the water treatment plant, including management of sludges and maintenance of structures (ditches and ponds) to ensure strongly acidic waters are not accidentally discharged.

Active water treatment of neutral metal drainage has not been identified as a requirement based on water quality results.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with filtered processed rock in a dry storage pile, separate from the non-PAG and overburden storage facilities. Surface runoff and infiltration from this facility are collected and directed to a treatment plant consisting of lime-based neutralization, precipitation, solid/liquid separation and including a high-density sludge (HDS) system to optimize lime demand and reduce residual sludge volumes, consistent with the pre-feasibility study (SRK 2017a). The water treatment system would operate on a seasonal basis for 5 months per year from May through September, with excess water stored in winter months in collection ponds and/or depleted open pits and would discharge to Telkwa River. A schematic of the system is shown in **Figure 5-6.**

Lime treatment is expected to be effective at reducing effluent metal loads to acceptable levels. However, localized ML/ARD seeps and acidic pond water may impact local flora and fauna, and long-term operation of the facility and management of sludge presents operational and environmental risks.

Figure 5-6: Active Water Treatment Option Schematic

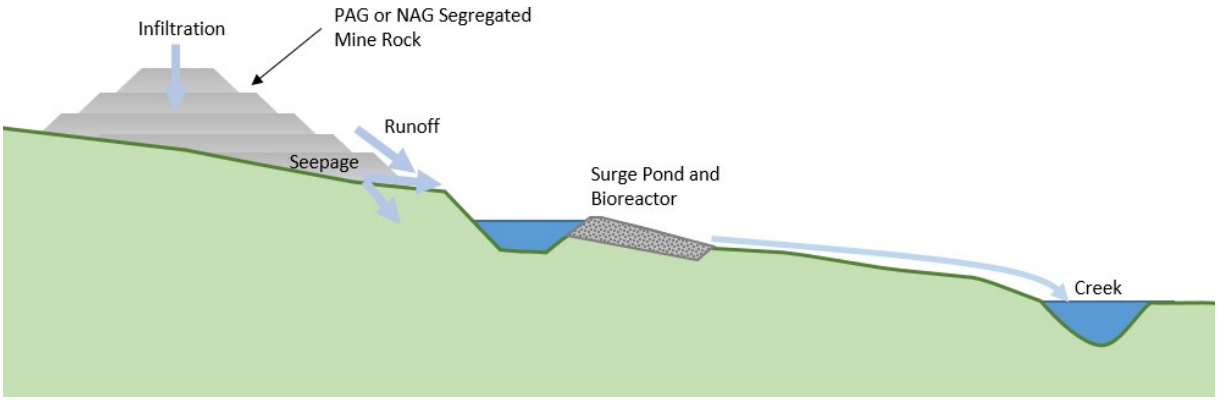


Notes: *Schematic. Not to scale.*

Passive Water Treatment

Passive water treatment has not previously been proposed for the project. Passive treatment systems exist for ARD neutralization and metal and nutrient removal from neutral drainage. This scenario evaluates a gravel bed bioreactor to remove nitrate and selenium, and potentially other parameters of concern, from the overflow from the sub-aqueous (PAG) and/or sub-aerial (non-PAG) mine rock storage areas during the Operation Phase. Design of passive treatment systems are highly dependent onsite conditions, including influent geochemistry, and site climate and hydrology. Detailed design of a passive treatment system has not been completed for the Project due to the significant challenges imposed by the site climate and geochemistry and significant retention times, water flow volumes, metal loading under ARD conditions, and areas expected to be required, and the inherent unpredictability of the systems at achieving water quality outcomes. See **Figure 5-7.**

Figure 5-7: Active Water Treatment Option Schematic



Notes: *Schematic. Not to scale.*

Potentially Acid Generating (PAG)/Non-PAG Blending

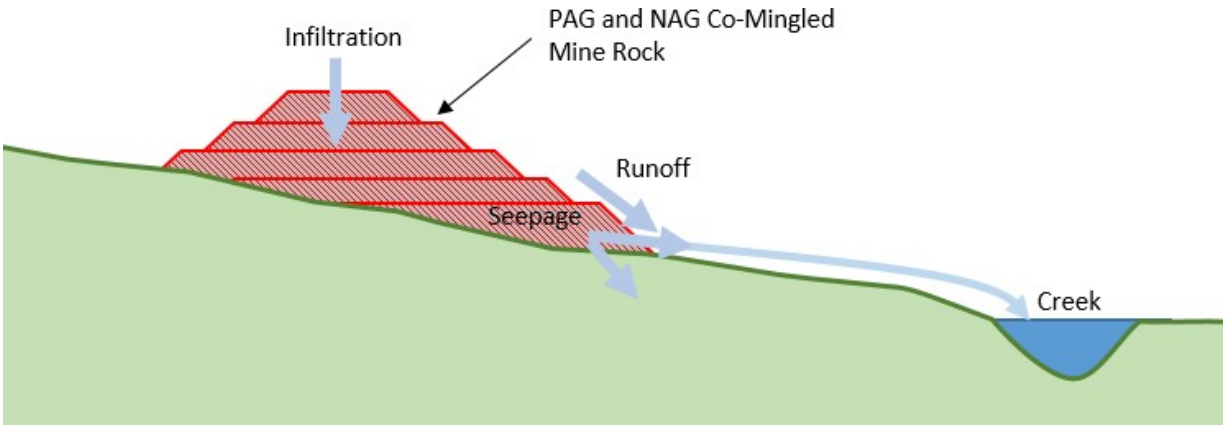
PAG/Non-PAG blending is achieved by co-mingling sufficient neutralizing alkaline materials with PAG materials, such that ML/ARD in the resulting seepage is avoided. An “ideal blend” occurs when, due to the availability and degree of blending of alkaline materials is sufficient that acidification and accelerated oxidation does not occur except at the grain scale. A “non-ideal” blend occurs when acidification and the resulting accelerated oxidation occurs at larger scales but is neutralized by alkaline materials along the flow path. In non-ideal blends, high concentrations of certain elements can persist in solution after neutralization, therefore these blends are less effective than ideal blends. The degree of mixing required to achieve an ideal blend is calculated in the form of a flow path length, based on the infiltration rate, degree of alkalinity and rate of acid generation. This alternative is shown schematically in **Figure 5-8.**

PAG/Non-PAG blending was initially proposed as part of the Manalta project in the 1990s (Manalta 1997, Piteau 1998), and was evaluated for the Project as part of the feasibility study (SRK 2017a, 2017b). The evaluation concluded that conventional blending will be challenging for the Project due to the lack of distinctive PAG and non-PAG layers, elevated sulphide content and high geochemical reactivity. Furthermore, due to the low NPR of PAG materials the lift thicknesses would need to be relatively thin (e.g., in the range of 150 mm) to achieve adequate blending. Lastly to ensure the blend was robust enough a NPR of in the range of 3 to 1 or greater would need to be achieved and there is simply not enough non-PAG rock to blend with PAG materials.

An important consideration for operational mine rock management is that as the stratigraphic average NP/AP_{blend} approaches the target NP/AP_{blend}, the need for rigorous operational control increases to ensure effective blending (SRK 2017b).

In addition, the NP/AP target for a blend mixture needs to be greater than that used to define ARD potential for individual samples ($NP/AP_{blend}>2$, as described in **Section 2**) to provide a factor of safety for inefficiencies of mixing. According to the mine plan, 52% of the mine rock to be produced from the Project is expected to be PAG, though all the PAG zones, except for Zone 1a, contained a component of non-PAG rock (SRK 2019b). Based on these proportions, heterogeneity of the zones, and relatively low NPRs of many of the zones (see **Table 2-2**), it is unlikely that sufficient neutralizing material will be produced over the course of mining activities to offset the PAG materials.

Figure 5-8: Potentially Acid Generating (PAG)/non-PAG Blending Option Schematic



Notes: *Schematic. Not to scale.*

Dry Covers

Dry covers were proposed for post-closure for the pre-feasibility study (SRK 2017a and 2017b) though, as noted above, they conservatively were assumed to not be sufficiently effective to preclude the need for water treatment of ML/ARD in the long term.

The objectives of the dry cover are to:

1. Reduce the supply of oxygen, to slow or prevent the sulphide oxidation reaction (acidification).
2. Reduce the supply of water available for ML/ARD.
3. Provide a surface for post-mining land-use reclamation and revegetation.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with dewatered processed rock in a dry storage pile, separate from the non-PAG and overburden storage facilities. Co-disposal of fine processed rock with mine rock reduces the available pore space within the PAG mine rock, reducing the rate of infiltration and oxygen ingress to the mine rock pile.

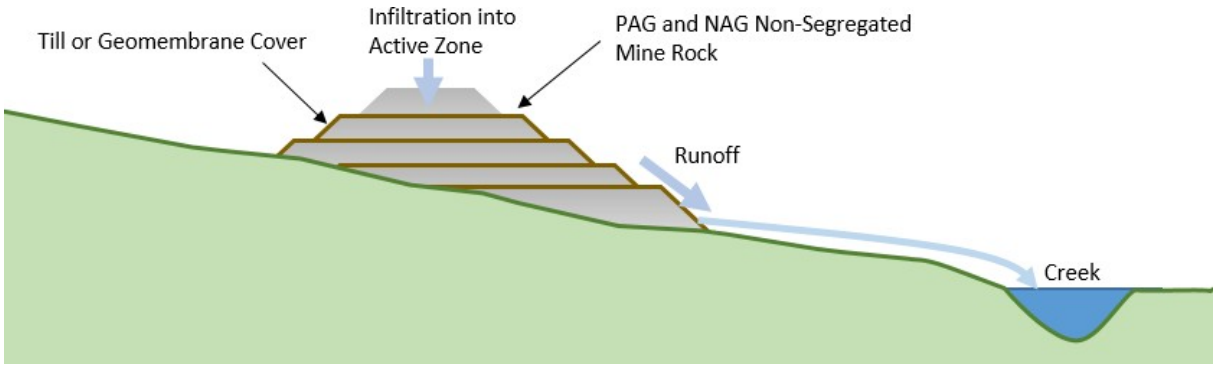
The mine rock piles are constructed in phases, and a dry cover is constructed progressively as shown in **Figure 5-9**. Based on geochemical characterization, the onset of acid generation of the PAG mine rock is expected to occur within 4 to 12 years (see **Section 2**), with some Zone 4 sections going acid in as little as 0.3 years. Onset of acid generation for processed rock is 6 years. Therefore, Zone 4 PAG materials should be segregated and stored separately and covered immediately (likely subaqueously). Progressive reclamation of the remaining PAG materials should be done with sufficient frequency to prevent the onset of acid generation (i.e., covers should be in place within 4 years of extraction). For the non-PAG rock piles, ML is expected to occur immediately but at relatively low concentrations. Progressive covering would be designed primarily to reduce mine rock infiltration and impacted seepage rates.

Areas of uncertainty regarding dry covers are generally related to long-term performance and the degree of effectiveness in reducing oxygen supply and infiltration (MEND 2009) and are related in large part to site climatic conditions and to the availability and properties of high-fines granular materials (glacial tills and clays) at the site. Due to the relatively wet climatic conditions at the

Project, some infiltration should be expected to occur through most covers. Addition of geosynthetic liners can further reduce rates of infiltration and oxygen advection but require additional cost and detailed Quality Assurance/Quality Control (QA/QC) during installation and operation.

For PAG rock piles, water treatment and/or other ML/ARD mitigation may be required during progressive operation of the PAG piles as they are progressively covered due to local variability in mine rock properties, and after closure due to imperfections in the cover system. However, water treatment rates would be expected to be significantly reduced compared to the active water treatment only case. For non-PAG rock piles, progressive cover is considered a conservative measure to further reduce effluent loadings to receiving water bodies.

Figure 5-9: Progressive Dry Cover Option Schematic



Notes: *Schematic. Not to scale.*

Wet Covers and Saturation Covers

Submergence or saturation of PAG materials has been demonstrated as being the most effective means of preventing ARD and reducing ML and has wide-ranging application in BC (MEND 2009). Due to the low solubility of oxygen in water, the rate of sulphide oxidation is controlled by mass transfer.

Key considerations for saturation covers are as follows:

- Submergence of weathered PAG materials can increase dissolution of soluble contaminants (e.g., from secondary oxidation reactions). Therefore, it is important to submerge PAG mine rock before onset of acid generation, or significant oxidation under non-acidic conditions;
- Saturation or water cover must be maintained in perpetuity, and design must account for natural and anthropogenic variations in hydrological regimes to prevent exposure of PAG materials to the atmosphere. However, finer materials can be partially saturated to a level at which the rate of oxygen ingress is the same as if the mine rock were fully saturated with water. The moisture content at which this typically occurs is about 60%. Therefore, if the PAG mine rock materials or (in the case of saturation cover, the cover materials) are sufficiently fine to maintain saturation in the pore spaces, temporary exposure should not result in oxidation reactions and ML/ARD; and
- Geotechnical risks increase with flooded impoundments. The potential consequence of impoundment failure must be considered, as well as the additional construction, maintenance,

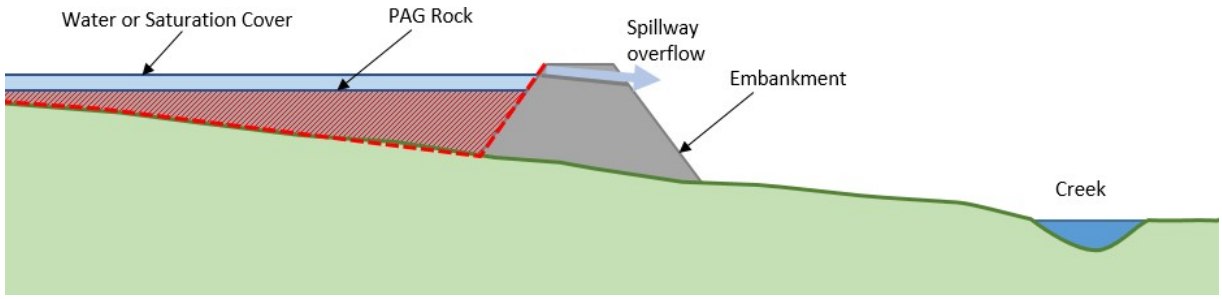
and surveillance requirements, in addition to the risk of ML/ARD.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with dewatered processed rock in a lined and flooded impoundment, separate from the non-PAG and overburden storage facilities. The impoundment embankment is raised progressively over the life of mine to accommodate PAG storage and water cover requirements. Construction of saturation covers are not considered feasible for operations because mine rock is continuously deposited in the PAG cells (management ponds).

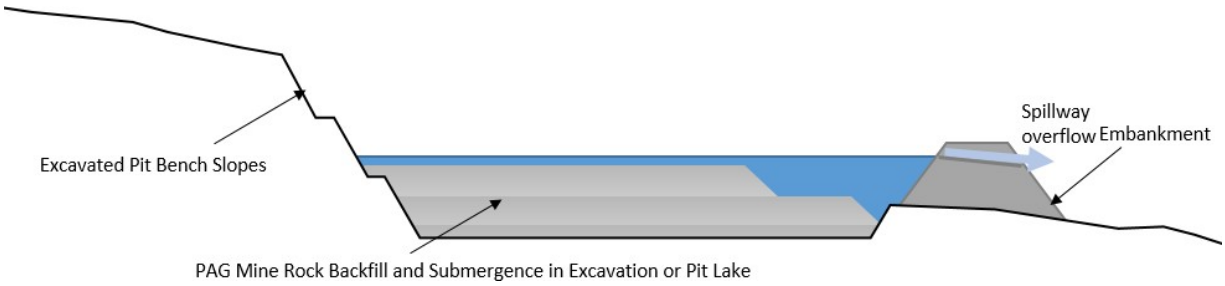
Co-disposal of fine processed rock with mine rock does not offer significant benefits to the PAG storage facility but eliminates the need for a separate PAG processed rock storage facility. An alternative configuration is considered in the feasibility study (2019a), in which PAG rock is deposited in excavated PAG cells (management ponds) with smaller impoundments. While this alternative reduces the overall embankment heights and thus geotechnical risks, it increases capital expenses (the entire facility must be excavated prior to PAG placement, rather than raised sequentially over the life of mine). Both alternatives are shown in **Figure 5-10**.

Figure 5-10: Wet Cover Option Schematic with Impoundment or Excavated Management Ponds (PAG cells)

a) Impoundment Disposal



b) Excavated PAG Cell (Management Pond) Disposal (shown as open pit)



Notes: *Schematic. Not to scale.*

5.1.6 Summary and Screening

Alternatives are summarized in **Table 5-2.** Initial screening of alternatives based on technical applicability and economic feasibility is presented in **Table 5-3.**

Technical applicability and economic feasibility selection criteria are defined as follows:

- **Unacceptable:** Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive). Alternatives that are either technically or economically unacceptable are discarded;
- **Challenging:** Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability. Alternatives that are either technically or economically challenging are discarded *if there is a more favorable alternative available*; and
- **Acceptable:** Is expected to achieve stated objectives without significant challenges or economic risk or liability.

Alternatives that are not discarded are either assessed further based on their effects on the natural environment and communities (**Section 5.2**) or selected if only one alternative is considered technically and economically feasible.

Table 5-2: Management Alternatives for Potentially Acid Generating (PAG) and non-PAG Materials

Component	Management Option	Description	ML/ARD Management Mechanism	Key Considerations
Mine rock	Do nothing	Non-segregated surface piles for PAG and non-PAG materials.	None.	The remineralization of carbon in some coal materials can consume oxygen at a greater rate than metal mine materials. Placement of coarser materials reduces oxidation reaction rates by reduced surface areas. However, mine rock at Telkwa is generally expected to be relatively fine.
	Active water treatment	Segregated surface piles for PAG and non-PAG materials. ARD or neutral metal leachate is collected and treated.	Neutralization of ARD and removal of neutral metals after onset.	Long term operations and maintenance, including sludge management post-closure.
	Passive water treatment	Segregated surface piles for PAG and non-PAG materials. Leachate is passed through a bioreactor to remove selected parameters of concern.	Neutralization of ARD and removal of neutral metals after onset. Biochemical anaerobic-anoxic reactions to consume nutrients and attenuate metals.	Site-specific design of system to address key parameters of concern and nutrient loading. High flow rates and low temperatures are key challenges for bioreactor effectiveness. Reliability of systems at meeting end-of-pipe concentration requirements makes permitting challenging Post-closure operations and maintenance challenges. Long term operations and maintenance, including sludge management post-closure.
	PAG and non-PAG blending	Blended PAG and non-PAG surface piles to achieve NPR>2.	Neutralization of PAG materials at source (ideal blend) or ARD after onset (non-ideal blend) ML/ARD.	Effectiveness of co-mingling of PAG and non-PAG materials, influenced by structural formation and mineralization. Challenging for the Project due to the lack of distinctive PAG and non-PAG layers, elevated sulphide content and high geochemical reactivity.
	Dry cover	Segregated surface piles for PAG and non-PAG materials. Piles are progressively covered with low-permeability materials (high-fines granular materials or geosynthetics).	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates.	Availability and material properties of high-fines granular materials (e.g., clays or glacial tills). Long-term (post-closure) effectiveness of cover, potentially supported by oxygen consumption of coal mine rock.
	Wet cover	Segregated PAG or non-PAG storage facility with water cover.	Limiting oxygen availability (diffusion).	Water cover maintenance. Geotechnical risk of impounded water and saturated processed rock, including post-closure. Placement of finer materials decreases rate of diffusion even under partial saturation conditions.
	Saturation cover	Segregated PAG or non-PAG storage facility with saturated granular fill cover.	Limiting oxygen availability (diffusion).	Maintaining saturation. Geotechnical risk of saturated processed rock (e.g., liquefaction). Presents logistical challenges during operations due to difficulty maintaining cover saturation during active placement. Placement of finer materials decreases rate of diffusion even under partial saturation conditions.
Processed rock (tailings)	Conventional slurry tailings impoundment	Deposition as conventional slurry in a tailings' impoundment with a water cover.	Limiting oxygen availability (diffusion).	Water cover maintenance during operations and post-closure. Geotechnical risk of impounded water and liquifiable tailings.
	Dewatered tailings stack (filter press) and on-surface coarse processed rock pile	Filter press circuit to dewater tailings and allow storage as dry stack or co-disposal with processed rock and/or mine rock.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Likely to require additional measures such as covers or active treatment if deposited on surface.	Placement of finer materials decreases oxygen ingress even under partial saturation conditions. Relatively small volumes to justify a separate disposal facility. Impact of the grain size distribution and water content of dewatered product on limiting oxygen advection and infiltration. Long-term geochemical weathering. Lower geotechnical risks compared to conventional slurry impoundments.
Coarse processed rock	Segregated processed rock piles	On-surface coarse reject pile and separate dewatered fine processed rock pile or impoundment (see Conventional slurry tailings impoundment).	None. Likely to require additional measures such as covers or active treatment.	Multiple PAG management facilities required, increasing cost, complexity, and post-closure risk. Oxidation near surface leading to ARD. Geotechnical stability and surface erosion. Relatively small volumes to justify a separate disposal facility.
	Blended fine/coarse processed rock piles	Processed rock and dewatered fine processed rock are blended and placed in dry surface stack.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Likely to require additional measures such as covers or active treatment.	Multiple PAG management facilities required, increasing cost, complexity, and post-closure risk. Oxidation near surface leading to ARD. Geotechnical stability and surface erosion.
	Blended and co-disposal with mine rock (PAG, non-PAG or unsegregated)	Processed rock and dewatered tailings are blended and co-mingled with mine rock prior to placement. Could be blended with segregated non-PAG rock, or unsegregated (PAG/non-PAG) mine rock.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Neutralization of PAG materials via blending (if option selected). May require additional measures such as covers or active treatment.	Geotechnical stability.

Component	Management Option	Description	ML/ARD Management Mechanism	Key Considerations
Open pit walls	Do nothing	Open pits are exploited sequentially. Inflow drains by gravity.	None.	Spatial constraints and haul distances for mine rock storage.
	Partial end-pit lake	Open pits are exploited sequentially, and open pit design and sequencing promotes formation of a partial end-pit lake in inactive open pits. Some of open pit walls remain exposed.	Limiting oxygen availability (diffusion).	Pit staging and geometry to promote ponding. Spatial constraints and haul distances for mine rock storage. Impact of exposed pit walls on pit lake geochemistry in the long term.
	Total submergence end-pit lake	Open pits are exploited sequentially, and embankments are constructed to promote formation of an end-pit lake in inactive open pits that completely submerges open pit walls.	Limiting oxygen availability (diffusion).	Embankment construction to promote ponding. Spatial constraints and haul distances for mine rock storage. Geotechnical risk of embankments during Operations and Post-closure phases.
	Backfill with mine rock and partial end-pit lake	Open pits are exploited sequentially, and embankments are constructed to promote formation of an end-pit lake in inactive open pits that partially submerges open pit walls.	Limiting oxygen availability (diffusion).	Embankment construction to promote ponding. Spatial constraints and haul distances for mine rock storage. Geotechnical risk of embankments during Operation, and Post-closure phases.

***Sources**: Compiled in report.*

***Notes**: ARD=acid rock drainage; ML=metal leaching; NPR=neutralization potential ratio; PAG=potentially acid generating*

Table 5-3: Initial Screening based on Technical and Economic Feasibility

Component	Management Option	Technical Applicability	Rationale	Economic Feasibility	Rationale	Screening Decision	Rationale
Fine processed rock (tailings)	Conventional slurry tailings impoundment	Acceptable	Conventional method which facilitates submergence of PAG materials, but results in requirement for a separate storage facility requiring long-term maintenance after closure.	Challenging	Lower initial capital and operating costs are offset by long-term costs of managing separate PAG facilities.	Discard	Lower initial cost and extensive precedence for effective management of PAG, however, creates additional technical challenges compared to other alternatives associated with managing multiple facilities, as well as geotechnical risk of impounded fine materials, without corresponding benefits.
	Dewatered fine processed rock (filter press)	Acceptable	Though more expensive, filter pressing is technically feasible and provides environmental benefits (e.g., increases process water recycling)	Challenging	Higher initial capital and operating costs due to process infrastructure requirements and transportation costs are offset by reduced long-term liability.	Select, in combination with other ML/ARD alternatives	Though higher cost initially, provides many benefits including reducing process water makeup demands, reducing geotechnical risk and project footprint, especially if paired with co-disposal with processed rock and mine rock. Does not, on its own, mitigate ML/ARD potential.
Coarse processed rock	Segregated coarse/fine processed rock piles	Challenging	Though surface coarse and dewatered processed rock disposal is well-established technology, it will present ML/ARD challenges in this application.	Challenging	Multiple PAG management facilities required, increasing cost and complexity.	Discard	Does not mitigate ML/ARD generation for PAG coal reject materials, and creates additional technical challenges associated with managing multiple facilities.
	Blended coarse/fine processed rock piles	Acceptable	Well established processed, that may help mitigate ML/ARD challenges.	Challenging	Multiple PAG management facilities required, increasing cost and complexity	Discard	Does not adequately mitigate ML/ARD generation for PAG coal reject materials, and creates additional technical challenges associated with managing multiple facilities. Does not offer benefits compared to co-disposal with mine rock.
	Blended and co-disposal with mine rock (non-PAG or unsegregated)	Acceptable	Well established technology, that may help mitigate ML/ARD challenges and reduces number of PAG management facilities.	Acceptable	Most economically viable method in the long-term, due to reduced number of separate PAG management facilities.	Select	Reduces technical complexity by providing a single PAG management location and provides additional benefits to geotechnical and geochemical performance of the mine rock pile.
Open pit walls	Do nothing	Unacceptable	Significant portions of the exposed pit wall area are expected to be acid generating, resulting in unacceptable water quality effects.	Challenging	Exposed PAG surfaces expected to require active dewatering and ARD water management.	Discard	Does not, on its own, adequately mitigate ML/ARD risk.
	Partial end-pit lake	Acceptable	Establishing end-pit lakes is feasible within the mine development staging plan and would reduce ARD as exposed open pit wall areas are relatively small compared to submerged open pit areas.	Acceptable	Establishing pit lakes is consistent with the mine plan and is expected to occur naturally due to the site hydrology, and therefore should not result in significant extra costs.	Discard	Provides adequate mitigation of ML/ARD risk due to reduction of exposed reactive surface areas, however, does not offer any corresponding benefits compared to the alternative with mine rock backfill.
	Total submergence end-pit lake	Challenging	Constructing embankments to submerge open pit walls is technically feasible, though introduces geotechnical risks without commensurate benefits of ARD risk reduction.	Challenging	Additional embankments introduce additional costs and long-term (post-closure) liabilities.	Discard	ARD-mitigation benefits offered by submerging pit walls during operations are offset by additional technical risk and long-term liability associated with the additional dams.
	Backfill with mine rock and partial end-pit lake	Acceptable	Backfilling open pits with mine rock and partial submerging is feasible within the mine development and has overall benefits of reducing the requirement for external PAG rock management and facilitating closure ARD management.	Acceptable	Backfilling with mine rock is complementary to the mine plan and reduces haul distances. Establishing end-pit lakes is consistent with the mine plan and is expected to occur naturally due to the site hydrology, and therefore should not result in significant extra costs	Select	Backfilling with mine rock is complementary to the mine plan and reduces haul distances, providing environmental, reclamation and economic benefits.
Mine rock	Do nothing	Unacceptable	Significant portions of the mine rock are expected to be acid generating, resulting in unacceptable water quality effects.	Unacceptable	Lack of ML/ARD management is expected to result in unacceptable long-term liability.	Discard	Does not, on its own, adequately mitigate ML/ARD risk.
	Active water treatment of PAG mine rock	Challenging	Lime treatment of ARD is a well-established technology, however, the ability to effectively capture ARD from sources presents potential challenges.	Challenging	Potential high capital costs, and requirement for long-term water treatment presents a significant long-term liability.	Assess further	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure conditions), and presents challenges associated with capturing ARD.
	Active water treatment of non-PAG mine rock	Challenging	Treatment methods of metals in neutral drainage are generally parameter specific, and multiple treatment methods would be required.	Unacceptable	Capital and operating cost of multiple treatment methods presents an unacceptable cost to the project.	Discard	Economic and technical challenges.
	Passive water treatment of non-PAG	Challenging	Passive water treatment systems have demonstrated effectiveness in reducing selected parameters of	Challenging	Significant areas and retention times are required for passive treatment in cold, wet climates, and challenges in	Discard	Economic and technical challenges.

Component	Management Option	Technical Applicability	Rationale	Economic Feasibility	Rationale	Screening Decision	Rationale
	mine rock		concern (notably selenium and nitrate), however, present challenges in cold, wet climates.		reliably predicting end-of-pipe compliance.		
	PAG/non-PAG blending	Unacceptable	PAG/non-PAG blending presents many challenges and has limited examples of successful application. In addition, PAG/non-PAG mass balance does not support this alternative.	Challenging	Significant logistical and construction effort is required to achieve effective blending.	Discard	Not likely to be achievable based on-site conditions.
	Dry cover over PAG (granular or geosynthetic)	Challenging	Dry covers are a well-established technology; however, it is generally agreed that they are effective at slowing, but not eliminating, processes for ARD in cold, wet BC climates.	Challenging	Significant construction effort and perpetual ongoing monitoring and maintenance required to ensure cover performance at limiting ARD reactions.	Discard	Unlikely to adequately mitigate ML/ARD from PAG materials.
	Dry cover over non-PAG (granular or geosynthetic)	Preferred	Dry covers are a well-established technology at limiting infiltration, which should be effective at limiting neutral metal leaching.	Acceptable	Significant construction effort and ongoing monitoring and maintenance required to ensure cover performance; however, lower performance measures are required to limit metal leaching than ARD reactions.	Assess further	Dry cover is an effective long-term risk mitigation method.
	Wet cover over PAG	Acceptable	Wet covers are a well-established technology for ML/ARD management in cold, wet BC climates.	Acceptable	Higher capital costs for impoundment construction are offset by lower long-term operating costs associated with preventing ARD.	Assess further	Most robust alternative and cost-effective alternative for mitigating ML/ARD from PAG materials in a humid environment. However, requires an impoundment which increases geotechnical risk.
	Wet cover over non-PAG	Acceptable	Wet covers are a well-established technology for ML/ARD management in cold, wet BC climates.	Unacceptable	The cost and effort required to maintain submergence of the full volume of both PAG and non-PAG materials is likely to be prohibitive.	Discard	Submerging both PAG and non-PAG material volumes would negatively affect project economics and create additional geotechnical risks without corresponding benefit of improving environmental outcomes.
	Saturation cover over PAG	Acceptable (closure)	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk. Not feasible during operations due to the need for continual material placement.	Acceptable (closure)	Logistically challenging to place progressive saturated covers during active deposition. For closure, higher capital costs for impoundment and cover construction are offset by lower long-term costs associated with preventing ARD post-closure.	Assess further	Most robust alternative and cost-effective alternative for mitigating ML/ARD from PAG materials in a humid environment post-closure. Geotechnical risk of impoundment exists but is reduced compared to water cover.
	Saturation cover over non-PAG	Acceptable	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk.	Unacceptable	The cost and effort required to construct and maintain saturated cover of the full volume of both PAG and non-PAG materials is likely to be prohibitive.	Discard	Submerging both PAG and non-PAG material volumes would negatively affect project economics and create additional geotechnical risks without corresponding benefit of improving environmental outcomes.

Sources: *Compiled in report.*

Notes*: ARD=acid rock drainage; ML=metal leaching; PAG=potentially acid generating*

Technical Applicability and Economic Feasibility selection criteria are defined as follows:

- *Unacceptable: Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive).*
- *Challenging: Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability.*
- *Acceptable: Is expected to achieve stated objectives without significant challenges or economic risk or liability.*

5.2 Environmental and Community Alternatives Assessment

Based on the pre-screening assessment detailed in **Table 5-3**, the alternative of blending dewatered fine rock and coarse processed rock and co-mingling with PAG mine rock is selected due to lack of technically and economically feasible alternatives. Similarly, ML/ARD from open pit walls will be managed by progressively backfilling with non-PAG rock and overburden and partially submerging as open pits become exhausted, and ML/ARD from non-PAG mine rock will be mitigated by progressive placement of overburden and reclamation material (surface soil) covers over the mine life.

Alternatives for PAG mine rock management (blended with processed rock) are evaluated against environmental and community effects criteria, as summarized in **Table 5-4.**

Table 5-4: Alternatives Assessment based on Effects on the Natural Environmental and Community Effects and Inputs including Human Health (Mine Rock)

Management Option	Environmental Effects	Rationale	Community Input	Rationale	Screening Decision	Rationale
Active water treatment of PAG mine rock	Challenging	Treating water will result in improved water quality outcomes in receiving environments but involves long-term management of water treatment sludge. Risk of not capturing ML/ARD seeps from the open pit and/or impoundments may result in environmental impacts.	Challenging	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure). Possibility of parameters of concern entering the downstream environment having a negative effect on human health.	Implement as contingency, in case of failure of other methods	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure conditions), and presents challenges associated with capturing ARD. However, water treatment is an effective mitigation technology in the case of failure of preferred ML/ARD prevention methods.
Wet cover over PAG	Acceptable	Wet covers are an effective method of effectively eliminating ML/ARD. Local climate lends itself to maintaining water cover, even under drought and climate change conditions. However, there is a risk of losing the wet cover due to evaporation and resultant ARD potential.	Challenging	Passive ML/ARD management option. However, presents long-term geotechnical risk associated with embankment failure	Select for operation phase	Effective at providing ML/ARD source control from PAG materials in a humid environment. However, requires an impoundment which increases geotechnical risk.
Saturation cover over PAG	Acceptable (closure)	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk.	Acceptable (closure)	Passive ML/ARD option that allows re-establishment of vegetation. Geotechnical risk of impoundment exists but is reduced compared to wet cover.	Select for Decommissioning and Reclamation and Post-closure phases	Effective at providing ML/ARD source control from PAG materials in a humid environment, but not practical to implement during active material placement. Geotechnical risk of impoundment exists but is reduced compared to water cover.

Sources: *Compiled in report.*

Notes*: ARD=acid rock drainage; ML=metal leaching; PAG=potentially acid generating*

Technical Applicability and Economic Feasibility selection criteria are defined as follows:

- *Unacceptable: Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive).*
- *Challenging: Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability.*
- *Acceptable: Is expected to achieve stated objectives without significant challenges or economic risk or liability.*

6 Conclusions and Recommendations

ML/ARD mitigations for PAG and non-PAG mine rock, including fine processed rock and open pit walls, recommended based on this assessment, and their rationale, are as follows:

Fine processed rock (tailings) treated as PAG: Dewatered fine processed rock (tailings) blended with coarse processed rock (also treated as PAG), for co-disposal with PAG mine rock and placed underwater for permanent storage:

- Increased process water recycling leading to lower freshwater makeup requirements; and
- Reduced operational complexity and risk of managing a single PAG facility.

Open pit walls: covered with non-PAG rock and overburden and partially submerged to form an end-pit lake during operations. Any remaining exposed open pit walls will be covered with an overburden and reclamation materials (surface soils) cover during the Decommissioning and Reclamation Phase to meet Post-closure land use objectives:

- Reduction of infiltration of water and oxygen to the open pit walls;
- Prevention of ML/ARD during Operation, Decommissioning and Reclamation, and Post-closure phases by providing constant availability of NP materials and seepage to the open pit wall; and
- Amenable to Post-closure restoration of pre-mining landforms.

Non-PAG mine rock: progressively covered with overburden and finally reclamation materials (surface soils):

- Reduced infiltration and seepage to the receiving environment; and
- Promote vegetation and meet Post-closure land use objectives.

PAG mine rock: impounded, with a water cover:

- Demonstrated effectiveness of the method in managing ML/ARD in the long-term;
- Ability to incorporate design contingencies to mitigate risks of system failure; and
- Relatively low operational and maintenance requirements, post-closure.

It is recommended that the Project design incorporate the following considerations:

1. Design the saturation cover depth with consideration to be resilient to drought conditions, considering the potential long-term effects of climate change.
2. Incorporate design measures to reduce the likelihood and potential consequence of an embankment failure on the downstream environment (e.g., closure spillways designed for the probable maximum flood (PMF), saturated rockfill cover Post-closure).

Other materials such as **overburden**, **reclamation materials (surface soils, woody debris)** and surficial construction materials (gravel and rock quarry) are not expected to require any specific material management procedures beyond best practices for excavation and placement of these materials.

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Regards,

SRK Consulting (Canada) Inc.



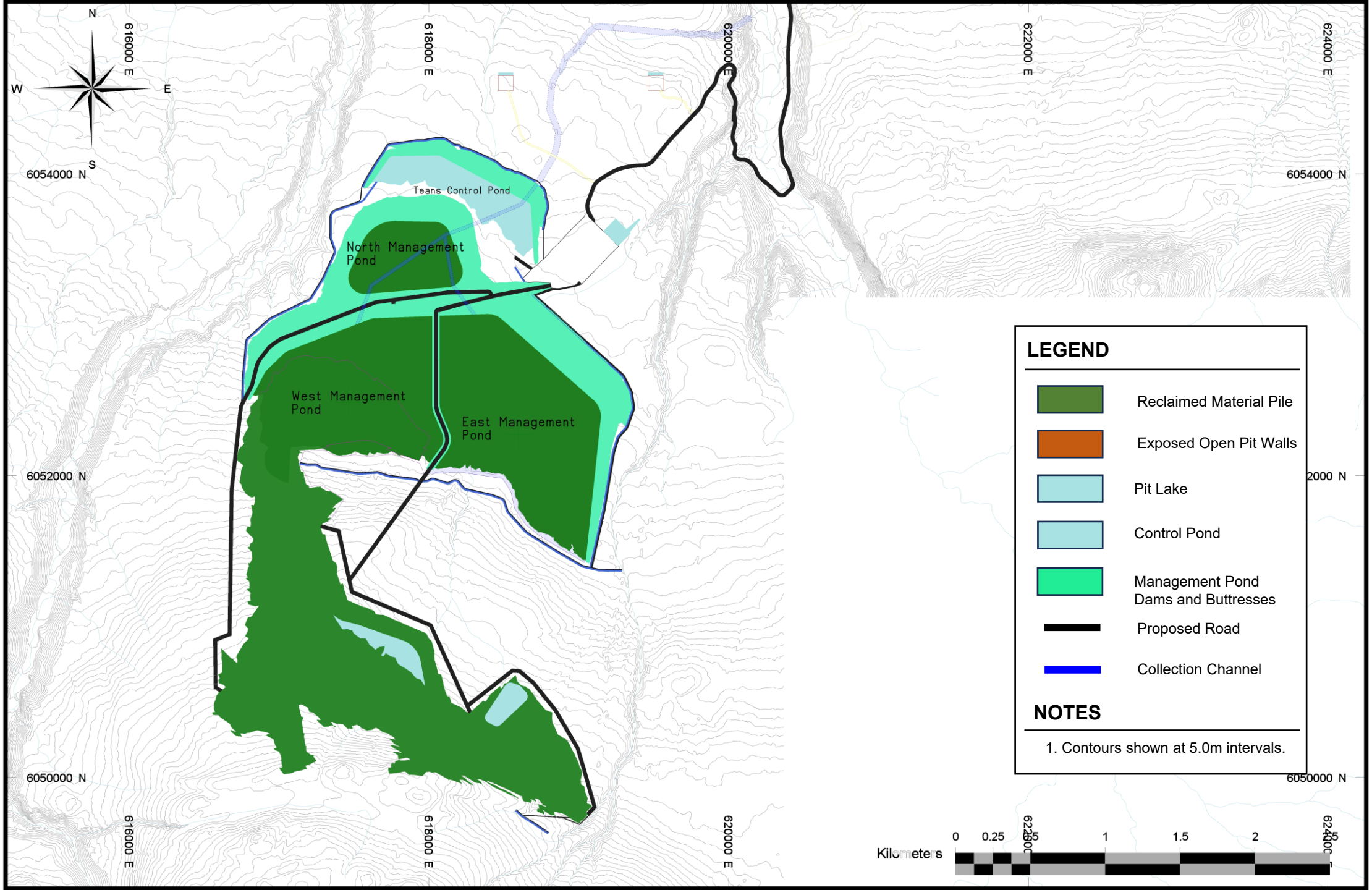
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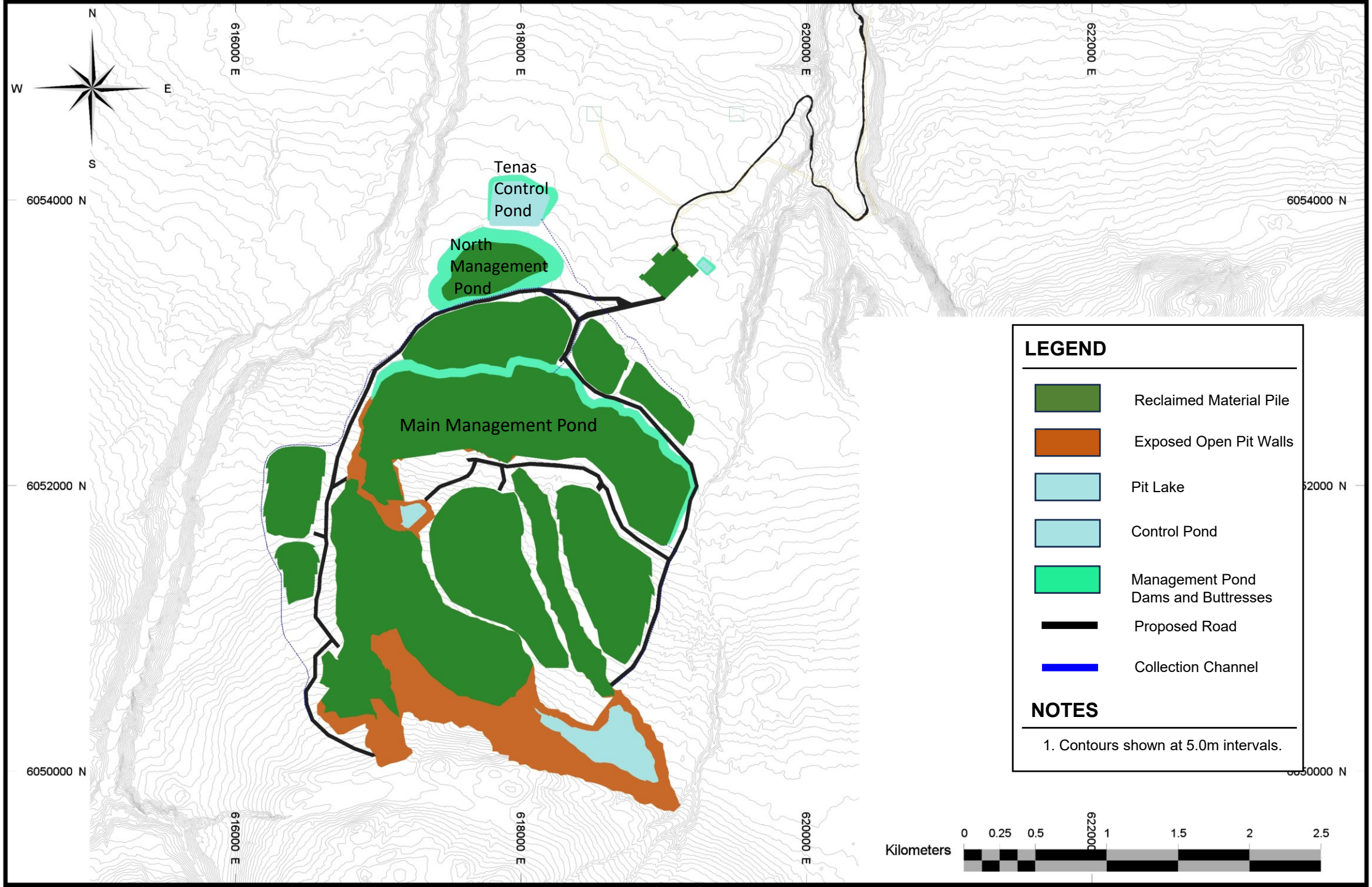
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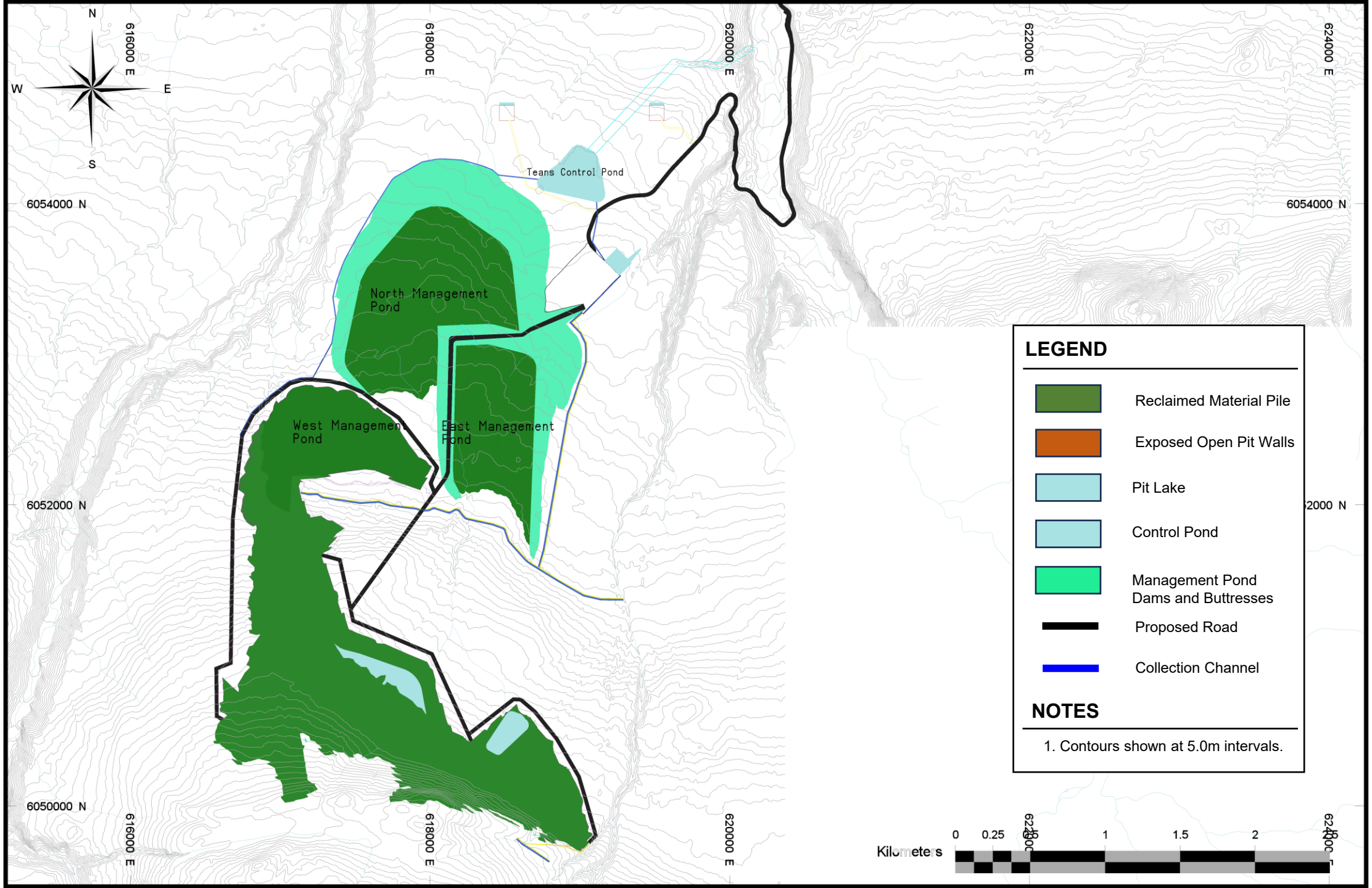
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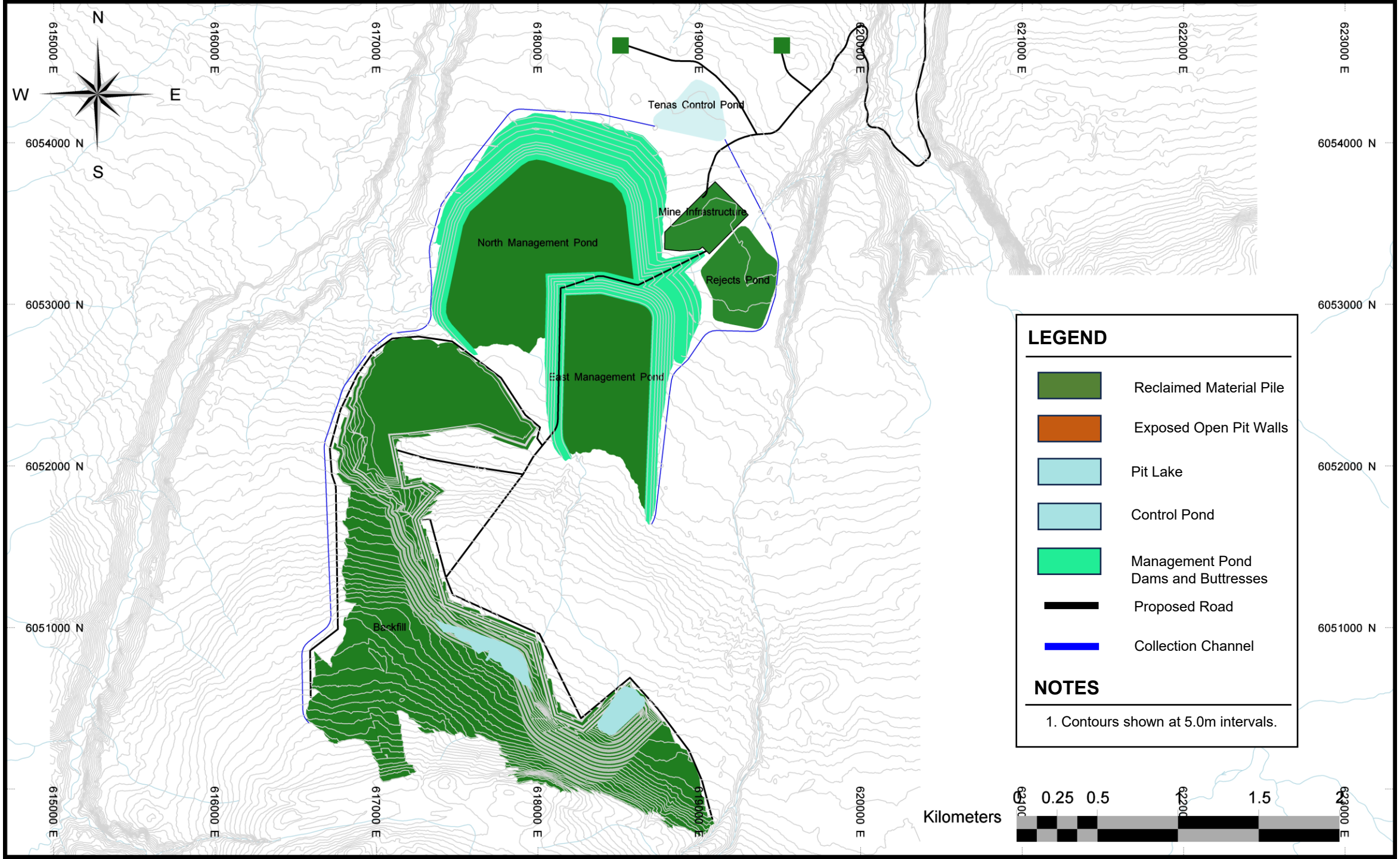
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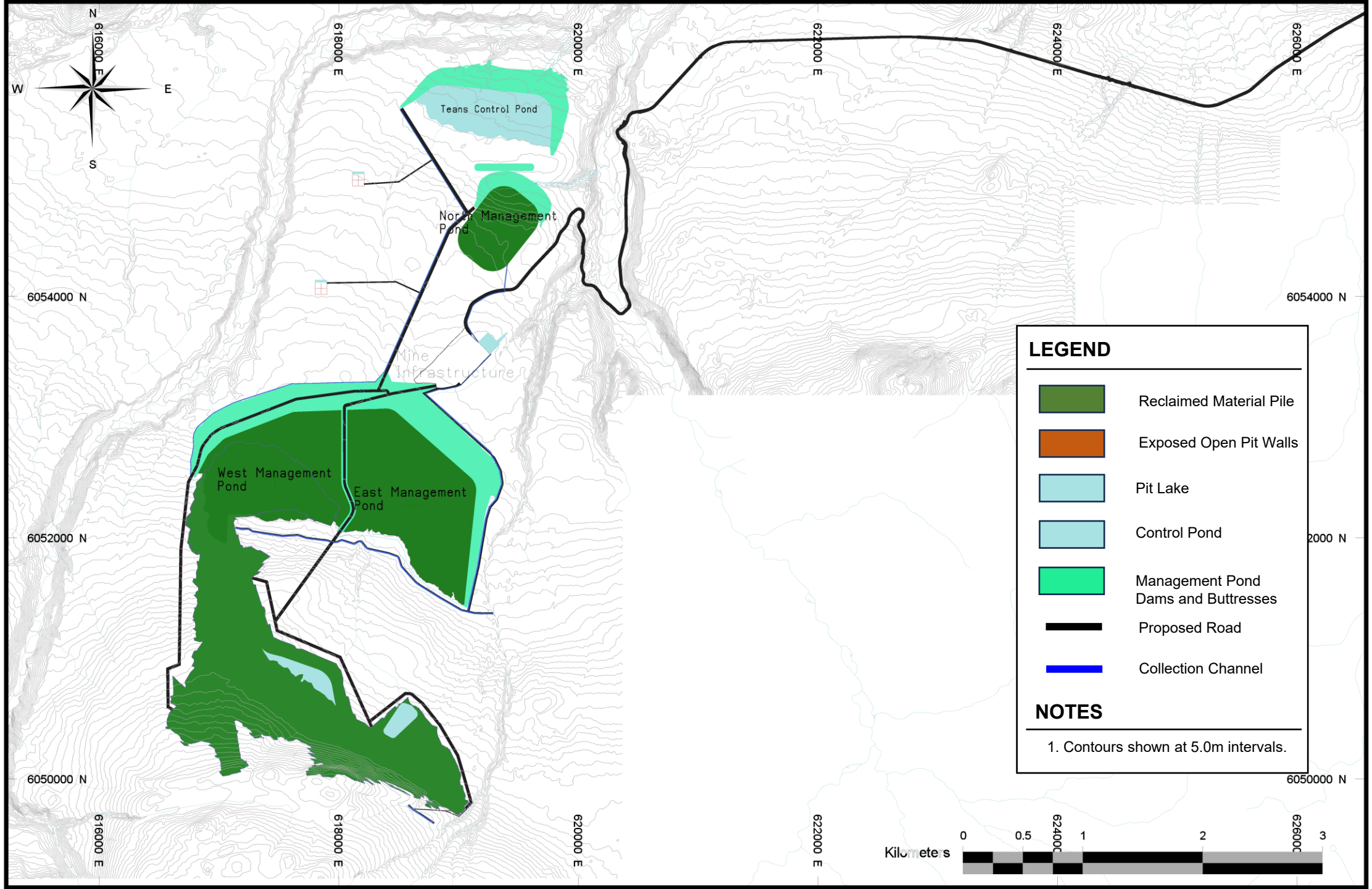
Appendix B Candidate Alternatives General Arrangements

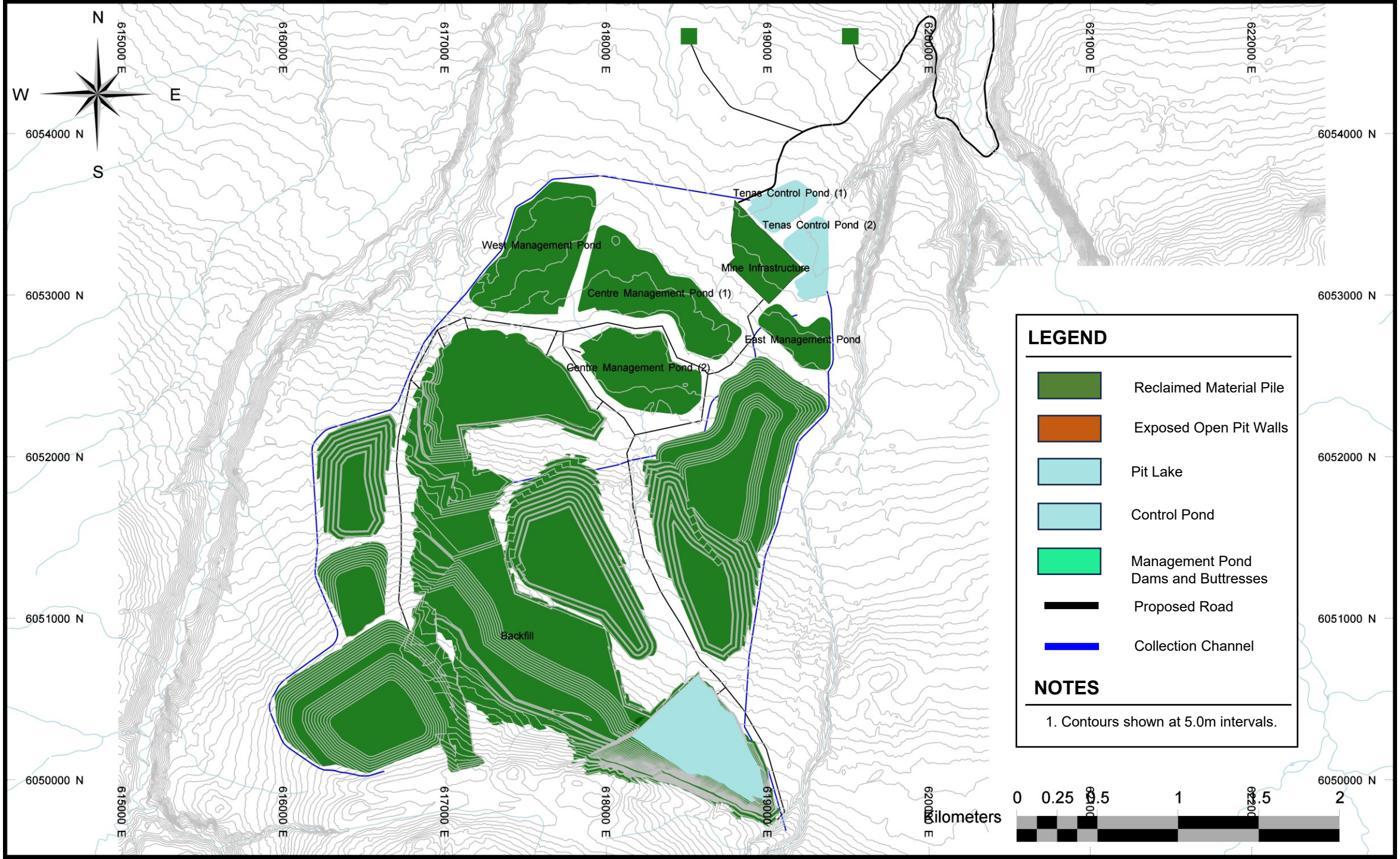

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Appendix C Alternatives Characterization

Appendix C.1 Environmental Characterization

Indicator	Rationale	Rank order	Unit	Comment
Aesthetics - Re-vegetation	Facilities with slope covers that differ from the natural environment pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest distrubance and variety of slopes and landforms in closure.
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.
Aquatic life and habitat	Facilities that affect aquatic fauna and their natural habitat pose greater environmental impacts.	High best		Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Aquatic life and habitat (endangered/protected fauna)	Facilities near to the presence of endangered/protected aquatic fauna and their habitat pose greater environmental impacts and more complex water quality monitoring and water treatment.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected aquatic fauna and their habitat as there is no endangered aquatic fauna witin the Project Area.
Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	COPC are important to the effects assessment	High best		Added after the workshop. Larger material movement, closenes to waterbodies and size/height of impoundments effect this indicator.
Atmospheric issues due to dam construction	Related to the amount of equipment mobilized for construction (trucks, compactors, blasting equipment, etc.) and its impact to air quality, noise and direct receptors (mine and construction personnel, wildlife, and nearby towns).	High best	-	Related to the materials needed and the dams/embankments volume for each alternative.
Bat and Bat Habitat	Bats have been identified by the regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options.
Bird life and habitat	Facilities that affect birds and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Bird life and habitat (endangered/protected species)	Facilities near the presence of endangered/protected birds and their habitat pose greater environmental impacts and more complex air quality monitoring and materials deposition and dust control.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected birds and their habitat as there is no endangered birds and habitat witin the Project Area.
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.
Caribou and Caribou Habitat	Caribou have been identified by First Nations, public and regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.

Indicator	Rationale	Rank order	Unit	Comment
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.

Indicator	Rationale	Rank order	Unit	Comment
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Prevalent wind speed and direction	Facilities whose relative location to the mine camp and mine installations is aligned with the prevailing wind speed and direction present greater risks of affecting air quality and mine personnel.	High best	-	Similar for all alternatives. Alternative 5 scores worse due to the waste rock dumps and the overall footprint.
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.
Quantity of non-PAG materials produced that remain above the closure water table	Non-PAG materials are the main source of contaiminants of concern for the Project. The more of this material above water the more metail leaching is expected to occur.	High best		Added after the workshop. Based on the quantity of Non-Pag materials above final closure water levels
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.

Indicator	Rationale	Rank order	Unit	Comment
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.
Tailings delivery and deposition system - Design	Related to the type, capacity, location and containment required.	High best		Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Terrestrial life and habitat	Facilities that affect terrestrial fauna and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Third-party reviews	The frequency for third-party reviews will depend on the complexities of the facility in terms of the design, construction, operation and closure.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix C.2 Technical Characterization

Indicator	Rationale	Rank order	Unit	Comment
Additional site investigation	Additional studies to determine foundation conditions. Related to the number of studies (e.g. CPT and lab studies) required to better characterize the foundation and deposited materials.	High best	-	Assumed to be related to the overall footprint of the facility.
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.
Capacity vs Dam construction ratio	Higher ratios indicate a better use of the natural topography for tailings/ materials deposition.	High best		Ruled out prior to the workshop. Since required capacity is considered to be the same for all alternatives, it is assumed the indicator is included within indicator 39 ("Embankment Volume").
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Compliance with industry good practice	Compliance with industry good practice includes tailings design guidelines, corporate guidelines and local/ national regulations.	High best	-	Ruled out prior to the workshop. All alternatives are to be designed to comply with good industry practices, guidelines and recommendations.
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.
Construction constraints	Related to the potential constraints and complexities related to the different construction tasks.	High best	-	Dam construction might pose higher risks of construction constrains, while alternative 5 do not require retaining structures.
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.
Construction time	Related with earthworks, lining placement, ancillary infrastructure, pipeline and pumping	High best	-	Assumed to be related to the embankment volume and the overall footprint (higher liner area requirements, infrastructure construction, etc.).
Containment structure design	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Higher structures require more complex designs.
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.

Indicator	Rationale	Rank order	Unit	Comment
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.
Distance between existing roads and the facility	Related to the need to build new roads or the possibility to use existing ones, depending on the facility location from existing access roads.	High best		Ruled-out during the workshop (all alternatives score equal).
Distance between the Coal Process Plant and the facility	Higher distances represent more complex delivery system designs, higher transportation costs and maintenance.	High best	-	Due to the process plant location, all alternatives pose similar distances. Alternative 5 requires less complex delivery systems and lower transportation costs due to digs backfilling.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Distance to streams/water reservoir/waterbodies	Facilities near streams/ water reservoir/ waterbodies require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. Assumed to be included within "Distance between the nearest waterway and the facility" Indicator.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).
Economic benefits	Partnerships, royalties, lease payments, compensation and benefit agreements	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.
Embankment height	Higher embankments are more complex, pose greater risks, require more construction material, and require more operation, maintenance and surveillance.	High best	-	Alternative 5 do not require retaining structures. Alternatives 4 and EAC Submitted Option have similar EMP maximum height centerline (about 36m), while the highest Alternative 2 structure is the NMP (about 44m).
Embankment volume	Volume of material required for the dam raise to provide containment for the target storage capacity.	High best	-	Alternatives 4 and EAC Submitted Option require similar dam and buttress volumes (about 20Mm3), and are both lower than the Alternative 2 requirement (about 27Mm3). The volume for the alternative 5 is the excavation amount required to make the PAG fit in the external holes (which is
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Flexibility to expand the storage capacity	Related to the possibility of increasing the storage capacity of the facility considering technical and topographic constraints.	High best	-	Small changes are required in every option for expansion. Alternative 5 will require additional digging for placing material, so it's considered to has the worst scoring. Alternative 4 is the best since construction at north of WMP and EMP is easier due to the relative location of the NMP and TCP. In the EAC Submitted Option, storage capacity might be expanded by placing material over the TCP and constructing a new one northern (downstream).

Indicator	Rationale	Rank order	Unit	Comment
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.
Geographical boundaries	Facilities that affect or are nearby country, provincial, territorial and municipal boundaries, land claim, land use, cadastral or other re-defined boundaries pose more complexities in the design, construction, operation and reclamation stages.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks)
Geotechnical conditions - Cavity formation		High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Impermeabilization Requirements	Related to the design of the liner. More complex liners require greater construction complexities and costs.	High best		Ruled-out during the workshop (covered in the other impermeabilization indicators).
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.
Interference with existing roads	Related to the usage of existing roads affecting local communities circulation.	High best		Ruled-out during the workshop (all alternatives will equally affect the usage of existing roads).
Interference with exploration/exploitation areas	A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.	High best	-	Ruled out prior to the workshop. Considered as a fatal-flaw.
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.

Indicator	Rationale	Rank order	Unit	Comment
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Physical interference with existing infrastructure (constraints)	Interferences with roads, monitoring systems, fences, surrounding features, pumping systems etc.	High best		Ruled-out during the workshop (none of the alternatives interfere with existing infrastructure).
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.
Project-specific technologies - Precedents of usage	Related to emerging/ not proven technologies for the project-specific conditions.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.
QA/QC requirements for segregating non-PAG from PAG	Testing requirements for PAG and non-PAG is a critical element for understanding of the alternatives	High best		Added after the workshop. Alt 5 would score the lowest due to the amount of overburden non-Pag material that needs to be tested.
Quantity of non-PAG materials produced that remain above the closure water table	Non-PAG materials are the main source of contaiminants of concern for the Project. The more of this material above water the more metail leaching is expected to occur.	High best		Added after the workshop. Based on the quantity of Non-Pag materials above final closure water levels
Rip-rap material requirement	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best	-	Added after the workshop. Material for spillway and other ancillary structures.

Indicator	Rationale	Rank order	Unit	Comment
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.
Road access to the facility	Related to earthworks to construct access roads to the intermediate berms and crest of the embankment.	High best		Ruled-out during the workshop (all alternatives score equal).
Seasonality	Sensitivity of the construction to the site-specific climate conditions.	High best	-	Alternative 5 scores better since digging is less affected by seasonality, while other alternatives require dams to be built. EAC submitted option scores slightly better regarding the overall footprint and infrastructure required (compared to alternative 4), and the lower dam height (compared to alternative 2). In terms of liner, all alternatives have similar requirements.
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.
Snow drifting		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Special features	Includes seismicity, avalanches, permafrost, radioactivity.	High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Stream diversion required		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Surplus material storage	Related to the amount of surplus material from the borrow source to be temporary or permanently stacked.	High best	-	
Tailings beach management	Monitoring and surveillance of the tailings beach parameters	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Tailings delivery and deposition system - Pipeline elevation difference between the process plant and the deposition area	Higher pipeline elevation differences represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	m	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Topography	Facilities constructed in complex reliefs and topographies are more complex for the design and construction of the facility, ancillary infrastructure and access roads, pose greater risk and complexities during materials deposition, maintenance and surveillance.	High best	-	Not used - Not assessed due to project characteristics.
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Waste physical characterization	Includes grain size distribution, settlement rate and consolidation parameters.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.

Indicator	Rationale	Rank order	Unit	Comment
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix C.3 Economic Characterization

Indicator	Rationale	Rank order	Unit	Comment
Additional site investigation	Additional studies to determine foundation conditions. Related to the number of studies (e.g. CPT and lab studies) required to better characterize the foundation and deposited materials.	High best	-	Assumed to be related to the overall footprint of the facility.
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.
Borrow source quarry design	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best		Ruled-out during the workshop (no quarry design needed - Added as rip-rap requirements).
Capacity vs Dam construction ratio	Higher ratios indicate a better use of the natural topography for tailings/ materials deposition.	High best		Ruled out prior to the workshop. Since required capacity is considered to be the same for all alternatives, it is assumed the indicator is included within indicator 39 ("Embankment Volume").
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Community/Local community land/mineral use rights	Includes formal or informal agreements and grandfathered agreements	High best	-	Ruled out prior to the workshop for not being applicable to the project characteristics.
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.
Construction time	Related with earthworks, lining placement, ancillary infrastructure, pipeline and pumping	High best	-	Assumed to be related to the embankment volume and the overall footprint (higher liner area requirements, infrastructure construction, etc.).
Containment structure design	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Higher structures require more complex designs.
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.

Indicator	Rationale	Rank order	Unit	Comment
Distance between existing roads and the facility	Related to the need to build new roads or the possibility to use existing ones, depending on the facility location from existing access roads.	High best		Ruled-out during the workshop (all alternatives score equal).
Distance between the Coal Process Plant and the facility	Higher distances represent more complex delivery system designs, higher transportation costs and maintenance.	High best	-	Due to the process plant location, all alternatives pose similar distances. Alternative 5 requires less complex delivery systems and lower transportation costs due to digs backfilling.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Distance to streams/water reservoir/waterbodies	Facilities near streams/ water reservoir/ waterbodies require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. Assumed to be included within "Distance between the nearest waterway and the facility" Indicator.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).
Economic benefits	Partnerships, royalties, lease payments, compensation and benefit agreements	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.
Embankment volume	Volume of material required for the dam raise to provide containment for the target storage capacity.	High best	-	Alternatives 4 and EAC Submitted Option require similar dam and buttress volumes (about 20Mm3), and are both lower than the Alternative 2 requirement (about 27Mm3). The volume for the alternative 5 is the excavation amount required to make the PAG fit in the external holes (which is
Employment	Short and long-term opportunities, 'boom-and-bust' cycles	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Flexibility to expand the storage capacity	Related to the possibility of increasing the storage capacity of the facility considering technical and topographic constraints.	High best	-	Small changes are required in every option for expansion. Alternative 5 will require additional digging for placing material, so it's considered to has the worst scoring. Alternative 4 is the best since construction at north of WMP and EMP is easier due to the relative location of the NMP and TCP. In the EAC Submitted Option, storage capacity might be expanded by placing material over the TCP and constructing a new one northern (downstream).
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.

Indicator	Rationale	Rank order	Unit	Comment
Geotechnical conditions - Cavity formation		High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Impermeabilization Requirements	Related to the design of the liner. More complex liners require greater construction complexities and costs.	High best		Ruled-out during the workshop (covered in the other impermeabilization indicators).
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.
Interference with exploration/exploitation areas	A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.	High best	-	Ruled out prior to the workshop. Considered as a fatal-flaw.
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.

Indicator	Rationale	Rank order	Unit	Comment
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.
Project-specific technologies - Precedents of usage	Related to emerging/ not proven technologies for the project-specific conditions.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.
QA/QC requirements for segregating non-PAG from PAG	Testing requirements for PAG and non-PAG is a critical element for understanding of the alternatives	High best		Added after the workshop. Alt 5 would score the lowest due to the amount of overburden non-Pag material that needs to be tested.
Rip-rap material requirement	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best	-	Added after the workshop. Material for spillway and other ancillary structures.
Road access to the facility	Related to earthworks to construct access roads to the intermediate berms and crest of the embankment.	High best		Ruled-out during the workshop (all alternatives score equal).
Seasonality	Sensitivity of the construction to the site-specific climate conditions.	High best	-	Alternative 5 scores better since digging is less affected by seasonality, while other alternatives require dams to be built. EAC submitted option scores slightly better regarding the overall footprint and infrastructure required (compared to alternative 4), and the lower dam height (compared to alternative 2). In terms of liner, all alternatives have similar requirements.
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.
Snow drifting		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Stream diversion required		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Surplus material storage	Related to the amount of surplus material from the borrow source to be temporary or permanently stacked.	High best	-	
Tailings beach management	Monitoring and surveillance of the tailings beach parameters	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.

Indicator	Rationale	Rank order	Unit	Comment
Tailings delivery and deposition system - Pipeline length	Larger pipeline length represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	km	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Time of legal and financial requirements and expected legal complexities	Degree of difficulty in obtaining approvals for construction and operation of the facility.	High best	-	The largest disturbance was felt to have the most dificulty in obtaining approvals and alternative 4 was felt more difficult as facilities are spread out.
Topography	Facilities constructed in complex reliefs and topographies are more complex for the design and construction of the facility, ancillary infrastructure and access roads, pose greater risk and complexities during materials deposition, maintenance and surveillance.	High best	-	Not used - Not assessed due to project characteristics.
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Waste physical characterization	Includes grain size distribution, settlement rate and consolidation parameters.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix C.4 Socio-Economic Characterization

Indicator	Rationale	Rank order	Unit	Comment
Aesthetics - Landforming engineering	Facilities with slopes that differ from the natural relief pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the distance between structures of the facility and the overall footprint. Also related to height and number of strutures for reclamation.
Aesthetics - Line of sight (distance)	Facilities near existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best		Ruled-out during the workshop (none of the facilities alternative is visible from either Smithers and/or Telkwa).
Aesthetics - Line of sight (elevation difference)	Facilities with higher elevation differences with existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest structure height and it's distance to Tenas Creek. TCP of alternative 4 is the closest one to Tenas Creek, and alternative 5 has the highest waste rock dumps.
Aesthetics - Re-vegetation	Facilities with slope covers that differ from the natural environment pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest distrubance and variety of slopes and landforms in closure.
Aquatic life and habitat	Facilities that affect aquatic fauna and their natural habitat pose greater environmental impacts.	High best		Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Aquatic life and habitat (endangered/protected fauna)	Facilities near to the presence of endangered/protected aquatic fauna and their habitat pose greater environmental impacts and more complex water quality monitoring and water treatment.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected aquatic fauna and their habitat as there is no endangered aquatic fauna witin the Project Area.
Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	COPC are important to the effects assessment	High best		Added after the workshop. Larger material movement, closenes to waterbodies and size/height of impoundments effect this indicator.
Archaeological and traditional site nearby the facility	Related to the location, type and importance of known archaeological sites nearby the facility and the risk of unidentified archaeological sites.	High best	-	No archaeological and traditional site nearby the facility.
Atmospheric issues due to dam construction	Related to the amount of equipment mobilized for construction (trucks, compactors, blasting equipment, etc.) and its impact to air quality, noise and direct receptors (mine and construction personnel, wildlife, and nearby towns).	High best	-	Related to the materials needed and the dams/embankments volume for each alternative.
Bat and Bat Habitat	Bats have been identified by the regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options.
Bird life and habitat	Facilities that affect birds and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Bird life and habitat (endangered/protected species)	Facilities near the presence of endangered/protected birds and their habitat pose greater environmental impacts and more complex air quality monitoring and materials deposition and dust control.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected birds and their habitat as there is no endangered birds and habitat witin the Project Area.
Capacity building	Training opportunities, contracting opportunities, community infrastructure	High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.
Caribou and Caribou Habitat	Caribou have been identified by First Nations, public and regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options

Indicator	Rationale	Rank order	Unit	Comment
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Community and stakeholders acceptance	Related to the apparent acceptance or distrust for each alternative.	High best	-	Higher dams are less accepted by community and stakeholders. Alternative 5 do not use embankments as retaining structures for processed materials.
Community safety	Construction methods, operational management of the facility, closure state of the facility.	High best	-	Higher dams pose higher risks (alternative 2 scores as the worst). The TCP of alternative 4 is close to Tenas Creek, and might pose higher risks and operation requirements.
Community/Local community land/mineral use rights	Includes formal or informal agreements and grandfathered agreements	High best	-	Ruled out prior to the workshop for not being applicable to the project characteristics.
Compliance with industry good practice	Compliance with industry good practice includes tailings design guidelines, corporate guidelines and local/ national regulations.	High best	-	Ruled out prior to the workshop. All alternatives are to be designed to comply with good industry practices, guidelines and recommendations.
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Distance to the nearest fresh water alluvium or wetland	Facilities near fresh water alluvium or wetlands require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. No recorded fresh water alluvium nor wetlands in the project location.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).
Embankment height	Higher embankments are more complex, pose greater risks, require more construction material, and require more operation, maintenance and surveillance.	High best	-	Alternative 5 do not require retaining structures. Alternatives 4 and EAC Submitted Option have similar EMP maximum height centerline (about 36m), while the highest Alternative 2 structure is the NMP (about 44m).
Employment	Short and long-term opportunities, 'boom-and-bust' cycles	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.

Indicator	Rationale	Rank order	Unit	Comment
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in tailings deposition	Related to the need of adequate tailings freeboards and supernatant pond location during construction and operation	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Overall perceived socio-economic consequences, benefits and relative preferences		High best	-	Same for all alternatives.
Physical interference with existing infrastructure (constraints)	Interferences with roads, monitoring systems, fences, surrounding features, pumping systems etc.	High best		Ruled-out during the workshop (none of the alternatives interfere with existing infrastructure).
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds

Indicator	Rationale	Rank order	Unit	Comment
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.
Prevalent wind speed and direction	Facilities whose relative location to the mine camp and mine installations is aligned with the prevailing wind speed and direction present greater risks of affecting air quality and mine personnel.	High best	-	Similar for all alternatives. Alternative 5 scores worse due to the waste rock dumps and the overall footprint.
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.
Tailings delivery and deposition system - Design	Related to the type, capacity, location and containment required.	High best		Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Tailings delivery and deposition system - Pipeline length	Larger pipeline length represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	km	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Terrestrial life and habitat	Facilities that affect terrestrial fauna and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Third-party reviews	The frequency for third-party reviews will depend on the complexities of the facility in terms of the design, construction, operation and closure.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix D Multiple-Accounts Ledges

Appendix D.1 Accounts and Sub-Accounts

Account	Sub-Account	Rationale
A1 - Environmental	Potential air quality impacts	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Appendix D.2 Sub-Accounts and Indicators

Sub-Account	Indicator	Account
Capex Requirements	Additional site investigation	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	A3 - Economic
Capex Requirements	Borrow source location	A3 - Economic
Capex Requirements	Borrow source material availability	A3 - Economic
Capex Requirements	Construction time	A3 - Economic
Capex Requirements	Containment structure design	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	A3 - Economic
Capex Requirements	Embankment volume	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	A3 - Economic
Capex Requirements	Impermeabilization area requirements	A3 - Economic
Capex Requirements	Impermeabilization Thickness	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	A3 - Economic
Capex Requirements	Materials delivery and deposition system	A3 - Economic
Capex Requirements	Number of ponds	A3 - Economic
Capex Requirements	QA/QC Requirements	A3 - Economic
Capex Requirements	Rip-rap material requirement	A3 - Economic
Capex Requirements	Seasonality	A3 - Economic
Capex Requirements	Surplus material storage	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	A3 - Economic
Capex Requirements	Topography	A3 - Economic
Closure and Post-Closure Costs	Closure design	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	A3 - Economic
Closure and Post-Closure Costs	Topography	A3 - Economic
Closure and Post-Closure Costs	Vegetation	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	A3 - Economic
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	A2 - Technical
Closure design and requirements	Overall Catchment Area	A2 - Technical
Closure design and requirements	Overall footprint of the facility	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	A2 - Technical
Closure design and requirements	Closure design	A2 - Technical
Closure plan implementation	Closure design	A4 - Socio-Economic
Closure plan implementation	Number of ponds	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	A4 - Socio-Economic
Closure plan implementation	Water management system design	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Closure plan implementation	Aesthetics - Re-vegetation	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	A4 - Socio-Economic
Community perception and safety	Community safety	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	A4 - Socio-Economic
Community perception and safety	Vegetation	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	A2 - Technical
Complete system flexibility	Topography	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	A1 - Environmental
Design and construction impacts	Borrow source location	A1 - Environmental
Design and construction impacts	Borrow source material availability	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	A1 - Environmental
Design and construction impacts	Number of embankments	A1 - Environmental
Design and construction impacts	Number of ponds	A1 - Environmental
Design and construction impacts	QA/QC Requirements	A1 - Environmental

Sub-Account	Indicator	Account
Design and construction impacts	Risk of cascade embankment failure	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	A2 - Technical
Infrastructure requirements	Topography	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	A2 - Technical
Mine materials management	Materials delivery and deposition system	A2 - Technical
Mine materials management	Operational complexity in materials deposition	A2 - Technical
Mine materials management	Overall footprint of the facility	A2 - Technical
Mine materials management	Surplus material storage	A2 - Technical
Mine materials management impacts	Materials delivery and deposition system	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	A1 - Environmental
Monitoring & Surveillance	Embankment height	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	A2 - Technical
Monitoring & Surveillance	Number of embankments	A2 - Technical
Monitoring & Surveillance	Number of ponds	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	A3 - Economic
Opex Requirements	Groundwater conditions	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	A3 - Economic
Opex Requirements	Materials delivery and deposition system	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	A3 - Economic
Opex Requirements	Pond water management	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	A4 - Socio-Economic
Post closure water management	Groundwater conditions	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	A4 - Socio-Economic
Post closure water management	Pond water management	A4 - Socio-Economic
Post closure water management	Water management system design	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from disch	A4 - Socio-Economic
Post-closure land use	Closure design	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	A1 - Environmental
Post-closure land use	Overall footprint of the facility	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	A1 - Environmental
Post-closure land use	Aesthetics - Re-vegetation	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	A1 - Environmental

Sub-Account	Indicator	Account
Potential groundwater impacts	Distance between the nearest waterway and the facility	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	A1 - Environmental
Potential impacts to receptors	Vegetation	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from disch	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	A1 - Environmental
Potential surface water impacts	Pond water management	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	A2 - Technical
Seepage and groundwater control	Groundwater conditions	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	A2 - Technical
Seepage and groundwater control	Water management system design	A2 - Technical
Storage Facility Construction	Borrow source material availability	A2 - Technical
Storage Facility Construction	Construction constraints	A2 - Technical
Storage Facility Construction	Construction time	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	A2 - Technical
Storage Facility Construction	Embankment volume	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	A2 - Technical
Storage Facility Construction	QA/QC Requirements	A2 - Technical
Storage Facility Construction	Seasonality	A2 - Technical
Storage Facility Construction	Surplus material storage	A2 - Technical
Storage Facility Construction	Topography	A2 - Technical
Storage Facility Design	Borrow source location	A2 - Technical
Storage Facility Design	Borrow source material availability	A2 - Technical
Storage Facility Design	Containment structure design	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	A2 - Technical
Storage Facility Design	Embankment height	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	A2 - Technical
Storage Facility Design	Number of embankments	A2 - Technical
Storage Facility Design	Number of ponds	A2 - Technical
Storage Facility Design	Overall Catchment Area	A2 - Technical
Storage Facility Design	Overall footprint of the facility	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	A2 - Technical
Storage Facility Design	Topography	A2 - Technical
Storage Facility Design	Water management system design	A2 - Technical
Storage Facility Design	Additional site investigation	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	A2 - Technical
Surface water management	Number of ponds	A2 - Technical
Surface water management	Overall Catchment Area	A2 - Technical
Surface water management	Overall footprint of the facility	A2 - Technical
Surface water management	Water management system design	A2 - Technical
Design and construction impacts	Construction methodology of non-PAG storage piles	A1 - Environmental
Storage Facility Construction	Construction methodology of non-PAG storage piles	A2 - Technical
Permitting complexity and delays	Construction methodology of non-PAG storage piles	A4 - Socio-Economic
Potential groundwater impacts	Coverage of Open Pit walls	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	A1 - Environmental
Closure design and requirements	Coverage of Open Pit walls	A2 - Technical
Closure and Post-Closure Costs	Coverage of Open Pit walls	A3 - Economic
Closure plan implementation	Coverage of Open Pit walls	A4 - Socio-Economic

Sub-Account	Indicator	Account
Mine materials management impacts	Design Criteria - maitenance of water cover	A1 - Environmental
Mine materials management	Design Criteria - maitenance of water cover	A2 - Technical
Opex Requirements	Design Criteria - maitenance of water cover	A3 - Economic
Potential surface water impacts	Diversion structures design, construction and maintenance	A1 - Environmental
Community perception and safety	Embankment height	A4 - Socio-Economic
Capex Requirements	Flexibility to expand the storage capacity	A3 - Economic
Design and construction impacts	Impermeabilization area requirements	A1 - Environmental
Design and construction impacts	Impermeabilization Thickness	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	A1 - Environmental
Community perception and safety	Maintenance of traditional lifestyle	A4 - Socio-Economic
Mine materials management impacts	Non-PAG material Segregation	A1 - Environmental
Mine materials management	Non-PAG material Segregation	A2 - Technical
Opex Requirements	Non-PAG material Segregation	A3 - Economic
Closure plan implementation	Non-PAG material Segregation	A4 - Socio-Economic
Community perception and safety	Number of embankments	A4 - Socio-Economic
Mine materials management	Pond water management	A2 - Technical
Closure design and requirements	Pond water management	A2 - Technical
Closure and Post-Closure Costs	Post-closure risk and uncertainties	A3 - Economic
Permitting complexity and delays	Prevalent wind speed and direction	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	A4 - Socio-Economic
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	A2 - Technical
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	A3 - Economic
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	A1 - Environmental
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	A2 - Technical
Capex Requirements	Rip-rap material requirement	A3 - Economic
Community perception and safety	Risk of cascade embankment failure	A4 - Socio-Economic
Opex Requirements	Seepage from the facility to groundwater system	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	A3 - Economic
Community perception and safety	Terrestrial life and habitat	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	A4 - Socio-Economic
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	A2 - Technical
Potential groundwater impacts	Water management system design	A1 - Environmental
Potential surface water impacts	Water management system design	A1 - Environmental
Capex Requirements	Water management system design	A3 - Economic

Appendix E Value-Based Decision Process

Appendix E.1 Scoring for Indicators

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Additional site investigation	Additional studies to determine foundation conditions. Related to the number of studies (e.g. CPT and lab studies) required to better characterize the foundation and deposited materials.	High best	-	Assumed to be related to the overall footprint of the facility.	4	2	3	3
Aesthetics - Landforming engineering	Facilities with slopes that differ from the natural relief pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the distance between structures of the facility and the overall footprint. Also related to height and number of strutures for reclamation.	4	5	3	2
Aesthetics - Line of sight (distance)	Facilities near existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best		Ruled-out during the workshop (none of the facilities alternative is visible from either Smithers and/or Telkwa).				
Aesthetics - Line of sight (elevation difference)	Facilities with higher elevation differences with existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest structure height and it's distance to Tenas Creek. TCP of alternative 4 is the closest one to Tenas Creek, and alternative 5 has the highest waste rock dumps.	5	5	1	2
Aesthetics - Re-vegetation	Facilities with slope covers that differ from the natural environment pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest distrubance and variety of slopes and landforms in closure.	5	4	3	2
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.	5	5	2	2
Aquatic life and habitat	Facilities that affect aquatic fauna and their natural habitat pose greater environmental impacts.	High best		Related to the overall footprint of the facility and the impact on general birds life and their habitat.	5	6	3	1
Aquatic life and habitat (endangered/protected fauna)	Facilities near to the presence of endangered/protected aquatic fauna and their habitat pose greater environmental impacts and more complex water quality monitoring and water treatment.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected aquatic fauna and their habitat as there is no endangered aquatic fauna witin the Project Area.	6	6	6	6
Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	COPC are important to the effects assessment	High best		Added after the workshop. Larger material movement, closenes to waterbodies and size/height of impoundments effect this indicator.	5	3	3	2
Archaeological and traditional site nearby the facility	Related to the location, type and importance of known archaeological sites nearby the facility and the risk of unidentified archaeological sites.	High best	-	No archaeological and traditional site nearby the facility.	6	6	6	6
Atmospheric issues due to dam construction	Related to the amount of equipment mobilized for construction (trucks, compactors, blasting equipment, etc.) and its impact to air quality, noise and direct receptors (mine and construction personnel, wildlife, and nearby towns).	High best	-	Related to the materials needed and the dams/embankments volume for each alternative.	5	5	3	2
Bat and Bat Habitat	Bats have been identified by the regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options.	4	5	3	2
Bird life and habitat	Facilities that affect birds and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Related to the overall footprint of the facility and the impact on general birds life and their habitat.	5	6	3	1
Bird life and habitat (endangered/protected species)	Facilities near the presence of endangered/protected birds and their habitat pose greater environmental impacts and more complex air quality monitoring and materials deposition and dust control.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected birds and their habitat as there is no endangered birds and habitat witin the Project Area.	6	6	6	6
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.	5	5	3	6
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.	5	5	3	2
Borrow source quarry design	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best		Ruled-out during the workshop (no quarry design needed - Added as rip-rap requirements).				
Capacity building	Training opportunities, contracting opportunities, community infrastructure	High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.				
Capacity vs Dam construction ratio	Higher ratios indicate a better use of the natural topography for tailings/ materials deposition.	High best		Ruled out prior to the workshop. Since required capacity is considered to be the same for all alternatives, it is assumed the indicator is included within indicator 39 ("Embankment Volume").				

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Caribou and Caribou Habitat	Caribou have been identified by First Nations, public and regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options	4	5	3	2
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.	4	1	2	6
Community and stakeholders acceptance	Related to the apparent acceptance or distrust for each alternative.	High best	-	Higher dams are less accepted by community and stakeholders. Alternative 5 do not use embankments as retaining structures for processed materials.	3	1	3	6
Community safety	Construction methods, operational management of the facility, closure state of the facility.	High best	-	Higher dams pose higher risks (alternative 2 scores as the worst). The TCP of alternative 4 is close to Tenas Creek, and might pose higher risks and operation requirements.	2	1	4	6
Community/Local community land/mineral use rights	Includes formal or informal agreements and grandfathered agreements	High best	-	Ruled out prior to the workshop for not being applicable to the project characteristics.				
Compliance with industry good practice	Compliance with industry good practice includes tailings design guidelines, corporate guidelines and local/ national regulations.	High best	-	Ruled out prior to the workshop. All alternatives are to be designed to comply with good industry practices, guidelines and recommendations.				
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.				
Construction constraints	Related to the potential constraints and complexities related to the different construction tasks.	High best	-	Dam construction might pose higher risks of construction constrains, while alternative 5 do not require retaining structures.	4	4	4	6
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.	5	5	5	5
Construction time	Related with earthworks, lining placement, ancillary infrastructure, pipeline and pumping	High best	-	Assumed to be related to the embankment volume and the overall footprint (higher liner area requirements, infrastructure construction, etc.).	5	5	3	3
Containment structure design	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Higher structures require more complex designs.	4	3	5	6
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.				
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.	5	5	5	5
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.	5	1	3	2
Distance between existing roads and the facility	Related to the need to build new roads or the possibility to use existing ones, depending on the facility location from existing access roads.	High best		Ruled-out during the workshop (all alternatives score equal).				
Distance between the Coal Process Plant and the facility	Higher distances represent more complex delivery system designs, higher transportation costs and maintenance.	High best	-	Due to the process plant location, all alternatives pose similar distances. Alternative 5 requires less complex delivery systems and lower transportation costs due to digs backfilling.	4	4	4	5
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.	2	2	1	2
Distance to streams/water reservoir/waterbodies	Facilities near streams/ water reservoir/ waterbodies require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. Assumed to be included within "Distance between the nearest waterway and the facility" Indicator.				
Distance to the nearest fresh water alluvium or wetland	Facilities near fresh water alluvium or wetlands require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. No recorded fresh water alluvium nor wetlands in the project location.				
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.	6	6	4	1

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).				
Economic benefits	Partnerships, royalties, lease payments, compensation and benefit agreements	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.				
Embankment height	Higher embankments are more complex, pose greater risks, require more construction material, and require more operation, maintenance and surveillance.	High best	-	Alternative 5 do not require retaining structures. Alternatives 4 and EAC Submitted Option have similar EMP maximum height centerline (about 36m), while the highest Alternative 2 structure is the NMP (about 44m).	4	2	4	6
Embankment length	Larger embankments are more complex, pose greater risks, require more construction materials, require a larger footprint and require more operation, maintenance and surveillance.	High best		Screened-out prior to the workshop. Assumed to be included within indicators related to embankment characteristics, OM&S requirements and overall footprint of the facility.				
Embankment volume	Volume of material required for the dam raise to provide containment for the target storage capacity.	High best	-	Alternatives 4 and EAC Submitted Option require similar dam and buttress volumes (about 20Mm3), and are both lower than the Alternative 2 requirement (about 27Mm3). The volume for the alternative 5 is the excavation amount required to make the PAG fit in the external holes (which is	5	3	5	1
Employment	Short and long-term opportunities, 'boom-and-bust' cycles	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.				
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.				
Flexibility to expand the storage capacity	Related to the possibility of increasing the storage capacity of the facility considering technical and topographic constraints.	High best	-	Small changes are required in every option for expansion. Alternative 5 will require additional digging for placing material, so it's considered to has the worst scoring. Alternative 4 is the best since construction at north of WMP and EMP is easier due to the relative location of the NMP and TCP. In the EAC Submitted Option, storage capacity might be expanded by placing material over the TCP and constructing a new one northern (downstream).	4	2	5	1
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.	6	6	6	4
Geographical boundaries	Facilities that affect or are nearby country, provincial, territorial and municipal boundaries, land claim, land use, cadastral or other re-defined boundaries pose more complexities in the design, construction, operation and reclamation stages.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks)				
Geotechnical conditions - Cavity formation		High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.				
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.	5	4	2	2
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.	3	3	3	2
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.	2	3	2	4
Impermeabilization Requirements	Related to the design of the liner. More complex liners require greater construction complexities and costs.	High best		Ruled-out during the workshop (covered in the other impermeabilization indicators).				

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.	3	3	3	4
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.	3	3	3	2
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.	2	2	2	5
Interference with existing roads	Related to the usage of existing roads affecting local communities circulation.	High best		Ruled-out during the workshop (all alternatives will equally affect the usage of existing roads).				
Interference with exploration/exploitation areas	A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.	High best	-	Ruled out prior to the workshop. Considered as a fatal-flaw.				
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.	6	6	5	4
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.	6	6	5	6
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.	5	4	4	6
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.	3	4	1	6
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.	6	6	6	4
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.	4	4	4	6
Operational complexity in tailings deposition	Related to the need of adequate tailings freeboards and supernatant pond location during construction and operation	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.	6	6	4	2
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.	6	6	4	2
Overall perceived socio-economic consequences, benefits and relative preferences		High best	-	Same for all alternatives.	5	5	5	5
Physical interference with existing infrastructure (constraints)	Interferences with roads, monitoring systems, fences, surrounding features, pumping systems etc.	High best		Ruled-out during the workshop (none of the alternatives interfere with existing infrastructure).				
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds	6	4	5	6
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.	2	1	2	6
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.	3	3	4	6
Prevalent wind speed and direction	Facilities whose relative location to the mine camp and mine installations is aligned with the prevailing wind speed and direction present greater risks of affecting air quality and mine personnel.	High best	-	Similar for all alternatives. Alternative 5 scores worse due to the waste rock dumps and the overall footprint.	6	6	6	5

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.	6	6	5	4
Project-specific technologies - Precedents of usage	Related to emerging/ not proven technologies for the project-specific conditions.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.				
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.	2	2	2	4
QA/QC requirements for segregating non-PAG from PAG	Testing requirements for PAG and non-PAG is a critical element for understanding of the alternatives	High best		Added after the workshop. Alt 5 would score the lowest due to the amount of overburden non-Pag material that needs to be tested.	6	6	6	4
Quantity of non-PAG materials produced that remain above the closure water table	Non-PAG materials are the main source of contaiminants of concern for the Project. The more of this material above water the more metail leaching is expected to occur.	High best		Added after the workshop. Based on the quantity of Non-Pag materials above final closure water levels	5	5	5	2
Rip-rap material requirement	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best	-	Added after the workshop. Material for spillway and other ancillary structures.	6	6	4	1
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.	2	3	5	6
Road access to the facility	Related to earthworks to construct access roads to the intermediate berms and crest of the embankment.	High best		Ruled-out during the workshop (all alternatives score equal).				
Seasonality	Sensitivity of the construction to the site-specific climate conditions.	High best	-	Alternative 5 scores better since digging is less affected by seasonality, while other alternatives require dams to be built. EAC submitted option scores slightly better regarding the overall footprint and infrastructure required (compared to alternative 4), and the lower dam height (compared to alternative 2). In terms of liner, all alternatives have similar requirements.	4	3	3	6
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.	4	5	1	3
Snow drifting		High best		Ruled out prior to the workshop. Not applicable to project characteristics.				
Special features	Includes seismicity, avalanches, permafrost, radioactivity.	High best		Ruled out prior to the workshop. Not applicable to project characteristics.				
Stream diversion required		High best		Ruled out prior to the workshop. Not applicable to project characteristics.				
Surplus material storage	Related to the amount of surplus material from the borrow source to be temporary or permanently stacked.	High best	-		4	4	4	3
Tailings beach management	Monitoring and surveillance of the tailings beach parameters	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Tailings delivery and deposition system - Design	Related to the type, capacity, location and containment required.	High best		Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Tailings delivery and deposition system - Pipeline elevation difference between the process plant and the deposition area	Higher pipeline elevation differences represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	m	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Tailings delivery and deposition system - Pipeline length	Larger pipeline length represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	km	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Terrestrial life and habitat	Facilities that affect terrestrial fauna and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Larger distrubance plans were scored lower and more spread out plans were also scored lower.	6	6	5	4
Third-party reviews	The frequency for third-party reviews will depend on the complexities of the facility in terms of the design, construction, operation and closure.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.				
Time of legal and financial requirements and expected legal complexities	Degree of difficulty in obtaining approvals for construction and operation of the facility.	High best	-	The largest disturbance was felt to have the most dificulty in obtaining approvals and alternative 4 was felt more difficult as facilities are spread out.	6	6	5	4

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Topography	Facilities constructed in complex reliefs and topographies are more complex for the design and construction of the facility, ancillary infrastructure and access roads, pose greater risk and complexities during materials deposition, maintenance and surveillance.	High best	-	Not used - Not assessed due to project characteristics.	6	6	5	4
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.	6	6	5	4
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.				
Waste physical characterization	Includes grain size distribution, settlement rate and consolidation parameters.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.				
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.	6	5	4	1
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.	6	5	4	2
Within formerly permitted area / Distance to other landowner properties Socio-Economic Property Ownership & Mineral Rights	Related to the need of expansion of the owners area (property boundary limits).	High best	-	Ruled out prior to the workshop. Considered as a threshold criteria for defining candidate alternatives.				

Appendix E.2 Weighting for Indicators

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	1,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	2,00	A3 - Economic
Capex Requirements	Borrow source location	3,00	A3 - Economic
Capex Requirements	Borrow source material availability	2,00	A3 - Economic
Capex Requirements	Construction time	3,00	A3 - Economic
Capex Requirements	Containment structure design	4,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	3,00	A3 - Economic
Capex Requirements	Embankment volume	5,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	5,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	5,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	6,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	4,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	6,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Capex Requirements	Number of ponds	3,00	A3 - Economic
Capex Requirements	QA/QC Requirements	2,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	1,00	A3 - Economic
Capex Requirements	Seasonality	3,00	A3 - Economic
Capex Requirements	Surplus material storage	1,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	4,00	A3 - Economic
Capex Requirements	Topography	3,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	2,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	2,00	A3 - Economic
Capex Requirements	Water management system design	2,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	6,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	4,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	3,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	6,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	5,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	4,00	A3 - Economic
Closure and Post-Closure Costs	Topography	3,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	4,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	5,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	5,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	2,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	3,00	A3 - Economic
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	5,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	4,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	3,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	3,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	4,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	4,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	6,00	A2 - Technical
Closure design and requirements	Closure design	3,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	3,00	A2 - Technical
Closure design and requirements	Pond water management	2,00	A2 - Technical
Closure plan implementation	Closure design	3,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	3,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	4,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	2,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Closure plan implementation	Aesthetics - Re-vegetation	3,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	3,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	4,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	4,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	5,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	6,00	A4 - Socio-Economic
Community perception and safety	Community safety	6,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	3,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	5,00	A4 - Socio-Economic
Community perception and safety	Vegetation	3,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	3,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	2,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	4,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	5,00	A4 - Socio-Economic
Community perception and safety	Embankment height	3,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	4,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	2,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	3,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	1,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	2,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	6,00	A2 - Technical
Complete system flexibility	Topography	3,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	1,00	A1 - Environmental
Design and construction impacts	Borrow source location	3,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	2,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	5,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	2,00	A1 - Environmental
Design and construction impacts	Number of embankments	2,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Number of ponds	2,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	3,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	2,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	3,00	A1 - Environmental
Design and construction impacts	Impermeabilization Thickness	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	2,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	6,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	4,00	A2 - Technical
Infrastructure requirements	Topography	4,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	3,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	4,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	6,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	6,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	3,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	5,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	5,00	A2 - Technical
Mine materials management	Overall footprint of the facility	4,00	A2 - Technical
Mine materials management	Surplus material storage	3,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	2,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	3,00	A2 - Technical
Mine materials management	Pond water management	4,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	3,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	3,00	A2 - Technical
Mine materials management impacts	Materials delivery and deposition system	4,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	1,00	A1 - Environmental
Mine materials management impacts	Design Criteria - maitenance of water cover	4,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	5,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	3,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	4,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	6,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	3,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	5,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	5,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	4,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	4,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	5,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	5,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	4,00	A3 - Economic
Opex Requirements	Groundwater conditions	5,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	4,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	6,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	2,00	A3 - Economic
Opex Requirements	Pond water management	4,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	6,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	3,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	5,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	2,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	4,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	2,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	4,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	3,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	5,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	6,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	4,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	5,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	6,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	4,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	3,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	4,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	2,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	2,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	2,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	5,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	2,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	2,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	2,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	2,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	5,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	4,00	A4 - Socio-Economic
Post closure water management	Pond water management	2,00	A4 - Socio-Economic
Post closure water management	Water management system design	1,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	2,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	5,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	4,00	A4 - Socio-Economic
Post-closure land use	Closure design	4,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	6,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	3,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	4,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	5,00	A1 - Environmental
Post-closure land use	Aesthetics - Re-vegetation	2,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	3,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	4,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	3,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	6,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	5,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	5,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	6,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	6,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	4,00	A1 - Environmental
Potential groundwater impacts	Water management system design	2,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	6,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	6,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	6,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	4,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	4,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	6,00	A1 - Environmental
Potential impacts to receptors	Vegetation	4,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	4,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	5,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	2,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	5,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	5,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	6,00	A1 - Environmental
Potential surface water impacts	Pond water management	3,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	4,00	A1 - Environmental
Potential surface water impacts	Water management system design	2,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	6,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	5,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	6,00	A2 - Technical
Seepage and groundwater control	Water management system design	4,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	5,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	5,00	A2 - Technical
Storage Facility Construction	Construction constraints	3,00	A2 - Technical
Storage Facility Construction	Construction time	3,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Storage Facility Construction	Embankment volume	5,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	2,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	6,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	5,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	6,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	3,00	A2 - Technical
Storage Facility Construction	Seasonality	5,00	A2 - Technical
Storage Facility Construction	Surplus material storage	2,00	A2 - Technical
Storage Facility Construction	Topography	4,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	3,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	1,00	A2 - Technical
Storage Facility Design	Borrow source location	2,00	A2 - Technical
Storage Facility Design	Borrow source material availability	5,00	A2 - Technical
Storage Facility Design	Containment structure design	6,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	3,00	A2 - Technical
Storage Facility Design	Embankment height	2,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	6,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	3,00	A2 - Technical
Storage Facility Design	Number of embankments	1,00	A2 - Technical
Storage Facility Design	Number of ponds	3,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	3,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	2,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	4,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	6,00	A2 - Technical
Storage Facility Design	Topography	2,00	A2 - Technical
Storage Facility Design	Water management system design	5,00	A2 - Technical
Storage Facility Design	Additional site investigation	1,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	6,00	A2 - Technical
Surface water management	Number of ponds	3,00	A2 - Technical
Surface water management	Overall Catchment Area	3,00	A2 - Technical
Surface water management	Overall footprint of the facility	3,00	A2 - Technical
Surface water management	Water management system design	5,00	A2 - Technical

Appendix E.3 Weighting for Accounts and Sub-Accounts

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	44,44%
A2 - Technical	Technical	3,00	2	ECCC	22,22%
A3 - Economic	Economic	1,50	3	ECCC	11,11%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	22,22%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	3,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	6,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	6,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	6,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	4,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	3,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	2,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	2,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	3,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	6,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	6,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	3,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	4,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	5,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	2,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	2,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	3,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	2,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	6,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	3,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	3,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	4,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	4,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	6,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	2,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Appendix E.4 Results of the Value-Based Decision Process

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,031	0,032	0,026	0,030
	Mine materials management impacts	0,058	0,042	0,045	0,052
	Post-closure land use	0,073	0,060	0,054	0,056
	Potential air quality impacts	0,060	0,060	0,048	0,037
	Potential groundwater impacts	0,097	0,096	0,071	0,059
	Potential impacts to receptors	0,105	0,111	0,083	0,062
	Potential surface water impacts	0,111	0,102	0,076	0,053
Total C1 - Environmental		**0,535**	**0,504**	**0,402**	**0,348**
C2 - Technical	Closure design and requirements	0,035	0,032	0,026	0,031
	Complete system flexibility	0,029	0,021	0,031	0,012
	Infrastructure requirements	0,017	0,017	0,011	0,008
	Maintenance Requirements	0,016	0,016	0,012	0,012
	Mine materials management	0,024	0,022	0,022	0,020
	Monitoring & Surveillance	0,020	0,019	0,015	0,019
	Seepage and groundwater control	0,037	0,036	0,022	0,019
	Storage Facility Construction	0,019	0,018	0,016	0,015
	Storage Facility Design	0,015	0,014	0,012	0,011
	Surface water management	0,056	0,053	0,040	0,019
Total C2 - Technical		**0,268**	**0,249**	**0,206**	**0,166**
C3 - Economic	Capex Requirements	0,023	0,021	0,019	0,016
	Closure and Post-Closure Costs	0,072	0,065	0,056	0,058
	Opex Requirements	0,035	0,032	0,027	0,027
Total C3 - Economic		**0,131**	**0,119**	**0,102**	**0,102**
C4 - Socio-Economic	Closure plan implementation	0,043	0,034	0,032	0,033
	Community perception and safety	0,076	0,075	0,065	0,071
	Permitting complexity and delays	0,029	0,027	0,024	0,019
	Post closure monitoring	0,045	0,039	0,038	0,034
	Post closure water management	0,056	0,051	0,041	0,029
Total C4 - Socio-Economic		**0,248**	**0,226**	**0,201**	**0,187**
Total		**1,183**	**1,097**	**0,910**	**0,803**

Appendix F Sensitivity Analysis

Appendix F.1 Equal Weighting for Accounts

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	25,00%
A2 - Technical	Technical	1,00	2	ECCC	25,00%
A3 - Economic	Economic	1,00	3	ECCC	25,00%
A4 - Socio-Economic	Socio-Economic	1,00	4	ECCC	25,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,017	0,018	0,015	0,017
	Mine materials management impacts	0,033	0,024	0,025	0,029
	Post-closure land use	0,041	0,034	0,031	0,031
	Potential air quality impacts	0,034	0,034	0,027	0,021
	Potential groundwater impacts	0,055	0,054	0,040	0,033
	Potential impacts to receptors	0,059	0,063	0,047	0,035
	Potential surface water impacts	0,063	0,058	0,043	0,030
Total C1 - Environmental		**0,301**	**0,284**	**0,226**	**0,196**
C2 - Technical	Closure design and requirements	0,040	0,036	0,029	0,035
	Complete system flexibility	0,032	0,023	0,035	0,014
	Infrastructure requirements	0,019	0,019	0,012	0,009
	Maintenance Requirements	0,018	0,018	0,014	0,013
	Mine materials management	0,027	0,025	0,024	0,023
	Monitoring & Surveillance	0,023	0,021	0,017	0,021
	Seepage and groundwater control	0,042	0,041	0,025	0,021
	Storage Facility Construction	0,021	0,020	0,018	0,017
	Storage Facility Design	0,017	0,016	0,013	0,012
	Surface water management	0,063	0,060	0,045	0,021
Total C2 - Technical		**0,302**	**0,280**	**0,232**	**0,187**
C3 - Economic	Capex Requirements	0,052	0,048	0,043	0,037
	Closure and Post-Closure Costs	0,163	0,146	0,125	0,132
	Opex Requirements	0,080	0,073	0,060	0,060
Total C3 - Economic		**0,295**	**0,267**	**0,229**	**0,229**
C4 - Socio-Economic	Closure plan implementation	0,048	0,038	0,037	0,038
	Community perception and safety	0,086	0,084	0,073	0,080
	Permitting complexity and delays	0,032	0,031	0,027	0,022
	Post closure monitoring	0,050	0,044	0,043	0,039
	Post closure water management	0,063	0,057	0,047	0,033
Total C4 - Socio-Economic		**0,279**	**0,254**	**0,226**	**0,211**
Total		**1,177**	**1,084**	**0,912**	**0,822**

Appendix F.2 Equal Weighting for Sub-Accounts

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	1,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	1,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	1,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	1,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	1,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	1,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	1,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	1,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	1,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	1,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	1,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	1,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	1,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	1,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	1,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	1,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	1,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,066	0,068	0,055	0,063
	Mine materials management impacts	0,083	0,060	0,065	0,074
	Post-closure land use	0,078	0,065	0,058	0,060
	Potential air quality impacts	0,086	0,086	0,068	0,052
	Potential groundwater impacts	0,070	0,069	0,051	0,042
	Potential impacts to receptors	0,075	0,079	0,059	0,044
	Potential surface water impacts	0,079	0,073	0,054	0,038
Total C1 - Environmental		**0,537**	**0,501**	**0,410**	**0,374**
C2 - Technical	Closure design and requirements	0,025	0,023	0,018	0,023
	Complete system flexibility	0,026	0,019	0,028	0,011
	Infrastructure requirements	0,031	0,031	0,019	0,014
	Maintenance Requirements	0,029	0,029	0,022	0,021
	Mine materials management	0,029	0,027	0,026	0,024
	Monitoring & Surveillance	0,024	0,023	0,018	0,022
	Seepage and groundwater control	0,022	0,022	0,013	0,011
	Storage Facility Construction	0,023	0,021	0,019	0,019
	Storage Facility Design	0,027	0,026	0,021	0,020
	Surface water management	0,033	0,032	0,024	0,011
Total C2 - Technical		**0,270**	**0,252**	**0,209**	**0,176**
C3 - Economic	Capex Requirements	0,042	0,039	0,035	0,030
	Closure and Post-Closure Costs	0,044	0,040	0,034	0,036
	Opex Requirements	0,043	0,039	0,033	0,033
Total C3 - Economic		**0,130**	**0,118**	**0,102**	**0,098**
C4 - Socio-Economic	Closure plan implementation	0,054	0,043	0,041	0,042
	Community perception and safety	0,048	0,047	0,041	0,045
	Permitting complexity and delays	0,054	0,052	0,045	0,037
	Post closure monitoring	0,042	0,037	0,036	0,033
	Post closure water management	0,053	0,048	0,039	0,028
Total C4 - Socio-Economic		**0,252**	**0,227**	**0,203**	**0,184**
Total		**1,189**	**1,098**	**0,923**	**0,833**

Appendix F.3 Equal Weighting for Indicators

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	1,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Borrow source location	1,00	A3 - Economic
Capex Requirements	Borrow source material availability	1,00	A3 - Economic
Capex Requirements	Construction time	1,00	A3 - Economic
Capex Requirements	Containment structure design	1,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Embankment volume	1,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	1,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	1,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	1,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	1,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	1,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Capex Requirements	Number of ponds	1,00	A3 - Economic
Capex Requirements	QA/QC Requirements	1,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	1,00	A3 - Economic
Capex Requirements	Seasonality	1,00	A3 - Economic
Capex Requirements	Surplus material storage	1,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	1,00	A3 - Economic
Capex Requirements	Topography	1,00	A3 - Economic
Capex Requirements	Water management system design	1,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	1,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	1,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	1,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	1,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	1,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	1,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	1,00	A3 - Economic
Closure and Post-Closure Costs	Topography	1,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	1,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Closure design and requirements	Closure design	1,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	1,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	1,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	1,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	1,00	A2 - Technical
Closure design and requirements	Pond water management	1,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	1,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	1,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	1,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	1,00	A4 - Socio-Economic
Closure plan implementation	Closure design	1,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	1,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	1,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	1,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	1,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	1,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	1,00	A4 - Socio-Economic
Community perception and safety	Community safety	1,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Community perception and safety	Embankment height	1,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	1,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	1,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	1,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	1,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	1,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Vegetation	1,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	1,00	A2 - Technical
Complete system flexibility	Topography	1,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	1,00	A1 - Environmental
Design and construction impacts	Borrow source location	1,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	1,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	1,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	1,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	1,00	A1 - Environmental
Design and construction impacts	Number of embankments	1,00	A1 - Environmental
Design and construction impacts	Number of ponds	1,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	1,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	1,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	1,00	A2 - Technical
Infrastructure requirements	Topography	1,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	1,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	1,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	1,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	1,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	1,00	A2 - Technical
Mine materials management	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Pond water management	1,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	1,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A2 - Technical
Mine materials management	Surplus material storage	1,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	1,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	1,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	1,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	1,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	1,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	1,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	1,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	1,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	1,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	1,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	1,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	1,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Opex Requirements	Groundwater conditions	1,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	1,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	1,00	A3 - Economic
Opex Requirements	Pond water management	1,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	1,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	1,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	1,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	1,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	1,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	1,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	1,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	1,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	1,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	1,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	1,00	A4 - Socio-Economic
Post closure water management	Pond water management	1,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	1,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	1,00	A1 - Environmental
Post-closure land use	Closure design	1,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	1,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	1,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	1,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	1,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	1,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	1,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	1,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	1,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential groundwater impacts	Water management system design	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Vegetation	1,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	1,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	1,00	A1 - Environmental
Potential surface water impacts	Pond water management	1,00	A1 - Environmental
Potential surface water impacts	Water management system design	1,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	1,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	1,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	1,00	A2 - Technical
Seepage and groundwater control	Water management system design	1,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	1,00	A2 - Technical
Storage Facility Construction	Construction constraints	1,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	1,00	A2 - Technical
Storage Facility Construction	Construction time	1,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Construction	Embankment volume	1,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	1,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	1,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	1,00	A2 - Technical
Storage Facility Construction	Seasonality	1,00	A2 - Technical
Storage Facility Construction	Surplus material storage	1,00	A2 - Technical
Storage Facility Construction	Topography	1,00	A2 - Technical
Storage Facility Design	Additional site investigation	1,00	A2 - Technical
Storage Facility Design	Borrow source location	1,00	A2 - Technical
Storage Facility Design	Borrow source material availability	1,00	A2 - Technical
Storage Facility Design	Containment structure design	1,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Design	Embankment height	1,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Design	Number of embankments	1,00	A2 - Technical
Storage Facility Design	Number of ponds	1,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	1,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	1,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	1,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	1,00	A2 - Technical
Storage Facility Design	Water management system design	1,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Surface water management	Number of ponds	1,00	A2 - Technical
Surface water management	Overall Catchment Area	1,00	A2 - Technical
Surface water management	Overall footprint of the facility	1,00	A2 - Technical
Surface water management	Water management system design	1,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,030	0,031	0,025	0,029
	Mine materials management impacts	0,056	0,044	0,047	0,049
	Post-closure land use	0,072	0,059	0,053	0,055
	Potential air quality impacts	0,061	0,061	0,050	0,039
	Potential groundwater impacts	0,102	0,098	0,076	0,060
	Potential impacts to receptors	0,108	0,115	0,082	0,058
	Potential surface water impacts	0,116	0,102	0,080	0,058
Total C1 - Environmental		**0,543**	**0,511**	**0,412**	**0,348**
C2 - Technical	Closure design and requirements	0,036	0,032	0,027	0,032
	Complete system flexibility	0,031	0,025	0,031	0,015
	Infrastructure requirements	0,017	0,017	0,011	0,008
	Maintenance Requirements	0,015	0,015	0,012	0,012
	Mine materials management	0,024	0,021	0,021	0,019
	Monitoring & Surveillance	0,020	0,019	0,015	0,019
	Seepage and groundwater control	0,039	0,037	0,024	0,019
	Storage Facility Construction	0,020	0,019	0,016	0,015
	Storage Facility Design	0,015	0,014	0,011	0,011
	Surface water management	0,056	0,054	0,041	0,020
Total C2 - Technical		**0,273**	**0,252**	**0,209**	**0,172**
C3 - Economic	Capex Requirements	0,024	0,022	0,019	0,016
	Closure and Post-Closure Costs	0,072	0,067	0,057	0,059
	Opex Requirements	0,035	0,032	0,027	0,028
Total C3 - Economic		**0,131**	**0,121**	**0,103**	**0,103**
C4 - Socio-Economic	Closure plan implementation	0,043	0,034	0,033	0,035
	Community perception and safety	0,078	0,079	0,066	0,070
	Permitting complexity and delays	0,030	0,029	0,025	0,021
	Post closure monitoring	0,037	0,033	0,035	0,047
	Post closure water management	0,060	0,054	0,043	0,029
Total C4 - Socio-Economic		**0,248**	**0,229**	**0,203**	**0,202**
Total		**1,195**	**1,112**	**0,927**	**0,825**

Appendix F.4 Equal Weighting for Accounts and Sub-Accounts

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	25,00%
A2 - Technical	Technical	1,00	2	ECCC	25,00%
A3 - Economic	Economic	1,00	3	ECCC	25,00%
A4 - Socio-Economic	Socio-Economic	1,00	4	ECCC	25,00%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	1,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	1,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	1,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	1,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	1,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	1,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	1,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	1,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	1,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	1,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	1,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	1,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	1,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	1,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	1,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	1,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	1,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,037	0,038	0,031	0,036
	Mine materials management impacts	0,046	0,034	0,036	0,042
	Post-closure land use	0,044	0,036	0,033	0,034
	Potential air quality impacts	0,048	0,048	0,038	0,029
	Potential groundwater impacts	0,039	0,039	0,029	0,024
	Potential impacts to receptors	0,042	0,045	0,033	0,025
	Potential surface water impacts	0,045	0,041	0,030	0,021
Total C1 - Environmental		**0,302**	**0,282**	**0,231**	**0,210**
C2 - Technical	Closure design and requirements	0,029	0,026	0,021	0,026
	Complete system flexibility	0,029	0,021	0,031	0,013
	Infrastructure requirements	0,035	0,035	0,021	0,016
	Maintenance Requirements	0,032	0,032	0,025	0,023
	Mine materials management	0,033	0,030	0,029	0,027
	Monitoring & Surveillance	0,027	0,025	0,020	0,025
	Seepage and groundwater control	0,025	0,025	0,015	0,013
	Storage Facility Construction	0,025	0,024	0,021	0,021
	Storage Facility Design	0,030	0,029	0,024	0,022
	Surface water management	0,038	0,036	0,027	0,013
Total C2 - Technical		**0,303**	**0,283**	**0,235**	**0,198**
C3 - Economic	Capex Requirements	0,095	0,088	0,078	0,067
	Closure and Post-Closure Costs	0,100	0,089	0,077	0,080
	Opex Requirements	0,098	0,089	0,074	0,074
Total C3 - Economic		**0,292**	**0,266**	**0,229**	**0,222**
C4 - Socio-Economic	Closure plan implementation	0,061	0,048	0,046	0,048
	Community perception and safety	0,054	0,053	0,046	0,051
	Permitting complexity and delays	0,061	0,059	0,050	0,041
	Post closure monitoring	0,048	0,042	0,040	0,037
	Post closure water management	0,060	0,054	0,044	0,031
Total C4 - Socio-Economic		**0,284**	**0,256**	**0,228**	**0,207**
Total		**1,181**	**1,087**	**0,922**	**0,837**

Appendix F.5 Equal Weighting for Accounts, Sub-Accounts and Indicators

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	25,00%
A2 - Technical	Technical	1,00	2	ECCC	25,00%
A3 - Economic	Economic	1,00	3	ECCC	25,00%
A4 - Socio-Economic	Socio-Economic	1,00	4	ECCC	25,00%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	1,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	1,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	1,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	1,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	1,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	1,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	1,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	1,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	1,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	1,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	1,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	1,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	1,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	1,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	1,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	1,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	1,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	1,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Borrow source location	1,00	A3 - Economic
Capex Requirements	Borrow source material availability	1,00	A3 - Economic
Capex Requirements	Construction time	1,00	A3 - Economic
Capex Requirements	Containment structure design	1,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Embankment volume	1,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	1,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	1,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	1,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	1,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	1,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Capex Requirements	Number of ponds	1,00	A3 - Economic
Capex Requirements	QA/QC Requirements	1,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	1,00	A3 - Economic
Capex Requirements	Seasonality	1,00	A3 - Economic
Capex Requirements	Surplus material storage	1,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	1,00	A3 - Economic
Capex Requirements	Topography	1,00	A3 - Economic
Capex Requirements	Water management system design	1,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	1,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	1,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	1,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	1,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	1,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	1,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	1,00	A3 - Economic
Closure and Post-Closure Costs	Topography	1,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	1,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Closure design and requirements	Closure design	1,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	1,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	1,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	1,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	1,00	A2 - Technical
Closure design and requirements	Pond water management	1,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	1,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	1,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	1,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	1,00	A4 - Socio-Economic
Closure plan implementation	Closure design	1,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	1,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	1,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	1,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	1,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	1,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	1,00	A4 - Socio-Economic
Community perception and safety	Community safety	1,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Community perception and safety	Embankment height	1,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	1,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	1,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	1,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	1,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	1,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Vegetation	1,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	1,00	A2 - Technical
Complete system flexibility	Topography	1,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	1,00	A1 - Environmental
Design and construction impacts	Borrow source location	1,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	1,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	1,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	1,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	1,00	A1 - Environmental
Design and construction impacts	Number of embankments	1,00	A1 - Environmental
Design and construction impacts	Number of ponds	1,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	1,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	1,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	1,00	A2 - Technical
Infrastructure requirements	Topography	1,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	1,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	1,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	1,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	1,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	1,00	A2 - Technical
Mine materials management	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Pond water management	1,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	1,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A2 - Technical
Mine materials management	Surplus material storage	1,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	1,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	1,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	1,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	1,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	1,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	1,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	1,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	1,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	1,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	1,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	1,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	1,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Opex Requirements	Groundwater conditions	1,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	1,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	1,00	A3 - Economic
Opex Requirements	Pond water management	1,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	1,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	1,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	1,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	1,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	1,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	1,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	1,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	1,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	1,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	1,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	1,00	A4 - Socio-Economic
Post closure water management	Pond water management	1,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	1,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	1,00	A1 - Environmental
Post-closure land use	Closure design	1,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	1,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	1,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	1,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	1,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	1,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	1,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	1,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	1,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential groundwater impacts	Water management system design	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Vegetation	1,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	1,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	1,00	A1 - Environmental
Potential surface water impacts	Pond water management	1,00	A1 - Environmental
Potential surface water impacts	Water management system design	1,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	1,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	1,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	1,00	A2 - Technical
Seepage and groundwater control	Water management system design	1,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	1,00	A2 - Technical
Storage Facility Construction	Construction constraints	1,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	1,00	A2 - Technical
Storage Facility Construction	Construction time	1,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Construction	Embankment volume	1,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	1,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	1,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	1,00	A2 - Technical
Storage Facility Construction	Seasonality	1,00	A2 - Technical
Storage Facility Construction	Surplus material storage	1,00	A2 - Technical
Storage Facility Construction	Topography	1,00	A2 - Technical
Storage Facility Design	Additional site investigation	1,00	A2 - Technical
Storage Facility Design	Borrow source location	1,00	A2 - Technical
Storage Facility Design	Borrow source material availability	1,00	A2 - Technical
Storage Facility Design	Containment structure design	1,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Design	Embankment height	1,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Design	Number of embankments	1,00	A2 - Technical
Storage Facility Design	Number of ponds	1,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	1,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	1,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	1,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	1,00	A2 - Technical
Storage Facility Design	Water management system design	1,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Surface water management	Number of ponds	1,00	A2 - Technical
Surface water management	Overall Catchment Area	1,00	A2 - Technical
Surface water management	Overall footprint of the facility	1,00	A2 - Technical
Surface water management	Water management system design	1,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,036	0,037	0,030	0,035
	Mine materials management impacts	0,045	0,036	0,038	0,039
	Post-closure land use	0,043	0,036	0,032	0,033
	Potential air quality impacts	0,049	0,049	0,040	0,031
	Potential groundwater impacts	0,041	0,040	0,031	0,024
	Potential impacts to receptors	0,043	0,046	0,033	0,023
	Potential surface water impacts	0,046	0,041	0,032	0,023
Total C1 - Environmental		**0,303**	**0,284**	**0,235**	**0,210**
C2 - Technical	Closure design and requirements	0,029	0,026	0,022	0,026
	Complete system flexibility	0,031	0,025	0,031	0,016
	Infrastructure requirements	0,035	0,035	0,023	0,017
	Maintenance Requirements	0,030	0,030	0,024	0,024
	Mine materials management	0,032	0,028	0,028	0,026
	Monitoring & Surveillance	0,027	0,025	0,020	0,026
	Seepage and groundwater control	0,026	0,025	0,016	0,013
	Storage Facility Construction	0,027	0,026	0,022	0,020
	Storage Facility Design	0,030	0,028	0,023	0,023
	Surface water management	0,038	0,036	0,028	0,014
Total C2 - Technical		**0,306**	**0,285**	**0,237**	**0,204**
C3 - Economic	Capex Requirements	0,099	0,091	0,079	0,066
	Closure and Post-Closure Costs	0,099	0,092	0,078	0,082
	Opex Requirements	0,097	0,088	0,075	0,076
Total C3 - Economic		**0,295**	**0,271**	**0,232**	**0,224**
C4 - Socio-Economic	Closure plan implementation	0,061	0,048	0,047	0,050
	Community perception and safety	0,056	0,057	0,047	0,050
	Permitting complexity and delays	0,063	0,062	0,053	0,044
	Post closure monitoring	0,040	0,035	0,038	0,050
	Post closure water management	0,064	0,058	0,046	0,031
Total C4 - Socio-Economic		**0,284**	**0,259**	**0,231**	**0,225**
Total		**1,188**	**1,099**	**0,934**	**0,863**

Appendix F.6 Inverse Weighting for Accounts, Sub-Accounts and Indicators

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	7,41%
A2 - Technical	Technical	4,00	2	ECCC	29,63%
A3 - Economic	Economic	4,50	3	ECCC	33,33%
A4 - Socio-Economic	Socio-Economic	4,00	4	ECCC	29,63%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	4,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	3,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	4,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	5,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	5,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	4,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	4,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	3,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	2,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	5,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	5,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	4,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	5,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	4,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	4,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	3,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	3,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	5,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	6,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	5,00	A3 - Economic
Capex Requirements	Borrow source location	4,00	A3 - Economic
Capex Requirements	Borrow source material availability	5,00	A3 - Economic
Capex Requirements	Construction time	4,00	A3 - Economic
Capex Requirements	Containment structure design	3,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	4,00	A3 - Economic
Capex Requirements	Embankment volume	2,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	5,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	2,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	2,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	1,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	3,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	1,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	6,00	A3 - Economic
Capex Requirements	Number of ponds	4,00	A3 - Economic
Capex Requirements	QA/QC Requirements	5,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	6,00	A3 - Economic
Capex Requirements	Seasonality	4,00	A3 - Economic
Capex Requirements	Surplus material storage	6,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	3,00	A3 - Economic
Capex Requirements	Topography	4,00	A3 - Economic
Capex Requirements	Water management system design	5,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	1,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	2,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	3,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	4,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	2,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	5,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	3,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	4,00	A3 - Economic
Closure and Post-Closure Costs	Topography	4,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	3,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	2,00	A3 - Economic
Closure design and requirements	Closure design	4,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	4,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	2,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	3,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	4,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	4,00	A2 - Technical
Closure design and requirements	Pond water management	5,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	3,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	3,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	1,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	4,00	A4 - Socio-Economic
Closure plan implementation	Closure design	4,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	4,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	4,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	4,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	3,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	3,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	2,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	4,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	5,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	3,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	2,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	1,00	A4 - Socio-Economic
Community perception and safety	Community safety	1,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Community perception and safety	Embankment height	4,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	3,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	5,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	4,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	2,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	4,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	6,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	5,00	A4 - Socio-Economic
Community perception and safety	Vegetation	4,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	1,00	A2 - Technical
Complete system flexibility	Topography	4,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	6,00	A1 - Environmental
Design and construction impacts	Borrow source location	4,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	5,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	5,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	2,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	5,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	4,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	6,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	5,00	A1 - Environmental
Design and construction impacts	Number of embankments	5,00	A1 - Environmental
Design and construction impacts	Number of ponds	5,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	4,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	6,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	1,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	3,00	A2 - Technical
Infrastructure requirements	Topography	3,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	4,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	3,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	4,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	1,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	5,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	4,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	2,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	4,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	2,00	A2 - Technical
Mine materials management	Overall footprint of the facility	3,00	A2 - Technical
Mine materials management	Pond water management	3,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	4,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	4,00	A2 - Technical
Mine materials management	Surplus material storage	4,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	3,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	3,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	2,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	6,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	6,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	4,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	3,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	4,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	2,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	2,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	3,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	4,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	3,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	2,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	2,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	3,00	A3 - Economic
Opex Requirements	Groundwater conditions	2,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	2,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	5,00	A3 - Economic
Opex Requirements	Pond water management	3,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	5,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	3,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	5,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	3,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	4,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	5,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	2,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	1,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	3,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	2,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	3,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	6,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	5,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	5,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	4,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	3,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	2,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	5,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	5,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	5,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	5,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	2,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	3,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	5,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	2,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	3,00	A4 - Socio-Economic
Post closure water management	Pond water management	5,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	6,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	5,00	A1 - Environmental
Post-closure land use	Closure design	3,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	4,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	1,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	4,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	3,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	2,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	3,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	4,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	3,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	2,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	2,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential groundwater impacts	Water management system design	5,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	4,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	3,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	2,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	4,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	5,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	2,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	3,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Vegetation	3,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	2,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	3,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	1,00	A1 - Environmental
Potential surface water impacts	Pond water management	4,00	A1 - Environmental
Potential surface water impacts	Water management system design	5,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	2,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	1,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	2,00	A2 - Technical
Seepage and groundwater control	Water management system design	3,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	2,00	A2 - Technical
Storage Facility Construction	Construction constraints	4,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	4,00	A2 - Technical
Storage Facility Construction	Construction time	4,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	5,00	A2 - Technical
Storage Facility Construction	Embankment volume	2,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	5,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	2,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	1,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	4,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	6,00	A2 - Technical
Storage Facility Construction	Seasonality	2,00	A2 - Technical
Storage Facility Construction	Surplus material storage	5,00	A2 - Technical
Storage Facility Construction	Topography	3,00	A2 - Technical
Storage Facility Design	Additional site investigation	6,00	A2 - Technical
Storage Facility Design	Borrow source location	5,00	A2 - Technical
Storage Facility Design	Borrow source material availability	2,00	A2 - Technical
Storage Facility Design	Containment structure design	1,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	4,00	A2 - Technical
Storage Facility Design	Embankment height	5,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	4,00	A2 - Technical
Storage Facility Design	Number of embankments	6,00	A2 - Technical
Storage Facility Design	Number of ponds	4,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	4,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	5,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	3,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	5,00	A2 - Technical
Storage Facility Design	Water management system design	2,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Surface water management	Number of ponds	4,00	A2 - Technical
Surface water management	Overall Catchment Area	4,00	A2 - Technical
Surface water management	Overall footprint of the facility	4,00	A2 - Technical
Surface water management	Water management system design	2,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,019	0,020	0,016	0,019
	Mine materials management impacts	0,019	0,016	0,017	0,016
	Post-closure land use	0,014	0,011	0,010	0,011
	Potential air quality impacts	0,022	0,022	0,018	0,014
	Potential groundwater impacts	0,005	0,005	0,004	0,003
	Potential impacts to receptors	0,005	0,005	0,004	0,002
	Potential surface water impacts	0,005	0,004	0,004	0,003
Total C1 - Environmental		**0,089**	**0,084**	**0,072**	**0,068**
C2 - Technical	Closure design and requirements	0,021	0,018	0,016	0,019
	Complete system flexibility	0,037	0,034	0,033	0,022
	Infrastructure requirements	0,064	0,064	0,045	0,031
	Maintenance Requirements	0,045	0,045	0,038	0,043
	Mine materials management	0,044	0,037	0,038	0,034
	Monitoring & Surveillance	0,038	0,034	0,026	0,039
	Seepage and groundwater control	0,010	0,009	0,007	0,004
	Storage Facility Construction	0,040	0,039	0,031	0,026
	Storage Facility Design	0,051	0,048	0,040	0,042
	Surface water management	0,013	0,013	0,010	0,005
Total C2 - Technical		**0,364**	**0,340**	**0,283**	**0,266**
C3 - Economic	Capex Requirements	0,204	0,186	0,159	0,130
	Closure and Post-Closure Costs	0,039	0,038	0,032	0,033
	Opex Requirements	0,155	0,137	0,123	0,129
Total C3 - Economic		**0,397**	**0,362**	**0,314**	**0,292**
C4 - Socio-Economic	Closure plan implementation	0,089	0,071	0,070	0,080
	Community perception and safety	0,021	0,022	0,018	0,018
	Permitting complexity and delays	0,122	0,121	0,104	0,088
	Post closure monitoring	0,036	0,032	0,039	0,069
	Post closure water management	0,076	0,068	0,054	0,035
Total C4 - Socio-Economic		**0,345**	**0,314**	**0,284**	**0,291**
Total		**1,195**	**1,100**	**0,953**	**0,917**

Appendix F.7 Random Weighting for Accounts, Sub-Accounts and Indicators

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	4,00	1	ECCC	33,33%
A2 - Technical	Technical	1,00	2	ECCC	8,33%
A3 - Economic	Economic	1,00	3	ECCC	8,33%
A4 - Socio-Economic	Socio-Economic	6,00	4	ECCC	50,00%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	2,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	5,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	4,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	5,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	6,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	2,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	6,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	6,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	2,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	4,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	5,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	5,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	5,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	5,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	3,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	6,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	4,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	5,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	5,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	4,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	2,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	2,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	5,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	4,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	6,00	A3 - Economic
Capex Requirements	Borrow source location	4,00	A3 - Economic
Capex Requirements	Borrow source material availability	1,00	A3 - Economic
Capex Requirements	Construction time	1,00	A3 - Economic
Capex Requirements	Containment structure design	1,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	5,00	A3 - Economic
Capex Requirements	Embankment volume	2,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	6,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	4,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	5,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	3,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	3,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	6,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	3,00	A3 - Economic
Capex Requirements	Number of ponds	5,00	A3 - Economic
Capex Requirements	QA/QC Requirements	2,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	2,00	A3 - Economic
Capex Requirements	Seasonality	5,00	A3 - Economic
Capex Requirements	Surplus material storage	4,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	3,00	A3 - Economic
Capex Requirements	Topography	1,00	A3 - Economic
Capex Requirements	Water management system design	2,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	6,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	2,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	4,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	3,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	6,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	3,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	6,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	6,00	A3 - Economic
Closure and Post-Closure Costs	Topography	3,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	6,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	2,00	A3 - Economic
Closure design and requirements	Closure design	3,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	4,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	4,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	6,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	3,00	A2 - Technical
Closure design and requirements	Pond water management	3,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	4,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	6,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	6,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	1,00	A4 - Socio-Economic
Closure plan implementation	Closure design	4,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	1,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	2,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	4,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	4,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	4,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	5,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	4,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	2,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	5,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	4,00	A4 - Socio-Economic
Community perception and safety	Community safety	4,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Community perception and safety	Embankment height	3,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	2,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	5,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	1,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	6,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	4,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	4,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	4,00	A4 - Socio-Economic
Community perception and safety	Vegetation	2,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	5,00	A2 - Technical
Complete system flexibility	Topography	6,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	2,00	A1 - Environmental
Design and construction impacts	Borrow source location	4,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	6,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	3,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	2,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	4,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	3,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	2,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	2,00	A1 - Environmental
Design and construction impacts	Number of embankments	4,00	A1 - Environmental
Design and construction impacts	Number of ponds	1,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	3,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	4,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	3,00	A2 - Technical
Infrastructure requirements	Topography	3,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	5,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	3,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	3,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	6,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	4,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	2,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	6,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	5,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	6,00	A2 - Technical
Mine materials management	Overall footprint of the facility	5,00	A2 - Technical
Mine materials management	Pond water management	1,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	2,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	3,00	A2 - Technical
Mine materials management	Surplus material storage	1,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	5,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	3,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	6,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	4,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	6,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	5,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	4,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	1,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	4,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	2,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	6,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	3,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	4,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	6,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	5,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	2,00	A3 - Economic
Opex Requirements	Groundwater conditions	5,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	5,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	5,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	1,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	6,00	A3 - Economic
Opex Requirements	Pond water management	5,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	6,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	6,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	3,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	3,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	4,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	5,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	6,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	4,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	1,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	5,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	5,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	5,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	5,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	5,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	3,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	6,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	5,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	6,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	6,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	2,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	6,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	6,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	5,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	5,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	2,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	2,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	1,00	A4 - Socio-Economic
Post closure water management	Pond water management	5,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	4,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	1,00	A1 - Environmental
Post-closure land use	Closure design	2,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	4,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	5,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	4,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	2,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	4,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	4,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	1,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	3,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	3,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	4,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	2,00	A1 - Environmental
Potential groundwater impacts	Water management system design	3,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	5,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	2,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	4,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	2,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	5,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	5,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	6,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	5,00	A1 - Environmental
Potential impacts to receptors	Vegetation	5,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	2,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	1,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	5,00	A1 - Environmental
Potential surface water impacts	Pond water management	6,00	A1 - Environmental
Potential surface water impacts	Water management system design	4,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	5,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	6,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	6,00	A2 - Technical
Seepage and groundwater control	Water management system design	2,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	3,00	A2 - Technical
Storage Facility Construction	Construction constraints	1,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	2,00	A2 - Technical
Storage Facility Construction	Construction time	3,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Storage Facility Construction	Embankment volume	4,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	6,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	6,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	4,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	4,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	4,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	2,00	A2 - Technical
Storage Facility Construction	Seasonality	5,00	A2 - Technical
Storage Facility Construction	Surplus material storage	2,00	A2 - Technical
Storage Facility Construction	Topography	3,00	A2 - Technical
Storage Facility Design	Additional site investigation	3,00	A2 - Technical
Storage Facility Design	Borrow source location	4,00	A2 - Technical
Storage Facility Design	Borrow source material availability	1,00	A2 - Technical
Storage Facility Design	Containment structure design	6,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Design	Embankment height	2,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	4,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	4,00	A2 - Technical
Storage Facility Design	Number of embankments	2,00	A2 - Technical
Storage Facility Design	Number of ponds	2,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	3,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	1,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	4,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	1,00	A2 - Technical
Storage Facility Design	Water management system design	3,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Surface water management	Number of ponds	3,00	A2 - Technical
Surface water management	Overall Catchment Area	2,00	A2 - Technical
Surface water management	Overall footprint of the facility	4,00	A2 - Technical
Surface water management	Water management system design	3,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,068	0,070	0,049	0,064
	Mine materials management impacts	0,028	0,022	0,023	0,023
	Post-closure land use	0,087	0,077	0,067	0,059
	Potential air quality impacts	0,029	0,029	0,020	0,014
	Potential groundwater impacts	0,066	0,063	0,055	0,039
	Potential impacts to receptors	0,052	0,056	0,040	0,028
	Potential surface water impacts	0,077	0,065	0,056	0,046
Total C1 - Environmental		**0,407**	**0,381**	**0,309**	**0,273**
C2 - Technical	Closure design and requirements	0,003	0,002	0,002	0,002
	Complete system flexibility	0,014	0,012	0,014	0,007
	Infrastructure requirements	0,016	0,016	0,010	0,007
	Maintenance Requirements	0,013	0,013	0,011	0,012
	Mine materials management	0,014	0,012	0,012	0,012
	Monitoring & Surveillance	0,008	0,006	0,006	0,007
	Seepage and groundwater control	0,003	0,002	0,002	0,001
	Storage Facility Construction	0,005	0,004	0,004	0,004
	Storage Facility Design	0,016	0,014	0,013	0,014
	Surface water management	0,014	0,013	0,010	0,005
Total C2 - Technical		**0,104**	**0,096**	**0,083**	**0,071**
C3 - Economic	Capex Requirements	0,039	0,036	0,031	0,025
	Closure and Post-Closure Costs	0,027	0,026	0,020	0,021
	Opex Requirements	0,031	0,029	0,024	0,025
Total C3 - Economic		**0,098**	**0,091**	**0,075**	**0,071**
C4 - Socio-Economic	Closure plan implementation	0,169	0,131	0,128	0,135
	Community perception and safety	0,058	0,058	0,051	0,060
	Permitting complexity and delays	0,172	0,168	0,142	0,125
	Post closure monitoring	0,091	0,079	0,087	0,110
	Post closure water management	0,075	0,068	0,055	0,040
Total C4 - Socio-Economic		**0,566**	**0,503**	**0,462**	**0,469**
Total		**1,175**	**1,071**	**0,929**	**0,885**

Appendix F.8 Excluding Environmental Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	0,00	1	ECCC	0,00%
A2 - Technical	Technical	3,00	2	ECCC	40,00%
A3 - Economic	Economic	1,50	3	ECCC	20,00%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	40,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,000	0,000	0,000	0,000
	Mine materials management impacts	0,000	0,000	0,000	0,000
	Post-closure land use	0,000	0,000	0,000	0,000
	Potential air quality impacts	0,000	0,000	0,000	0,000
	Potential groundwater impacts	0,000	0,000	0,000	0,000
	Potential impacts to receptors	0,000	0,000	0,000	0,000
	Potential surface water impacts	0,000	0,000	0,000	0,000
Total C1 - Environmental		**0,000**	**0,000**	**0,000**	**0,000**
C2 - Technical	Closure design and requirements	0,063	0,058	0,046	0,057
	Complete system flexibility	0,052	0,037	0,056	0,022
	Infrastructure requirements	0,031	0,031	0,019	0,014
	Maintenance Requirements	0,029	0,029	0,022	0,021
	Mine materials management	0,044	0,040	0,039	0,037
	Monitoring & Surveillance	0,036	0,034	0,027	0,033
	Seepage and groundwater control	0,067	0,065	0,040	0,034
	Storage Facility Construction	0,034	0,032	0,028	0,028
	Storage Facility Design	0,027	0,026	0,021	0,020
	Surface water management	0,100	0,096	0,072	0,033
Total C2 - Technical		**0,483**	**0,448**	**0,370**	**0,299**
C3 - Economic	Capex Requirements	0,042	0,039	0,034	0,029
	Closure and Post-Closure Costs	0,130	0,117	0,100	0,105
	Opex Requirements	0,064	0,058	0,048	0,048
Total C3 - Economic		**0,236**	**0,213**	**0,183**	**0,183**
C4 - Socio-Economic	Closure plan implementation	0,077	0,061	0,058	0,060
	Community perception and safety	0,137	0,134	0,117	0,128
	Permitting complexity and delays	0,051	0,049	0,042	0,035
	Post closure monitoring	0,080	0,071	0,068	0,062
	Post closure water management	0,101	0,091	0,075	0,052
Total C4 - Socio-Economic		**0,447**	**0,406**	**0,361**	**0,337**
Total		**1,165**	**1,067**	**0,914**	**0,819**

Appendix F.9 Excluding Techincal Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	57,14%
A2 - Technical	Technical	0,00	2	ECCC	0,00%
A3 - Economic	Economic	1,50	3	ECCC	14,29%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	28,57%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,040	0,041	0,033	0,038
	Mine materials management impacts	0,074	0,054	0,058	0,067
	Post-closure land use	0,094	0,078	0,070	0,072
	Potential air quality impacts	0,078	0,078	0,061	0,047
	Potential groundwater impacts	0,125	0,124	0,092	0,076
	Potential impacts to receptors	0,135	0,143	0,106	0,080
	Potential surface water impacts	0,143	0,131	0,097	0,069
Total C1 - Environmental		**0,688**	**0,648**	**0,517**	**0,448**
C2 - Technical	Closure design and requirements	0,000	0,000	0,000	0,000
	Complete system flexibility	0,000	0,000	0,000	0,000
	Infrastructure requirements	0,000	0,000	0,000	0,000
	Maintenance Requirements	0,000	0,000	0,000	0,000
	Mine materials management	0,000	0,000	0,000	0,000
	Monitoring & Surveillance	0,000	0,000	0,000	0,000
	Seepage and groundwater control	0,000	0,000	0,000	0,000
	Storage Facility Construction	0,000	0,000	0,000	0,000
	Storage Facility Design	0,000	0,000	0,000	0,000
	Surface water management	0,000	0,000	0,000	0,000
Total C2 - Technical		**0,000**	**0,000**	**0,000**	**0,000**
C3 - Economic	Capex Requirements	0,030	0,028	0,024	0,021
	Closure and Post-Closure Costs	0,093	0,083	0,072	0,075
	Opex Requirements	0,046	0,041	0,034	0,034
Total C3 - Economic		**0,168**	**0,152**	**0,131**	**0,131**
C4 - Socio-Economic	Closure plan implementation	0,055	0,043	0,042	0,043
	Community perception and safety	0,098	0,096	0,084	0,091
	Permitting complexity and delays	0,037	0,035	0,030	0,025
	Post closure monitoring	0,057	0,050	0,049	0,044
	Post closure water management	0,072	0,065	0,053	0,037
Total C4 - Socio-Economic		**0,319**	**0,290**	**0,258**	**0,241**
Total		**1,176**	**1,091**	**0,906**	**0,819**

Appendix F.10 Excluding Economic Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	50,00%
A2 - Technical	Technical	3,00	2	ECCC	25,00%
A3 - Economic	Economic	0,00	3	ECCC	0,00%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	25,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,035	0,036	0,029	0,033
	Mine materials management impacts	0,065	0,048	0,051	0,058
	Post-closure land use	0,082	0,068	0,061	0,063
	Potential air quality impacts	0,068	0,068	0,054	0,041
	Potential groundwater impacts	0,110	0,108	0,080	0,066
	Potential impacts to receptors	0,118	0,125	0,093	0,070
	Potential surface water impacts	0,125	0,115	0,085	0,060
Total C1 - Environmental		**0,602**	**0,567**	**0,453**	**0,392**
C2 - Technical	Closure design and requirements	0,040	0,036	0,029	0,035
	Complete system flexibility	0,032	0,023	0,035	0,014
	Infrastructure requirements	0,019	0,019	0,012	0,009
	Maintenance Requirements	0,018	0,018	0,014	0,013
	Mine materials management	0,027	0,025	0,024	0,023
	Monitoring & Surveillance	0,023	0,021	0,017	0,021
	Seepage and groundwater control	0,042	0,041	0,025	0,021
	Storage Facility Construction	0,021	0,020	0,018	0,017
	Storage Facility Design	0,017	0,016	0,013	0,012
	Surface water management	0,063	0,060	0,045	0,021
Total C2 - Technical		**0,302**	**0,280**	**0,232**	**0,187**
C3 - Economic	Capex Requirements	0,000	0,000	0,000	0,000
	Closure and Post-Closure Costs	0,000	0,000	0,000	0,000
	Opex Requirements	0,000	0,000	0,000	0,000
Total C3 - Economic		**0,000**	**0,000**	**0,000**	**0,000**
C4 - Socio-Economic	Closure plan implementation	0,048	0,038	0,037	0,038
	Community perception and safety	0,086	0,084	0,073	0,080
	Permitting complexity and delays	0,032	0,031	0,027	0,022
	Post closure monitoring	0,050	0,044	0,043	0,039
	Post closure water management	0,063	0,057	0,047	0,033
Total C4 - Socio-Economic		**0,279**	**0,254**	**0,226**	**0,211**
Total		**1,183**	**1,101**	**0,910**	**0,789**

Appendix F.11 Excluding Socio-Economic Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	57,14%
A2 - Technical	Technical	3,00	2	ECCC	28,57%
A3 - Economic	Economic	1,50	3	ECCC	14,29%
A4 - Socio-Economic	Socio-Economic	0,00	4	ECCC	0,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,040	0,041	0,033	0,038
	Mine materials management impacts	0,074	0,054	0,058	0,067
	Post-closure land use	0,094	0,078	0,070	0,072
	Potential air quality impacts	0,078	0,078	0,061	0,047
	Potential groundwater impacts	0,125	0,124	0,092	0,076
	Potential impacts to receptors	0,135	0,143	0,106	0,080
	Potential surface water impacts	0,143	0,131	0,097	0,069
Total C1 - Environmental		**0,688**	**0,648**	**0,517**	**0,448**
C2 - Technical	Closure design and requirements	0,045	0,041	0,033	0,040
	Complete system flexibility	0,037	0,026	0,040	0,016
	Infrastructure requirements	0,022	0,022	0,014	0,010
	Maintenance Requirements	0,021	0,021	0,016	0,015
	Mine materials management	0,031	0,029	0,028	0,026
	Monitoring & Surveillance	0,026	0,024	0,019	0,024
	Seepage and groundwater control	0,048	0,047	0,029	0,024
	Storage Facility Construction	0,024	0,023	0,020	0,020
	Storage Facility Design	0,019	0,018	0,015	0,014
	Surface water management	0,071	0,068	0,051	0,024
Total C2 - Technical		**0,345**	**0,320**	**0,265**	**0,213**
C3 - Economic	Capex Requirements	0,030	0,028	0,024	0,021
	Closure and Post-Closure Costs	0,093	0,083	0,072	0,075
	Opex Requirements	0,046	0,041	0,034	0,034
Total C3 - Economic		**0,168**	**0,152**	**0,131**	**0,131**
C4 - Socio-Economic	Closure plan implementation	0,000	0,000	0,000	0,000
	Community perception and safety	0,000	0,000	0,000	0,000
	Permitting complexity and delays	0,000	0,000	0,000	0,000
	Post closure monitoring	0,000	0,000	0,000	0,000
	Post closure water management	0,000	0,000	0,000	0,000
Total C4 - Socio-Economic		**0,000**	**0,000**	**0,000**	**0,000**
Total		**1,202**	**1,120**	**0,913**	**0,792**

Appendix G Multi-Disciplinary Workshop Minutes

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Telkwa – PAG Storage Alternatives Assessment

Minutes for the Meeting: SRK Consulting

Held: Microsoft Teams, Feb 28th 2024 at 1:00pm

1 Present and apologies

Sue Bonham Carter- Bathurst
Dan Farmer (DF) - Telkwa
James Henderson (JH) – Telkwa
Victoria Hughes (VH) – Telkwa
Jessy Chaplin – Telkwa
Paul Weber (PW) – MWM
Greg Meiers (GM) – MWM

Rick Palmer – Palmer Environmental
Alexandra LeClair – Palmer Environmental

Calvin Boese – SRK CA
Celine Michiels – SRK CA
Santiago Pastine – SRK AR
Nicolas Alscher – SRK AR

2 Objective of the workshop

The objective of the workshop is to present the overall process for assessing alternatives for the different mine materials from the Tenas Project. This includes:

1. Presenting the methodology adopted for the storage alternatives assessment.
2. Presenting and discussing the candidate alternatives.
3. Presenting the indicators, sub-accounts and accounts considered in the analysis.
4. Discussing the scoring for indicators and weightings for accounts and sub-accounts.

3 Confirmation of agenda

Wednesday, February 28, 2024	Duration	Saskatoon		Vancouver		Buenos Aires	
Opening	5 min	13:00	13:05	11:00	11:05	16:00	16:05
Introductions	10 min	13:05	13:15	11:05	11:15	16:05	16:15
Project Background & Pre-Screening Assessment	15 min	13:15	13:30	11:15	11:30	16:15	16:30
MAA Process Overview	15 min	13:30	13:45	11:30	11:45	16:30	16:45
Sub-Accounts Weighting	15 min	13:45	14:00	11:45	12:00	16:45	17:00
Indicators Scoring	45 min	14:00	14:45	12:00	12:45	17:00	17:45
Coffee Break	15 min	14:45	15:00	12:45	13:00	17:45	18:00
Indicators Scoring	60 min	15:00	16:00	13:00	14:00	18:00	19:00
Break / Compiling results	15 min	16:00	16:15	14:00	14:15	19:00	19:15
Workshop Closure	15 min	16:15	16:30	14:15	14:30	19:15	19:30

4 Opening

- Dan Farmer (Telkwa) advised this is an Information Request (IR) given by the Ministry of Mines through the Environmental Assessment Office (EAO) asking for a materials storage alternatives assessment following the Environment and Climate Change Canada (ECCC) guidelines for federal EAS.
  - Explained today's team consists of a diverse group of people to discuss all considerations.
  - Dan advised that SRK Consulting put together today's presentation and then handed it over to Calvin Boese, Principal Consultant, SRK Consulting.
- Calvin explained the process and background for today's meeting before everyone introduced themselves.

5 Discussion Points – from presentation:

5.1 Project Background & Pre-Screening Assessment

5.1.1 History Review of the Project

- 2018 through 2021 – field programs have been done to investigate the foundation conditions for previous versions of the Management Ponds (MP) design and rock geotechnical investigations for the open pit slopes.
- 2020 – 2021 – Several works were conducted:
  - Geochemical characterization and assessment of management strategies to prevent Acid Rock Drainage (ARD) and Metal Leaching (ML) of the different mine materials.
  - Site-wide water balance and water balance for the management ponds.
  - Alignments for the liner design and construction methodology.
  - Geotechnical assessment of both the management ponds and the Tenas Control Pond at a Feasibility Study level.
- 2022 February – submission of the Environmental Assessment Certificate Application (EACA) to the EAO.
- 2022 November – EAO presented a list of IRs, including a request to complete a detailed review of the PAG material storage alternatives assessed to support the mine plan and management ponds provided in the EACA.
  - Objective for this workshop is to provide a comprehensive review of the different alternatives assessed by Telkwa.
  - Beyond the informal alternatives assessments previously done by Telkwa and SRK. The ministry requires a more compiled and formalized assessment including the MAA and general state conditions.

5.2 Site Conditions

- Project is located in central BC
- Nearest townsite is Telkwa.
- Geotechnical Profile – mainly composed of interceptions of silts and clays commonly stiff to hard in consistency and dense to very dense sands and gravels.
- Seismicity - Relatively stable area (NCR 2015). This is supported by a site-specific seismic hazard assessment conducted by SRK in 2023 – 2024.

5.3 Mine Plan and Mine Materials

- LOM – 21 years
- Coal production rate – 775,000 to 825,000 ton/s annum
- By product of the concentration process – fine and coarse processed rock combined for disposal.

5.4 Mine Materials Characterization

- Geochemical characterization for the EACA and planning purposes based on Acid-Base Accounting (ABA) Tests.
- Criterion: PAG material: NPR≤ 2. – Non PAG > 2.

Q - Paul Weber:
The slides are looking at a classification based on an NPR of two for acid forming vs. non acid forming for the design which will mean partially more non-acid forming material release acid forming materials which contributes to some additional capacity. Any comments?

A - Dan Farmer:
Working with Mike Herrell and his team. Putting forward for classification in the Operations Phase 1.2. The dams will be less, but the idea is we build them in stages and learn from each. May have more than one big facility. Can alter the construction as you go and when you have less PAG then you don't build the next one as big.

- Material enters the Coal Process Plant (CPP) and is divided into streams – coarse and fine.
- Final product is coal.
- Byproduct is fine and coarse processed rock combined for disposal with Potentially Acid Generating (PAG) rock from the open pit.
- Mine waste, some topsoil and overburden also come from the open pit.
- 2020: A geochemical characterization was done based on the acid base account test. Showed the topsoil and overburden materials are Non-PAG while some parts of the mine rock material are PAG.
- Will monitor during the operational phase to determine PAG and Non-PAG.

5.5 Mine Materials Management

An alternatives assessment for ARD/ML mitigation strategy was conducted in 2020 – 2021 for the different mine materials. The outcomes of the study were that:

- Fine processed rock should be dewatered and blended with coarse processed rock for co-disposal with PAG mine rock. This increase the process waste recycling and reduce risks and operational complexities associated with the management of more than one facility for each.
- Open pit walls are PAG. Cover with overburden which is a Non-PAG material and then prepare the landform for the post closure condition.
- The Non-PAG material should be progressively covered with topsoil for post closure. Also, could be a candidate material for the construction of the embankment.
- PAG mine rock should be impounded, with a water cover to minimize oxygen and prevent ARD/ML.
- Construction Materials – Non-PAG rock materials, some topsoil and overburden with the appropriate compaction requirements. An impermeabilization of the full deposition area is needed to ensure a positive water balance in the management ponds and keep water cover of the PAG materials. To achieve this:
    - 0.3 meters thick low permeability soil-bentonite liner – constructed in two stages, 0.15 m.
    - A maximum seepage rate of ~3000 cubic meters per day is needed to keep the positive water balance. A target hydraulic conductivity of $1x10^{-8}$ meters per second to achieve this.

Q - Paul Weber: 2800 cubic meters per day? Is that just the seepage from the PAG cells based on the original design? That could change a little depending on what option goes forward.

A – Dan Farmer: Yes. That's the maximum allowed for seepage out of the management facilities and having a positive water cover. That is the maximum that can come out of the management ponds.

Q – Paul Weber: So that's the managements ponds change? That's the maximum based on the containment load model. That's the goal and anything less works as far as that containment load goes. Any fix on the receiving environment?

A – Dan Farmer: No, it's limited on what keeps a positive water cover in the pond itself. The number might even be smaller if based on load going into the pond but it wasn't.

5.6 Alternatives Assessment

- **First step** – identify the candidate alternatives: Threshold criteria to identify Candidate Alternatives:

    - Protected area
    - Topographic constraints
    - Existing infrastructure
    - TCL property or coal license boundaries
    - Distance to the CPP
    - Distant to the EA Open Pit

    Due to the requirement to store materials – the TCL coal licenses located north of the open pit are the only areas the comply with all threshold criteria and storage requirements. Within this area, 6 configurations were identified.

Q – Paul Weber: What does it mean when you say preserve the deposit for future generations? That it won't be mined as part of this project and therefore, the other scenarios won't be mined, but you'll place material on top of it?
A – Santiago Pastine / Dan Farmer – Yes. Correct.

- **Second step – Pre-Screening Assessment** – using criteria to establish fatal flaws for eliminating options. All options already went through an initial list of about 15 or 20 items each had to meet to qualify. If one gets a "Yes" it is excluded.
    - Infrastructure outside the boundaries of the Tenas and Four Creek.
    - Impacting future resources.
    - Disposal of the fine and coarse processed rock in separate facilities than the PAG rock.

  (EAC / Option 2 / Option 4 received no yes's and move forward).

Q – Calvin Boese: Because these were pre-screened and we are now down to three options, is everyone in agreement that these three configurations move forward to the multiple accounts analysis (MAA) or should there be others carried forward?
Q - Paul Weber: You talk about fine and coarse waste material from the processing plant being stored separately. Does this introduce other geotechnical risks in regards liquefaction due to earthquakes. Was this ticked off and ruled out?
A – Calvin Boese and summarized by Paul Weber: There's no real difference in risk for liquefaction because of the material properties for either coal disposal or separate disposal?
A – Calvin Boese: Correct.
Q – Paul Weber: One of the key issues from all these design options is what is the long-term effect on the receiving environment? It doesn't seem to be anything in the screening that looks at the affect difference from these options either the load coming out or the two streams that run past it.
A – Dan Farmer: No, there isn't one scenario that would have eliminate exceedances. We couldn't see one eliminate exceedances. Could be the criteria, one that doesn't have exceedances in the pre-screening.
Q – Paul con't: Add some commentary that you know the difference wasn't the key driver for the MAA process, it was other parameters.
A – Dan con't: Good point, will add some commentary on it.

Q – Jessy Chaplin – Are SRK jumping too quickly to this location? Will the government say you need to look at span of 50km radius for example? Is it possible to add the economic to this?
A – Dan Farmer – (Shows the map and explains how they limited down to specific area (white)). And stay within the property, eliminating areas that don't make sense.
Q – Jessy – Should you consider damming a river/creek and why did we exclude that? And ensure the government knows why these areas were eliminated.

Comments / Considerations – working through options:

- Look at some of the key concerns, alternative assessment looking at storing PAG underwater
- Quality is an issue
- More disturbance we have, the larger footprints
- Commentary around environment
- Not have facility over top
- Were alternatives looked at for explosive facilities. (yes)
- Facilities need to be other side of creek
- Introduces us to another watershed
- 3 - Separating the waste into two types of facilities. May be way of incorporating that within existing watersheds
- Could put in sub note – it's outside but could be moved.
- Examine alternatives in a larger span – 50km radius or a 25 km radius. (Cost concern)

List of initial goals:

- Goals for developing Configurations:
- Minimize disturbance footprint;
- Promote a water cover to prevent ARD;
- Stable embankments;
- Robust water management for sediment control;
- Contain all PAG material plus contingencies;
- Avoid provincial Agricultural Land Reserve;
- Avoid private lands;
- Avoid municipal boundaries;
- Avoid provincial infrastructure;
- Avoid BC Hydro Infrastructure;
- Avoid PNG infrastructure;
- Avoid Ministry of Transportation roads;
- Prevent potential non-cascading dam failures;
- Avoid steep terrain greater than 4H to 1V or 14%;
- Avoid structures on the east side of Goathorn Creek;
- Avoid structures on the west or north sides of Tenas Creek;
- Avoid structures on the north side of Telkwa River;
- Avoid High Elevation Caribou habitat;
- Avoid placing material directly within a watercourse and/or its riparian zone;
- Do not sterilize potential future coal resources; and
- Minimize haul distance and associated emissions with dust and GHG.

Comments / Considerations con't:

- Minimize potential environmental effect OR minimize the load that would report to those two streams. Could expand on this as needed for what you have looked at.
- Material quantities – would knock out some of the more complex ones. Non acid forming rock.
- Excavated storage – huge external piles that needed placement.
- Pre-screening – material requirements / height of dam under 30 to 35 meters.
- Enough material at the right time – all possible within the mine plan.
- Enough water for PAG storage? (should be able to generate enough water each year to flood when needed and in gross system design).
- Request received – look at alternatives to the PAG management system.
- Potentially all scenarios are within a couple of months of having the right amount of material at the right time to physically build the dams.

- The Tenas Control Pond is oversized to meet our needs to maintain water cover – keep the water level in the active PAG cell managed. Can dump safely and flood as required. (filling of water related to freshet).
- The IR says applications must include an alternatives assessment for the management ponds, tailing storage facilities as per the app information requirements. Provide a detailed review of tailing storage alternatives assessed to support the proposed mine plan.
- (The gov't calls it tailings because it goes through a process – material that came out of a washing is processed material)
- Would we have a tailings stamp – technically under the code, no. Tailings not included in the build – looked at having a separate facility for tailings (more things to manage then).
    - Discussion about separating the waste streams
    - The ARD component of the rock behind the dam, even though submerged, has it's own risks.
    - Memo on why the PAG is underwater vs. not underwater in original application
    - Why we went dry stack vs we for tailings with the main reason water usage. Main drivers was feedback received - we wanted us to use as little water as possible from the community.
- Fish and village driving it to extreme rating – good to see the option is sitting between two creeks and fish on all sides.
    - Both flow and watershed for steelhead especially.
    - Option least impact on watershed, reduced flows.
    - Dam failure consequence is considered. Breach analysis included on the design option submitted.
    - The bigger the project the more water discharge.
    - Proper analysis each area has. MAA all these have been discussed. Adequate options are: 1, 2 & 4.
- Was assessment done on buildings with constructability of liner – risk of geochemical stability if not?
    - Liner – looked at and implemented in other projects. Challenging if done in layers.
    - Feasibility – detailed design – looking at dual drainage system with a geo membrane on top taking most of the head.
- Building assessment – originally planned for above ground – less work.
    - Water cover vs dry cover – is it a potential risk? (Yes – dry cover systems is an option. Challenge is can we demonstrate it will not generate PAG in the next 10000 years?)
    - Hybrid water cover – both dry and wet and being able to discharge and retain. Keeping the geochemical.
- …next slide

5.7 Multiple Account Analysis (MAA)

A method on weighting each indicator to get to the preferred one. Nicolás explained how the process works to get to the end choice. He showed an example to help everyone understand the process.

Four accounts that will be weighted, each having a sub account attached to consider:

- Environmental
- Technical
- Economic
- Socio Economic

Alternatives to Discuss:

- Economic costs have been excluded in others completed, why?
    - Sensitivity analysis is when these components will be removed.
    - Government provided governing guidance on weighting for main accounts.
    - Sub accounts are moving individual depending on team.
    - SRK put in as this is what they would see. Can change later.

- Potential groundwater and receptor impacts – was there a detailed assessment on these?
    - Once we get to these, you will see and understand them better.
    - Potential impact receptors – both fish and wildlife? (Could state that in there).
    - Separate land animals to water. Cross reference on habitat check. Have as Fish and Aquatic Resources.
- How does the weighting work? Surface vs. Groundwater?
    - These can be changed.
    - Impact Receptors fish base and post closure land use impacts wildlife.
    - **Add text around post closure management. How passive it is or how active it is. Have a range.

Technical:

- **Will send a draft around on the weightings and discuss if there should be more changes post meeting.

Economic (lower weight from the IECCC) and Socio Economic:

Discussion around weightings in this area.

- Weightings provided to regulator

COFEE BREAK – 3PM

Calvin/Santiago/Nicolas – included option 5 which was earlier screened out. No dams excavated but larger footprint. It was previously removed for precluding future exploitation or mining of future resources in the center or the deposit. It was decided to include this option for giving a completely different configuration (i.e., no dams vs dams).

Nicolás brought up and explained the spreadsheet and process for weighting with the added option 5.

- 4 indicators – pre-scored to help explain the process. The idea is not to assess the value of the score but the difference between the indicators.
- The list of indicators is brought together by the project team and all here today are able to add/delete to this list.
- Calvin provided an example on how he would weigh each for each option and why to help everyone understand.

Scoring Discussion for each Option:

1. **Additional site investigation**
    - Assumed to be related with the overall footprint of the facility (i.e., facility and ancillary infrastructure).
    - Submitted Option and Alternative Configuration 4 re in the same footprint and a lot of investigation has been done there already.
    - Alternative Configuration 2 has the most work since those dams are the significant part of the design and most of the effort needs to be done.
    - Alternative Configuration 5 has the least work since no dams are needed. Geotechnical investigation for the waste rock dumps should be accounted separately, but some of these areas are already in the feasibility study (i.e., some knowledge of the foundation conditions is available).

2. **Aesthetics – Land forming engineering**
    - Related to the need to create a land forming in accordance with the environment. If land forming differs from natural slopes, it would be a worse solution. This was assumed to be related with the distance between each structure, and the overall footprint of the facility.
    - Option 4 is worse than Option 2 since it has all the distractions and is more distributed.
    - Option 2 has the highest dams and might stick out from topography more than the submitted option because of the height of dams.

- Option 5 - is the worst from a landform perspective, for putting a lot of landforms and changing it quite a bit.

3. **Aesthetics – Line of sight (distance)**
   - All alternatives are visible from Telkwa since they are all behind the ridge that is on the other side of Goathorn Creek.
   - Hence all alternatives have the same scoring.

4. **Aesthetics – line of sight (elevation difference)**
   - Related to the highest structure
   - Town sees no configuration change except from the ski hill.
   - (we can also say, we don't need to consider this)
   - Would see the Tenas Control Pond of Alternative Configuration 4 from Tenas Creek and Telkwa river.
   - Whole project invisible from towns
   - Only ones visibly difference is 4 and 5. 2 and the EAC submitted option are not different from each other.
   - Config 4 most likely to be visible.
   - All four visible from ski hill.
   - Single cross sections could be provided by Telkwa.
   - James explained the perspectives that could be seen and provided already to regulators. You need to be above the project to the high enough degree above the trees which will not be touched.
   - Project practically invisible.

5. **Ancillary infrastructure design, construction and maintenance.**
   - Footprint and connections between structures.
   - Ancillary infrastructure includes roads, powerline, pipelines and pumping systems.

6. **Aquatic life and habitat**
   - Alternative Configurations 4 and 5 are worst since they are much closer to the actual stream.
   - Alternative Configuration 2 also is further away from Fourth Creek.
   - Alternative Configuration 2 looks like a preference, EAC, 4 and 5.
   - Seepage to the groundwater system – how much rock will be disturbed,
   - *will include more to this list. Will distribute indicator list to all after meeting.

7. **Archaeological and traditional site nearby the facility**
   - Heritage sites on property.
   - Far away from archaeology sites.

8. **Atmospheric issues due to dam construction (materials, dam volume)**
   - Distances from borrow.
   - Material to dams.
   - Material moved.

9. **Bird life and habitat**
   - Overall footprint as an indicator of loss of habitat.
   - Water quality – relatively good (Dan) – good water quality for birds to land on.
   - Wildlife habitat restoration.
   - Does not impact habitat – not near any protected habitat.
   - Presence of birds – change wording. Should score low because there is no protected habitats.
   - All these are streams – not a lot of migratory birds. Not habitats they would habitate.
   - Score 6 across the board.
   - Add another indicator for birds not protected.

10. **Borrow source location**
    - Alternative Configurations 4 and 5 worst and Alternative Configurations 1 and 2 are similar.
    - All borrow materials will come from the open pit.

- Material balance – till and overburden – 1/3 1/3 1/3 – go through an area that has overburden in the mine cycle.
- Is the overburden the right quality – and yes, it's a good material.
- Putting in liners – can't just dump on top of liner…how are we layering it prior to the big rock? – foot layer of overburden prior to putting on the rock. Current plan.
- Suitable materials for all options – Paul asked.
    - Config 5 less materials used – dig more holes and no special material
    - Others need more managed materials – compaction, etc.
- Material quantity suitable

11. Borrow source material availability

- "borrow source is the open pit"
- Overburden is suitable for construction – add this comment for those outside reading this.
- Ranking will take place after volumes figured out.
- James to confirm.
- All rock too soft on site

12. ~~Borrow source quarry design~~ Rename – Rip rap material required for water management.

- Related to footprint
- Alternative Configuration 5 will be a challenge.
- Alternative Configuration 4 will have a bit more water management because now you've separated the facilities.
- Quarry rock – Will need to come from outside. Who would provide/where would it come from? This indicator should be considered in the Economic account.

13. Closure design

- The objective of this indicator is to capture if one of these alternatives are more complex than the other ones in terms of closure design.
- Alternative Configuration 5 – closure may be easiest for being excavated facilities.
- Alternative Configuration 4 worst for having separate facilities. Also would be very hard to maintain water cover because they're not in the same watershed as by taking away the cascading failures, we take away the link ability of the different pawns.
- Alternative Configuration 2 – man made solutions at closure. Will be pumping & managing forever.
- EAC Submitted Option better than Alternative Configuration 2 but worse than Alternative Configuration 5.

14. Community and stakeholders acceptance

- Alternative Configuration 5 is the best in terms community acceptance since they don't like dams.
- The smaller the dams, better acceptance. Hence, EAC Submitted Option and Alternative Configuration 4 are equally scored. Alternative Configuration 2 is the worst.

15. Community safety

- Failure modes / cascading failure comes to mind.

16. Construction constraints

- Alternative Configuration 5 is easy to build – no compaction required.
- The three other alternatives are similar. No major construction constraints are expected.

17. Construction time

- Associated with earthworks and impermeabilization area requirements
- Alternative Configuration 5 does not require earthworks but needs total impermeabilization, which is more complex than for the other alternatives.
- All other configurations need both liners and dams.
- Seasonality – snow on ground – liners cannot be placed in the winter. Same with dams.
- James explained the construction plans, timeline, and options for all.
- Management ponds take 5 ½ years in all of them.
- All same for timeline and fairly similar.

- Some may need more to do in the same time – 5-6 years. Time doesn't change but the amount done in the timeline may.
- Alternative Configuration 4 requires more efforts due to the more complex surface water management.
- Alternative Configuration 4 has about the same material cost as Alternative Configuration 1 and 2, but the hulls are significantly longer, committing more resources to doing the job, and Alternative Configuration 5 has the most material to move by a long shot.

18. Distance between the nearest waterway and the facility

- All the same. All have a minimal distance.
- Influence of the footprint on the flow to this creed and the least impact looks like Alternative Configuration 2.
- Highest impact on waterway.
- This may have been touched on with birds and habitat indicator.
- Add definition on waterways to distinct between natural and man-made water courses.

19. Distance between the Coal Process Plant and the facility

- Alternative Configuration 2 has higher dams.
- Alternative Configuration 4 has same dam configuration as the EAC Submitted Option.
- Truck hours considered to move materials.
- Alternative Configuration 5 would be a little bit cheaper because it doesn't go as high, so you save all that elevation gain.
- *Remove from environmental.

20. Geochemical characterization of all construction materials and associated excavation waste

- Due to the increase soil stripping for the Alternative Configuration 5, all that soil needs to be kept and stored for capping it eventually.
- Overburden is non-reactive in assessment
- Associated waste
- Glacial till being reactive – zero
- 40% NAG, 60% overburden
- Sample collection, testing, analysis – very minimal to nil.
- Related to costs and resources associated to geochemical testing requirements – Alternative Configuration 5 requires additional testing. The other alternatives are equally scored for having similar dam volumes.

21. Geotechnical conditions of the foundation.

- Alternative Configuration 4 has a higher risk because there is any drill holes by those two lower facilities.
- Alternative Configuration 5 has a slightly higher risk as well because there's no geotechnical investigation done.
- The EAC Submitted Option and Alternative Configuration 2 has good geotechnical baseline.
- Alternative Configuration 2 could be worse than EAC Submitted Option for being outside a bit more.

22. Groundwater conditions

- All the same for EAC Submitted Option and Alternative Configurations 2 and 4.
- Challenges on the depth of the holes - with liners and constructability for Alternative Configuration 5. Not flow and intermingle.
- Material above groundwater level.
- Liner gives knowledge of flow.
- Modelling shown minimal impact from the liners on facilities.
- Natural level of groundwater – tables aren't modeled.

23. Seepage from the facility to groundwater system.

- Alternative Configuration 4 should have the highest impact.
- Alternative Configuration 2 is a little bit better than the EAC Submitted Option since the configuration two stays further away from Four Creek.

24. Maintenance of traditional lifestyle.
- EAC Submitted Option and Alternative Configurations 2 and 4 are very close.
- Alternative Configuration 5 is worst.

25. Materials delivery and deposition system
- Alternative Configuration 4 is worst for requiring further haulage to the NMP.

26. Number of embankments
- Alternative 4 has 2 distinct areas.
- EAC Submitted Option and Alternative Configuration 2 have only 2 distinct areas.
- Alternative Configuration 2 would be slightly better than EAC Submitted Option since the TCP is excavated.

27. Number of ponds
- Alternative Configuration 5 has the most ponds.
- EAC Submitted Option and Alternative Configurations 2 and 4 are equal.

28. Operational complexity in materials deposition
- Related to the amount of material you need to segregate.
- Alternative Configuration 5 is the easiest. No dams, only holes – no segregation.
- EAC Submitted Option and Alternative Configurations 2 and 4 – all the same due to the dams.

29. Overall Catchment Area
- Alternative Configuration 5 has the highest.
- Alternative Configuration 4 is a bit lower but higher than 2 and EAC Submitted Option.

30. Overall footprint of the facility
- Similar to the above indicator.

31. Pond water management – related to number of ponds
- Related to the management requirements of water level on top of the PAG material. Hence, the more surface area, the greater the risk.
- Below ground – may not be easier to hold water if dry.
- Alternative Configuration 2 is worst since requires pumping to keep the water cover.
- Alternative Configuration 5 has more ponds but pit pond, and other off to the side.

32. Post closure maintenance and monitoring requirements
- Alternative Configuration 2 – need to pump water from one of the management ponds to the other one, hence requiring more maintenance and monitoring.
- EAC Submitted Option and Alternative Configuration 2 and 4 will require comprehensive monitoring on an annual basis, following the requirements of BC.
- Stable – non pollutant
- Address the safe stable and non-pollutant – add comment.

33. Prevalent wind speed and direction
- More dust to mine operators in Alternative Configuration 5 – could also get rid of it as well.
- Not much difference in rest.
- Prevailing wind is NE.

34. Previous and existing land use
- Related to footprint.

35. QA/QC Requirements
- Liner makes them a challenge.
- Alternative Configuration 5 may be a bit less since it does not require dams.
- EAC Submitted Option and Alternative Configuration 2 and 4 are worst for requiring QA/QC for dam construction.

36. Risk of cascade embankment failure
- EAC Submitted Option and Alternative Configuration 2 are the worst.
- Alternative Configuration 4 potential to breach and flow down.
- No risk for Alternative Configuration 5.

37. Terrestrial life and habitat
- Related to footprint.

38. Vegetation
- Related to footprint.

39. Water Management / Treatment to achieve water quality criteria/objectives
- Currently no water treatment.
- 6 OR 7 TREATING FOR TSS currently.
- Slowing down water.

40. Diversion structures design, construction and maintenance.
- Use the same scoring as 'riprap material required for water management' indicator.
- Alternative Configuration 5 – operational nightmare.

41. Impermeabilization area requirements
- Liner requirements include thickness and area requirements.
- Alternative Configuration 5 is thinner and with footprint similar. Best case.
- EAC Submitted Option and Alternative Configuration 2 and 4 have similar requirements. Alternative Configuration 2 is slightly better.

42. Instrumentation requirements and operation maintenance and surveillance
- Monitoring less with dumps.
- EAC Submitted Option and Alternative Configurations 2 and 4 have an 'Extren' Dam Consequence Category, requiring more instrumentation and more rigorous surveillance during operation and closure.

43. Overall perceived socio-economic consequences benefits and relative preferences.
- Perceived socio economic is positive.
- Benefits to people, housing and economy.
-

44. Physical interference with existing infrastructure (constraints)
- All the same for public roads.
- Only one that has to be maintained for public access.
-

45. Post closure risk and uncertainties
- EAC Submitted Option and Alternative Configuration 2 – larger dams with cascading potential.
- Alternative Configuration 4 is slightly better.
- Alternative Configuration 5 is the best.

46. Water management system design
- Touch base with Celine on this.
- Pumping requirements higher for Alternative Configurations 2 and 4.
- Too many ponds.

47. Water Treatment – changed to 39
-TSS treatments required?
- Don't have the dilution.
- Touch base with Celine on this.

48. Containment structure design
- Alternative Configuration 5 is the best since it doesn't have dams.

- Alternative Configuration 4 is better than the EAC Submitted Option and Alternative Configuration 2 for not posing a risk of cascading failure.

49. Distance between existing roads and the facility
- Same for all.

50. Diversion structures design, construction, and maintenance
- Same for all.

51. Flexibility to expand the storage capacity
- Alternative Configuration 5 is hardest to expand.
- Dam options are straightforward for a little bit of height.
- Dam options are more work if higher.
- Redesigning buttressing/building a new dam if expansion is required.
- Alternative Configuration 4 is best – the whole area can be utilized to construct and add space between existing facilities. Best water control.
- EAC Submitted Option is the next – convert the TCP to a PAG material storage facility and expand that and build the TCP as per Alternative Configuration 4.
- Alternative Configuration 2 – the dams are quite large and no spaces applicable.
- Alternative Configuration 5 the hardest to expand but has some options to expand.
- All of them are weak to expanding but potential to expand capacity.
- Changing capacity – small change in every option.

52. Impermeabilization requirements – REMOVE THIS INDICATOR
- Alternative Configuration 5 a bit thinner and lest to construct.
- Less head pressure.

53. Impermeabilization thickness
- Same as above.

54. Impermeabilization topographic complexities
- Alternative Configuration 5 could be a bit more complex due to steeper slopes.
- Dam alternatives are similar.

55. Surplus material storage
- Alternative Configuration 5 is the best.
- The rest are the same.

56. Calvin – will reach out for any further inputs
1. Do a first pass
2. Send to Dan and he will share with certain team members and come back to Calvin.
3. Calvin will meet with SRK

Dan – good first start, send out to all for further input**.**

Conclude 5:45pm

Action item – distribute the indicator list to all for addition submissions.
Action item – come back with rankings. Take home the list. N/A – list completed by end of day.

Minutes taken by: Lisa Thomson, Project Coordinator, SRK Consulting (Canada) Inc.

Signed by: Lisa Thomson Date: March 25, 2024

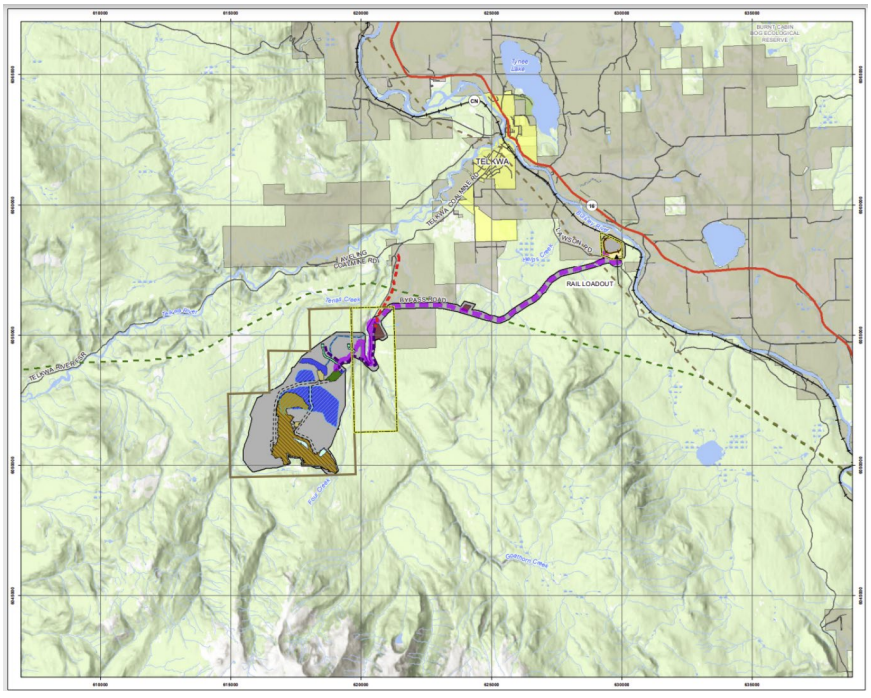
Attachment 2 Tenas Project, Site-Specific Probabilistic Seismic Hazard Assessment, SRK

FINAL

Site Specific Probabilistic Seismic Hazard Assessment

CAPR002055 Tenas Project Canada

Telkwa Coal Ltd.



SRK Consulting (Canada) Inc. ■ CAPR002055 ■ March 2024

srk consulting

FINAL

Site Specific Probabilistic Seismic Hazard Assessment

CAPR002055, Tenas Project Canada

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File Name:
CAPR002055-01-B Tenas Project - Site Specific Seismic Hazard Assessment_FINAL_20240312.docx

Suggested Citation:
SRK Consulting (Canada) Inc. 2024. Site Specific Probabilistic Seismic Hazard Assessment. FINAL. Prepared for Telkwa Coal Ltd.: Vancouver, BC. Project number: CAPR002055. Issued March. 2024.

Cover Image(s):
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Executive Summary

SRK Consulting (Canada) Inc. was appointed by Telkwa Coal Ltd. (TCL) to undertake a site-specific seismic hazard assessment (PSHA) at the Tenas Project in Telkwa, BC, Canada. The following points summarise the most important results and findings of this study.

- Seismic design criteria and design guidance for the embankments are presented in terms of ground acceleration, spectral accelerations, and horizontal seismic coefficients for use in stability analysis. Peak-ground accelerations (PGA), peak-ground velocities (PGV), Arias intensities (AI), and pseudo-accelerations $S_a(T_n)$ were computed for rock site conditions with annual exceedance probabilities (AEP) of 1:1,000, 1:2,500, 1:5,000, and 1:10,00 years.
- Target AEP (and return periods) for the TSF have been defined according to the failure's consequences rating. The Tailings Dam (TD) has been classified as Extreme Consequence, according to *Global Industry Standard on Tailings Management* (**2020**) (GISTM). GISTM recommendations set a target AEP of 1:5,000 years for the active-care stages (operations) and a target AEP of 1:10,000 years for the passive-care stages (post-closure)
- For **rock site conditions**, the *maximum design earthquake* (**MDE**) will have a PGA of 0.1 g (mean) and 0.129 g (84%) with a target AEP of 1:10,000 years. At operational stages (active-care) the *operating basis earthquake* (**OBE**) will have a PGA of 0.068 g (mean) and 0.089 g (84%) with a target AEP of 1:5,000 years, according to GISTM (**2020**)
- The faults identified in the source model have a maximum credible magnitude that does not exceed the maximum magnitude adopted in the source model. Until neotectonics evidence associated with the local faults of the project becomes available, the *maximum credible earthquake* (**MCE**) will be assumed to be the maximum design earthquake (MDE) with 1:10,000 years AEP and 84% confidence level.
- From a simplified dynamic site response model based on amplification factors, design earthquakes were obtained assuming different geotechnical conditions at the base of the TSF (**Chapter 5**). Amplification factors were reported for site classes **BC**, **C**, **CD**, **D**, and **DE** (according to ASCE/SEI 7-22), representing the most common geotechnical scenarios expected at the different locations of the site.
- For Tenas Project, a $\bar{v}_S$ value ranging between 440 to 640 m/s has been assumed as a representative average shear-wave velocity for all foundation scenarios, which corresponds to very dense soils or hard clays and a C site class as per ASCE/SEI 7-22 (**2021**).
- For C site class and **Extreme** Consequences Category, the maximum design earthquake **MDE** for passive-care stages will have a PGA of 0.11 g (mean) and 0.142 g (84%), according to GISTM (**2020**).
- Finally, a range of seismic coefficients (pseudo-static) have been calibrated for different dam heights for the **Extreme** Consequence Category.

1. Introduction

1.1. Background

SRK Consulting (Canada) Inc. was appointed by Telkwa Coal Ltd. (TCL) to undertake a site-specific seismic hazard assessment (PSHA) at the Tenas Project in Telkwa, BC, Canada.

A geotechnical assessment of the MP was completed by SRK in April, 2021. Based on this, among others, TCL prepared the Environmental and Social Impact Assessment (ESIA) and submitted to the Environmental Assessment Office (EAO). In response, the EOA submitted a letter to TCL with a list of questions and concerns related to water quality, pond liner design, water and load balance, ARD/ML and MP management and design. Among others, the EAO requested TCL to provide justification for selection of a 'Very High' Consequence Category for the MP. As a response, TCL is considering changing the Consequence Category to 'Extreme' and upgrade the pseudo-static slope stability assessment for the new seismic criteria.

1.2. Objectives and scope

This study provides an estimate of the seismic hazard of the project site for a representative site condition and presents seismic design criteria and design guidance for the embankment in terms of ground acceleration, spectral accelerations and horizontal seismic coefficients for use in stability analysis.

The main objectives of the study are as follows:

- Outline the tectonic framework of the study area and identify all seismically active fault systems within 500 km of the site. Review the strong motion catalogues and identify the maximum considered earthquakes of potentially seismogenic faults.
- Identify and characterise seismic sources capable of producing significant ground motion at the site and define the source geometry and probability distribution of potential rupture locations within the source.
- Select ground-motion prediction equations (GMPE) appropriate for the region under study and calibrate the specific parameters of each model to the particular conditions of each source model (PSHA) and each seismic scenario (DSHA).
- Perform a full probabilistic seismic hazard assessment for the site and provide an estimate of the annual probability of exceeding a specific level of seismic intensity due to the potential occurrence of earthquakes from all sources.
- Select the earthquakes expected at the site for different service levels and target AEPs in hard soil site conditions.
- Provide an estimate of the expected site amplification for different target site conditions in terms of the shear wave velocities of the upper 30 m (V_{s30})
- Provide an estimate of fundamental periods of critical slopes and seismic (pseudo-static) coefficients for performance-based stability analysis.

1.3. Organization of this report

The structure of the report includes the following chapters.

- **Chapter 1** (this chapter) introduces the project and outlines the background, objectives, and scope.
- **Chapter 2** presents a brief description of the tectonic framework of the mine area, the neotectonics (the fault systems that may be seismically active) and the seismic activity of the study area.
- **Chapter 3** presents the ground motion models selected to be used in the seismic hazard analysis to estimate the strong ground motion that may occur at the Site if an earthquake of a certain magnitude occurs at a nearby location.
- **Chapter 4** presents the development of seismic hazard analysis including hazard deaggregation to identify contributing events for a given ground motion intensity and annual exceedance probability AEP (or return period).
- **Chapter 5** presents the site response, which was evaluated in terms of site-amplification factors for different site class conditions. This chapter includes a site characterisation of the site foundation in terms of the average shear wave velocity v_s.
- **Chapter 6** provides an estimate of slope's fundamental periods and seismic (pseudo-static) coefficients k_{max} using empirical correlations. Values of k_{max} are presented for both active and passive-care stages, assuming different scenarios of residual displacements, material properties (in terms of shear wave velocities v_S^o), site conditions and embankment geometries.

1.4. Acknowledgments

This study was carried out by an interdisciplinary team from offices in SRK Mendoza (Argentina) and SRK Johannesburg (South Africa). Seismicity and tectonics were reported by Lindsay Linzer and summarised by Juan Mussat. Seismic scenarios were defined by Wesley Harrison and reviewed by Juan Mussat. Ground-motion intensity models have been implemented by Juan Mussat and reviewed by Alejandro Verri. Open-source code for ground-motion design parameters and seismic hazard assessment has been developed by Alejandro Verri and reviewed by Juan Mussat. The dynamic report has been compiled by Alejandro Verri.

1.5. Disclaimer

The opinions expressed in this Report have been based on the information supplied to Telkwa Coal Ltd. (SRK) by Telkwa Coal Ltd. (TCL). The opinions in this Report are provided in response to a specific request from TCL to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

2. Seismotectonic Setting

2.1. Definitions

Tectonics is a branch of geology that studies the Earth's lithospheric structure and the forces acting upon it, that result in the formation of geological features. It examines the large-scale processes, such as the movement and collision of continental and oceanic plates, that lead to earthquakes, volcanic activities, and the formation of landscape features like mountains and ocean trenches.

Neotectonics focuses on the most recent and ongoing movements and deformations of the Earth's crust. It seeks to understand the associated stresses implicated in these movements, primarily concentrating on geodynamic activities that have transpired over the last few million years up to the present era. This time period includes the late Cenozoic Era (which encompasses the Neogene and Quaternary Periods) and can provide insights into tectonic activities that have shaped the current configuration of the Earth's crust.

Seismicity refers to the systematic study of the spatial and temporal patterns of earthquakes. It involves the comprehensive examination of earthquake occurrences, including their frequency, magnitude, and geographical dispersion, particularly in regions known as high seismicity areas. Such regions frequently overlap with tectonic plate boundaries, underscoring the interconnected relationship between the disciplines of tectonics, neotectonics, and seismicity. This multidisciplinary nexus helps in understanding the dynamics of the Earth's crust and the seismic phenomena associated with it.

2.2. Seismotectonic Framework in Canada

The Pacific Coast is the most earthquake-prone region of Canada. In the offshore region to the west of Vancouver Island, more than 100 earthquakes of magnitude 5 or greater have occurred during the past 70 years. Earthquakes in this region occur along the faults in the offshore region (e.g., the M=8.1 Haida Gwaii earthquake of 1949); within the subducting ocean plate (e.g., a magnitude 6.5 earthquake beneath downtown Seattle in 1965); and within the continental crust (e.g., a magnitude 7.3 earthquake on central Vancouver Island in 1946). Moving inland from the coast (and the active plate boundaries), the frequency and size of the earthquakes decreases. Saskatchewan and Manitoba are the least earthquake-prone areas in Canada. The most significant inland zone of seismicity follows the Dalton and Duke River segments of the Denali fault zone through the southwest Yukon. Farther inland, there is minor seismicity between the Denalli and Tintina fault systems. The rate of seismic activity increases at the eastern edge of the Cordillera (**Earthquakes Canada**).

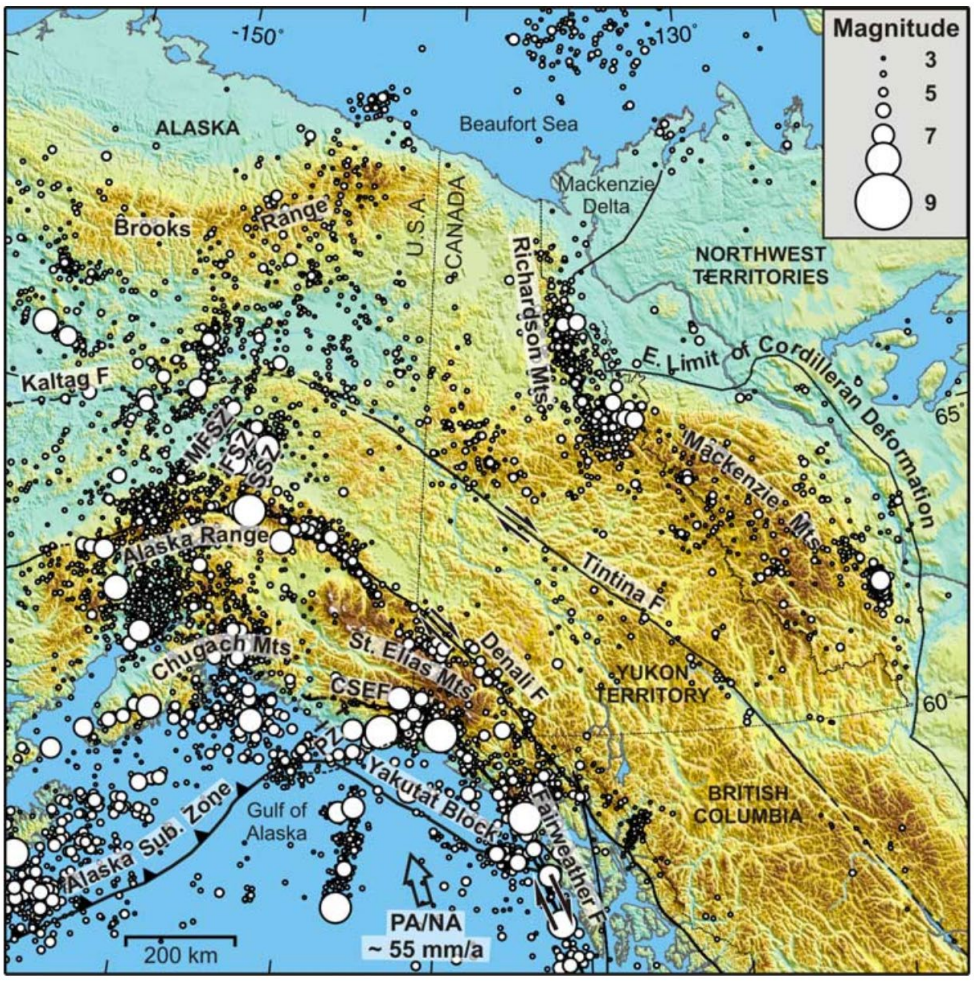


Figure 2.1: Tectonic setting, major faults and seismicity of the northen Cordillera of NW Canada (Leonard, Mazzotti, and Hyndman 2008)

2.3. Seismic Hazard Model and Intensity Parameters for the Tenas Site

Natural Resources Canada (NRC) developed the 6th Generation Seismic Hazard Model of Canada (CanadaSHM6), which is the basis for the seismic design values in the 2020 edition of the National Building Code of Canada (NBCC) (**Kolaj, Adams, and Halchuk 2020**). A **seismic hazard application** provides the values in accordance with Part 4 of the NBC 2020 (Division B, Article 1.1.3.1, Appendix C). The parameters used to represent seismic hazard at a geographic location are peak horizontal acceleration (PGA), peak ground velocity (PGV), and spectral acceleration (Sa) for a damping factor of 5% at periods of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s, and 10.0 s. All correspond to a 2% probability of exceedance in 50 years. Additionally, it provides values for other periods and probabilities of exceedance. The CanadaSHM6 model is available on the **NRC's page**. There, one can access the input files and a summary of the source model, including, among other things, the parameters of the Gutenberg-Richter distribution[1]. It is implemented within the OpenQuake open-source platform.

[1] Relationship between the magnitude and total number of earthquakes in any given region and time period of at least that magnitude

3.2.1. Source Model Characteristics

The model is composed of area sources[2] and fault sources[3] to represent the main tectonic regimes controlling the hazard in Western Canada: active crustal, interplate subduction, and intraplate subduction. Truncated Gutenberg-Richter (G-R) distributions are used for all area source zones. The uncertainty in parameter estimation is represented by three separate activity rates (a and b pairs; estimated from the (**S. Halchuk et al. 2015**) catalog) and three Mmax values[4] (**Kolaj, Adams, and Halchuk 2020**). Fault sources use a combination of characteristic rates and truncated G-R distributions (**Allen et al. 2015**; **Stephen Halchuk et al. 2019**).

For the Western Canada zone, the CanadaSHM6 relies on the CanadaSHM5 model (**Adams et al. 2015**), which consists of a single source model with alternative hypotheses for variations in the geometry of subduction fault sources (**Kolaj, Adams, and Halchuk 2020**). The 5th Generation model included fault sources for three subduction areas in the Cascadia zone, an update of the offshore faults of Haida Gwaii (Queen Charlotte Islands) and added five strike-slip and reverse faults in the Yukon-Alaska region (**Allen et al. 2015**). The modeled faults concentrate the occurrence of earthquakes near the faults, instead of averaging it over a wider area (as was done in the 4th Generation of 2010). The CanadaSHM6 updates: the earthquake rate of the Great Cascadia, the spatial geometry of intraplate earthquakes and adds a potentially active fault in southern Vancouver Island (**Kolaj, Adams, and Halchuk 2020**). The **Figure 2.2** shows the earthquakes with a magnitude greater than 3.0 from the **ISC** catalog together with major Canadian faults and the **Figure 2.3** shows the sources from the CanadaSHM6 seismic hazard model. Due to the distance from the subduction zones, active crustal areas are the main contributors to the site's threat, particularly for PGA. For longer return periods, the contribution from subduction zones increases for higher spectral periods, with the sources where the epicentres of the largest earthquakes are located (**Figure 2.4**).

[2] This type of source is often adopted for modeling distributed seismicity. They are used to model seismic regions with or without tectonic evidence. The seismicity occurrence rate is assumed uniform within the source area.

[3] Represent a single tectonic feature. They are defined by the projection of their trace on the surface and are supposed to have a uniform earthquake occurrence within the source. They are commonly used to describe shallow seismogenic faults.

[4] The maximum magnitude is the upper boundary of the magnitude distribution.

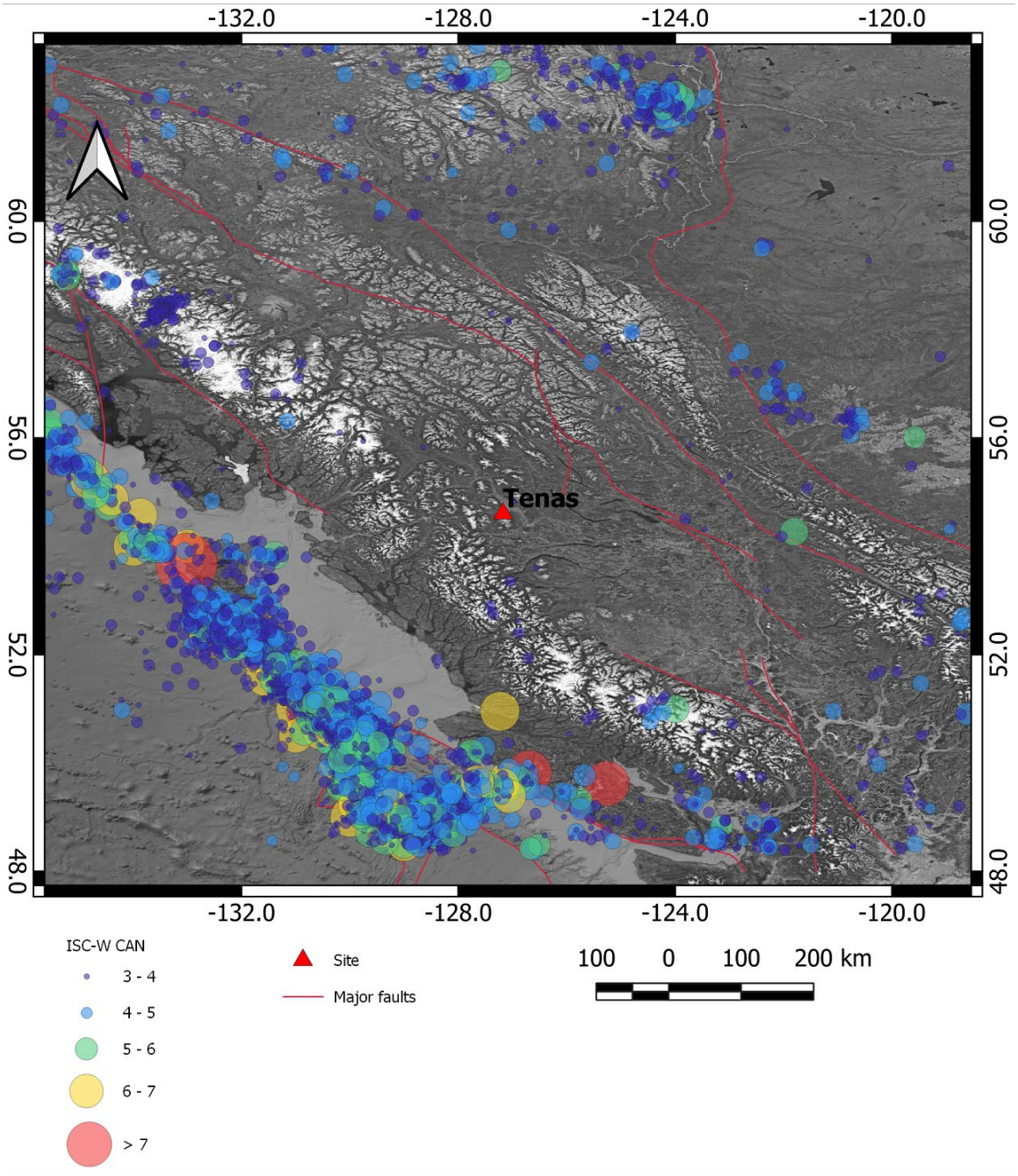


Figure 2.2: Epicentres and magnitudes of seismic events from the ISC catalogue (M>3) and major faults in Canada

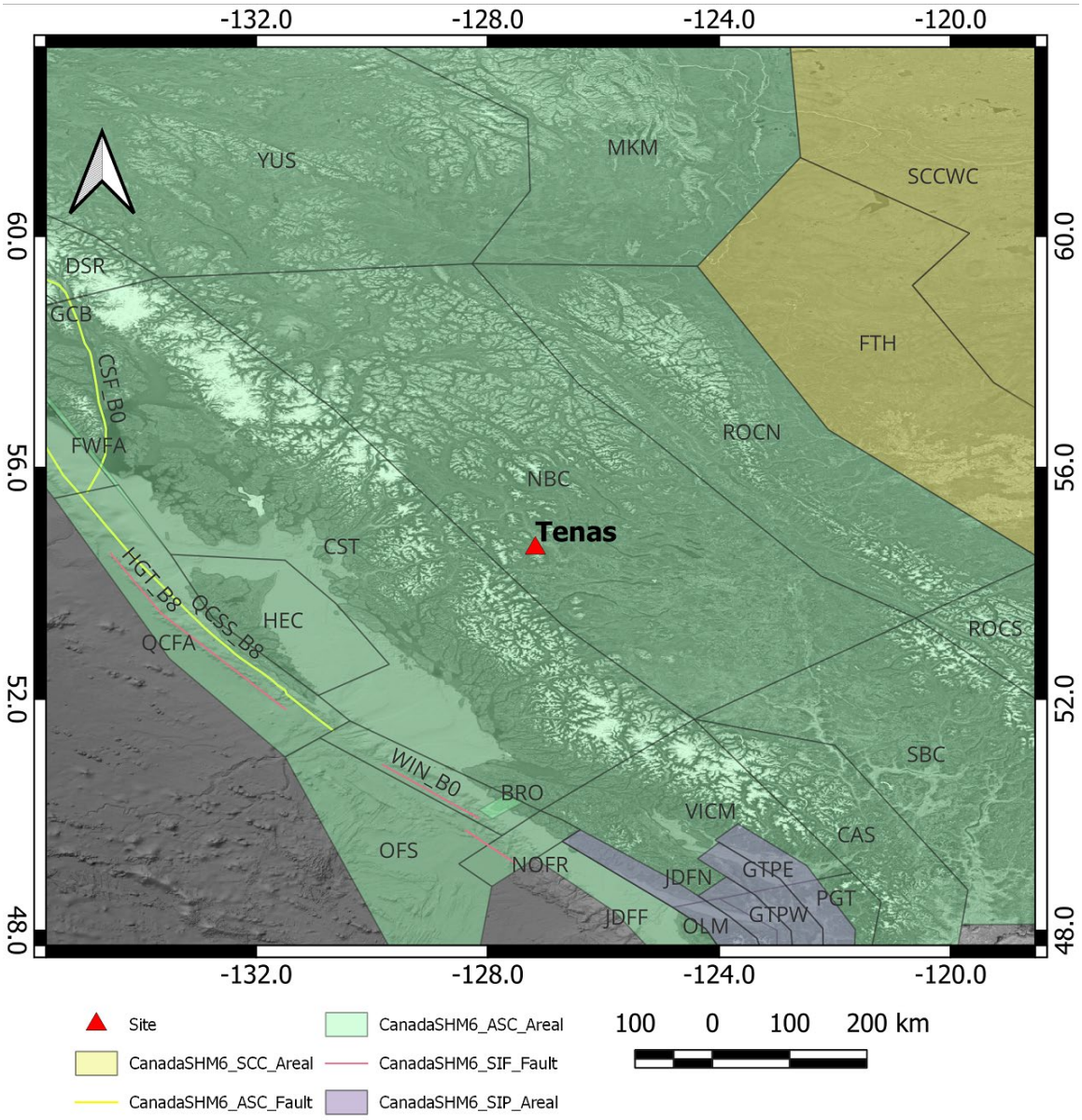


Figure 2.3: Area sources and faults from the CanadaSHM6 seismic hazard model

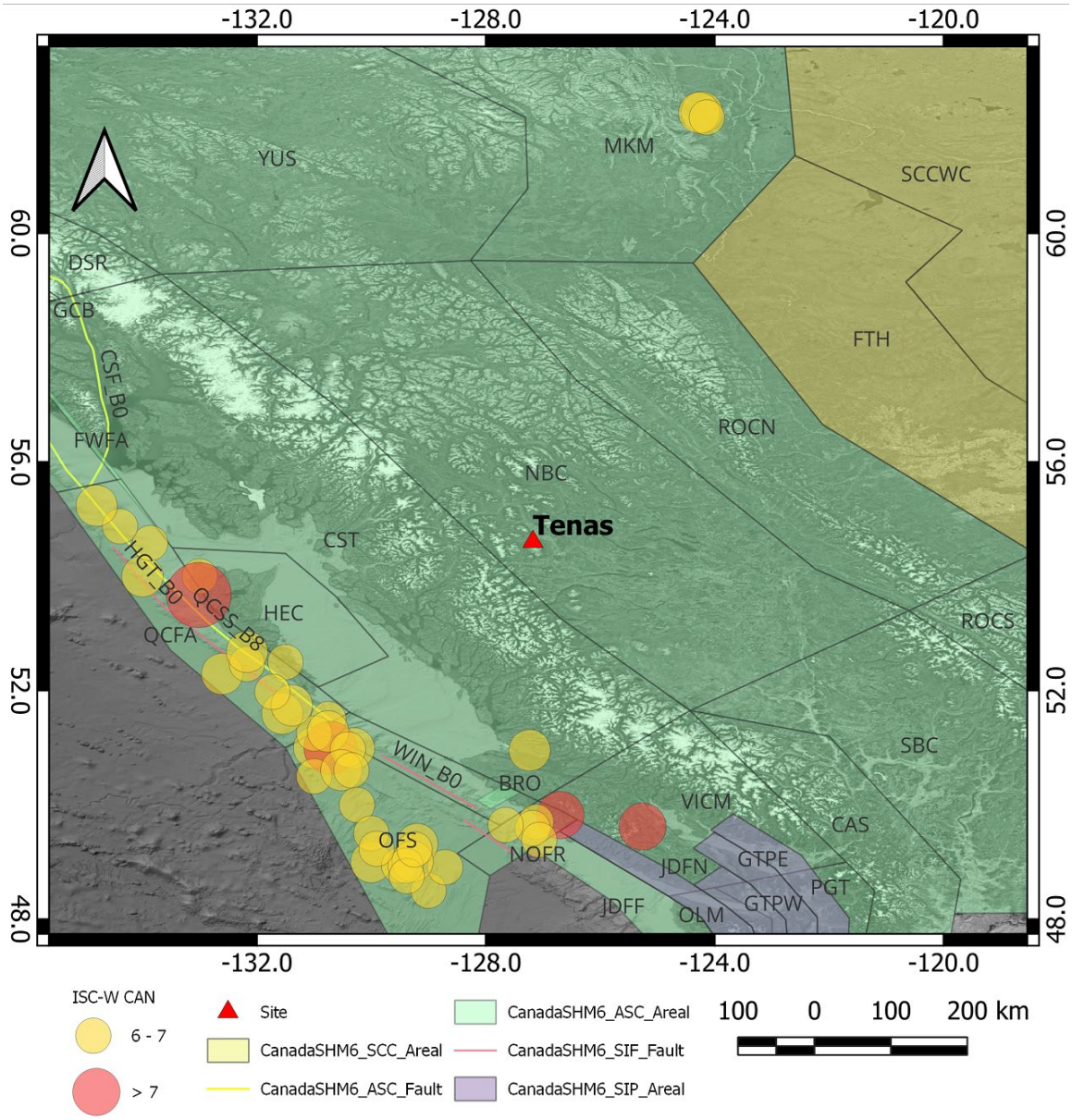


Figure 2.4: Filtered M > 6.0 events and seismic sources

NRC compiled records of **significant earthquakes** since 1600 (**Lamontagne et al. 2018**). The most intense events near the site are:

- Date: **1700-01-27**, Mw 9.0, Cascadia Subduction Zone, British Columbia, offshore of Vancouver Island, Washington and Oregon. Recorded widely in oral native accounts and by geological evidence for subsidence and a tsunami along the outer coast; confirmed by a tsunami record in Japan. Extent of damage unknown. Distance from project site: 700 km.
- Date: 1929-05-26, Mw 7.5, Offshore British Columbia in the Revere-Dellwood-Wilson Fault region. The epicentre of this tremor is in a region that was not heavily populated. The earthquake was felt as far north as Ketchikan, Alaska, and Anyox, British Columbia, and to the east as far as Terrace, Skeena and Lakelse. Distance from project site: 460 km.
- Date: **1946-06-23**, Ms 7.3, Vancouver Island, British Columbia. Vancouver Island's largest historic earthquake (and Canada's largest historic onshore earthquake). The epicentre was in the Forbidden

Plateau area of central Vancouver Island, just to the west of the communities of Courtenay and Campbell River. This earthquake caused considerable damage on Vancouver Island and was felt as far away as Portland, Oregon, and Prince Rupert, British Columbia. Distance from project site: 550 km.

- Date: **1949-08-22**, Mw 8.1, Offshore of Haida Gwaii, British Columbia. Widely felt over a large area of western North America; this was Canada's largest and one of the world's greatest earthquakes (since 1700). It occurred on the Queen Charlotte Fault (Canada's equivalent of the San Andreas Fault) - the boundary between the Pacific and North American plates that runs underwater along the west coast of the Haida Gwaii (formerly Queen Charlotte Islands). Distance from project site: 415 km.
- Date: **2012-10-28**, Mw 7.7, Haida Gwaii. Felt throughout British Columbia and as far away as Yukon, Alberta, and Montana. Coseismic displacement, tsunami run-ups, landslides, debris flows, rock falls and some chimney damage reported. Tens of thousands of aftershocks recorded in the following months. It was the largest and most recent event close to the site: 415 km.

The closest events of magnitudes greater than 5.0 are the earthquake on 1986-03-21, mB 5.4, in Eastern British Columbia at 350 km from the site; and the earthquake on 1990-01-12, mB 5.3, in Hecate Strait at 290 km from the site.

The maximum magnitudes of the faults and area sources of the model cover those reached by these events, except for the 1700-01-27 event of Mw 9.0 with epicenter 700 km from the site.

3.2.2. Ground Motion Prediction Equations

CanadaSHM6 generates seismic intensities using an equally weighted logic tree of multiple ground motion prediction equations (GMPEs) (**Kolaj et al. 2019**). The model considers the site amplification of each GMPE separately based on the Vs30[5].

For the active crustal regime, the updated GMPEs from **NGA West 2** were adopted: N. A. Abrahamson, Silva, and Kamai (**2014**) Boore et al. (**2104**), Campbell and Bozorgnia (**2014**), Chiou and Youngs (**2014**).

For intraplate subduction events, GMPEs from N. Abrahamson, Gregor, and Addo (**2016**), Gail M. Atkinson and Boore (**2003**), García et al. (**2005**), and Zhao et al. (**2006**) are used. For interface subduction events, GMPEs from N. Abrahamson, Gregor, and Addo (**2016**), Zhao et al. (**2006**), Ghofrani and Atkinson (**2014**), and Gail M. Atkinson and Macias (**2009**) are used. Models developed for other regions are adjusted for the Cascadia zone using the method by (**Gail M. Atkinson and Adams 2013**). For GMPEs whose spectral ordinates do not reach 10.0 seconds, the extrapolation is performed using the corresponding relationship from N. Abrahamson, Gregor, and Addo (**2016**) for the same magnitude, distance, and location.

[5] The mean travel time velocity of shear (S) waves to a depth of 30 meters.

3. Intensity Model

3.1. Definitions

Seismic ground motion is generally characterised by a scalar (spectral) measure of intensity $I = i^*$. The seismic intensity of site i^* will generally depend on the distance from the site to the nearest point on fault r^* and the magnitude m^* of the seismic event, which is directly related to the size of the fault rupture area.

Ground-motion intensity models, also called ground motion prediction equations (GMPE), are most commonly derived from strong ground motion recordings. For a given event of magnitude m^* located at some distance r^*, the strong motion intensity $i^* = f(m^*, r^*, \theta)$ can be estimated in terms of a probabilistic model expressed in terms of its conditional $\eta_{I|M,R}$ mean and an error term ε

$$\eta_{I|M,R} = \phi_I(m^*, r^*, \theta) + \varepsilon_I$$

where $\phi(M = m^*, R = r^*, \theta)$ is a regression model defined in terms of earthquake magnitudes (m^*), source-to-site distances (r^*) and geological/geotechnical site conditions (θ) and ε_I is a random variable with mean $E[log(\varepsilon_I)] \approx 0$ and variance $var[\varepsilon_I] \approx (\sigma_{ln\ I})^2$.

In general, not enough strong ground-motion records are available for a given region to formulate a specific GMPE model for the particular site. To address this epistemic uncertainty, several models defined for similar tectonic regimes are combined by means of logic trees, with weights selected by expert judgement. The ground-motion intensity for a given hazard level β can be obtained by a weighted sum of ground-motion intensities from different models for a given target $(M = m^*, R = r^*)$

$$\tilde{\imath}^* \approx \sum_{b=1}^{N_b} w_b\ \eta_I^{(b)}(m^*, r^*)\ \ (\sigma_I)^\beta$$

Most ground-motion intensity models are defined in terms of finite fault distance metrics assuming a planar rupture geometry. The trace of the rupture is defined as the projection of the top edge of the rupture on the ground surface. The rupture plane, trace and the surface projection allow to define four finite fault distance metrics: R_{RUP}, R_{JB} ,R_X and R_{Y0}.

The rupture distance R_{RUP} is the distance from the site to the closest point of the rupture plane. The Joyner-Boore distance R_{JB} is the closest distance between the site and the surface projection of the rupture plane and the auxiliary parameters R_X, R_{Y0} and Z_{TOR} are the coordinates from the site to the closest point of the top of the rupture.

Figure 3.1 illustrates different metrics for source-to-site distances. A full description of these finite fault metrics can be found in Kaklamanos et al. (**2011**).

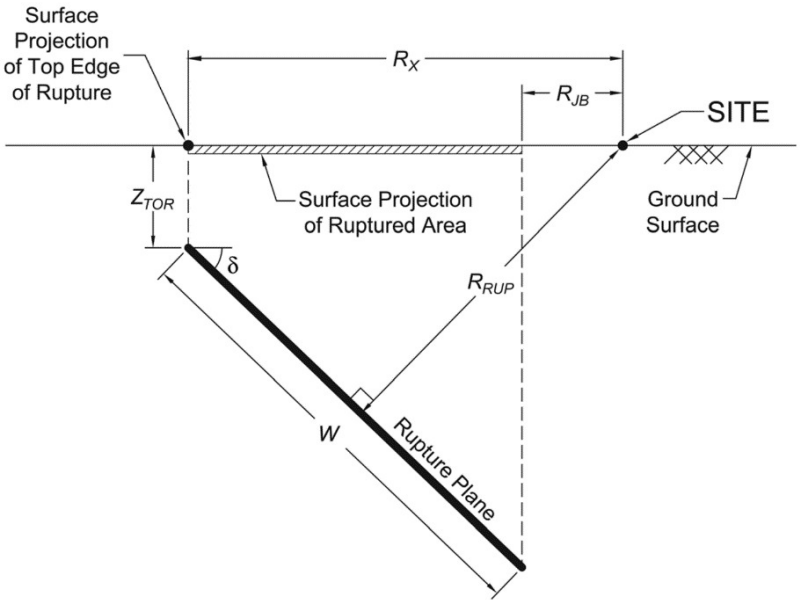


Figure 3.1: Source-to-site distances

3.2. Probability Distributions

The transformation usually performed on random variables associated with the occurrence of seismic events is the logarithmic transformation, which is equivalent to assuming a normal distribution law for the intensity logarithms. Under this transformation, the seismic intensity is determined according to a new normalized random variable β_I, with mean value $E[\beta_I] = 0$ and variance $var[\beta_I] = 1$ with null expectation and unit variance.

$$\beta_I(i,m,r) \approx \frac{ln\ i - ln[\eta_I(i,m,r)]}{\sigma_{ln\ I}}$$

From this transformation the CDFs $P[I > i^*/m^*, r^*]$ can be defined explicitly in terms of the cumulative normal density function $Phi_C(\beta_I^*) = 1 - \Phi(\beta_I^*)$ the seismic intensity exceedance probability for a given scenario r_s^*, m_s^* can be obtained from:

$$P[I > i^*] \approx \ \Phi_C[\beta_I(i^*, r_s^*, m_s^*)]$$

Using the TPT the annual exceedance rate of earthquakes with magnitude greater than m^* can be expressed in terms of an asymptotically truncated Gutenberg-Richter magnitude-frequency distribution. The discrete mass probability for magnitudes $P\left[M = m_j\right]^{(s)} = f_M^{(s)}(m_j)\, dM$ can be obtained from the first derivative of the magnitudes cumulative-density function $F_M^{(s)}(m_j)$ valid for $M_{max}^{(s)} < m^* < M_o^{(s)}$:

$$\lambda^{(s)}[M > m^*] = \lambda_M^{(s)}(m^*) = \nu_o^{(s)}\left(1 - F_M^{(s)}(m^*)\right) \simeq \nu_o^{(s)} \frac{\mathrm{e}^{-\beta\left(m^* - M_o^{(s)}\right)}}{1 - \mathrm{e}^{-\beta\left(M_{max}^{(s)} - M_o^{(s)}\right)}}$$

The discrete mass probability function for distances $f_{R/M}^{(s)}(r^*|m^*)dr^* = P[R = r^*|m^*]^{(s)}$ can be obtained numerically from the histogram of an array of epicentres inside the boundaries of each source.

3.3. Epistemic Uncertainty

A minimum number N_b of independent region-specific ground-motion model were selected to capture the expected range of possible ground-motions in the target region. They are selected following guidelines from Boomer et al. (**2008**) and weighted in logic trees to address their relative confidence based on the available information.

If a sufficient number of seismic records are available for the region, selection of weights for each branch w_b used to be adopted by expert judgment. A more rational way of accommodating epistemic uncertainty is by constructing a new random variable $\tilde{I}$ using the weighted average of $b = 1 \ldots N_B$ different branches of the ground motion models $\eta_I^{(b)}(m, r, \theta)$ and assuming $r = 1 \ldots N_R$ realizations for all possible source parameters θ_r and the random variable $\varepsilon^{(b)}$“.

When a sufficiently large number of local seismic records are not available to provide spectral characteristics of the seismic motion at the site, the ground-motion intensity models of each tectonic regime are evenly weighted and the uncertainty associated for lack of knowledge of local seismic records is managed by adopting the 84% percentile of the AEP values. Further details of ground-motion intensity models selected for the site are summarised in the appendices.

4. Seismic Hazard

4.1. Definitions

The probability of exceeding a certain level of seismic intensity i^* at a given location is known as the seismic hazard of the site and can be estimated from the contribution of intensities from the different active faults of interest in the region. A *probabilistic seismic hazard assessment* (PSHA) quantifies the contributions of all sources for all possible magnitudes within the affected area. The PSHA stages identify all earthquake sources capable of producing significant ground-motion at the site and captures the expected range of all possible ground-motions in the target region. For a given source (s)

$$P[I > i^*]^{(s)} \approx \sum_{all\ m^*} \sum_{all\ r^*} P\left[I > i^*/m^*, r^*, \theta^*\right] P[M = m^*, R = r^*] \qquad (4.1)$$

The spatial variability is given by all possible locations of the hypocentres of future seismic events that may affect the site. Temporal variability, on the other hand, is associated with the number of events per unit time that we should expect in a given region and can be linked to the seismic magnitude and rupture area through the Gutenberg-Richter (**Gutenberg and Richter 1944**) probability model.

The fundamental difference between PSHA and DSHA methodologies, is the inclusion of random uncertainty in the calculation of the spatial and temporal distribution of earthquakes, as well as the (aleatory) uncertainty associated with the ground-motion models.

The earthquake sources capable of producing significant ground-motion at the site are identified and characterised through source models. Source characterisation includes definition of source geometry and probability distributions of potential rupture locations within the source. The source models are grouped into the following four seismic source models classes:

- *Background area-source models* that use broad geographic zones within which earthquakes can occur anywhere with equal probability.
- *Regional area-source models* that assume the spatial distribution of seismicity is not uniform at the scale of background source models and that the distribution of historical seismicity is useful to forecast future earthquake occurrence.
- *Seismotectonic models* that combine regional source models with fault-source models.
- *Smoothed seismicity models*: data-driven models that assume that historical seismicity is a good predictor of future seismic hazard and combine short-term information from the instrumental catalogue with long-term geological information from the fault-source model.

Each model type contributes different information towards probabilistic hazard assessments. Additional epistemic uncertainty is accounted for during the model parameterisation.

4.2. Annual Exceedance Probability

In a probabilistic framework, service levels are expressed in terms of *annual exceedance probability (AEP)* of ground-motion accelerations (pga, S_a). The AEP is the rate of exceedance of a specific level of seismic intensity due to the potential occurrence of earthquakes from that source over a one-year period. The Return Period T_R is defined as the inverse of the AEP:

$$T_R = 1/\lambda_I(i^*) = -T_e/\ln\left(1 - P_{T_e}[I > i^*]\right) \qquad (4.2)$$

The methodology employed for estimating the AEP is based on the Cornell-McGuire methodology Cornell (**1968**), McGuire (**1993**), Kramer (**1997**) which combines earthquake occurrence models, seismic source zone models, magnitude-recurrence relationships, and ground-motion intensity models through the total probability theorem. Assuming the occurrence of earthquakes follows a Poisson process, the probability that a certain strong motion intensity I exceeds a certain value i^* during a time interval T_e is given by:

$$P_{T_e}[I > i^*] = 1 - \exp(-\lambda_I(i^*)\, T_e) \qquad (4.3)$$

where $\lambda_I(i^*)$ is the annual rate of exceedance and T_e is the exposure time. For a given source, the annual rate of exceedance of an intensity target level i^* $\lambda_I(i^*)$ can be expressed by the Total Probability Theorem (TPT):

$$\lambda_I^{(s)}(i^*) \simeq \nu_o^{(s)} \sum_{N_R} \sum_{N_M} P\left[I > i^* | m_j, r_k\right]^{(s)} f_M^{(s)}(m_j)\, \Delta m\, f_{R|M}^{(s)}(r_k|m_j) \Delta r \qquad (4.4)$$

where $M_{max}^{(s)}$ is the maximum earthquake size of the source (s) and $\nu_o = P\left[M > M_o^{(s)}\right]$ is the annual frequency of occurrence of earthquakes with magnitude greater than a minimum value M_o. The conditional probability $P[I > i^*]$ can be obtained by assuming a probability distribution law for the seismic intensity I. Details of probability density functions used in the proposed model can be found in **Section 3.2**.

The following picture shows the AEP for PGA in rock (BC), considering different fractiles. Solid lines correspond to the median plus one-standard deviation (+84%). AEP values for different ordinates T_n are shown in **Appendix C**.

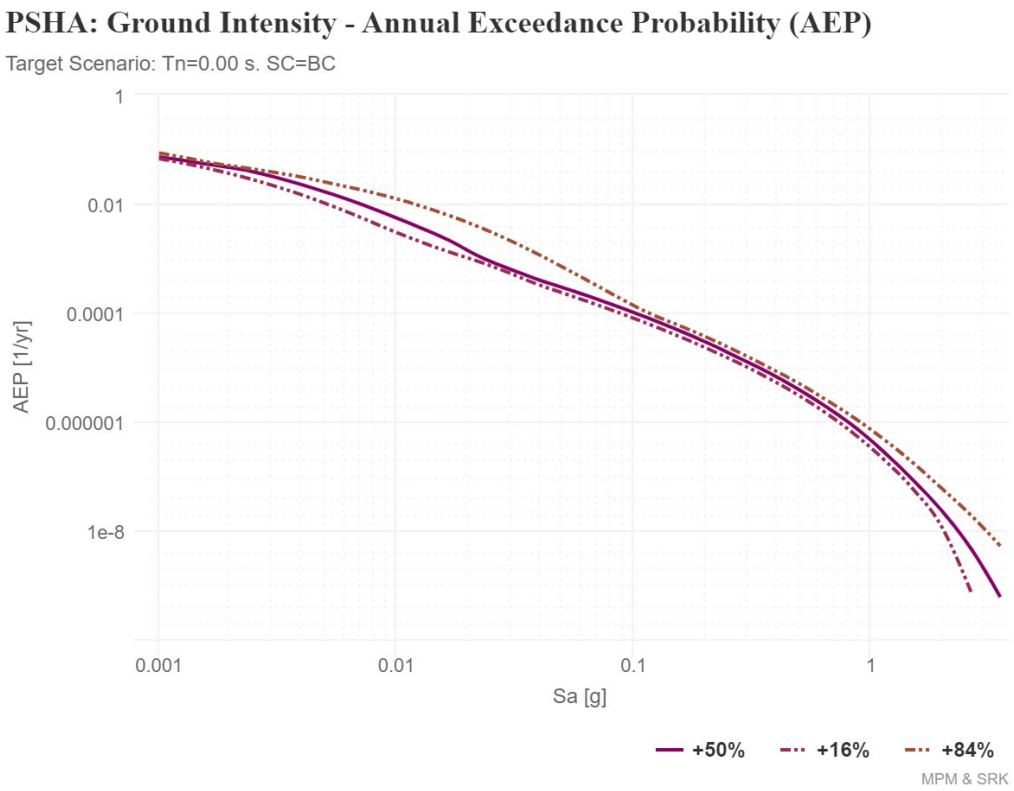


Figure 4.1: AEP for PGA in [g] with 5% damping in rock (BC) for 50%, mean and 84% values.

4.3. Response Spectra in site class BC

The *peak ground acceleration* (pga) is an intensity measure (IM) of the maximum acceleration (in absolute value) that occurred during an earthquake. The (pga) value for different fractiles and service levels is obtained from the spectral ordinates evaluated at $T_n = 0$.

The spectral ordinate $S_a(T_n)$ is the maximum acceleration reported by a single-degree-of-freedom (SDOF) oscillator with fundamental period T_n and represents the seismic ground-motion defined of a given target service level for each structural period. The response spectra represent the uniform hazard spectra (UHS) for all spectral ordinates $S_a(T_n)$ expressed in terms of the SDOF's fundamental period T_n for a given target annual exceedance probability (AEP). The *UHS* represents spectral ordinates $S_a(T_n)$ with the same probability of exceedance defined for all structural periods T_n. The following figures shows the response spectra for spectral ordinates with 5% damping in rock (BC) for mean and 84% values. Spectral ordinates are presented in the following table for different service levels.

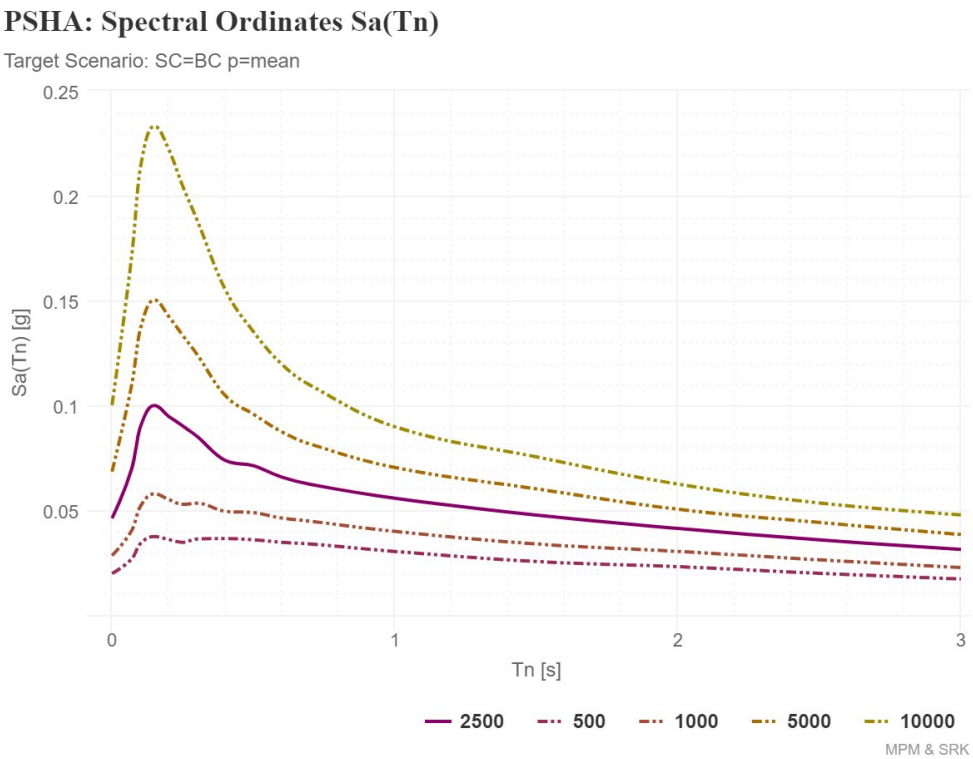


Figure 4.2: Response spectra in rock (BC) for 1:10000, 1:5000, 1:2500 and 1:1000 target AEP (mean values) Sa(Tn) [g] - mean values

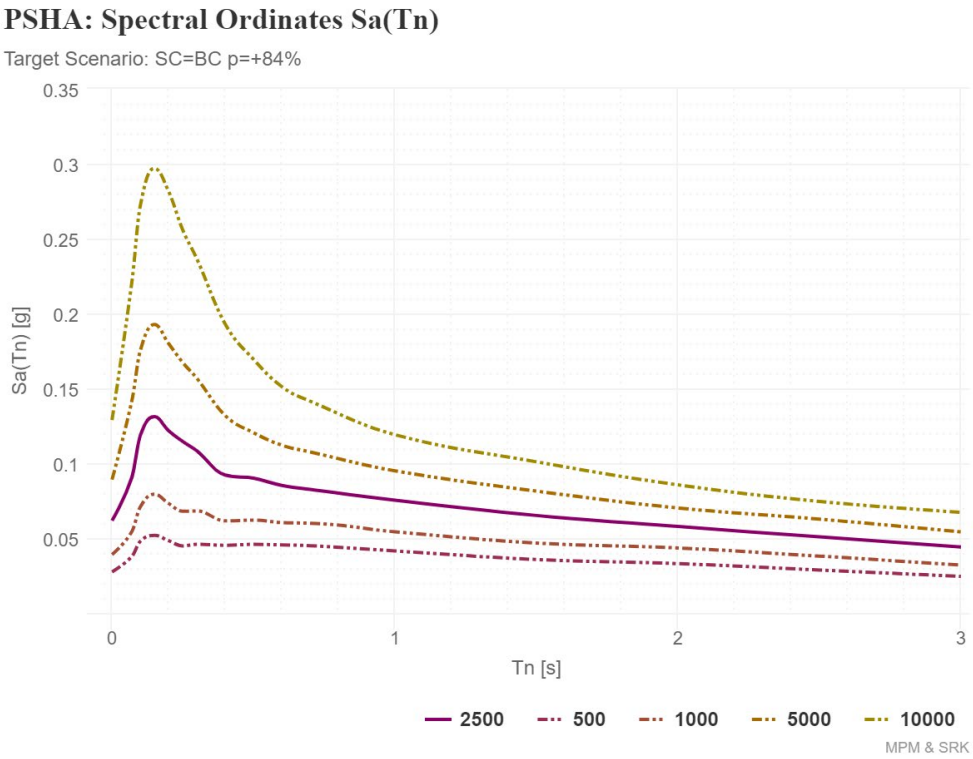


Figure 4.3: Response spectra in rock (BC) for 1:10000, 1:5000, 1:2500 and 1:1000 target AEP (mean values) Sa(Tn) [g] - 84% values

Table 4.1: Spectral ordinates Sa(Tn) [g] in rock (BC) for 1:10000, 1:5000, 1:2500 and 1:1000 target AEP (mean values)

	Sa(Tn) [g] - p=mean			
Tn	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
0.00	0.028	0.046	0.068	0.100
0.20	0.055	0.095	0.142	0.222
0.30	0.053	0.085	0.124	0.189
0.50	0.049	0.071	0.096	0.135
0.75	0.044	0.061	0.080	0.106
1.00	0.040	0.056	0.070	0.090

Table 4.2: Spectral ordinates Sa(Tn) [g] in rock (BC) for 1:10000, 1:5000, 1:2500 and 1:1000 target AEP (84% values)

	Sa(Tn) [g] - p=+84%			
Tn	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
0.00	0.039	0.062	0.089	0.129
0.20	0.073	0.122	0.180	0.281
0.30	0.068	0.108	0.157	0.236
0.50	0.062	0.090	0.120	0.169
0.75	0.059	0.081	0.105	0.138
1.00	0.054	0.075	0.095	0.119

4.4. Design Criteria

Design ground motions can be selected using either a consequence-based (deterministic) or a risk-based (probabilistic) approach. The probabilistic approach evaluates the seismic demand of a wide range of seismic ground motions on the facilities to satisfy a tolerable risk criterion based on failure probabilities. The deterministic approach on the other hand requires the selection of design earthquakes taking into consideration the failure consequences of the facility. Under this approach, target AEP for critical infrastructure shall be defined according to the failure's consequences rating for a given target service level (construction, operation, closure or post-closure). The consequence-based seismic design of a critical facility must ensure a very low probability of failure for a maximum design

earthquake, and an acceptable level of damage for an earthquake likely to occur during the service life of the facility.

Many agencies such as *Application of Dam Safety Guidelines to Mining Dams* (**2014**) (CDA-ACB) , *Guidelines for Design of Dams and Appurtenant Structures for Earthquake* (**2019**) (ANCOLD) or *Global Industry Standard on Tailings Management* (**2020**) (GISTM) have dual performance criteria to address the safety and serviceability of dams. The consequence classification system should be used together with the prescribed performance levels in selecting the required seismic loading criteria. An upper level earthquake is used to address safety while a lower level with less intensity is used to address serviceability. Safety is related to the ultimate limit state. At the serviceability limit state, the dam as well as appurtenant structures and equipment should remain functional and damage, if any, could be easily repairable after the earthquake motion.

Safety considerations primarily focus on the **ultimate limit state**, utilizing a higher-level earthquake, while serviceability considerations emphasize a lower-level earthquake with reduced intensity. During the serviceability limit state, the dam, along with its associated structures and equipment, should remain functional, and any incurred damage should be easily reparable following the earthquake event.

For Post-Closure stages, the *Maximum Design Earthquake (MDE)*, also called *Safety Evaluation Earthquake (SEE)* is the recommended maximum level of ground motion for which the dam should be remain safe. For operational stages phases, the *Operating Basis Earthquake (OBE)* is that level of ground motion for which only minor damage is acceptable, the TSF should remain functional and damage from the occurrence of earthquake shaking not exceeding the OBE should be easily reparable.

Operations involves all phases of construction and operation, periods of temporary cessation of operations, and the Closure phase (transition phase into post-closure also referred to as active care closure). Post-Closure refers to permanently closed facilities that have been configured for their perpetual form/state and thereby will be subjected to the maximum time of exposure irrespective of the Consequence Classification for the facility.

In the context of dam safety, the serviceability requirement does not always hold paramount importance. Typically, it is primarily imposed on dams with significant economic significance, especially when safety requirements requires retrofitting. In such cases, meeting serviceability requirements is pursued alongside ensuring the safety of the dam.

Maximum design earthquakes for different agencies (CDA, ANCOLD) and risk categories are summarized in the **Appendix C**.

4.5. Ground Motions in Rock (BC)

The Tenas Project, has been classified with a Extreme degree of consequences, according to CDA. The CDA recommendations set an AEP target of 1:5,000 years for active care stages (operations). target AEP of 1:5,000 years for active care stages (operations) and a target AEP of 1:10,000 years AEP for passive care stages (closure and post-closure).

According to this standard, the maximum design earthquake (MDE) for rock site conditions will have a PGA of 0.1 g (mean) and 0.129 g (84%) with a target AEP of 1:10,000 years. At operational stages (active-care) the operating basis earthquake (OBE) will have a PGA of 0.068 g (mean) and 0.089 g (84%) with a target AEP of 1:5,000 years

4.6. Epistemic uncertainty. Seismic record selection

Epistemic uncertainty can be addressed by adopting different confidence intervals. The confidence interval (target hazard level) should be established based on the uncertainty of the seismic hazard characterisation, the critical nature of the project, and the consequences of under-performance Kramer (**1997**).

Due to the lack of seismic records (accelerograms) for the study region, ground-motion intensity models have been defined with equally-weighted logic trees, which implies assuming higher epistemic uncertainty for regional ground motions. In this context, it is recommended that a suite of seismic records for dynamic deformation analysis be selected based on spectral ordinates ranging the +25%/+75% fractiles to capture the epistemic uncertainty ($\pm 25\%$). The following figure shows the range of epistemic uncertainty to be adopted in the seismic record selection procedures for passive-care stages (MDE) according to GISTM. Ranges for other consequences categories are shown in **Appendix C** .

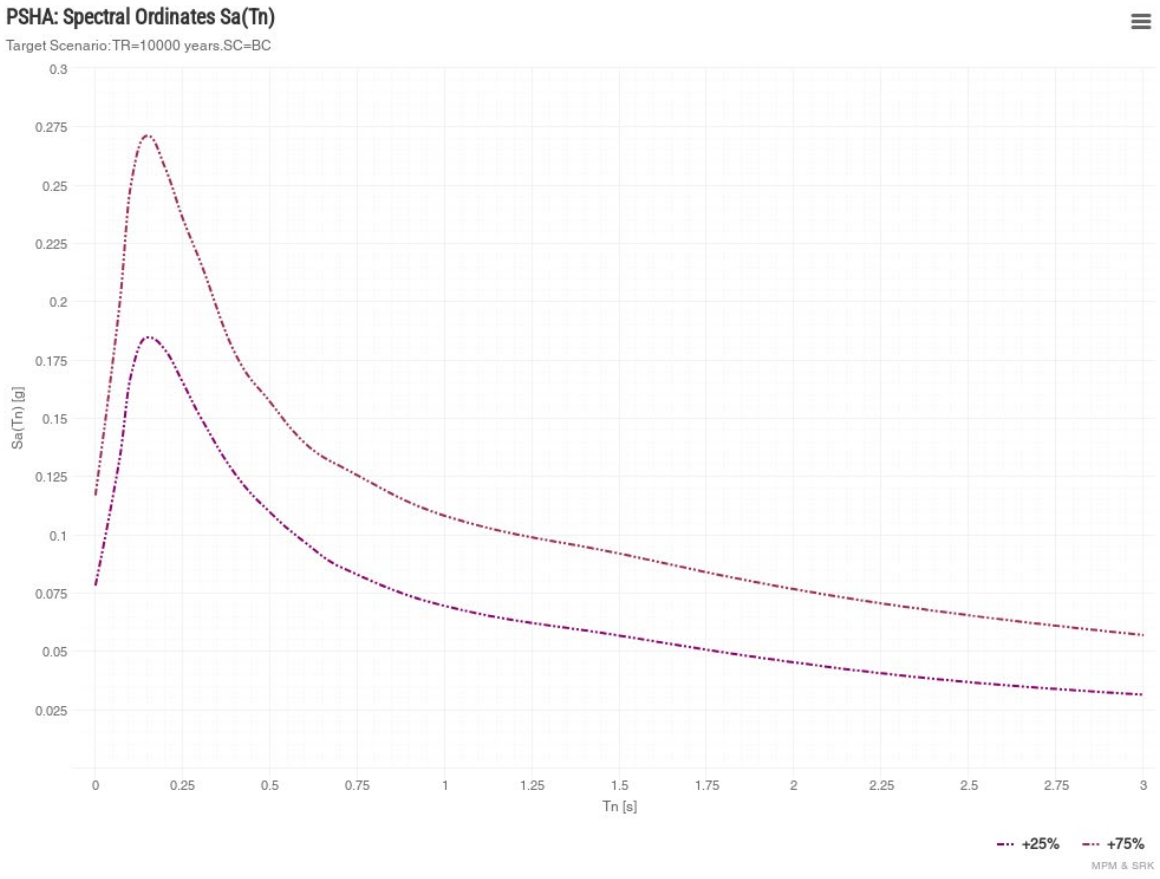


Figure 4.4: Response Spectra Sa(T) [g] in rock (BC), for 1:10,000-year AEP. Uncertainty boundaries for passive-care stages (MDE).

5. Dynamic Site Response

5.1. Site Class

Seismic ground motions will be affected by the geotechnical and dynamic characteristics of the different soil layers overlying the bedrock. The procedure by which the ground motions at the surface level are determined is known as the dynamic site response. The site response spectra must be obtained for the specific geotechnical conditions of the foundation soil of each project facility. In this section, state-of-the-art methodologies for the estimation of design earthquakes under different geotechnical site conditions are summarised.

The site classification systems for soils are used to categorise the geological and geotechnical properties of a site in order to assess its response to seismic activity. According to ASCE/SEI 7-22 (**2021**), the site soil shall be classified in accordance with **Table 5.1** based on the average shear wave velocity parameter, $\bar{v}_S$, which is derived from the measured shear wave velocity profile from the ground surface to a depth of 30 m.

The average shear wave velocity $\bar{v}_S$ is used to characterize the foundation and account for seismic site conditions. N-values from Standard Penetration Test (SPT) [6] or Cone Penetration Test (CPT) can be used to estimate shear wave velocities of the foundation materials.

Table 5.1: Site Classification according to ASCE 7-22

SC	Description	Vs30 [m/s]
A	Hard rock	>1500
B	Medium hard rock	>910-1500
BC	Soft rock	>640-910
C	Very dense soil or hard clay	>440-640
CD	Dense sand of very stiff clay	>300-440
D	Medium dense sand or stiff clay	>210-300
DE	Loose sand or medium stiff clay	>150-210
E	Very loose sand or soft clay	>=150
F	Soils requiring site response analysis (ASCE/SEI 7-22 21.1)	*See section 20.2.1

For rock and hard soils site conditions (site class A, B, and BC soils), it can be assumed that the ground has virtually no effect on the frequency content of seismic ground motions. For Site Class E or F soils, the site response must be obtained from a site-specific dynamic (time-history) analysis according to ASCE/SEI 7-22 (**2021**) Section 21.1. For Site Class C, CD, D, and DE soils, spectral

[6] Numerous correlations have been developed between SPT N values and $\bar{v}_S$ and are summarised in a report by the Wair, DeJong, and Shantz (**2012**)

ordinates $S_a(T_n)^{sc}$ can be obtained from an multi-period amplification factor $F_o^{sc}(T_n, v_S)$ in terms of shear-wave velocities $\bar{v}_S$, as detailed in the following section. Further details of ASCE classification system can be found in **Appendix E**

5.2. Shear-wave velocity profile

Profiles containing distinct soil and rock layers shall be subdivided into those layers designated by a number that ranges from 1 to n at the bottom, where there is a total of n distinct layers in the 30 m. The symbol i refers to any one of the layers between 1 and n. The average shear wave velocity, $\bar{v}_S$, shall be determined according to the following formula:

$$\bar{v}_S = \frac{30\ m}{\sum_{j=1}^{n} \frac{d_j}{v_{S_j}}}$$

where d_i, d_j is the thickness of any layer between 0 and 30 m, v_{S_j} is the shear-wave velocity in m/s and $\sum_{i=1}^{n} d_i = 30\ m$ is the profile depth. Where measured shear-wave velocity data are not available, shear wave velocity shall be estimated as a function of depth using correlations with suitable geotechnical parameters, including standard penetration test (SPT) blow counts, shear strength, overburden pressure, void ratio, or cone penetration test (CPT) tip resistance, measured at the site. Site class based on estimated values of $\bar{v}_S$ shall be derived using $\bar{v}_S$, $v_S/1.3$ and $1.3\ v_S$ when correlation models are used to derive shear wave velocities. Where the soil properties are not known in sufficient detail to determine the site class, the most critical site conditions of Site Class C, Site Class CD and Site Class D, as defined before, shall be used unless the Authority Having Jurisdiction or geotechnical data determine that Site Class DE, E, or F soils are present at the site.

5.3. Site amplification factors

The dynamic site response can be estimated by a site class-dependent scalar amplification factor according to ASCE/SEI 7-22 (**2021**). The model proposed by J. P. Stewart et al. (**2017**) is a three-component model dependent on shear-wave velocities $\bar{v}_S$ and can be used for both hard rock with v_{s30} of 3000 m/s or soft rock with v_{S30} of 760 m/s reference values.

$$\ln F \approx F_V + F_{760} + F_{NL} + \varepsilon \qquad (5.1)$$

where F_V is a scaling term relative to V_{s30} = 760 m/s, F_{760} is amplification at V_{S30} = 760 m/s relative to V_{s30} = 3000 m/s and F_{NL} is a factor that considers non-linear effects, which has strong influence in soft-soil conditions. The error term ε is a log-normal random variable, with mean $E[\varepsilon] \approx 0$ and variance $\mathrm{Var}[\varepsilon] \approx \sigma_V^2 + \sigma_{760}^2 + \sigma_A^2$.

Because the spectral ordinates in rock are actually random variables, with expectation $E[\ln F] = \eta_{Sa(T)}$ and variance $var[\ln F] = \sigma_A^2$, the error term from this model has been adapted to incorporate the seismic hazard's uncertainty. Based on this model, the following tables summarises the amplification factors defined for different site classes sc and natural periods T_n under the following assumptions

- Shear-wave velocity reference for bedrock level: $v_S^{ref} = 760\ m/s$ (BC)
- Site conditions: sc: BC, C, CD, D, and DE
- Confidence levels for β_q: mean, 84%

Table 5.2: Amplification Factors F (mean values)

	F(Tn=0)			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	1.024	1.014	1.002	0.991
C	1.148	1.132	1.114	1.087
CD	1.298	1.272	1.238	1.195
D	1.331	1.294	1.247	1.194
DE	1.331	1.283	1.236	1.153

Table 5.3: Amplification Factors F (84% values)

	F(Tn=0)			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	1.293	1.276	1.263	1.252
C	1.451	1.428	1.407	1.374
CD	1.654	1.626	1.573	1.519
D	1.718	1.668	1.608	1.531
DE	1.726	1.654	1.601	1.499

5.4. Peak Ground Accelerations PGA. Site Response Spectra.

For a given service level (AEP) and structural period T_n, median spectral ordinates $s_a(T_n)^{sc}$ expected on arbitrary site conditions can be also obtained from spectral ordinates on rock $s_a(T_n)^o$ from

$$s_a(T_n)^{sc} \approx F_o^{sc}(T_n, \bar{v}_S)\ s_a(T_n)^o \qquad (5.2)$$

with the particular case for $s_a(T_n = 0)^{sc} = pga^{sc}$:

$$pga^{sc} \approx F_o^{sc}(\bar{v}_S)\ s_a(0)^o \qquad (5.3)$$

where $F_o^{sc}(T_n, v_S)$ is the multi-period site factor defined in **Section 5.3** and $s_a(T_n)^o$ is the spectral ordinate for the structural period T_n in rock. **Figure 5.1** and **Figure 5.2** below presents the site response spectra (mean values) for the maximum design earthquake (MDE).

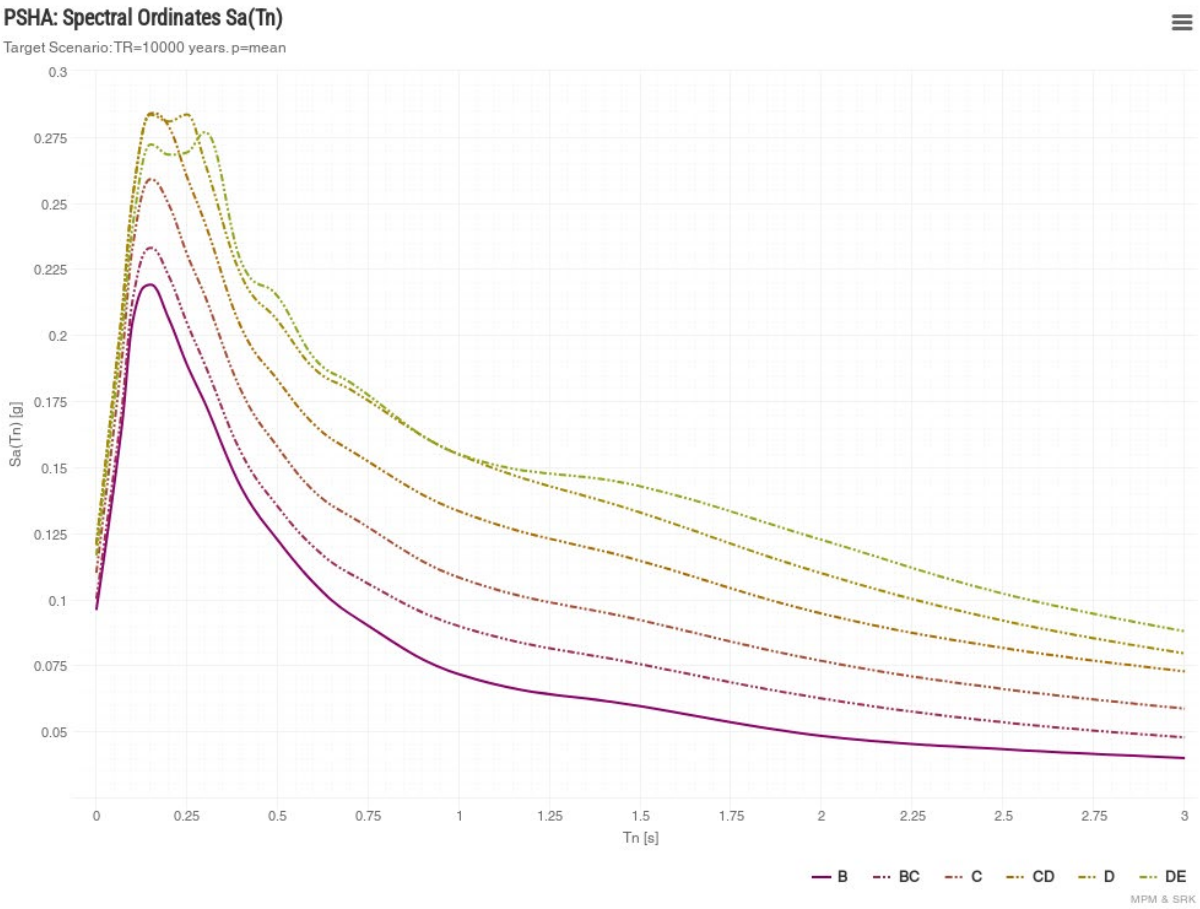


Figure 5.1: Maximum Design Earthquake (MDE) for different site conditions - Sa(T), 5% Damping in [g]. (mean values)

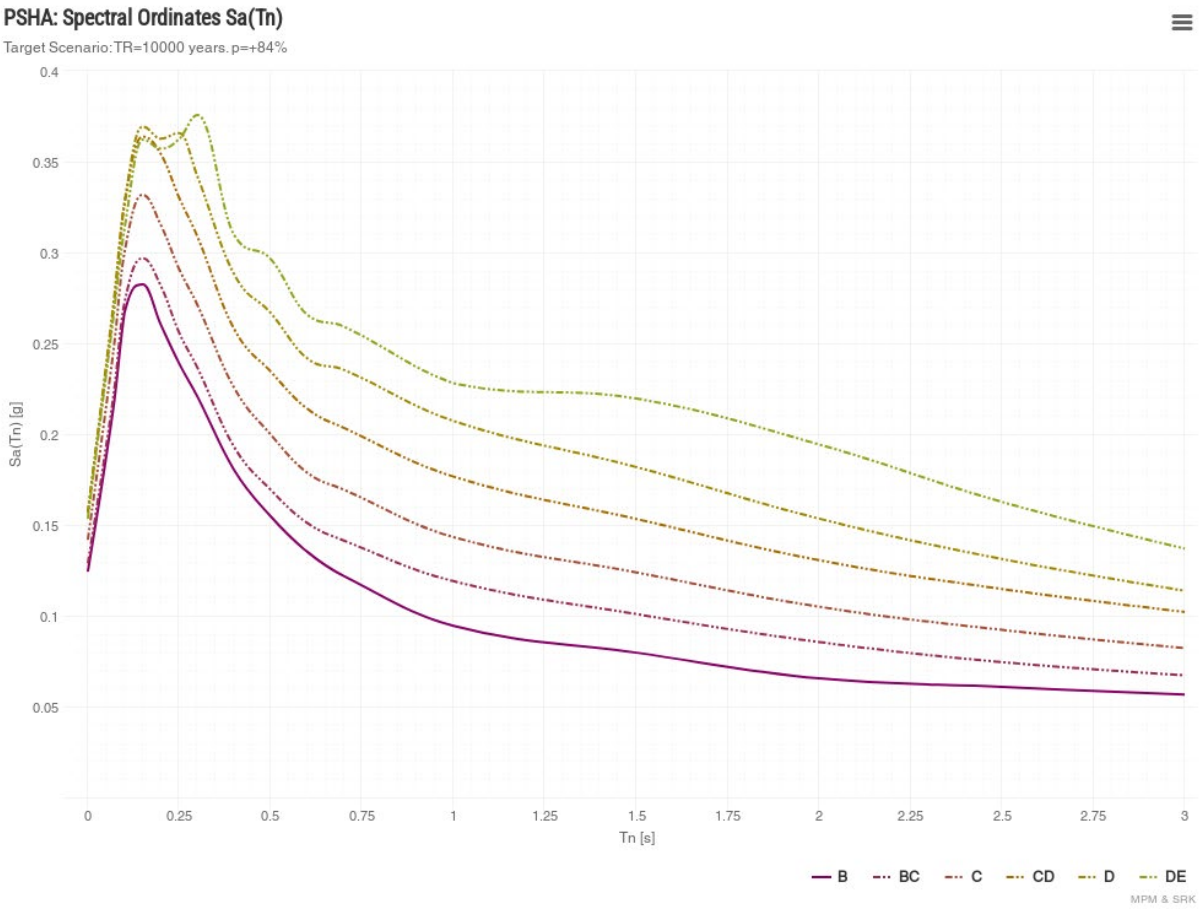


Figure 5.2: Maximum Design Earthquake (MDE) for different site conditions - Sa(T), 5% Damping in [g]. (84% values)

Table 5.4 and Table 5.5 present mean and 84% values of pga for different geotechnical conditions and return periods. **Appendix F** presents the site's response spectra for different site conditions and target AEPs.

Table 5.4: Design Ground Motions - Peak Ground Acceleration PGA [g] (mean values)

	PGA [g]			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	0.028	0.046	0.068	0.100
C	0.032	0.051	0.076	0.110
CD	0.036	0.058	0.084	0.121
D	0.037	0.059	0.085	0.121
DE	0.037	0.058	0.084	0.117

Table 5.5: Design Ground Motions - Peak Ground Acceleration PGA [g] (84% values)

	PGA [g]			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	0.039	0.062	0.089	0.129
C	0.043	0.069	0.099	0.142
CD	0.049	0.078	0.110	0.157
D	0.051	0.080	0.112	0.157
DE	0.052	0.079	0.113	0.153

5.5. Peak Ground Velocity PGV

There are several measures of the ground motion intensity that allow defining the service level to which the installation will be exposed during the different stages of its service life.

The *peak ground velocity* (pgv) can be obtained from empirical (regression) models [7] based on peak ground accelerations. Seed and Idriss (**1982**) provided an estimate of median (pgv) values (no error term reported) assuming a linear relationship as $pgv \approx (55\ cm/s)\ pga/g$. A similar expression incorporating random uncertainty can be obtained by means of a conditional median and an error term from the following expression proposed by the author (**2017**)

$$pgv(pga^o) \approx \eta_V(pga^o) \approx \phi_1\ (pga^o/g)^{\phi_2}\ [m/s] \qquad (5.4)$$

where pgv is the median peak-ground velocity expressed in m/s, pga^o are the peak-ground accelerations in rock expressed in units of g, and $\phi_1 \approx 1.058$, $\phi_2 \approx 1.084$ are model parameters. The peak-ground velocity PGV can be explained in terms of its conditional median $\eta_V(a_*)$ and a random variable ε_V with unit mean $E[\varepsilon_V] \approx 1$ and constant variance $var[\varepsilon_V] \approx \sigma^2_{lnPGV} + \sigma^2_{lnSa}$ [8].

$$PGV \approx pgv(pga^o)\ \varepsilon_V \qquad (5.5)$$

For a given shear-wave velocity $\bar{v}_S$ or site class $sc = f(\bar{v}_S)$, peak-ground velocities pgv^{sc} expected on arbitrary site conditions pgv^{sc} can be obtained from peak-ground velocities on rock from the multi-period amplification factor:

[7] A number of ground motion prediction equations for pgv and ai are available in the literature, which are based on source parameters such as magnitude M , distance to the source R_{jb}, R_e and other site or earthquake parameters. These ground motion prediction equations are used in the same way as the GMPE for PGA (see **Section 3.2**) and allow the incorporation of random uncertainty in a formal way in a vector formulation of the seismic hazard (VPSHA) that is beyond the scope of this study. In this report, we consider only empirical models based exclusively on ground accelerations, which are assumed to be known through an exceedance probability curve.

[8] Because $PGA = S_a(T_n = 0)$ is a random variable, PGV and AI will also be random variables that will have built-in the epistemic uncertainty of PGA $\varepsilon_{Ln\ PGA/AEP}$ for a given AEP and the random uncertainty from the PGV and AI models $\varepsilon^2_{Ln\ PGV}$ and $\varepsilon^2_{Ln\ AI}$, respectively.

$$pgv^{sc} \approx F_o^{sc}(v_S)\ \phi_1\ (pga^o/g)^{\phi_2}\ [m/s] \qquad (5.6)$$

where $F_o^{sc}(v_S)$ is the multi-period site factor defined in **Section 5.3**, pga^o is the peak-ground acceleration in rock and ϕ_1, ϕ_2 are model parameters. **Table 5.6** and **Table 5.7** presents mean and 84% pgv values respectively, for different service levels.

Table 5.6: Peak ground velocities in rock PGV [m/s] (mean values)

	PGV [m/s]			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	0.025	0.043	0.065	0.099
C	0.029	0.048	0.074	0.110
CD	0.033	0.055	0.082	0.122
D	0.034	0.056	0.083	0.122
DE	0.034	0.055	0.082	0.118

Table 5.7: Peak ground velocities in rock PGV [m/s] (84% values)

	PGV [m/s]			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	0.052	0.086	0.128	0.191
C	0.058	0.097	0.143	0.212
CD	0.067	0.111	0.161	0.236
D	0.070	0.114	0.164	0.236
DE	0.071	0.112	0.165	0.230

5.6. Arias Intensity

The *Arias* intensity is an IM strongly correlated with seismic demand in terms of permanent settlement of slopes and are often used as a proxy for the selection of seismic records for dynamic deformation analysis. In similar way as pgv, Arias Intensities (ai) can be obtained from a probabilistic model based on peak ground accelerations (**2017**) from:

$$ai(pga^o) \approx \eta_A(pga^o) \approx \psi_1\ (pga^o/g)^{\psi_2}\ [m/s] \qquad (5.7)$$

where ai is the median Arias Intensity in m/s, pga are the peak-ground accelerations for rock site conditions in units of g , $\psi_1 \approx 11.623$, $\psi_2 \approx 1.956$ are model parameters.

As a random variable, Arias intensity has a conditional mean$\eta_A(a_*)$ and an error term ε_A with unit mean $E[\varepsilon_A] \approx 1$ and constant variance $var[\varepsilon_A] \approx \sigma^2_{lnAI} + \sigma^2_{lnSa}$

$$AI \approx ai(pga^o)\ \varepsilon_A \qquad (5.8)$$

For a given shear-wave velocity $\bar{v}_S$ or site class $sc = f(\bar{v}_S)$, Arias intensities a_i^{sc} expected on arbitrary site conditions ai^{sc} can be obtained from the peak-ground accelerations on rock from the multi-period amplification factor:

$$ai^{sc} \approx F_o^{sc}(v_S)\ \psi_1\ (pga^o/g)^{\psi_2}\ [m/s] \qquad (5.9)$$

where $F_o^{sc}(v_S)$ is the multi-period site factor defined in **Section 5.3**, pga^o is the peak-ground acceleration in rock and ψ_1, ψ_2 are model parameters.

Table 5.8 and **Table 5.9** presents mean and 84% ai values respectively, for different service levels.

Table 5.8: Arias Intensities in rock (BC) AI [m/s] (mean values)

	AI [m/s]			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	0.014	0.037	0.079	0.168
C	0.018	0.045	0.098	0.202
CD	0.023	0.058	0.119	0.243
D	0.024	0.060	0.122	0.243
DE	0.024	0.058	0.119	0.228

Table 5.9: Arias Intensities in rock (BC) AI [m/s] (84% values)

	AI [m/s]			
SC	**TR=1000**	**TR=2500**	**TR=5000**	**TR=10000**
BC	0.042	0.104	0.211	0.436
C	0.051	0.128	0.260	0.526
CD	0.066	0.163	0.319	0.640
D	0.071	0.171	0.331	0.640
DE	0.074	0.167	0.337	0.609

5.7. Design earthquakes for Tenas Project

For Tenas Project, a $\bar{v}_S$ value ranging between 440 to 640 m/s has been assumed as a representative average shear-wave velocity for all foundation scenarios, which corresponds to very dense soils or hard clays and a C site class as per ASCE/SEI 7-22 (**2021**). Target AEP (return periods) for the TSF has been defined according to the failure's consequences rating. The most critical facilities have been classified as **Extreme** consequences grade. For C site class and **Extreme** consequences grade, the maximum design earthquake **MDE** for passive-care stages will have a PGA of 0.11 g (mean) and 0.142 g (84%). **Appendix C** summarises the design earthquakes for other failure's consequences ratings and standards.

6. Dynamic Slope Response

6.1. Slope's fundamental periods

The main parameter that controls the dynamic response of slopes is the fundamental period, which is dependent on the geometrical properties of the tailings dam and the mechanical properties of the construction materials and foundation soils. Fundamental periods of the embankment T_s, can be obtained from the shear-beam models from Dakoulas and Gazetas (**1985**) , (**1986**) assuming a truncated-wedge geometry with a shear module varying as $G_m \simeq G_0(z/H_{max})^m$ where z is the distance from the top, G_0 is the shear module at the surface, and H_{max} is the truncated-wedge height. The jth-period of the embankment in terms of the shear-wave velocity at the base v_S^o are given by:

$$T_s^{(j)} \simeq \frac{4\,\pi\,H_{max}}{a^{(j)}\,(2-m_o)\,v_S^o} \qquad (6.1)$$

where, $a^{(j)} = f(m_o, \lambda_o)$ is the jth-root of the characteristic equation (eigenvalues) that depend on the inhomogeneity ratio m_o and the truncation ratio λ_o. The appendix **Section F.1** summarise the characteristic roots for the first two modes $a^{(1)}, a^{(2)}$ for different values of m_o and λ_o.

The homogeneity ratio m_o reflects the law of variation of shear module $G(z) \approx G_o\,(z/H_{max})^{m_o}$, where G_o is the (maximum) shear moduli at the base $(z = 0)$. The truncation ratio can be defined in terms of the height H_{max}, the berm width b_o and the average slope $tan\beta = 1/s$ in the form:

$$\lambda_o = \frac{b_o}{b_{max}} = \frac{bo\ s}{2\ H_{max}\ s + b_o} \qquad (6.2)$$

Typical truncation ratios ranges from $\lambda_o \approx 0.05$ to $\lambda_o \approx 0.4$ (embankments). According to the **Equation 6.2** a 45 m high slope with $b_{max} \approx 225$ m at the base and $b_o \approx 20$ m at the top, will have a truncation ratio close to $\lambda_o \approx 0.1$. For a shear stiffness modulus ranging 153 to 269 MPa (308 to 394m/s) , the fundamental period of the embankment ranges between 0.33 to 0.4 sec. according to the **Equation 6.1**.

6.2. Seismic (Pseudo-Static) Coefficients

The pseudo-static seismic coefficient represents the maximum horizontal pseudo-acceleration $(\bar{a}_{h.max})$ expected in a failure wedge in slip potential and is obtained by averaging the horizontal (instantaneous) forces in the deformable sliding mass. The *horizontal* seismic coefficient, measured in units of g, is usually expressed in terms of the maximum ground acceleration pga according to $k_{max} = k_h\ pga$. In pseudo-static slope stability analysis, the adoption of seismic coefficients $k < k_{max}$ combined with $FoS = 1$ indicates that some residual displacements will be expected.

The empirical model from Bray and Macedo (**2019**) provides an estimate of residual displacements D_n for different yield coefficients k_y and intensity levels $Sa(T_d)$. The seismic coefficient k_{max} is obtained for that value of the yield coefficient k_y such that the residual displacements η_D are less than or equal to a target displacement D_a according to the following expression:

$$\ln k_{max} \approx a_0 + a_1 \ln s_a^* + a_2\ + a_2\,(\ln s_a^*)^2 \qquad (6.3)$$

where s_a^* is the intensity level defined as $s_a^* = S_a(1.3\ T_d)$, and a_0, a_1, a_2 are model parameters depending on the target displacement d_a^*, the peak-ground velocity pgv, the slope's fundamental period T_s and the moment magnitude M_w representative for the maximum considered seismic event.

Seismic coefficients from this methodology are based on the condition of rigid plastic yielding deformation on a well-defined failure surface and therefore limited in terms of their application to compacted clayey embankments and dry or dense cohesionless soils that experience very little reduction in strength due to cyclic loading. The proposed methodology should not be applied in cases where embankments or their foundations are susceptible to liquefaction or strain weakening, as the residual displacements will be significantly underestimated.

The pseudo-static coefficients k_{max} for existing dam heights on the project are shown in the table below, assuming different geotechnical conditions of the embankment foundation soil. The slope fundamental period T_s is calculated using **Equation 6.1**. Values in Table 6.1 were calibrated for residual displacements in the order of 0.6 % H_{max} and a target AEP of 1:10,000 years, corresponding to an 'Extreme' Consequence Category. Appendix **F** summarizes seismic coefficients calibrated for other performance levels.

Table 6.1: Summary of the pseudo-static coefficients k_{max}

Dam height [m]	AEP	Da 0.6 % H_{max} [cm]	Vs [m/s]	Ts [s]	k_{max} [g]
15	1:10,000	10	310	0.15	0.0437
			400	0.10	0.0340
25	1:10,000	15	310	0.25	0.0438
			400	0.15	0.0323
45	1:10,000	25	310	0.45	0.0361
			400	0.30	0.0331

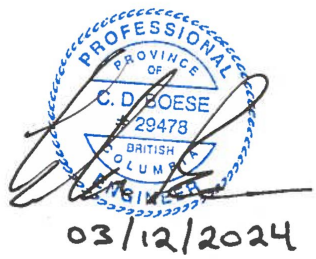
Closure

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A Seismicity

Seismic Catalogue

The seismic catalogue used in this study was downloaded from the International Seismological Centre (ISC), and is a compilation from multiple data sources, one of which is the Council for Geoscience. Throughout its history, a total of 580 agencies have contributed to the ISC Bulletin. The agencies who contributed to the data catalogue compiled for this project are listed in the following table.

Table A.1: Agencies whose data contributed to the ISC catalogue used in this project

Abbreviation	Agency	Country
BGSI	Botswana Geoscience Institute	Botswana
BJI	China Earthquake Networks Center	China
BUL	Goetz Observatory	Zimbabwe
CNG	Seismographic Station Changalane	Mozambique
EAF	East African Network	
EHB	Engdahl, van der Hilst and Buland	U.S.A.
EIDC	Experimental (GSETT3) International Data Centre	U.S.A.
GFZ	Helmholtz Centre Potsdam GFZ German Research Centre	Germany
IASPEI	IASPEI Working Group on Reference Events	U.S.A.
IDC	International Data Centre, CTBTO	Austria
ISC	International Seismological Centre	United Kingdom
ISC-EHB	Revision and continuation of the EHB project	
ISS	International Seismological Summary	United Kingdom
JOH	Bernard Price Institute of Geophysics	South Africa
LSZ	Geological Survey Department of Zambia	Zambia
MOS	Geophysical Survey of Russian Academy of Sciences	Russia
NAM	The Geological Survey of Namibia	Namibia
NEIC	National Earthquake Information Center	U.S.A.
NEIS	National Earthquake Information Service	U.S.A.
PAS	California Institute of Technology	U.S.A.
PRE	Council for Geoscience	South Africa
USCGS	United States Coast and Geodetic Survey	U.S.A.

Appendix B Annual Exceedance Probabilities (AEP)

AEP for PGA

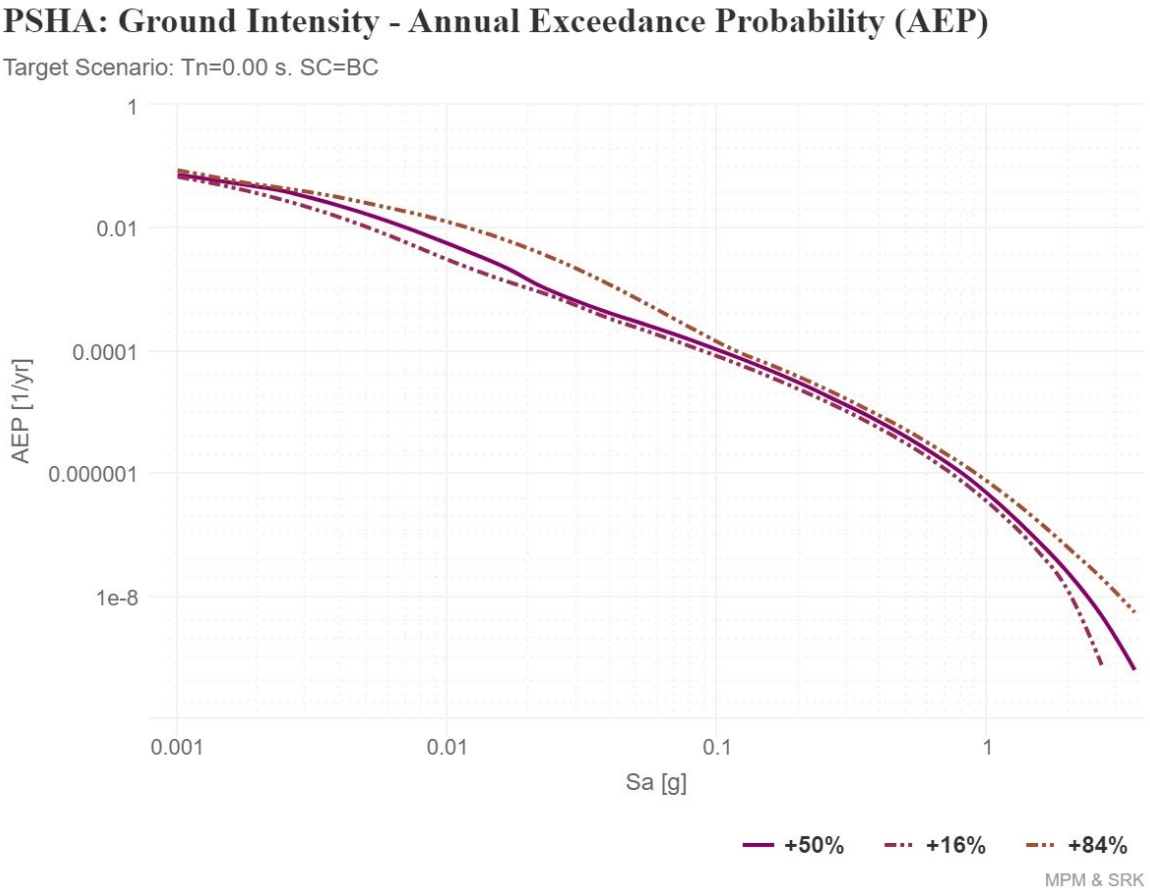


Figure B.1: AEP for PGA in [g] with 5% damping in rock (BC)

AEP for $S_a(T_n = 0.2)$

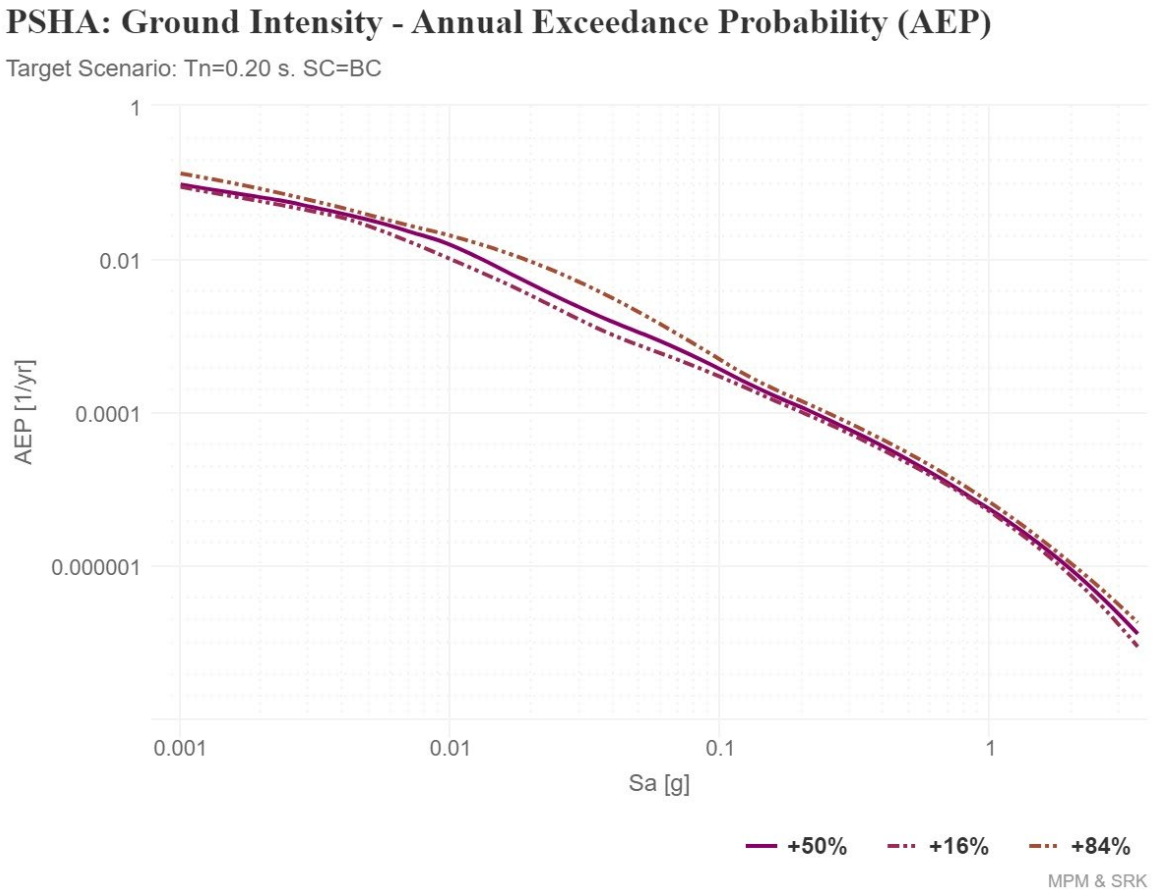


Figure B. 2: AEP for $S_a(T_n = 0.2)$ in [g] with 5% damping in rock (BC)

AEP for $S_a(T_n = 0.5)$

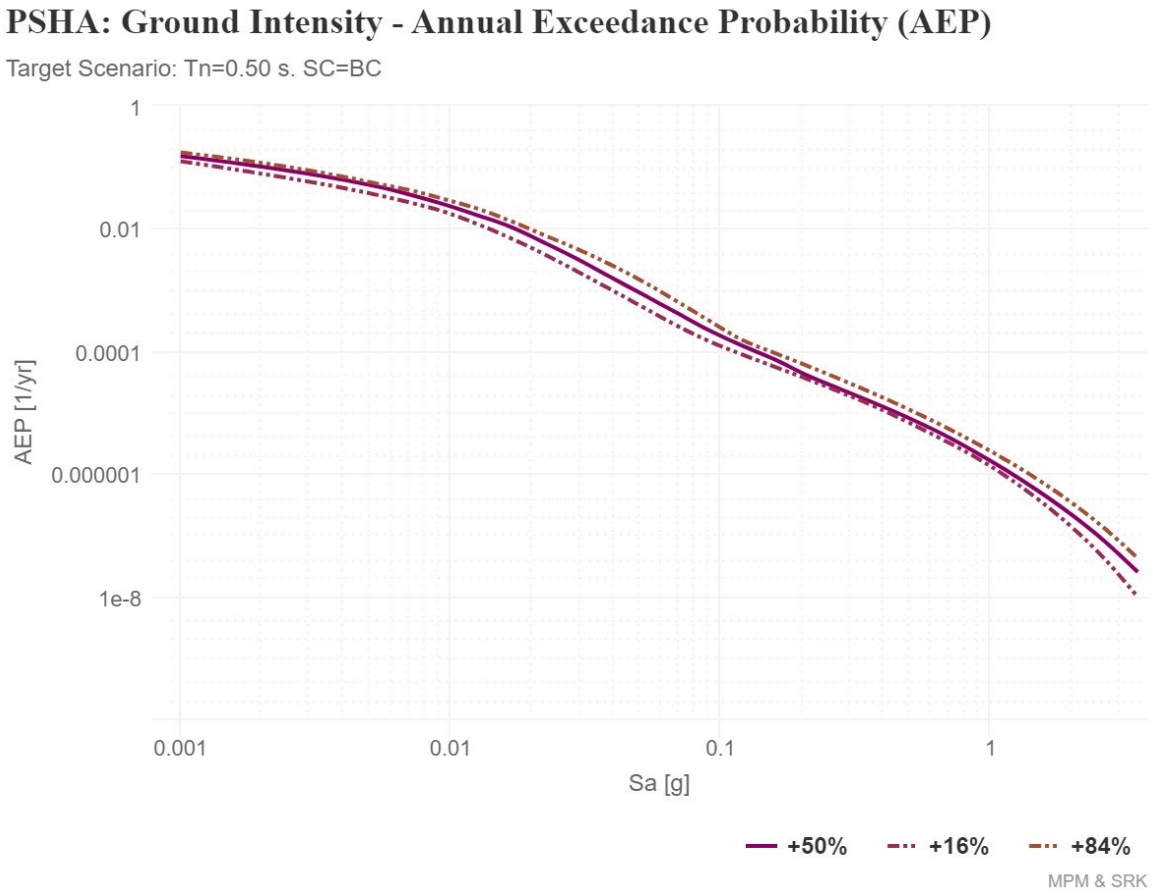


Figure B. 3: AEP for $S_a(T_n = 0.5)$ in [g] with 5% damping in rock (BC)

AEP for $S_a(T_n = 1.0)$

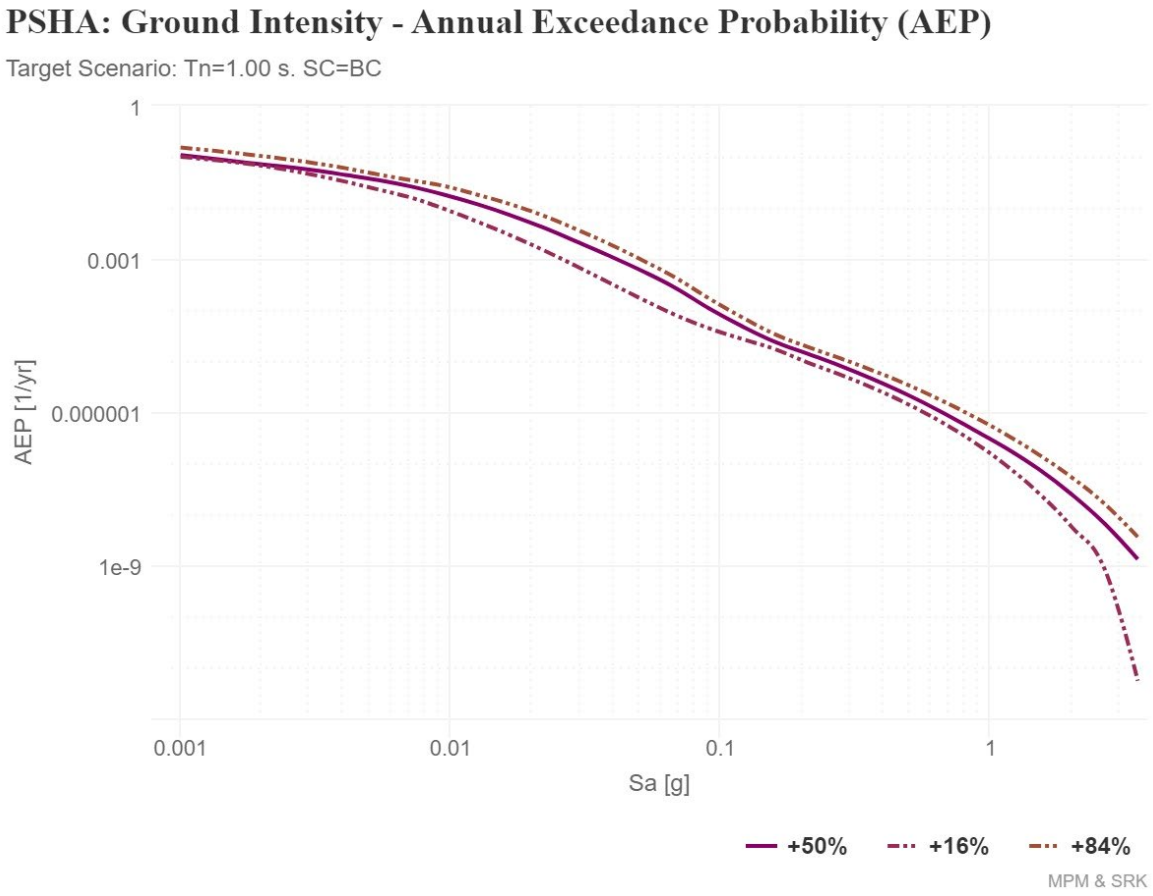


Figure B. 4: AEP for $S_a(T_n = 1.0)$ in [g] with 5% damping in rock (BC)

AEP for $S_a(T_n = 1.5)$

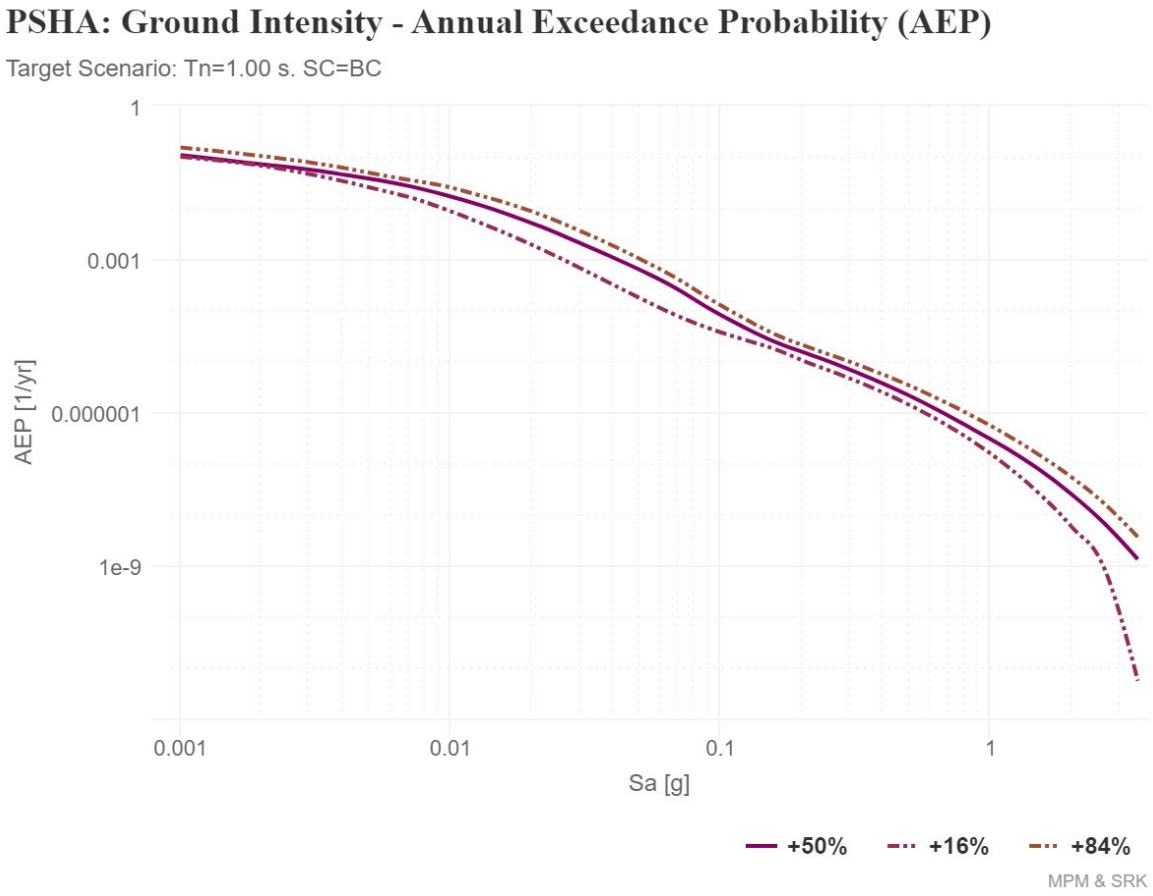


Figure B. 5: AEP for $S_a(T_n = 1.5)$ in [g] with 5% damping in rock (BC)

Appendix C Design Earthquakes in Rock

Australian National Committee On Large Dams (ANCOLD)

Table C. 1: Maximum Design Earthquake (MDE) for site class B, according to ANCOLD - mean values

Category	PGA[g]	PGV[m/s]	AI[m/s]	TR
Extreme	0.124	0.183	0.404	10,000
High A	0.096	0.095	0.155	10,000
High B	0.065	0.062	0.072	5,000
High C	0.043	0.040	0.032	2,500
Significant	0.027	0.024	0.013	1,000
Low	0.027	0.024	0.013	500

Table C. 2: Maximum Design Earthquake (MDE) for site class B, according to ANCOLD - 84% values

Category	PGA[g]	PGV[m/s]	AI[m/s]	TR
Extreme	0.124	0.183	0.404	10,000
High A	0.124	0.183	0.404	10,000
High B	0.086	0.123	0.197	5,000
High C	0.059	0.082	0.094	2,500
Significant	0.036	0.048	0.036	1,000
Low	0.036	0.048	0.036	500

Source: *Guidelines on the Consequence Categories for Dams* (**2012**), *Guidelines for Design of Dams and Appurtenant Structures for Earthquake* (**2019**)

Canadian Dam Association (CDA)

Table C. 3: Maximum Design Earthquake (MDE) for site class B, according to CDA - mean values

Category	PGA[g]	PGV[m/s]	AI[m/s]	TR
Extreme	0.096	0.095	0.155	10,000
Very High	0.096	0.095	0.155	10,000
High	0.065	0.062	0.072	5,000
Significant	0.043	0.040	0.032	2,500
Low	0.027	0.024	0.013	1,000

Table C. 4: Maximum Design Earthquake (MDE) for site class B, according to CDA - 84% values

Category	PGA[g]	PGV[m/s]	AI[m/s]	TR
Extreme	0.124	0.183	0.404	10,000
Very High	0.124	0.183	0.404	10,000
High	0.086	0.123	0.197	5,000
Significant	0.059	0.082	0.094	2,500
Low	0.036	0.048	0.036	1,000

Source: *Dam Safety Guidelines* (**2013**), *Application of Dam Safety Guidelines to Mining Dams* (**2014**), *Technical Bulletin - Seismic Hazard Considerations for Dam Safety* (**2007**)

Global Industry Standard on Tailings Management (GISTM)

Table C.5: Maximum Design Earthquake (MDE) for site class B, according to GISTM - mean values

Category	PGA[g]	PGV[m/s]	AI[m/s]	TR
Extreme	0.096	0.095	0.155	10,000
Very High	0.096	0.095	0.155	10,000
High	0.096	0.095	0.155	10,000
Significant	0.096	0.095	0.155	10,000
Low	0.096	0.095	0.155	10,000

Table C.6: Maximum Design Earthquake (MDE) for site class B, according to GISTM - 84% values

Category	PGA[g]	PGV[m/s]	AI[m/s]	TR
Extreme	0.124	0.183	0.404	10,000
Very High	0.124	0.183	0.404	10,000
High	0.124	0.183	0.404	10,000
Significant	0.124	0.183	0.404	10,000
Low	0.124	0.183	0.404	10,000

Source: *Global Industry Standard on Tailings Management* (**2020**)

Appendix D Site Classification Procedure

American Society of Civil Engineers Standards ASCE/SEI 7-22

The ASCE/SEI 7-22 Standard American Society of Civil Engineers (**2021**) provides guidelines for conducting geotechnical investigations and includes a site classification system that categorises sites into classes based on their soil properties, such as shear wave velocity, depth to bedrock, and soil type. According to ASCE 7-22 (**2021**), the site soil shall be classified in accordance with **Table F.1** based on the average shear wave velocity parameter, v_S, which is derived from the measured shear wave velocity profile from the ground surface to a depth of 30 m.

Table D.1: Site Classification according to ASCE/SEI 7-22

SC	Description	Vs30 [m/s]
A	Hard rock	>1500
B	Medium hard rock	>910-1500
BC	Soft rock	>640-910
C	Very dense soil or hard clay	>440-640
CD	Dense sand of very stiff clay	>300-440
D	Medium dense sand or stiff clay	>210-300
DE	Loose sand or medium stiff clay	>150-210
E	Very loose sand or soft clay	>=150
F	Soils requiring site response analysis (ASCE/SEI 7-22 21.1)	*See section 20.2.1

- *Site Class F:* Where any of the following conditions is satisfied, the site shall be classified as Site Class F and a full site response analysis, in accordance with ASCE/SEI 7-22 (**2021**) Section 21.1, shall be performed:

    1. Soil profile that includes soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils, quick and highly sensitive clays, and collapsible weakly cemented soils.

    2. Soil profile includes peats and/or highly organic clays ($H > 3\ m$) where H_s = thickness of soil.

    3. Soil profile includes very high plasticity clays ($H > 8\ m$) with PI > 75 in a soil profile that would otherwise be classified as Site Class CD, D, DE, or E.

    4. Soil profile includes very thick soft/medium stiff clays ($H > 37\ m$) with su < 50 kPa.

- *Site Class E (Soft Clay):* Where a site does not qualify under the criteria for Site Class F and there is a total thickness of soft clay greater than $3\ m$, where a soft clay layer is defined by $s_u < 25\ kPa$, $\omega \geq 40\%$, and $PI > 20$, it shall be classified as Site Class E. This classification is made regardless of v_S

- *Site Class C,C,D,DE and E:* The assignment of Site Class C, CD, D, DE, and E soils shall be made based on the average shear wave velocity, v_s, which is derived from the site shear wave velocity profile from the ground surface to a depth of 30 m

- *Site Class B and BC (Medium Hard and Soft Rock):* Site Class B can only be assigned to a site on the basis of shear wave velocity measured on site. If shear wave velocity data are not available and the site condition is estimated by a geotechnical engineer, engineering geologist, or seismologist as Site Class B or BC on the basis of site geology, consisting of competent rock with moderate fracturing and weathering, the site shall be classified as Site Class BC. Softer and more highly fractured and weathered rock shall either be measured on site for shear wave velocity or classified as Site Class C.

- *Site Class A (Hard Rock):* The hard rock, Site Class A, category shall be supported by shear wave velocity measurement, either on site or on profiles of the same rock type in the same formation with an equal or greater degree of weathering and fracturing.

Appendix E Site Response Spectra

Uniform Hazard spectra (UHS) for 1/AEP=1,000

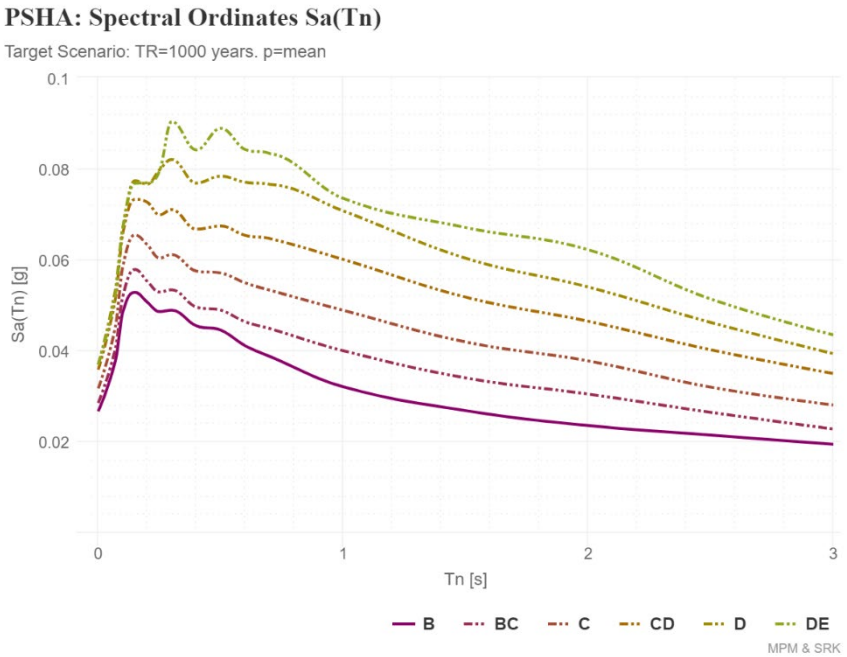


Figure E.1: Response Spectra for 1/1,000 yr and different site conditions - Sa(T), 5% Damping in [g] - (mean values)

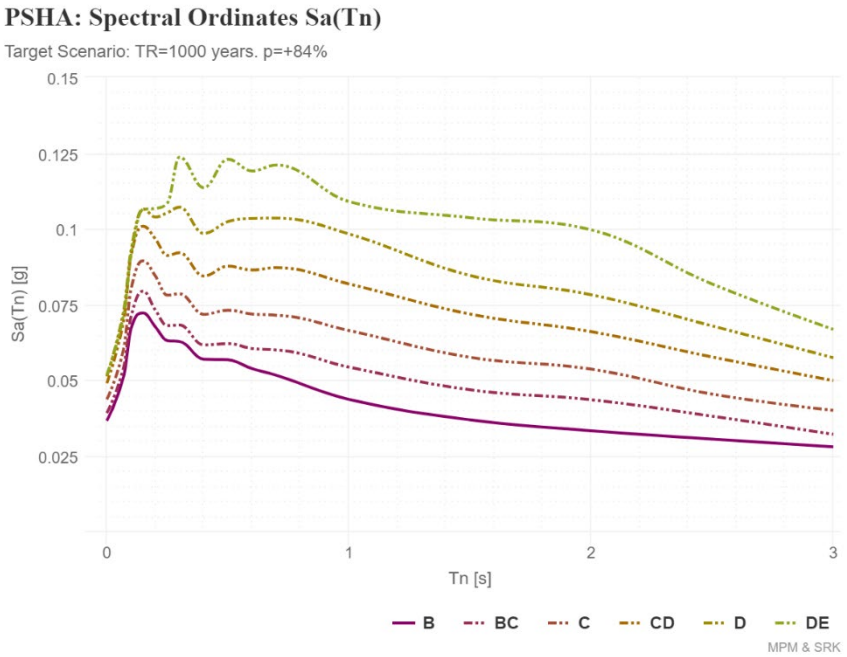


Figure E.2: Response Spectra for 1/1,000 yr and different site conditions - Sa(T), 5% Damping in [g] - (84% values)

Uniform Hazard spectra (UHS) for 1/AEP=2,500 yr

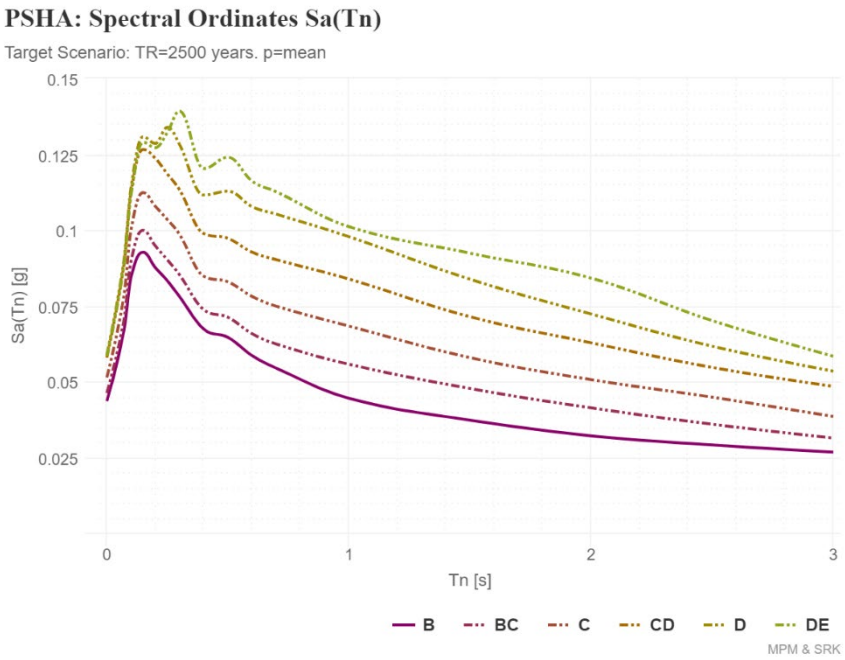


Figure E.3: Response Spectra for 1/2,500 yr and different site conditions - Sa(T), 5% Damping in [g] - (mean values)

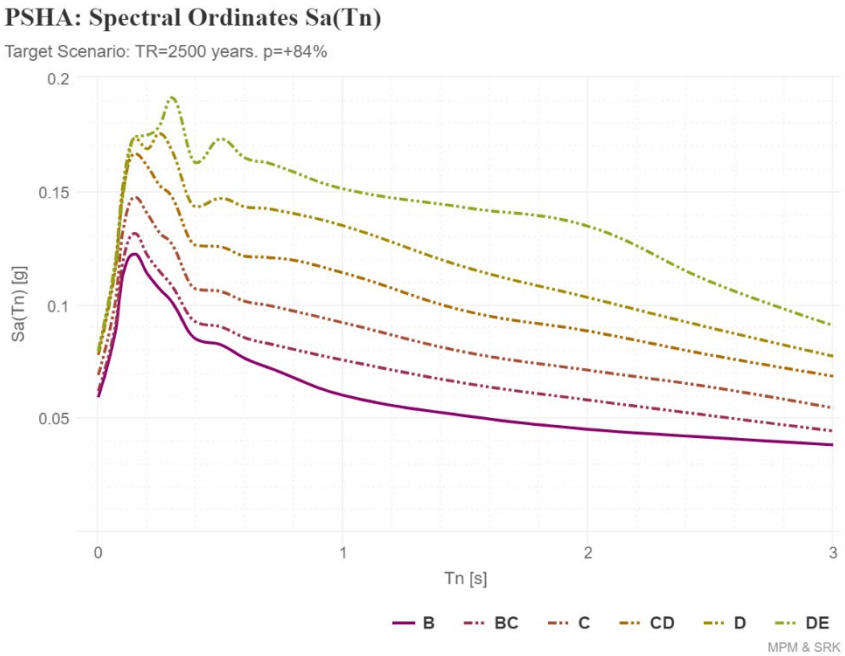


Figure E.4: Response Spectra for 1/2,500 yr and different site conditions - Sa(T), 5% Damping in [g] - (84% values)

Uniform Hazard spectra (UHS) for 1/AEP=5,000 yr

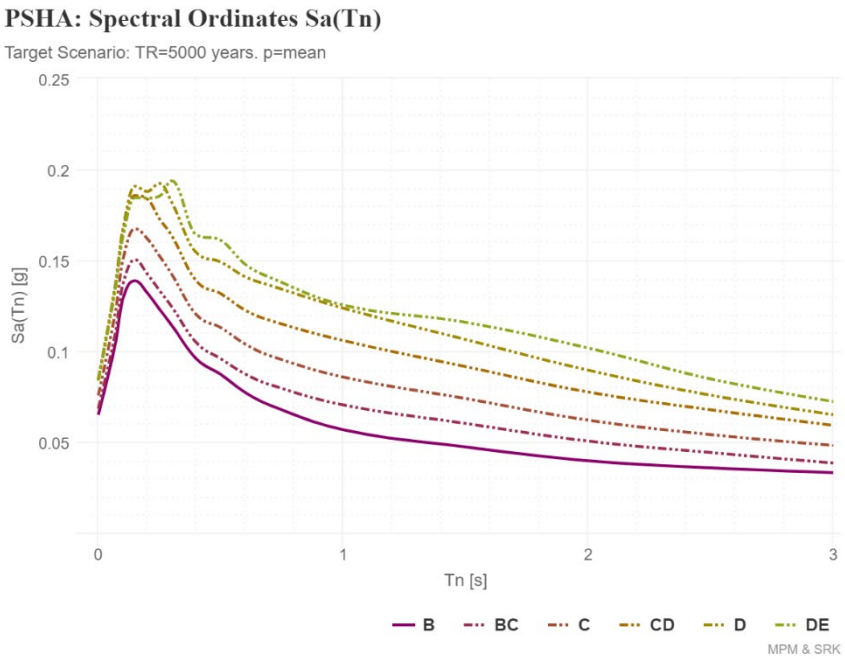


Figure E.5: Response Spectra for 1/5,000 yr and different site conditions - Sa(T), 5% Damping in [g] - (mean values)

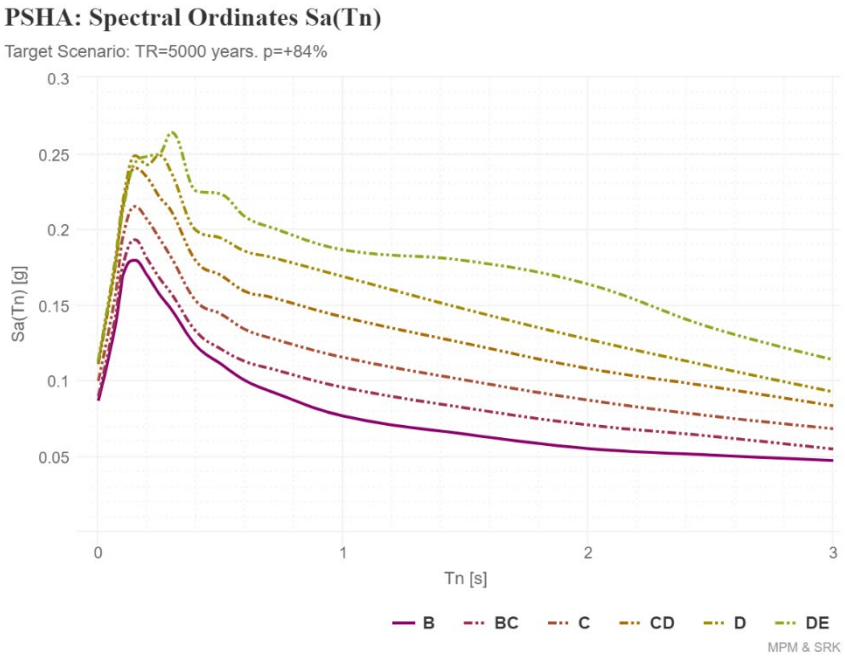


Figure E.6: Response Spectra for 1/5,000 yr and different site conditions - Sa(T), 5% Damping in [g] - (84% values)

Uniform Hazard spectra (UHS) for 1/AEP=10,000 yr

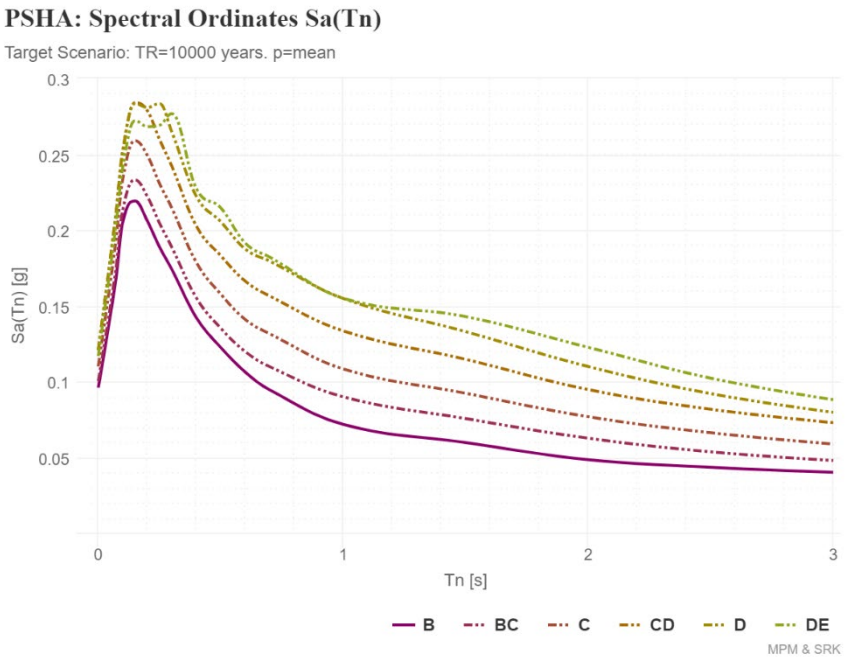


Figure E.7: Response Spectra for 1/10,000 yr and different site conditions - Sa(T), 5% Damping in [g] - (mean values)

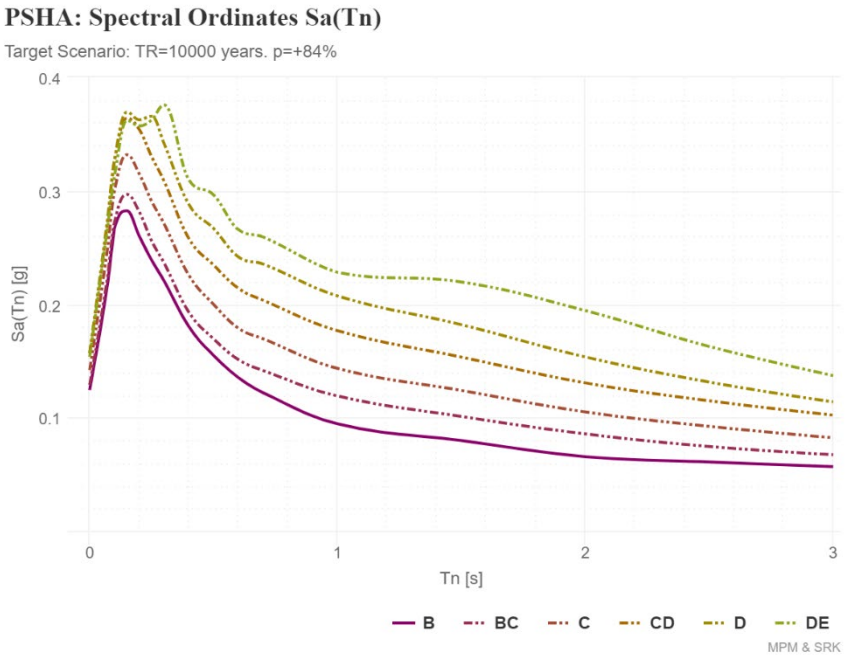


Figure E.8: Response Spectra for 1/10,000 yr and different site conditions - Sa(T), 5% Damping in [g] - (84% values)

Appendix F Dynamic Slope Response

Fundamental periods

The following tables summarises the characteristic roots for the first and second mode a_1, a_2 used in **Equation 6.1** considering different homogeneity ratios m_o and truncation ratios λ_o from Dakoulas and Gazetas (**1985**)

Table F.1: Characteristic roots for typical TSF slopes a_1 (n=1)

l	m=0.4	m=0.45	m=0.5	m=0.525	m=0.55	m=0.625	m=0.65	m=0.675	m=0.75	m=0.775	m=0.8
0.02	2.784	2.843	2.906	2.939	2.972	3.081	3.119	3.159	3.287	3.333	3.381
0.04	2.792	2.851	2.915	2.948	2.982	3.092	3.130	3.171	3.300	3.347	3.395
0.06	2.805	2.865	2.929	2.963	2.998	3.109	3.148	3.189	3.321	3.368	3.417
0.08	2.822	2.884	2.949	2.983	3.019	3.132	3.172	3.214	3.348	3.396	3.447
0.10	2.844	2.907	2.974	3.009	3.045	3.160	3.201	3.244	3.381	3.431	3.482
0.16	2.936	3.003	3.075	3.112	3.151	3.275	3.319	3.365	3.514	3.567	3.623
0.18	2.975	3.044	3.117	3.155	3.195	3.323	3.369	3.416	3.569	3.624	3.681
0.22	3.065	3.137	3.215	3.256	3.298	3.433	3.481	3.531	3.693	3.752	3.812
0.24	3.116	3.191	3.271	3.313	3.356	3.495	3.545	3.597	3.764	3.824	3.886
0.26	3.172	3.249	3.332	3.375	3.420	3.563	3.614	3.668	3.840	3.902	3.966
0.28	3.233	3.312	3.397	3.442	3.488	3.636	3.689	3.744	3.922	3.986	4.052
0.32	3.369	3.454	3.545	3.592	3.641	3.800	3.856	3.915	4.105	4.173	4.244
0.34	3.446	3.534	3.627	3.676	3.727	3.891	3.949	4.010	4.206	4.277	4.351
0.38	3.618	3.712	3.812	3.865	3.919	4.095	4.157	4.222	4.433	4.509	4.588
0.40	3.714	3.811	3.915	3.970	4.027	4.209	4.274	4.341	4.560	4.639	4.721
0.44	3.930	4.035	4.148	4.207	4.268	4.464	4.534	4.607	4.843	4.928	5.017

Table F.2: Characteristic roots for typical TSF slopes a_2 (n=2)

l	m=0.4	m=0.45	m=0.5	m=0.525	m=0.55	m=0.625	m=0.65	m=0.675	m=0.75	m=0.775	m=0.8
0.02	5.924	5.987	6.054	6.089	6.126	6.243	6.284	6.328	6.468	6.519	6.571
0.04	5.971	6.038	6.110	6.148	6.187	6.312	6.358	6.405	6.557	6.612	6.669
0.06	6.043	6.115	6.193	6.233	6.276	6.413	6.462	6.513	6.679	6.740	6.803
0.08	6.133	6.212	6.296	6.340	6.386	6.535	6.588	6.644	6.825	6.891	6.960
0.10	6.240	6.325	6.415	6.463	6.513	6.674	6.732	6.793	6.990	7.061	7.136
0.16	6.637	6.743	6.856	6.915	6.977	7.177	7.249	7.324	7.568	7.657	7.749
0.18	6.793	6.906	7.026	7.090	7.156	7.370	7.446	7.526	7.787	7.881	7.980
0.22	7.139	7.266	7.403	7.475	7.550	7.791	7.878	7.969	8.263	8.369	8.480
0.24	7.329	7.465	7.610	7.686	7.765	8.021	8.114	8.209	8.521	8.634	8.751
0.26	7.532	7.675	7.829	7.910	7.994	8.265	8.363	8.464	8.794	8.913	9.037
0.28	7.747	7.899	8.062	8.147	8.236	8.523	8.626	8.733	9.082	9.208	9.339
0.32	8.219	8.389	8.571	8.667	8.766	9.087	9.201	9.321	9.709	9.850	9.996
0.34	8.479	8.658	8.850	8.952	9.056	9.394	9.516	9.642	10.051	10.199	10.354
0.38	9.050	9.250	9.464	9.577	9.694	10.070	10.205	10.346	10.801	10.966	11.137
0.40	9.365	9.576	9.803	9.921	10.045	10.442	10.584	10.732	11.213	11.387	11.567
0.44	10.064	10.300	10.552	10.685	10.822	11.265	11.424	11.589	12.124	12.317	12.518

Seismic coefficients

The following tables summarises the seismic coefficient for different performance levels, in terms of residual displacements D_a according to **Equation 6.3**, under the following assumptions:

- Site class: sc: BC,C,CD,D,DE
- Homogeneity ratio: m: 0.49
- Truncation ratio: $\lambda \approx 0.1$
- Height H_{max}: 45 m
- Shear stiffness v_S^o: 308 to 394m/s (153 to 269 MPa)
- Fundamental period T_a: 0.33 to 0.4 sec.
- Confidence levels for β_q: 84%
- Service Level: ($AEP = 1/T_R$ = 1:1,000 - 1:10,000 yr)

Table F.3: Pseudo-static (seismic) Coefficient k_{max} [g] for Da=5 cm

	kmax [g] - Da =5 cm				
TR	**SC=BC**	**SC=C**	**SC=CD**	**SC=D**	**SC=DE**
1,000	0.0137	0.0162	0.0195	0.0232	0.0247
2,500	0.0255	0.0303	0.0358	0.0416	0.0436
5,000	0.0407	0.0478	0.0561	0.0637	0.0650
10,000	0.0675	0.0783	0.0903	0.1003	0.1003

Table F.4: Pseudo-static (seismic) Coefficient k_{max} [g] for Da=10 cm

	kmax [g] - Da =10 cm				
TR	**SC=BC**	**SC=C**	**SC=CD**	**SC=D**	**SC=DE**
1,000	0.0079	0.0096	0.0117	0.0141	0.0150
2,500	0.0156	0.0188	0.0225	0.0264	0.0277
5,000	0.0258	0.0306	0.0362	0.0415	0.0424
10,000	0.0441	0.0516	0.0599	0.0669	0.0669

Table F.5: Pseudo-static (seismic) Coefficient k_{max} [g] for Da=15 cm

	kmax [g] - Da =15 cm				
TR	**SC=BC**	**SC=C**	**SC=CD**	**SC=D**	**SC=DE**
1,000	0.0054	0.0066	0.0082	0.0100	0.0107
2,500	0.0112	0.0136	0.0165	0.0195	0.0205
5,000	0.0190	0.0227	0.0272	0.0313	0.0320
10,000	0.0333	0.0393	0.0459	0.0515	0.0515

Table F.6: Pseudo-static (seismic) Coefficient k_{max} [g] for Da=20 cm

	kmax [g] - Da =20 cm				
TR	**SC=BC**	**SC=C**	**SC=CD**	**SC=D**	**SC=DE**
1,000	0.0038	0.0048	0.0061	0.0076	0.0082
2,500	0.0085	0.0105	0.0128	0.0153	0.0162
5,000	0.0149	0.0180	0.0217	0.0252	0.0258
10,000	0.0269	0.0318	0.0374	0.0421	0.0421

Table F.7: Pseudo-static (seismic) Coefficient k_{max} [g] for Da=25 cm

	kmax [g] - Da =25 cm				
TR	**SC=BC**	**SC=C**	**SC=CD**	**SC=D**	**SC=DE**
1,000	0.0028	0.0036	0.0047	0.0059	0.0064
2,500	0.0067	0.0084	0.0104	0.0125	0.0132
5,000	0.0122	0.0148	0.0180	0.0210	0.0215
10,000	0.0224	0.0267	0.0316	0.0357	0.0357

Attachment 3 Tenas Project, Management and Control Ponds Stability Assessment Review, SRK

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FINAL

Management Ponds Stability Assessment Review

To	Dan Farmer	**Client**	Telkwa Mining Ltd.
From	Nicolás Alscher, Sanmtiago Pastine	**Project**	CAPR002055
Cc	Calvin Boese	**Date**	March 12, 2024

Subject Review of the slope stability assessment of the Management Ponds of the Tenas Project, British Columbia, Canada

File name: CAPR002055-02-B Tenas Project - Management Ponds Stability Assessment Review_FINAL_20240312.docx

1 Introduction

1.1 Project description

The Tenas Project is a Telkwa Mining Ltd. (Telkwa) owned coal project located in central British Columbia, approximately 25 km south of Smithers and 7 km southwest of Telkwa. The Project site is located south of the Tenas River and the boundaries of the Project encompass the lower reaches of the Telkwa River, Goathorn Creek, and Tenas Creek. The Tenas Project's total mine life is anticipated to be 22.5 years, including one and half years of mine development and construction followed by 21 years of production.

The mine plan was designed and scheduled in a manner that allows potentially-acid generating (PAG) rock to be deposited into Management Ponds (MP), including the East Management Pond (EMP), West Management Pond (WMP), and North Management Pond (NMP).

These MP will be constructed ahead of time, in sequence as per the mine plan developed by Telkwa, and allowed to flood with water to a level that maintains a minimum 1 m water cover above the PAG material placed in the MP. This PAG management plan is intended to reduce oxygen levels so that oxidization of rock will be minimized with the goal of preventing Acid Rock Drainage and associated implications to water quality from occurring.

The mine plan also includes the construction of the Tenas Control Pond (TCP) to aid with onsite water management. The TCP will be constructed at the north of the NMP, and adjacent to the Coal Processing Plant and Mine Infrastructure Complex Pad.

1.2 Project background

During 2018 and 2019, SRK Consulting (Canada) Inc. (SRK) conducted field programs to investigate the foundation characteristics for the previous versions of the MP design, and rock geotechnical investigations for the proposed open pit slopes.

During 2021, a geotechnical assessment of the Management Ponds (MP) and the Tenas Control Pond (TCP) at the Tenas Project was completed by SRK (SRK, 2021), at a feasibility study level, based on the proposed ponds design provided by Telkwa (v.7 20210304) and the field investigation results from 2018 and 2019.

Based on this, among others, Telkwa prepared the Environmental Assessment Certificate Application (EACA) and submitted this to the Environmental Assessment Office (EAO) in February 2023.

In response, the EAO submitted a letter to Telkwa with a list of information requests (IRs) related to First Nation requests, water quality, pond liner design, water and load balance, ARD/ML and MP management and design. Among others, the EAO requested Telkwa to provide justification for selection of a 'Very High' Consequence Category for the MP. As a response, Telkwa is considering changing the Consequence Category to 'Extreme' and upgrade the pseudo-static slope stability assessment for the new seismic criteria based on further review of important fish habitat and residences located downstream of the MP, in addition to the public comment that was received on this topic during the application review phase.

Following this, SRK conducted a site-specific seismic hazard assessment for the Tenas Project. The outcomes of the site-specific seismic hazard assessment (SRK, 2023) were used to update the pseudo-static slope stability assessment for the new seismic criteria.

This document presents the outcomes of the updated stability assessment of the MP and TCP at a feasibility study level based on the outcomes of the site-specific seismic hazard assessment.

1.3 Objective and scope

The objective of this document is to review the MP and TCP pseudo-static slope stability analyses considering the new Consequence Category of the facilities (and hence, the new seismic design criteria) and the outcomes of the site-specific seismic hazard assessment for the Tenas Project developed by SRK (SRK, 2023) at a feasibility design level.

The scope of the study involves the validation of the MP and TCP facilities design configuration using limit equilibrium (LE) analyses for both static and pseudo-static conditions against international standards, best practice guidelines and Telkwa's internal requirements, including:

- revision of the Consequence Category and definition of the design criteria.
- slope stability assessment.
- sensitivity assessment.
- conclusions and recommendations.

1.4 Exclusions

The results presented herein are intended for the feasibility study of the MP and TCP of the Tenas Project and should not be extended beyond this specific scope.

2 Design criteria

The MP design configuration and properties for this desktop study are the same as presented on the "*Tenas Project – Management and Control Ponds Stability Assessment*" report (SRK, 2021). The design criteria of the main design events (i.e., freeboards, storm storage allowance, seismicity, factor of safety) were determined based on the consequence category, in accordance with the CDA guidelines (CDA, 2019), the Global International Standards on Tailings Management (GISTM) (ICMM, 2020) and Telkwa's internal requirements.

2.1 Consequence category

In the "*Tenas Project – Management and Control Ponds Stability Assessment*" report (SRK, 2021) the Consequence Category for the MP and TCP were assessed based on the outcomes of the Dam Breach Assessment, included as an Appendix in (SRK, 2021). The Consequence category for the MP and TCP were defined as 'Very High' according to the CDA guidelines and the Global International Standards on Tailings Management (GISTM) (ICMM, 2020).

In response to the EAO requirement to provide justification for selection of a 'Very High' Consequence Category for the MP and TCP, the presences of important fish habitat and public residences located downstream, and comments received during the public comment periods the Consequence Category for the MP and TCP of the Tenas Project were upgraded to 'Extreme' according to CDA guidelines (CDA, 2019) and the Global International Standards on Tailings Management (GISTM) (ICMM, 2020).

2.2 Seismic design criterion

Since the MP and TCP at the Tenas Project are considered to be 'Extreme' consequence category facilities, the horizontal seismic accelerations values (k_h) associated with a 1:10,000 Annual Exceedance Probability (AEP) were evaluated according to CDA guidelines (CDA, 2019) and the Global International Standards on Tailings Management (GISTM) (ICMM, 2020).

2.3 Target Factor of safety (FoS)

Slope stability of each scenario and condition has been assessed using the CDA (2019) guidelines (CDA, 2019), and suggested acceptance criteria, and Telkwa´s internal requirements. The minimum Factor of Safety (FoS) required for the different loading conditions is presented in Table 2-1.

Table 2-1: Target Factor of safety (FoS).

Loading condition	FoS required	Comments
During or at the end of construction (steady state static loading condition)	1.30	(CDA, 2019)
Long-term drained (steady state static loading condition):	1.60	Telkwa´s internal requirements which is greater than $FoS > 1.5$ (CDA, 2019)
Long-term seismic loading (Pseudo-static condition)	1.00	(CDA, 2019)

3 Slope stability assessment

3.1 Introduction

The slope stability assessment presented herein is based on the "*Tenas Project – Management and Control Ponds Stability Assessment* " report (SRK, 2021), and is aimed to update the pseudo-static analyses for the new seismic criteria and horizontal seismic acceleration determined in the site-specific seismic hazard assessment (SRK, 2023)

The slope stability assessment of the MPs was undertaken using standard limit equilibrium analyses in Slide v9 (Rocscience, 2023) and followed the acceptance criteria presented in Section 2.3.

Deterministic analyses for non-circular surfaces were performed under static and pseudo-static conditions to identify potential failure surfaces and the associated FoS using GLE/Morgenstern & Price method. Overall and buttress scale failures mechanisms were studied, and the Optimize Surfaces option was used in the analyses.

3.2 Material parameters

Geotechnical strength parameters for the bedrock, foundation soils, potentially-acid generating (PAG) and non-acid generating (NAG) materials, and pond materials were previously defined and described in the "*Tenas Project – Management and Control Ponds Stability Assessment* " report (SRK, 2021).

The geotechnical and hydrogeological parameters used for the limit equilibrium slope stability analyses are summarized in Table 3-1. The following parameters are specified for each material:

- γ: bulk unit weight;
- c': effective cohesion;
- ϕ': effective internal friction angle;
- k_h: horizontal hydraulic conductivity;
- k_v: vertical hydraulic conductivity.

Given that materials used for the embankment construction will be compacted and foundation material will be over-consolidated even for the expected loads, potential for softening under seismic loading, or

strength reduction under undrained loads is not expected and has not been considered for these materials in the stability assessment. This assumption should be confirmed during the following engineering stages.

Table 3-1: Material Parameters (SRK, 2021).

Material	Failure Criterion	Color	γ [kN/m^3]	c' [kPa]	ϕ' [°]	k_h [m/s]	k_v/k_h
Dam	Mohr Coulomb		20.5	0	30	1.0E-07	1
Buttress	Mohr Coulomb		20.5	0	30	1.0E-07	1
NAG Rock	Mohr Coulomb		23.5	0	35	1.0E-05	1
PAG Rock	Mohr Coulomb		23.5	0	35	1.0E-05	1
Liner	Mohr Coulomb		18.0	0	20	1.0E-10	1
CH [1]	Mohr Coulomb		18.0	0	20	3.0E-06	1
CL [2]	Mohr Coulomb		18.0	0	27	3.0E-06	1
Loose Silt	Mohr Coulomb		18.0	0	25	3.0E-06	1
Sand	Mohr Coulomb		20.0	0	30	3.0E-05	1
Bedrock	Infinite Strength		25.5	Infinite Strength		3.0E-07	1

[1] *CH: High plasticity clay.*
[2] *CL: Low plasticity clay.*

3.3 Geometric configuration

The eleven cross-sections previously assessed in the "*Tenas Project – Management and Control Ponds Stability Assessment* " report (SRK, 2021) were re-assessed for the new seismic design criterion and new horizontal seismic acceleration (refer to Section 3.4).

In Figure 3-1, the locations of the cross-sections and the potential weaker zones are presented. The analysed cross-sections are shown in Appendix A, from Figure A-1 to Figure A-13. These sections are:

- TCP-01 (Figure A-1): highest section of the TCP's dam;
- TCP & NMP-01 (Figure A-2 and Figure A-3): near several drill holes and test pits;
- NMP-01 (Figure A-4): highest section of the northwest area of NMP's dam, and near to several drill holes and test pits;
- NMP-02 (Figure A-5): middle of the west side of the NMP;
- NMP & WMP-01 (Figure A-6 and Figure A-7): transversal section; near several drill holes and test pits;
- WMP-01 (Figure A-8): highest WMP's dam section;
- WMP-02 (Figure A-9): nearest to the Tenas Open Pit; near several drill holes and test pits;
- EMP & WMP-01 (Figure A-10): highest section of the EMP&WMP embankment;

- EMP-01 (Figure A-11): highest EMP's dam section;
- EMP-02 (Figure A-12): near several drill holes and test pits; and
- EMP-03 (Figure A-13): middle of the east side of the EMP.

Every facility was verified for the end of operation condition (i.e., including the NAG and CL layers and maximum water elevation) except the EMP&WMP-01 section, which was modelled considering that only the EMP is full at the end of operation condition for this structure (based on the mining schedule provided by Telkwa and to represent worse state conditions for this structure).

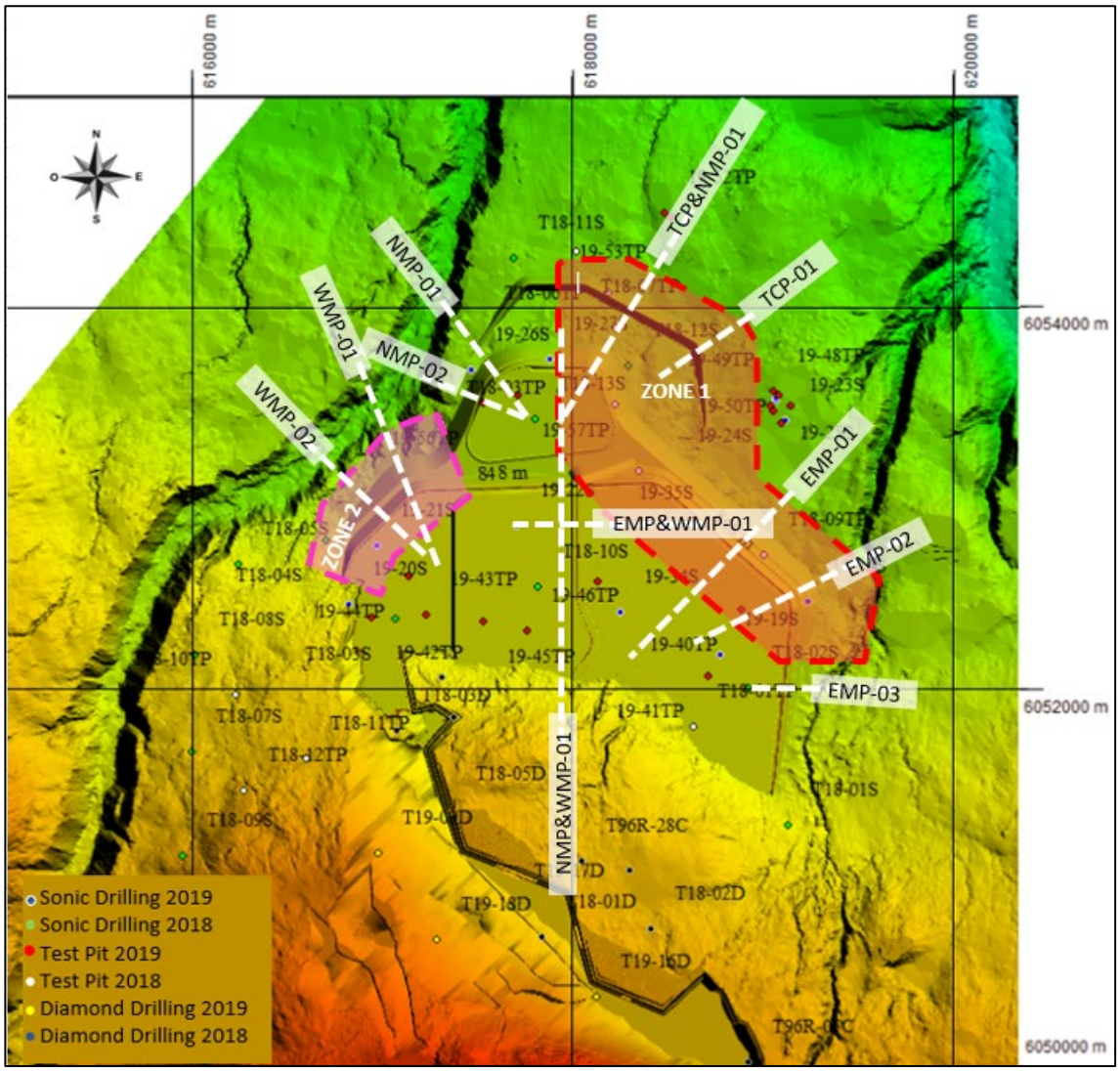


Figure 3-1: Cross-section Locations and Potential Weaker Zones (SRK, 2021).

3.4 Seismicity

SRK developed a site-specific seismic hazard assessment (SHA) for the Tenas Project (SRK, 2023), where horizontal seismic accelerations (k_h) were determined for different return periods, considering the foundation terrain and embankments characteristics.

Since the MP and TCP at the Tenas Project are 'Extreme' consequence category facilities, the horizontal seismic accelerations (k_h) values associated with a 1:10,000 Annual Exceedance Probability (AEP) were evaluated. Table 3-2 presents a summary table of the different k_h values obtained for the different embankment heights. The obtained values are approximately between 0.032g and 0.044g. For the purposes of this analysis, a maximum horizontal seismic acceleration (0.045g) was conservatively adopted for the pseudo-static stability assessment.

Table 3-2: Summary of the different k_h values (SRK, 2023).

Dam height [m]	AEP	Da ($0.6\%\ H_{max}$) [cm]	Vs [m/s]	Ts [s]	k_h [g]
15	1:10,000	10	310	0.15	0.0437
			400	0.10	0.0340
25	1:10,000	15	310	0.25	0.0438
			400	0.15	0.0323
45	1:10,000	25	310	0.45	0.0361
			400	0.30	0.0331

V_s: Shear wave velocity; T_s: Slope fundamental period; Da: Target residual displacement; AEP: Annual Exceedance Probability; k_h: horizontal seismic acceleration (pseudo-static coefficient).

3.5 Water table and piezometric conditions

A steady state groundwater flow was computed to determine the pore pressure distribution along the MP and TCP, and the foundation. Table 3-3 presents the water levels at closure for each facility.

Table 3-3: Pond Water Elevations (SRK, 2021).

MP	Pond Water Elevations [masl]	Comments (based on top of spillway)
EMP	850	2 m below the dam crest
WMP	850	2 m below the dam crest
NMP	828	2 m below the dam crest
TCP	798	3 m below the dam crest

The groundwater elevation considered is the maximum target operating level.
A 1 m contingency storage was considered to the spillway invert.

For the dividing embankment between the EMP and WMP, different piezometric levels were considered for the containment materials (i.e., PAG and NAG) in EMP and the foundation since it is expected that PAG and NAG will be deposited in the WMP before a steady state condition is achieved. Figure 3-2 presents the groundwater conditions assumed for the dividing embankment.

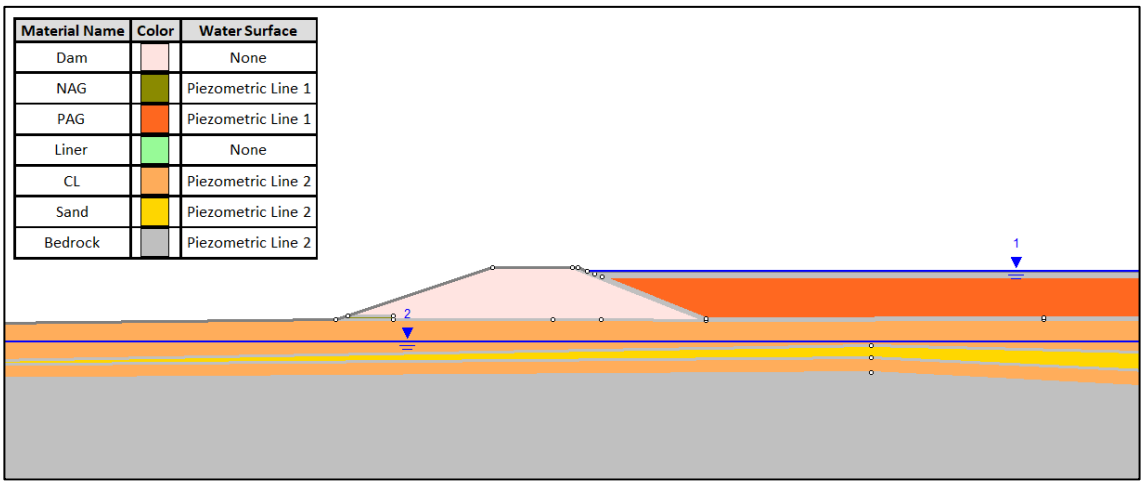


Figure 3-2: Diving Embankment. Groundwater Condition (SRK, 2021).

3.6 Results

The results of the limit equilibrium analyses are summarized in Table 3-4. In all cases, the obtained factors of safety (FoS) comply with the target FoS for both static and pseudo-static conditions. The reported FoS are for the buttress and overall scale failures. Failure surfaces and the associated FoS for each section and scenario are included in Appendix B (from Figure A-14 to Figure A-39).

Table 3-4: Limit equilibrium results. Slope stability analyses.

Section	Condition	FoS required	FoS achieved	
			Overall scale failures	Buttress scale failures
TCP-01 (refer to Figure A-1)	Static	1.60	2.21	1.85
	Pseudo-static	1.00	1.67	1.60
TCP&NMP-01 (TCP) (refer to Figure A-2)	Static	1.60	1.87	1.80
	Pseudo-static	1.00	1.58	1.38
TCP&NMP-01 (NMP) (refer to Figure A-3)	Static	1.60	1.75	1.89
	Pseudo-static	1.00	1.37	1.42
NMP-01 (refer to Figure A-4)	Static	1.60	1.99	1.79
	Pseudo-static	1.00	1.62	1.55
NMP-02 (refer to Figure A-5)	Static	1.60	1.76	1.63
	Pseudo-static	1.00	1.45	1.34
NMP&WMP-01 (WMP) (refer to Figure A-6)	Static	1.60	1.81	N/A
	Pseudo-static	1.00	1.55	N/A
NMP&WMP-01 (NMP) (refer to Figure A-7)	Static	1.60	2.07	1.80
	Pseudo-static	1.00	1.62	1.55
WMP-01 (refer to Figure A-8)	Static	1.60	2.44	1.81
	Pseudo-static	1.00	1.98	1.65
WMP-02 (refer to Figure A-9)	Static	1.60	2.40	1.86
	Pseudo-static	1.00	1.96	1.63
EMP&WMP-01 (refer to Figure A-10)	Static	1.60	1.85	N/A
	Pseudo-static	1.00	1.60	N/A
EMP-01 (refer to Figure A-11)	Static	1.60	1.98	1.69
	Pseudo-static	1.00	1.54	1.34
EMP-02 (refer to Figure A-12)	Static	1.60	1.81	1.70
	Pseudo-static	1.00	1.26	1.48
EMP-03 (refer to Figure A-13)	Static	1.60	1.62	N/A
	Pseudo-static	1.00	1.42	N/A

4 Sensitive assessment

4.1 Introduction

The sensitivity analyses conducted in the "*Tenas Project – Management and Control Ponds Stability Assessment* " report (SRK, 2021) for the EMP and WMP areas were upgraded considering the new seismic criteria and horizontal seismic acceleration determined in the site-specific seismic hazard assessment (SRK, 2023).

Sensitivity assessment was made only for EMP and WMP due to the lack of drilling data in those areas. The sensitivity assessment was undertaken in sections EMP-01, EMP-02 and WMP 01 to determine the impact of varying foundation and construction conditions in potential failure surfaces and the associated FoS.

The following scenarios were analysed:

- Different weak layer (CH) thickness in the foundation;
- Different dam material configurations;
- Different stratigraphy configurations;
- A total breakdown of the liner; and
- Internal seepage considering a chimney drain.

4.2 Different CH layer thickness

A sensitivity assessment on the FoS considering different thickness of the CH layer was carried out:

- WMP-01 sections: Figure A-40, Figure A-41 and Figure A-42 (Appendix C.1).
- EMP-01 sections: Figure A-49, Figure A-50 and Figure A-51 (Appendix C.1).

The results of the limit equilibrium analyses are presented in Table 4-1. The minimum required FoS (Table 2-1) was achieved in every scenario for both the static and pseudo-static conditions.

Based on the results, the thicker the CH layer, the lower FoS. Stability results and limit equilibrium outputs are presented in Appendix C.1.

Table 4-1: Limit equilibrium results. CH layer sensitivity assessment.

Section	Condition	FoS required	FoS achieved (*) Overall scale failures	FoS achieved (*) Buttress scale failures
WMP-01 –0.0 m CH thickness (Figure A-40, Appendix C.1)	Static	1.60	2.40 (2.44)	1.84 (1.81)
	Pseudo-static	1.00	1.93 (1.98)	1.74 (1.65)
WMP-01 – 5.0 m CH thickness (Figure A-41, Appendix C.1)	Static	1.60	2.35 (2.44)	1.74 (1.81)
	Pseudo-static	1.00	1.91 (1.98)	1.38 (1.65)
WMP-01 – 10.0 m CH thickness (Figure A-42, Appendix C.1)	Static	1.60	2.14 (2.44)	1.72 (1.81)
	Pseudo-static	1.00	1.70 (1.98)	1.38 (1.65)
EMP-01 – 0.0 m CH thickness (Figure A-49, Appendix C.1)	Static	1.60	2.20 (1.98)	1.78 (1.69)
	Pseudo-static	1.00	1.78 (1.54)	1.55 (1.34)
EMP-01 – 5.0 m CH thickness (Figure A-50, Appendix C.1)	Static	1.60	2.09 (1.98)	1.78 (1.69)
	Pseudo-static	1.00	1.61 (1.54)	1.42 (1.34)
EMP-01 – 10.0 m CH thickness (Figure A-51, Appendix C.1)	Static	1.60	1.99 (1.98)	1.69 (1.69)
	Pseudo-static	1.00	1.54 (1.54)	1.34 (1.34)

(*) Values in brackets show the base case results (see Table 3-4)

4.3 Different dam materials configurations

The following alternatives for a sensitivity analysis considering different materials' configurations of the dam construction for EMP-01 were assessed:

- Base case (Table 3-4 configuration): dam entirely constructed with overburden material, and buttress constructed with both NAG and overburden materials (Figure A-11);
- Alternative 1: buttress constructed entirely with NAG material (Figure A-58);
- Alternative 2: dam upstream face constructed with overburden, dam body constructed with NAG material and buttress constructed with overburden (Figure A-59); and
- Alternative 3: dam upstream face constructed with overburden; dam body and buttress constructed with NAG material (Figure A-60).

The results of the limit equilibrium analyses are presented in Table 4-2 comparing the FoS obtained against the base case. The minimum required FoS was achieved in every scenario for both the static and pseudo-static conditions. Failure surfaces and the associated FoS for each section and scenario are included in Appendix C.2 (Figure A-61 to Figure A-66).

Based on the results, the performance of Alternatives 1 and 3 are practically the same as the base case since the piezometric levels are quite similar. Minimum differences are expected due to the better shear strength of the NAG material. For Alternative 2, the obtained FoS slightly decreases, and local failures

are obtained at the toe of the buttress because of the pore pressures development due to the lower permeability characteristics of the overburden material.

Table 4-2: Limit equilibrium results. Different embankment design configurations.

Section	Condition	FoS required	FoS achieved (*) Overall scale failures	FoS achieved (*) Buttress scale failures
EMP-01 – Alternative 1 (Figure A-58, Appendix C.2)	Static	1.60	2.00 (1.98)	1.67 (1.69)
	Pseudo-static	1.00	1.54 (1.54)	1.33 (1.34)
EMP-01 – Alternative 2 (Figure A-59, Appendix C.2)	Static	1.60	1.93 (1.98)	1.57 (1.69)
	Pseudo-static	1.00	1.54 (1.54)	1.24 (1.34)
EMP-01 – Alternative 3 (Figure A-60, Appendix C.2)	Static	1.60	2.05 (1.98)	1.67 (1.69)
	Pseudo-static	1.00	1.61 (1.54)	1.32 (1.34)

(*) Values in brackets show the base case results (see Table 3-4)

4.4 Different stratigraphy configurations

A sensitivity assessment of the FoS considering different stratigraphy configurations was carried out for WMP-01 considering the results of the field-testing program completed in 2021. A foundation composed by a 9 m thick CH layer, followed by a layer of 6 m loose silt and a CL layer until bedrock is achieved was assessed (Figure A-67, Appendix C.3). The minimum required FoS (Table 4-3) was achieved in every scenario for both the static and pseudo-static conditions. Failure surfaces and their associated FoS are presented in Appendix C.3 (Figure A-68 and Figure A-69).

Table 4-3: Limit equilibrium results. WMP stratigraphy configurations.

Section	Condition	FoS required	FoS achieved (*) Overall scale failures	FoS achieved (*) Buttress scale failures
WMP-01 – Sensitivity case (Figure A-67, Appendix C.3)	Static	1.60	2.21 (2.44)	1.81 (1.81)
	Pseudo-static	1.00	1.87 (1.98)	1.38 (1.65)

(*) Values in brackets show the base case results (see Table 3-4)

4.5 Liner failure

A sensitivity assessment was completed considering a total breakdown of the liner for WMP-01, EMP-01 and EMP-02. Due to the likelihood of occurrence, under this scenario, the minimum CDA requirements (CDA, 2019) were considered (i.e., $FoS > 1.5$ for long-term static condition, $FoS > 1.0$ for pseudo-static seismic condition given the low likilhood of this occurring).

The results of the analyses are presented in Table 4-4, showing a significant decrease in the FoS. Even though the minimum target FoS was not achieved for the static condition in none of the scenarios, results were still above 1.3 and imminent failure would be unlikely, and the minimum required FoS was achieved

in all the pseudo-static analyses. The target FoS for the pseudo-static condition was achieved in every section for both overall scale and buttress failures. Failure surfaces and their associated FoS are presented in Appendix C.4.

Table 4-4: Limit equilibrium results. Liner failure (base case).

Section	Condition	FoS required	FoS achieved (*)	
			Overall scale failures	Buttress scale failures
WMP-01 – Liner failure (Figure A-8, Appendix A)	Static	1.50	1.78 (2.44)	1.47 (1.81)
	Pseudo-static	1.00	1.45 (1.98)	1.22 (1.65)
EMP-01 – Liner failure (Figure A-11, Appendix A)	Static	1.50	1.65 (1.98)	1.47 (1.69)
	Pseudo-static	1.00	1.30 (1.54)	1.17 (1.34)
EMP-02 – Liner failure (Figure A-12, Appendix A)	Static	1.50	1.43 (1.81)	1.29 (1.70)
	Pseudo-static	1.00	1.14 (1.26)	1.12 (1.48)

(*) Values in brackets show the base case results (see Table 3-4)

Based on these results, the performance of a chimney drain under a potential total breakdown of the liner was also assessed. The chimney drain was placed at the centre of the embankment considering a 5.0 m width and an elevation equal to the maximum pond water elevation. The resulting analysed sections are presented in Figure A-70 (WMP-01), Figure A-71 (EMP-01) and Figure A-72 (EMP-02).

The results of the limit equilibrium analyses showed that, under a total failure of the liner, the chimney drain does improve the stability of the main dam sufficiently to meet the CDA minimum requirements. However, the buttress does not meet the minimum requirements due to pore pressures development at the toe. In the scenario that a chimney drain exists, and liner failure occur, the buttress could be enhanced to meet long term stability requirements (i.e., considering a 6H:1V buttress slope).

Table 4-5 presents the FoS obtained, comparing the results obtained with and without the chimney drain (values in brackets). Failure surfaces and their associated FoS are presented in Appendix C.4.

Table 4-5: Limit equilibrium results. Liner failure and chimney and toe drain.

Section	Condition	FoS required	FoS achieved (*)	
			Overall scale failures	Buttress scale failures
WMP-01 – Chimney drain (Figure A-70, Appendix C.4)	Static	1.50	1.92 (1.78)	1.48 (1.47)
	Pseudo-static	1.00	1.57 (1.45)	1.22 (1.22)
EMP-01 – Chimney drain (Figure A-71, Appendix C.4)	Static	1.50	1.71 (1.65)	1.48 (1.47)
	Pseudo-static	1.00	1.33 (1.30)	1.17 (1.17)
EMP-02 – Chimney drain (Figure A-72, Appendix C.4)	Static	1.50	1.51 (1.43)	1.41 (1.29)
	Pseudo-static	1.00	1.21 (1.14)	1.22 (1.12)

(*) Values in brackets show the liner failure case results (see Table 4-4)

5 Conclusions and recommendations

The review of the MP and TCP stability analyses at a feasibility study level considering the site-specific seismic hazard assessment for the Tenas Project was carried out. The analyses presented above were conducted considering the same material parameters, geometric configuration and piezometric conditions assessed on the "*Tenas Project – Management and Control Ponds Stability Assessment* " report (SRK, 2021).

In response to the EAO requirement to provide justification for selection of a 'Very High' Consequence Category for the MP and TCP, presence of important fish habitat and public residences located downstream, and feedback TML received during the public comment period, the Consequence Category for the MP and TCP of the Tenas Project were upgraded to 'Extreme' according to CDA guidelines (CDA, 2019) and the Global International Standards on Tailings Management (GISTM) (ICMM, 2020).

The seismic design criterion was defined as 1:10,000 AEP, in accordance with the 'Extreme' Consequence Category provided for in the CDA and GISTM guidelines. A maximum horizontal seismic acceleration of 0.045g associated to a 1:10,000 AEP was obtained from the site-specific seismic hazard assessment and used for the pseudo-static analyses.

Following the CDA suggested acceptance criteria (CDA, 2019) and Telkwa´s internal requirements, a minimum FoS of 1.60 was required for long-term steady state condition, and of 1.0 for the pseudo-static condition.

In all the analysed scenarios, the obtained factor of safety (FoS) was acceptable and in accordance with the design standards. Based on the exposed results, the proposed ponds design provided by Telkwa (v.7 20210304) do meet the requirements of the design standards for an 'Extreme' Consequence Category provided in the CDA and GISTM guidelines.

Regarding the sensitivity assessment, the conclusions presented in the "*Tenas Project – Management and Control Ponds Stability Assessment* " report (SRK, 2021) remains the same. In terms of the pseudo-static analyses, most scenarios complied with the target FoS with only the total liner failure.

The recommendations presented in the "*Tenas Project – Management and Control Ponds Stability Assessment* " report (SRK, 2021) are still applicable and are listed below:

- undertake further field and laboratory testing to reduce uncertainties related to the foundation conditions and material strength and hydraulic parameters, including:
  - additional geotechnical boreholes to determine the presence, extension, depth, and thickness of weak layers (i.e. CH layers); and
  - oedometric consolidation tests in selected samples to: (i) determine the pre-consolidation stress and (ii) define if undrained conditions are expected or not.
  - isotropically consolidated undrained compression tests on undisturbed sample to determine the drained and undrained shear strength parameters and confirm if undrained behaviour is expected or not; and

  - more detailed liquefaction assessment on soil data collected during the 2021 field investigation.
  - further field testing to confirm the weak CH layer thickness and properties.
- update the stability assessment based on the results of the recommended field and laboratory testing and material testing;
- design an erosion protection layer on the downstream face of the dam; and
- complete a detailed design report for the Management and Tenas Control Ponds including a review of alternative configurations to deal with potential liner failures.

6 Closure

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Appendixes:

Appendix A	MP and TCP geometric configurations
Appendix B	Stability assessment outputs
Appendix C	Sensitivity Assessment
Appendix C.1	Different CH layer thickness
Appendix C.2	Different dam materials configurations
Appendix C.3	Different stratigraphy configurations
Appendix C.4	Liner failure

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References

CDA. (2019). *Application of Dam Safety Guidelines to Mining Dams.*

ICMM. (2020). Global Industry Standard on Tailings Management.

SRK. (2021). 2CT025.008 – Tenas Project – Management and Control Ponds Stability Assessment.

SRK. (2023). CAPR002055-01-A - Tenas Project - Site Specific Seismic Hazard Assessment.

Appendix A MP and TCP geometric configurations

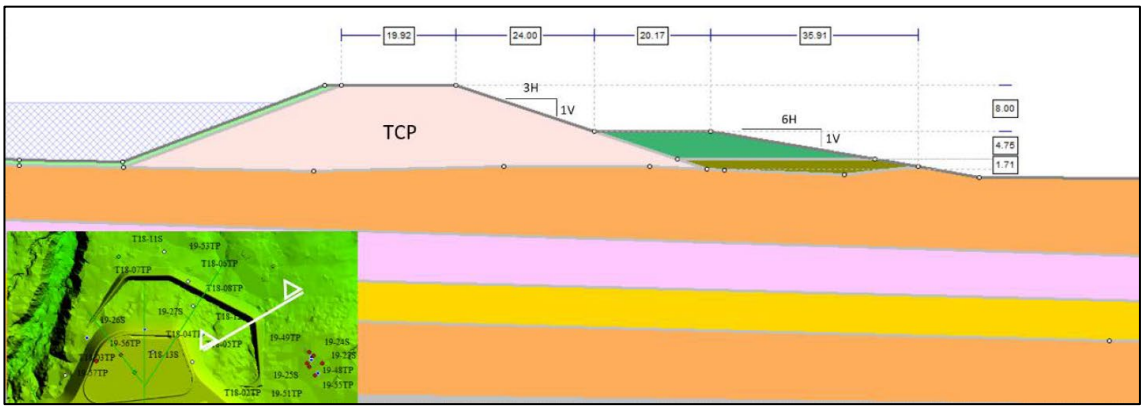


Figure A-1: TCP-01 Section. Geometric Configuration.

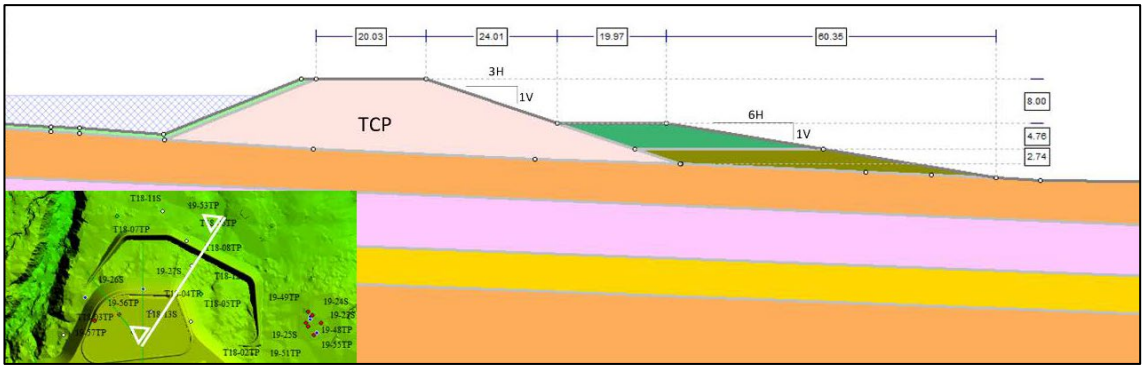


Figure A-2: TCP&NMP-01 (TCP) Section. Geometric Configuration.

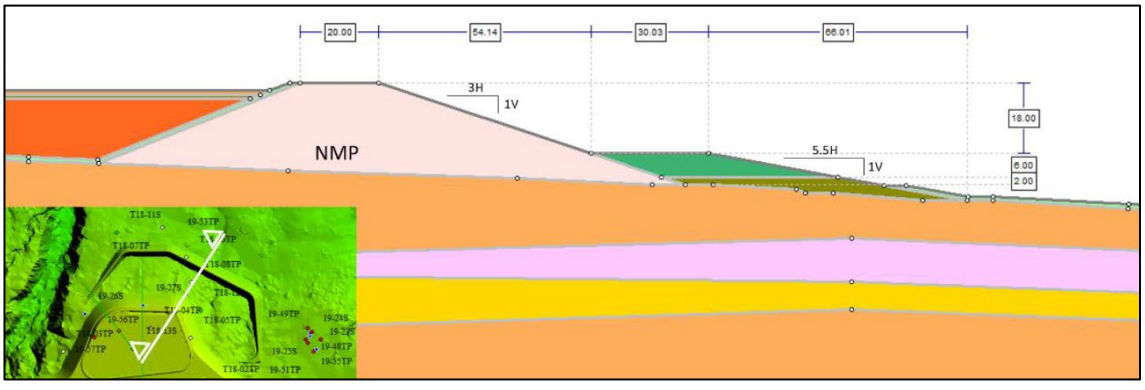


Figure A-3: TCP&NMP-01 (NMP) Section. Geometric Configuration.

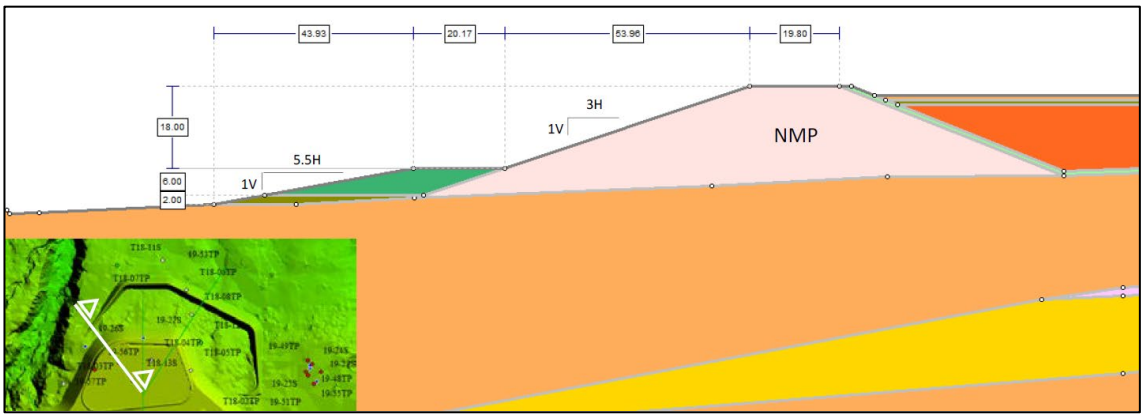


Figure A-4: NMP-01 Section. Geometric Configuration.

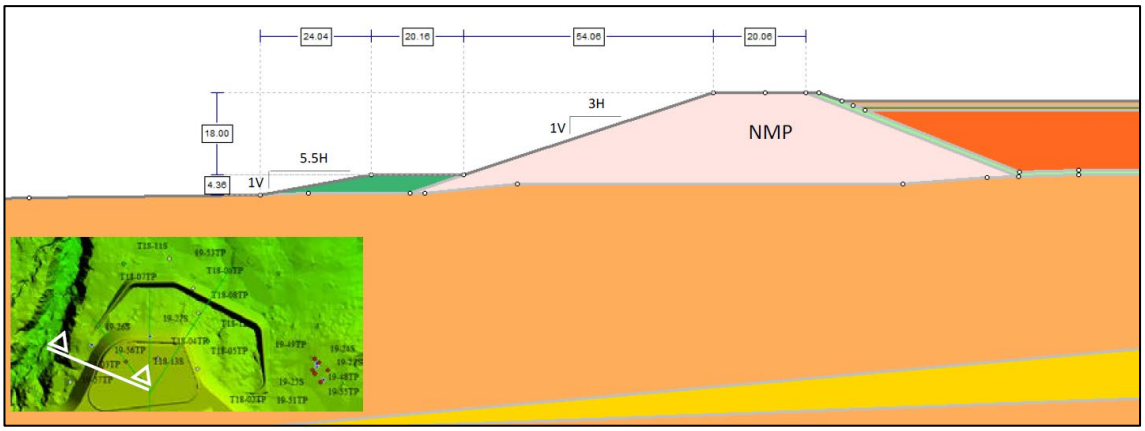


Figure A-5: NMP-02 Section. Geometric Configuration.

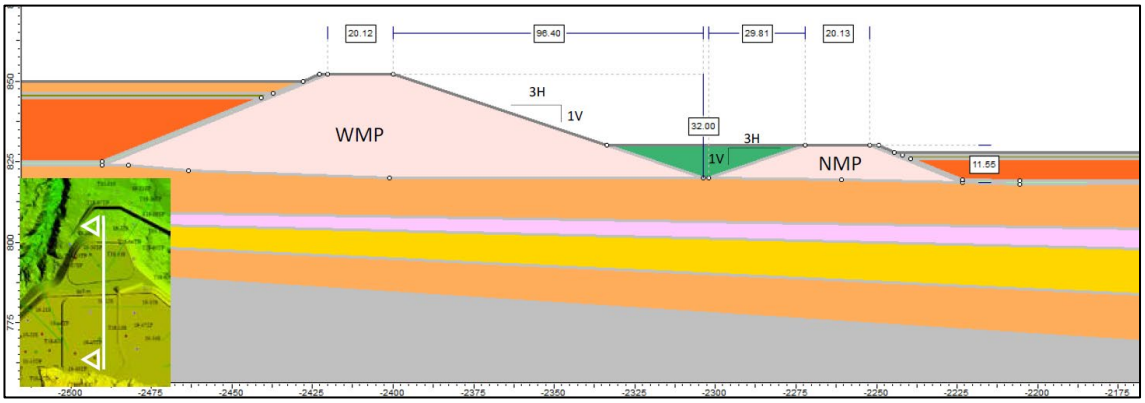


Figure A-6: NMP&WMP-01 (WMP) Section. Geometric Configuration.

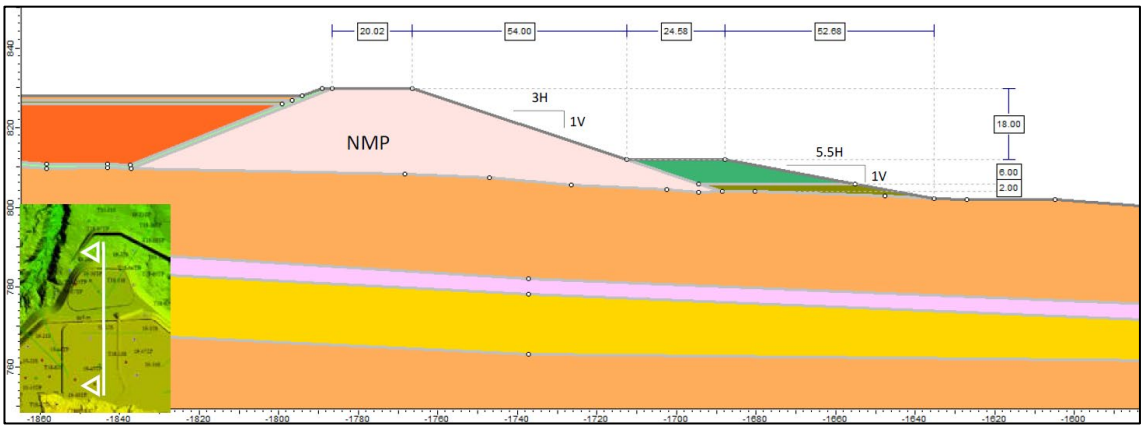


Figure A-7: NMP&WMP-01 (NMP) Section. Geometric Configuration.

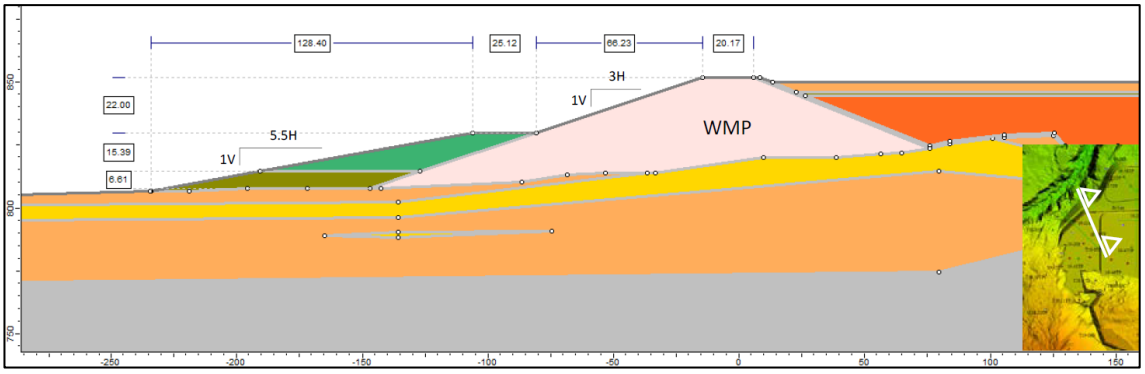


Figure A-8: WMP-01 Section. Geometric Configuration.

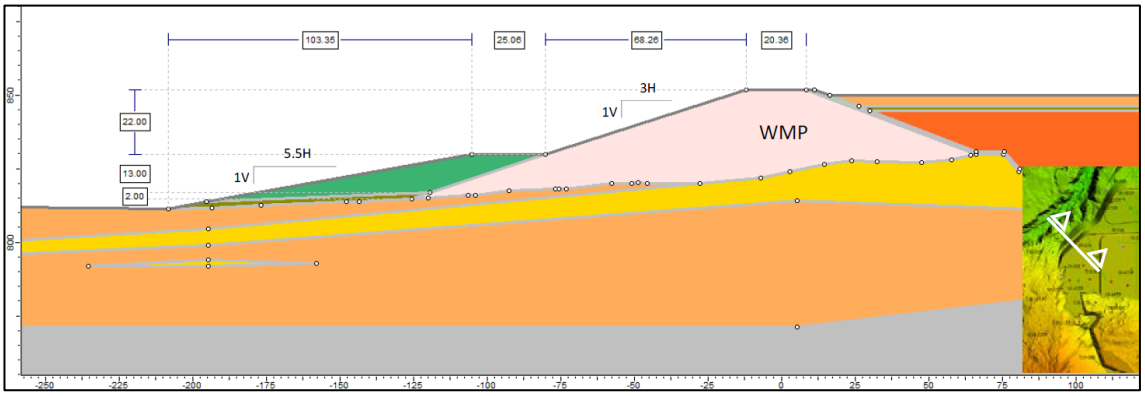


Figure A-9: WMP-02 Section. Geometric Configuration.

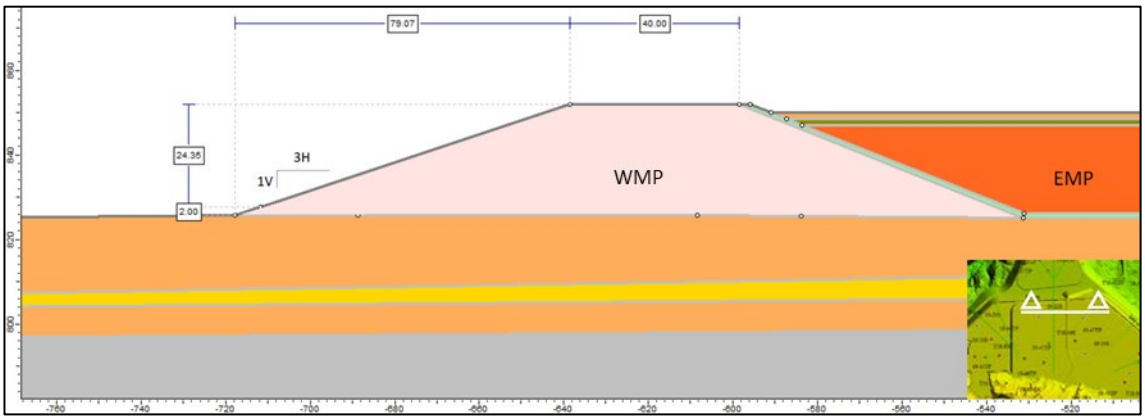


Figure A-10: EMP&WMP-01 Section. Geometric Configuration.

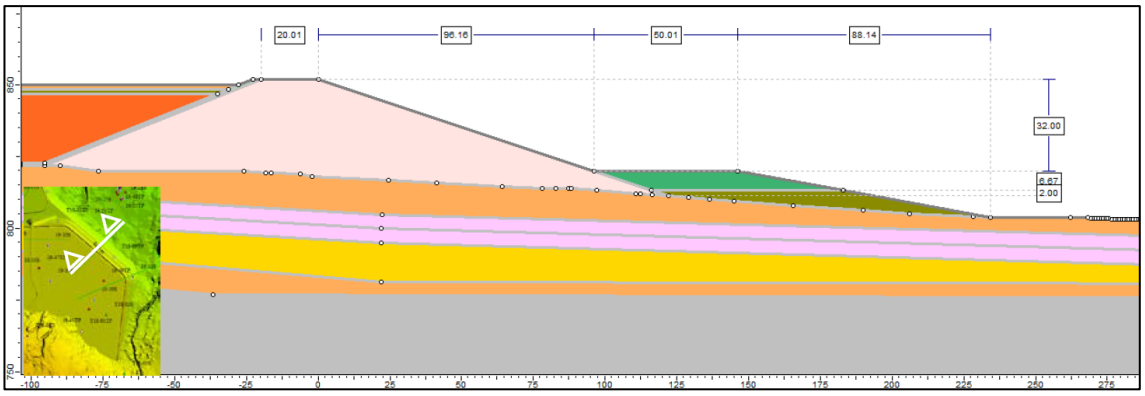


Figure A-11: EMP-01 Section. Geometric Configuration.

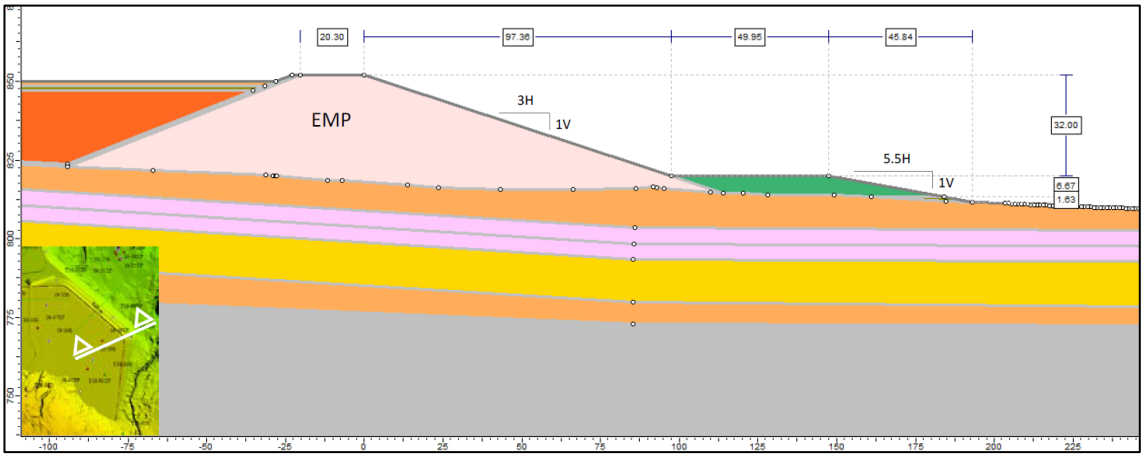


Figure A-12: EMP-02 Section. Geometric Configuration.

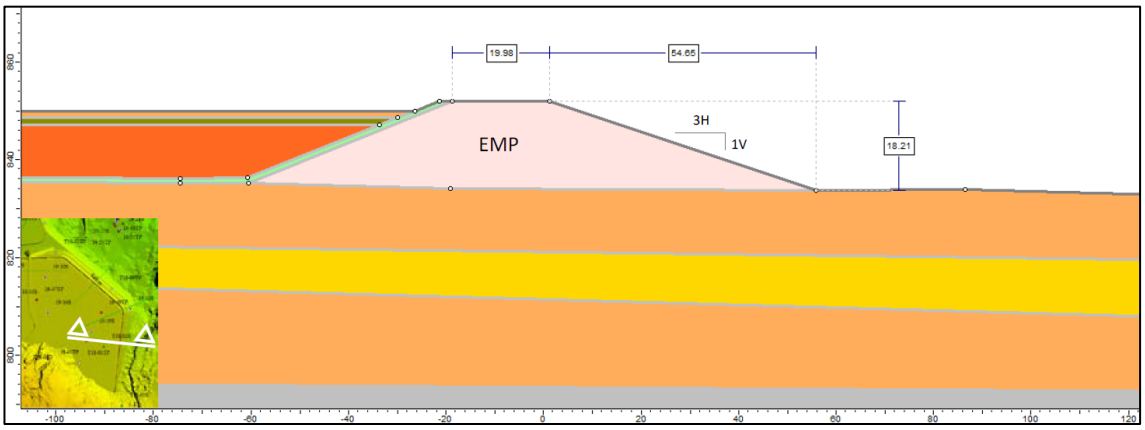


Figure A-13: EMP-03 Section. Geometric Configuration.

Appendix B Stability assessment outputs

B.1 – Tenas Control Pond (TCP)

B.1.1 – TCP-01

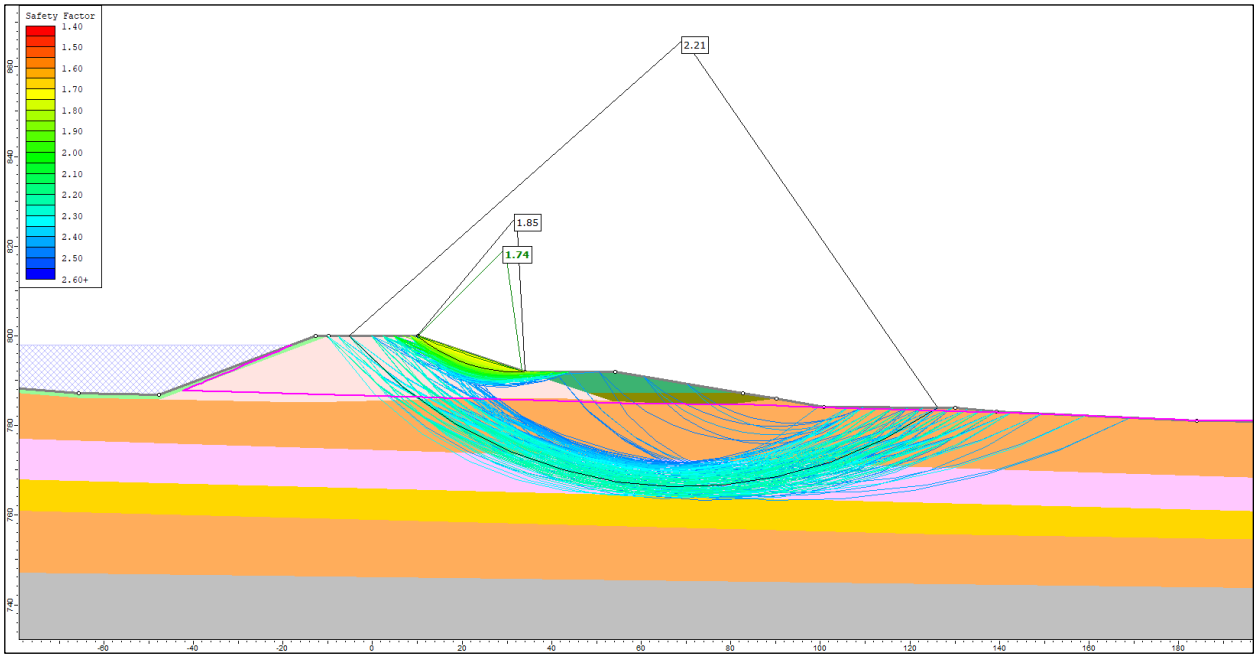


Figure A-14: TCP-01. Static condition.

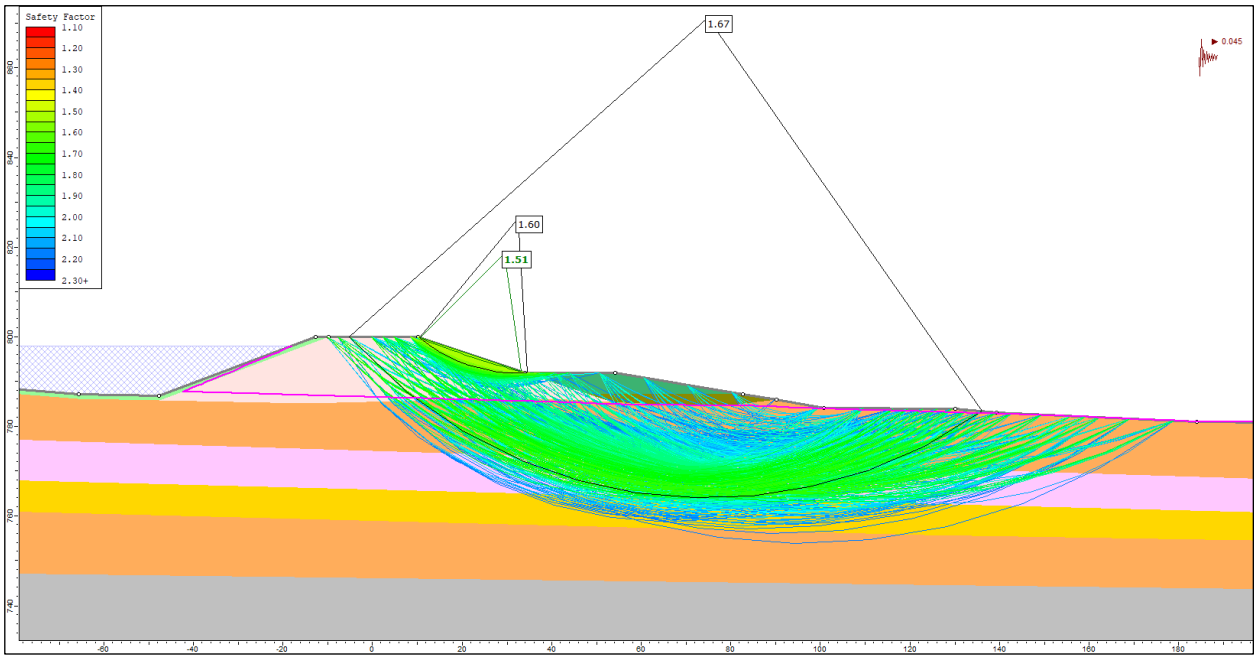


Figure A-15: TCP-01. Pseudo-static condition.

B.1.2 – TCP&NMP-01 (TCP)

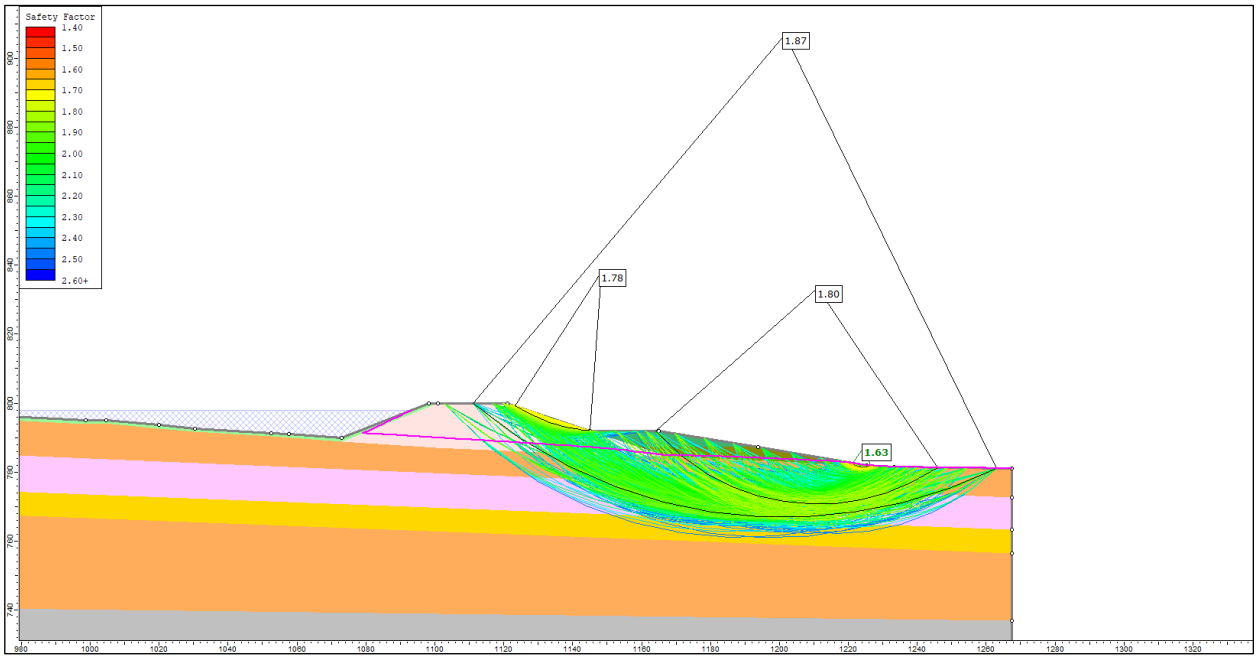


Figure A-16: TCP&NMP-01 (TCP). Static condition.

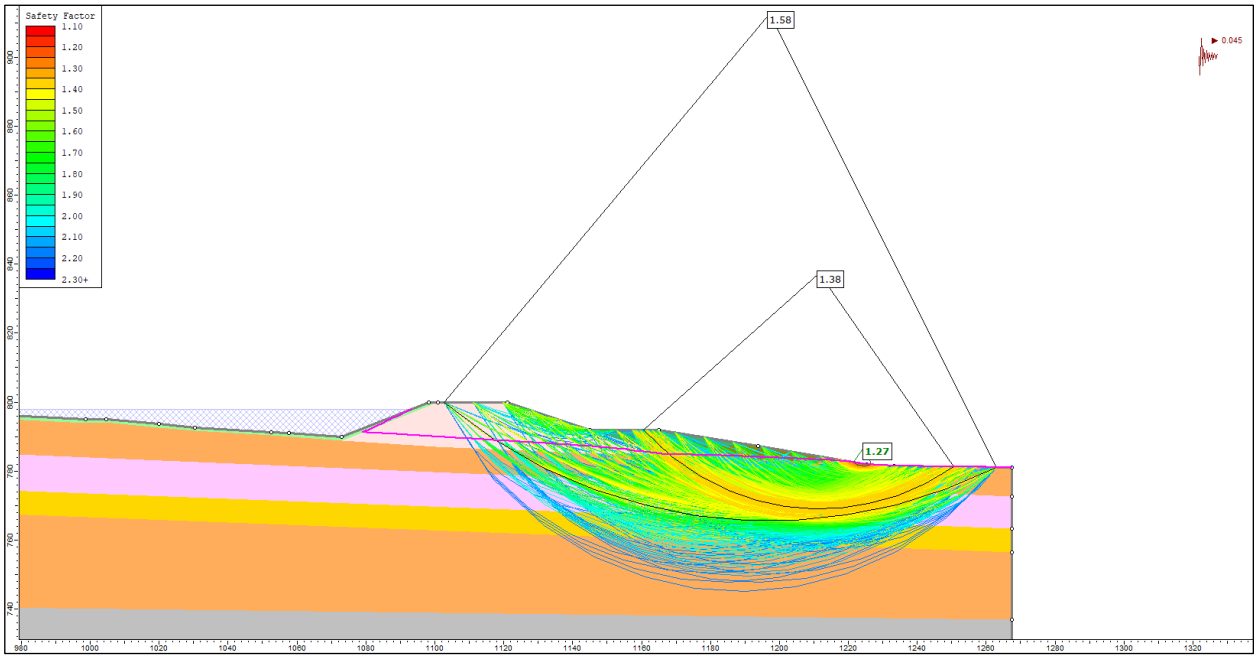


Figure A-17: TCP&NMP-01 (TCP). Pseudo-static condition.

B.1.3 – TCP&NMP-01 (NMP)

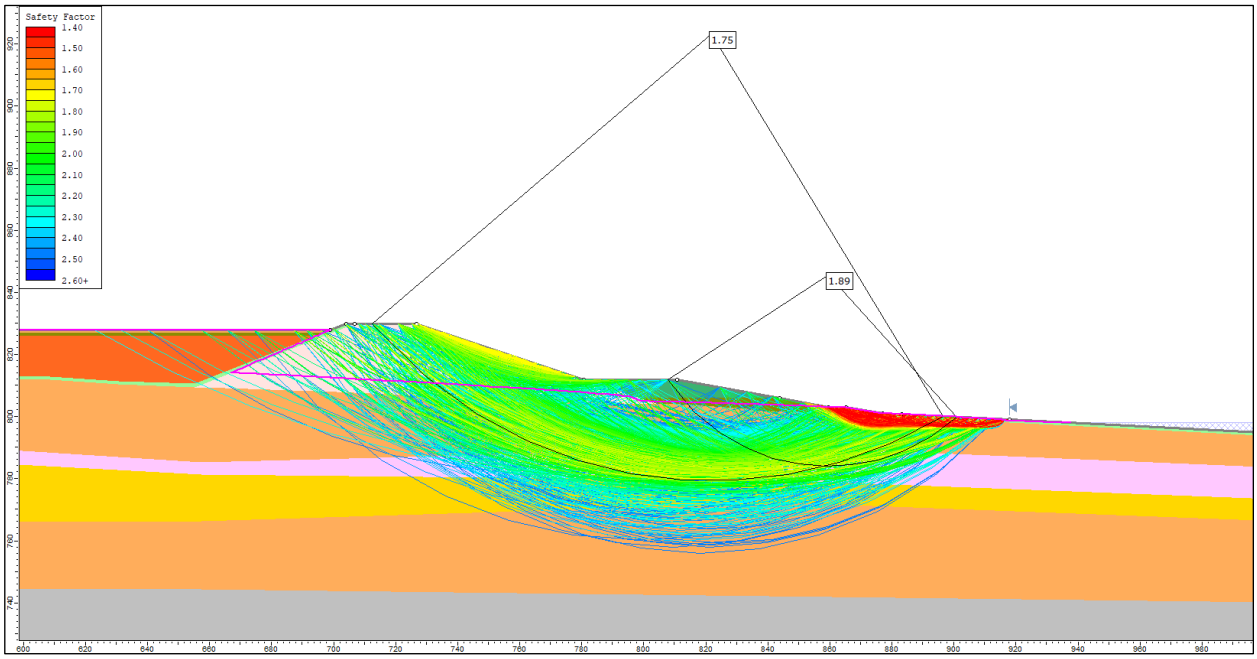


Figure A-18: TCP&NMP-01 (NMP). Static condition.

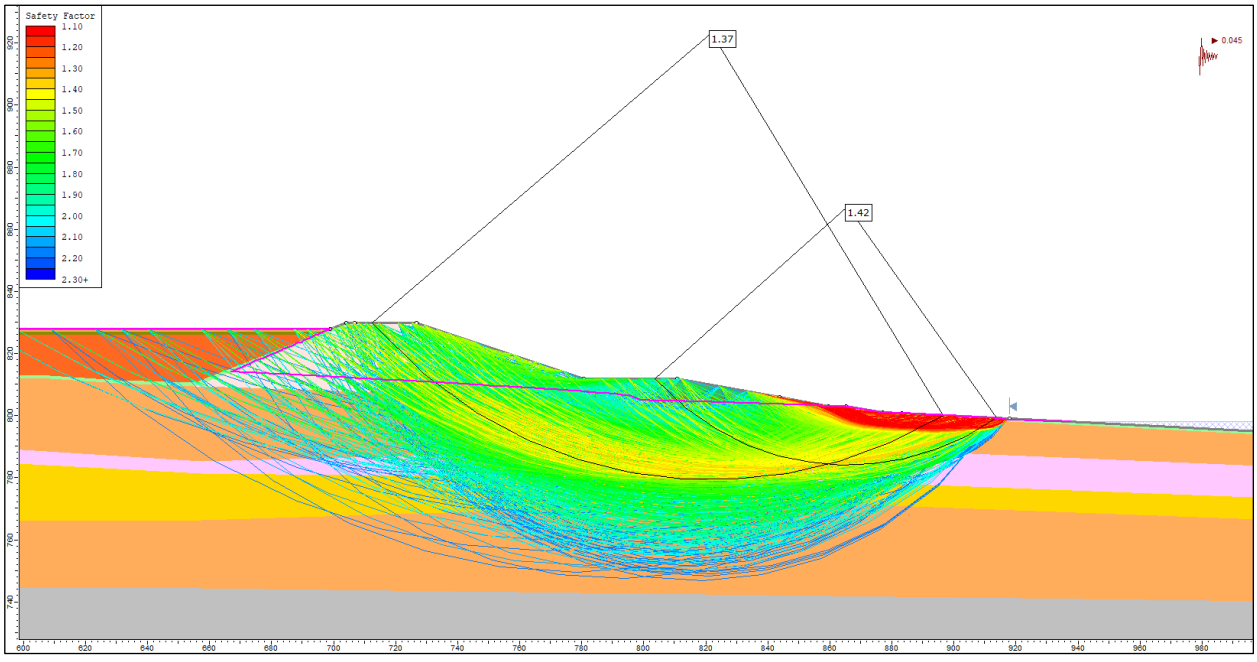


Figure A-19: TCP&NMP-01 (NMP). Pseudo-static condition.

B.2 – North Management Pond (NMP)

B.2.1 – NMP-01

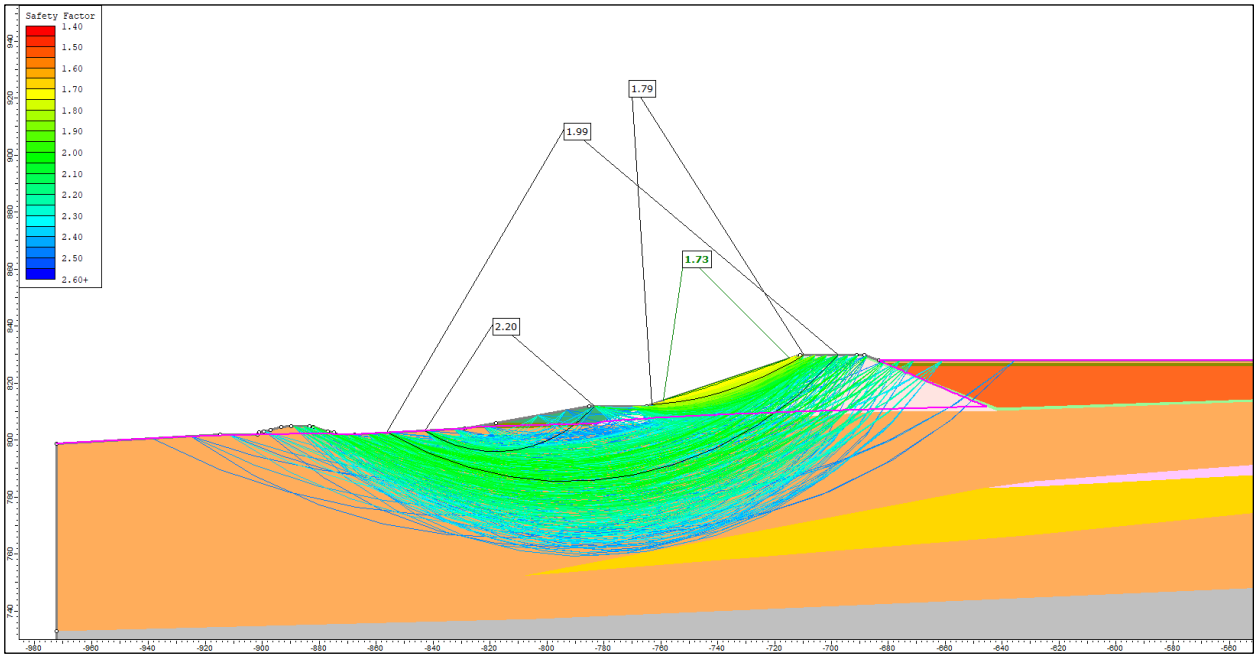


Figure A-20: NMP-01. Static condition.

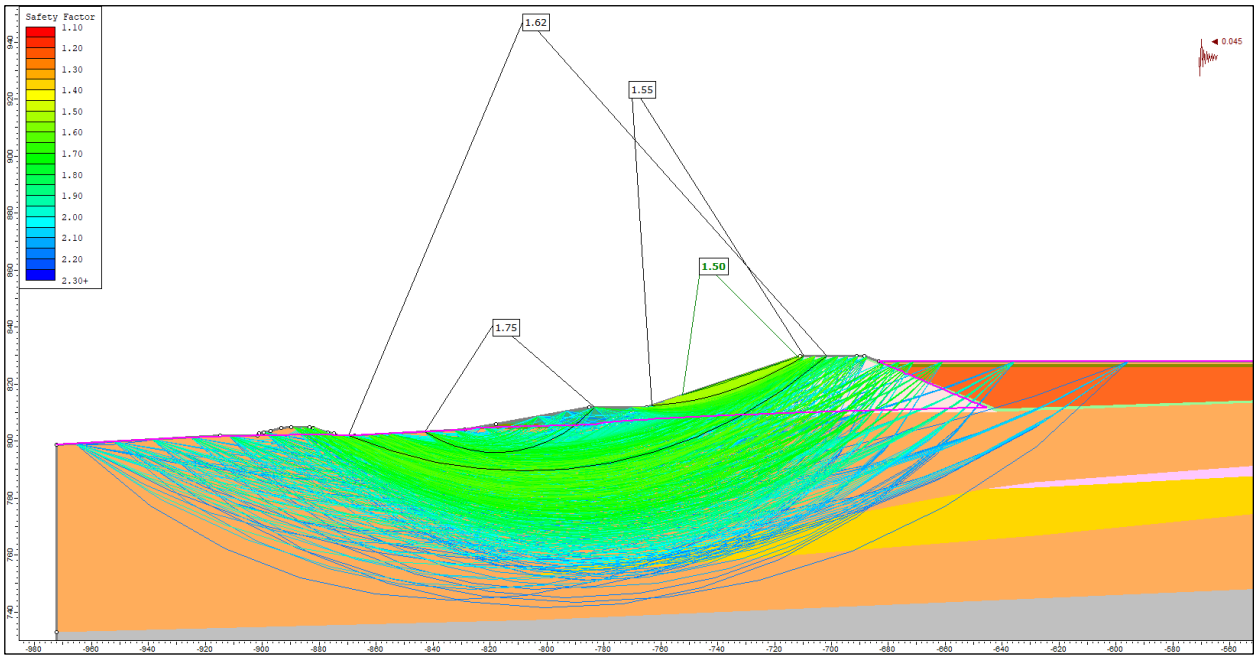


Figure A-21: NMP-01. Pseudo-static condition.

B.2.2 – NMP-02

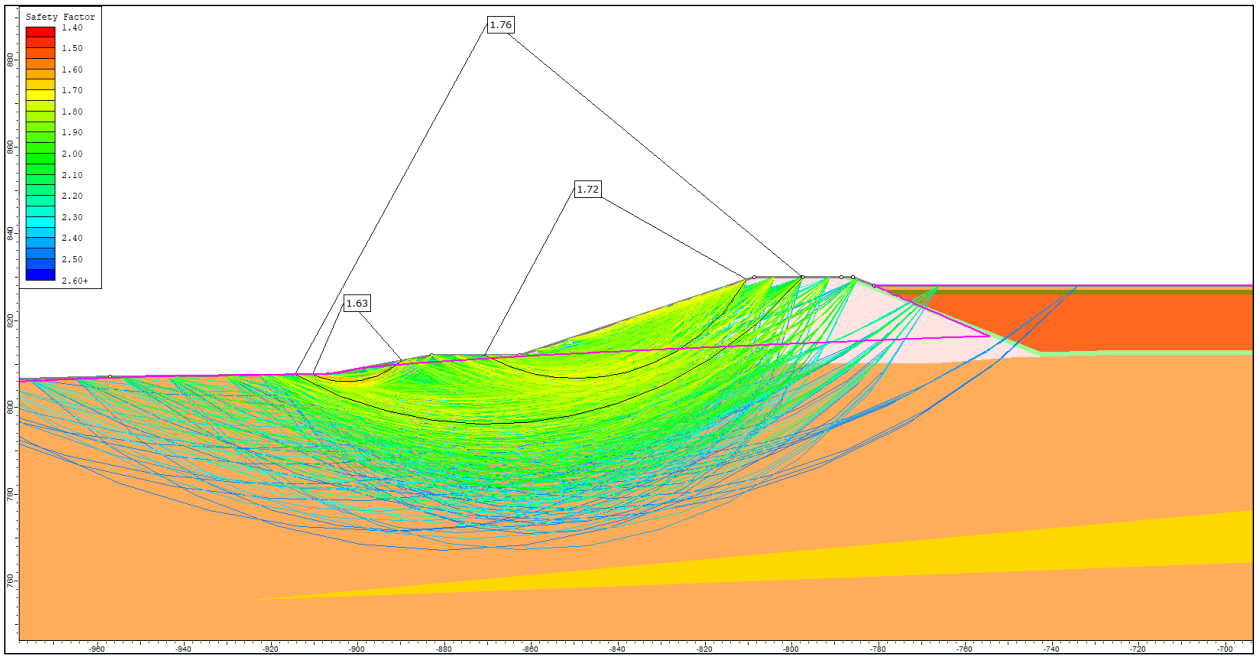


Figure A-22: NMP-02. Static condition.

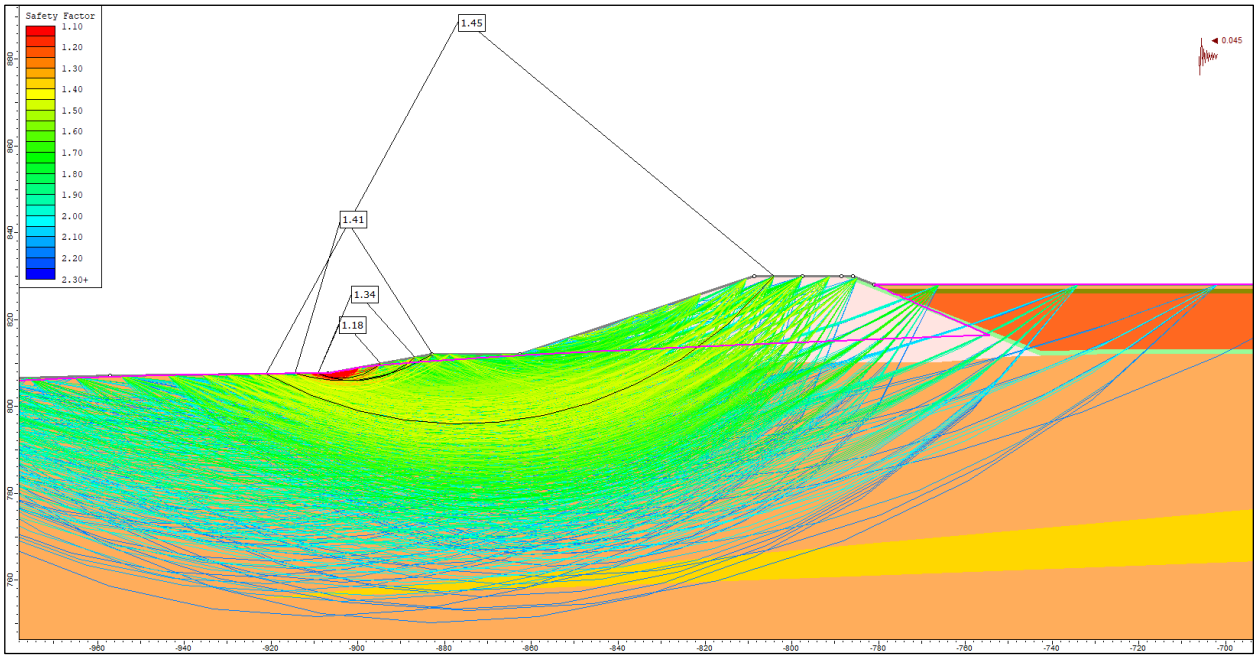


Figure A-23: NMP-02. Pseudo-static condition.

B.2.3 – NMP&WMP-01

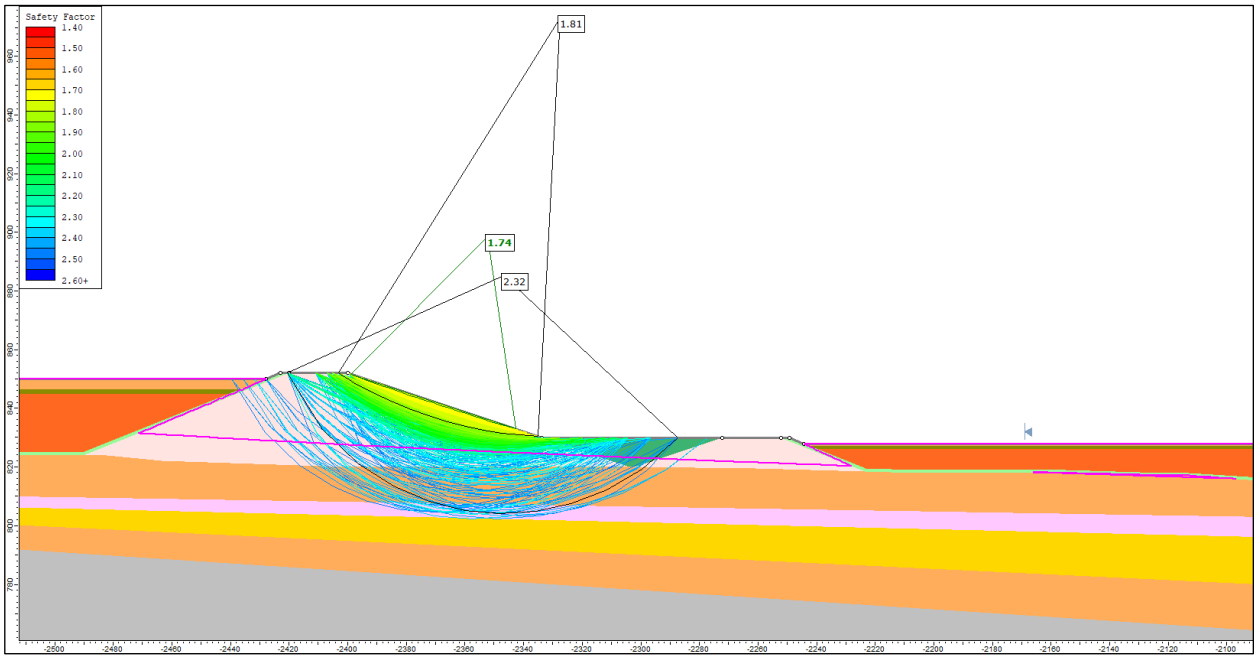


Figure A-24: NMP&WMP-01 (WMP). Static condition.

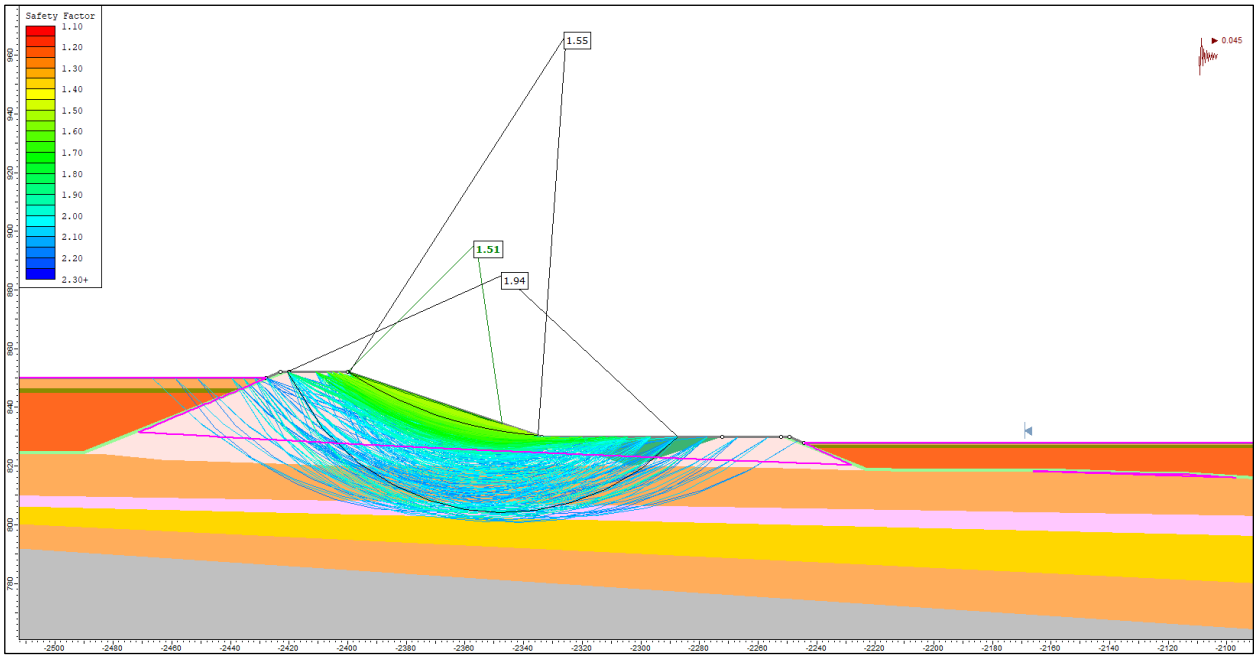


Figure A-25: NMP&WMP-01 (WMP). Pseudo-static condition.

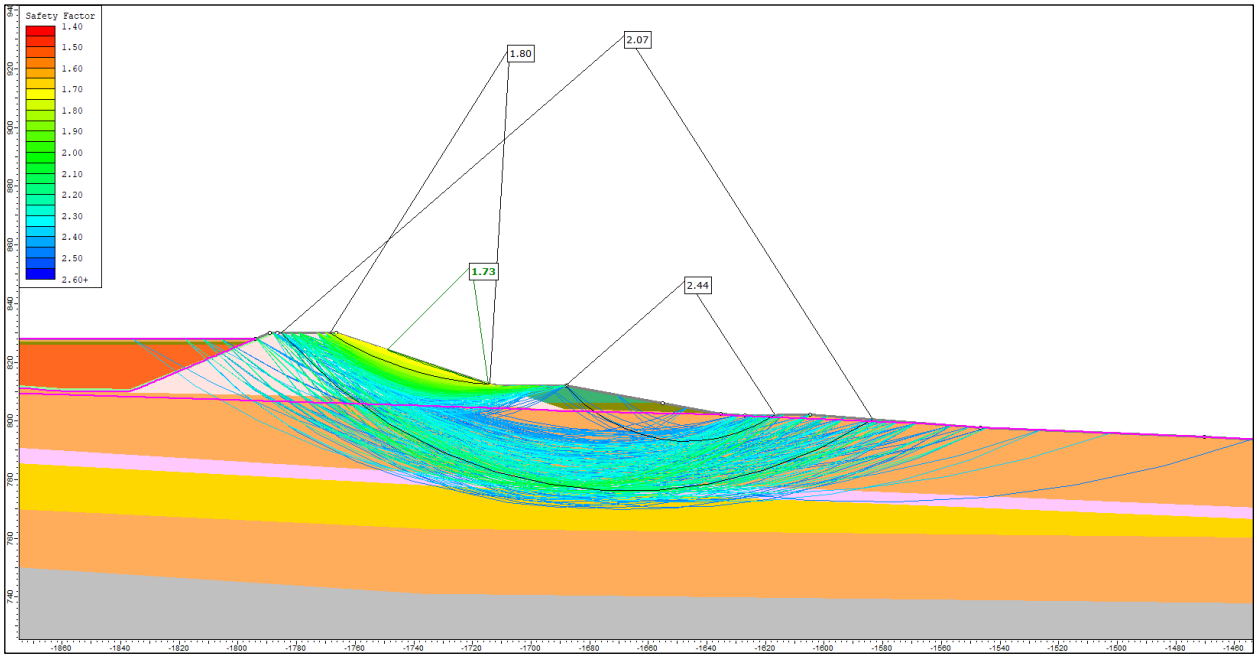


Figure A-26: NMP&WMP-01 (NMP). Static condition.

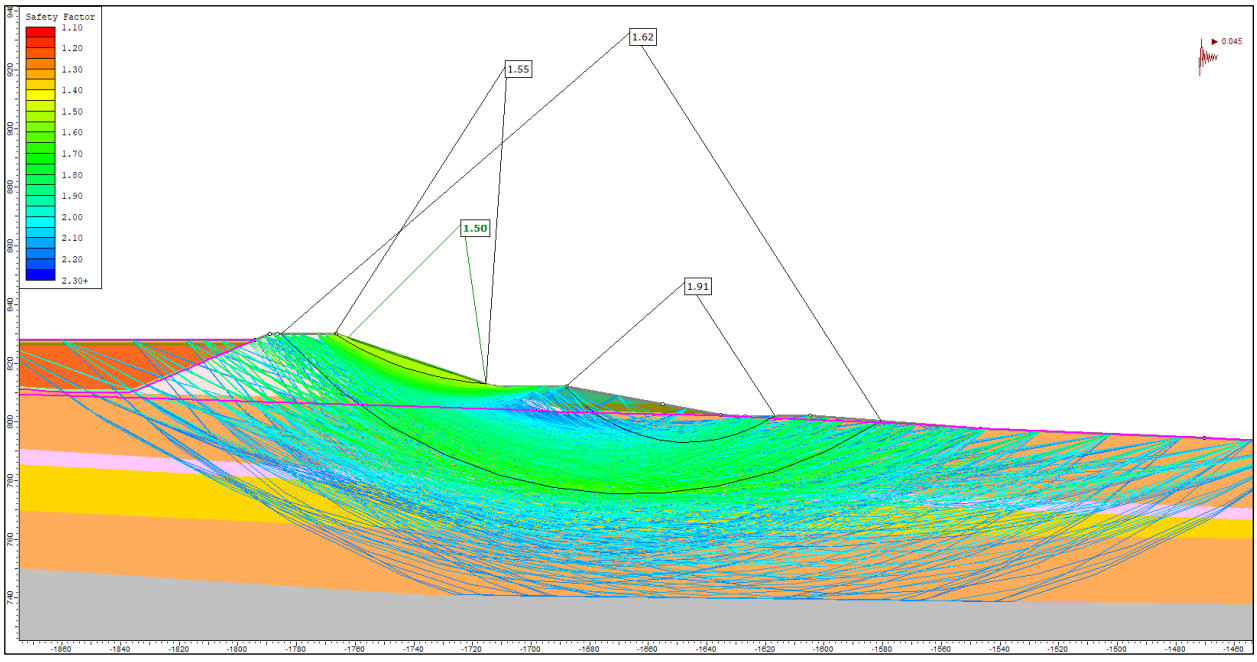


Figure A-27: NMP&WMP-01 (NMP). Pseudo-static condition.

B.3 – West Management Pond (WMP)

B.3.1 – WMP-01

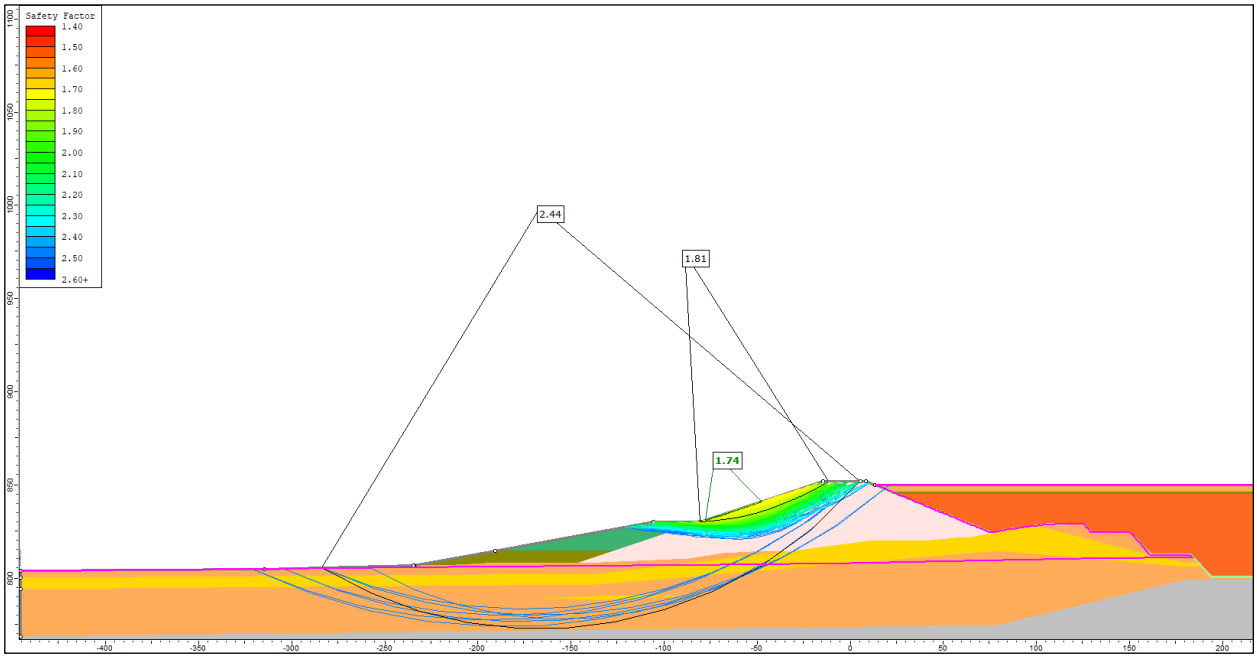


Figure A-28: WMP-01. Static condition.

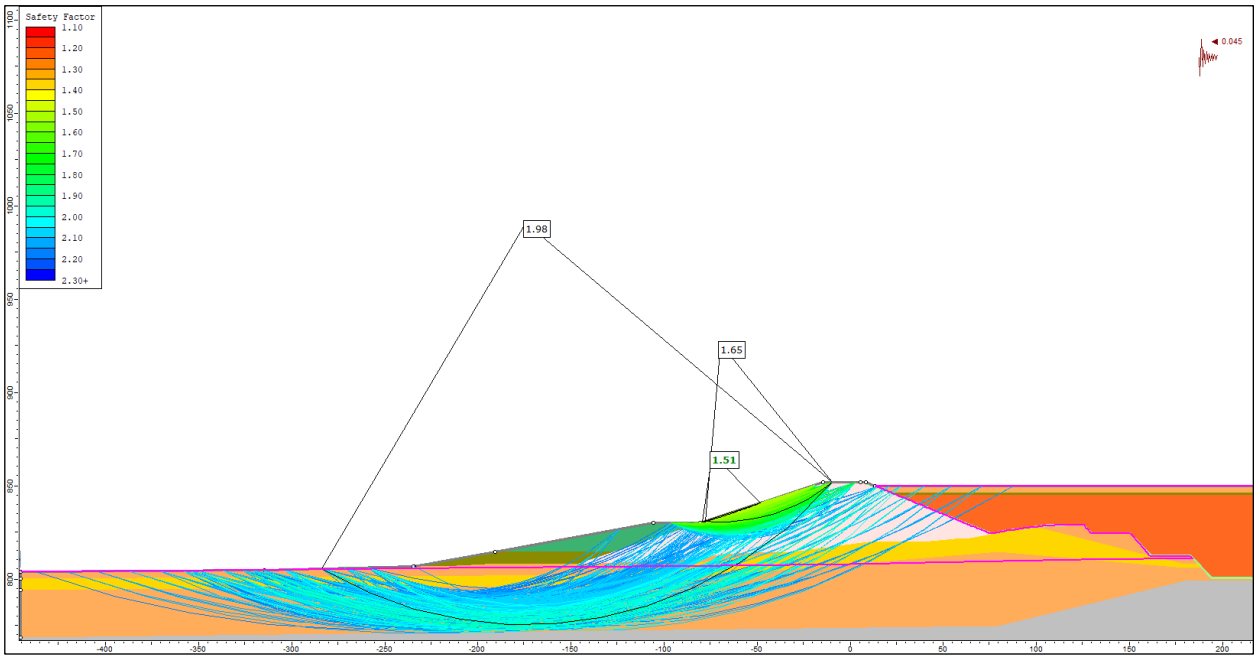


Figure A-29: WMP-01. Pseudo-static condition.

B.3.2 – WMP-02

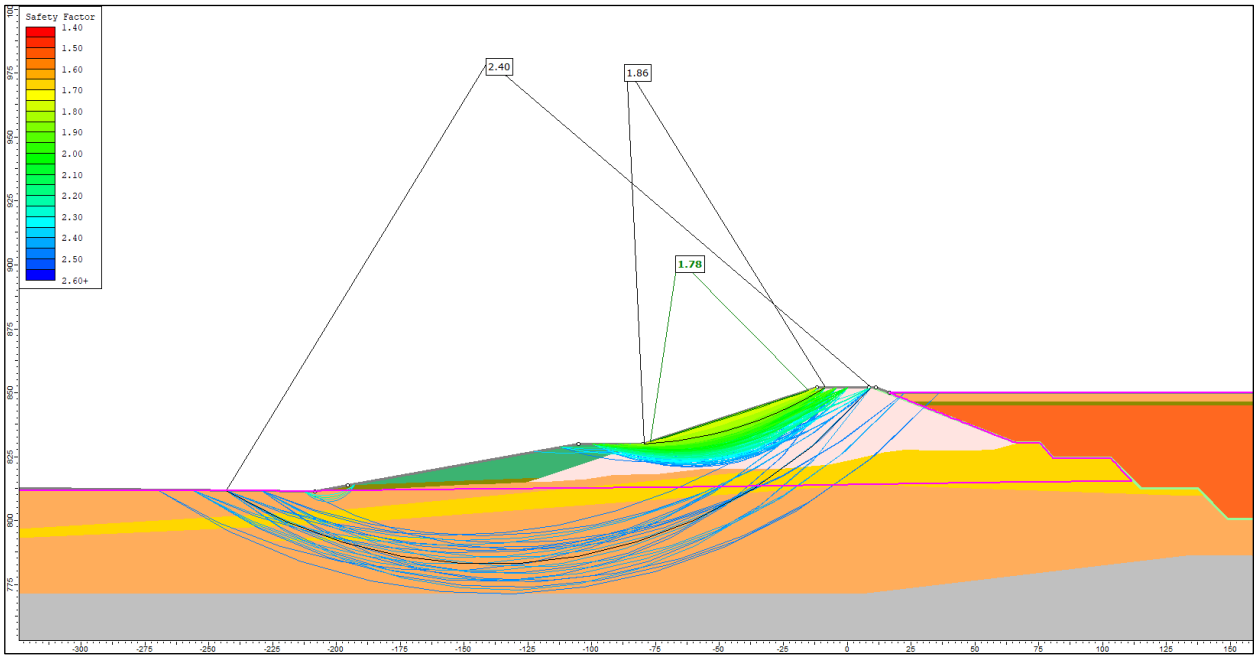


Figure A-30: WMP-02. Static condition.

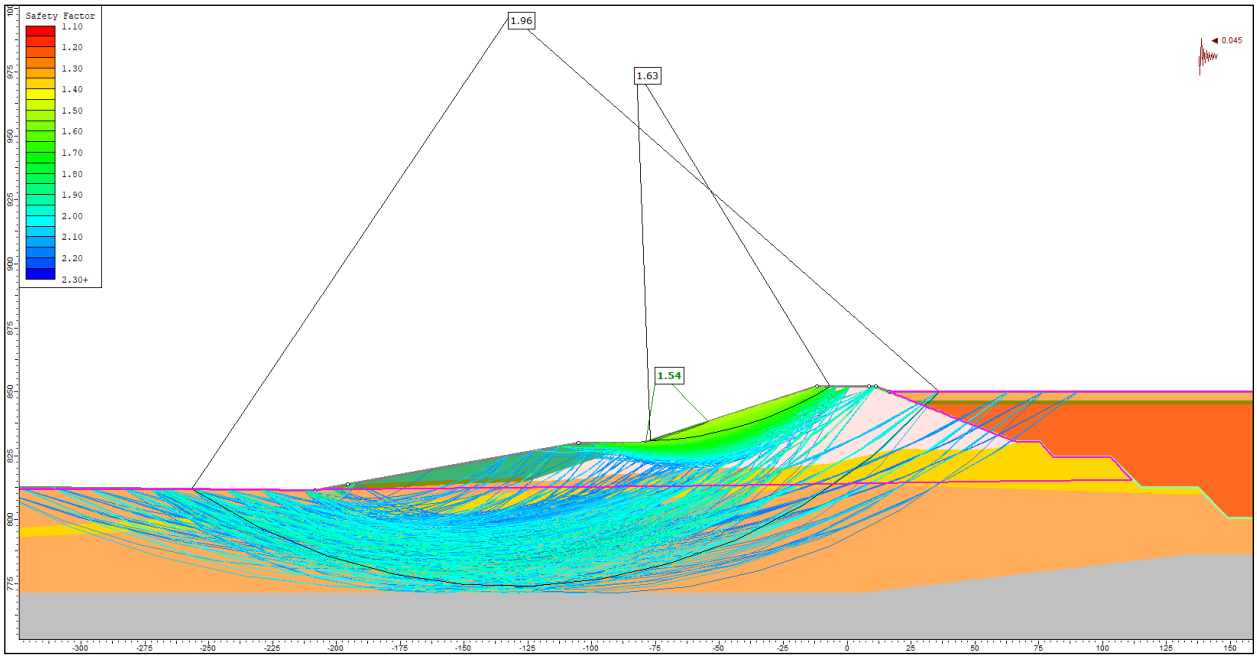


Figure A-31: WMP-02. Pseudo-static condition.

B.4 – East Management Pond (EMP)

B.4.1 – EMP&WMP-01

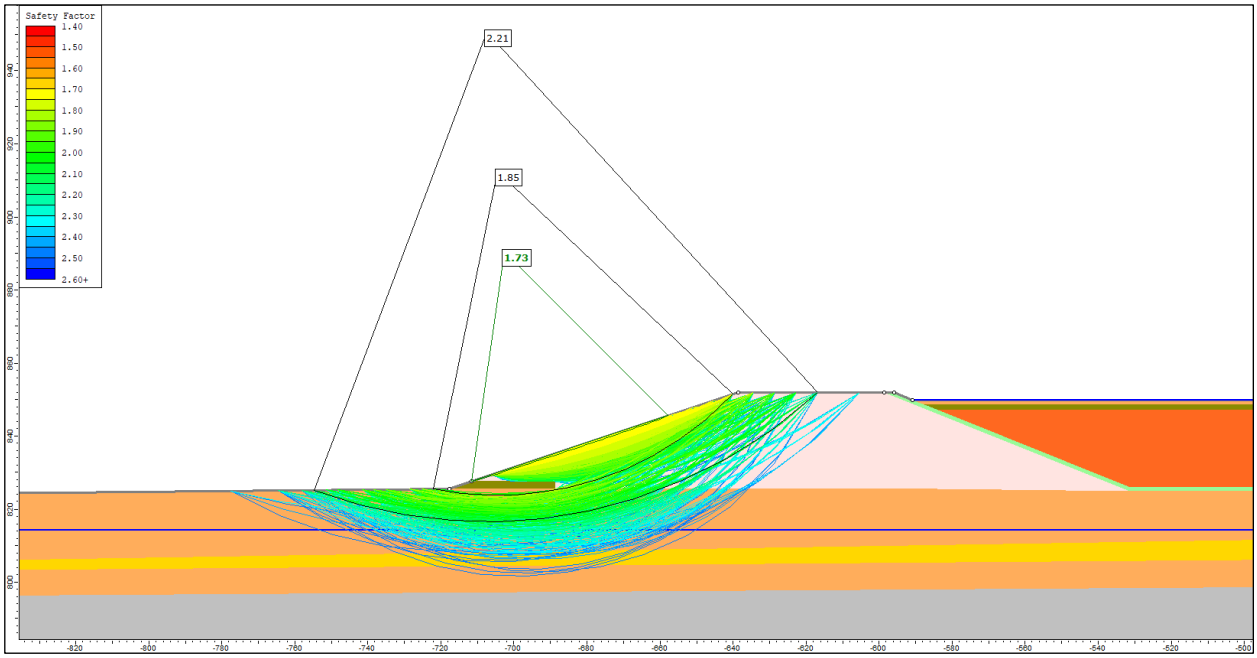


Figure A-32: EMP&WMP-01. Static condition.

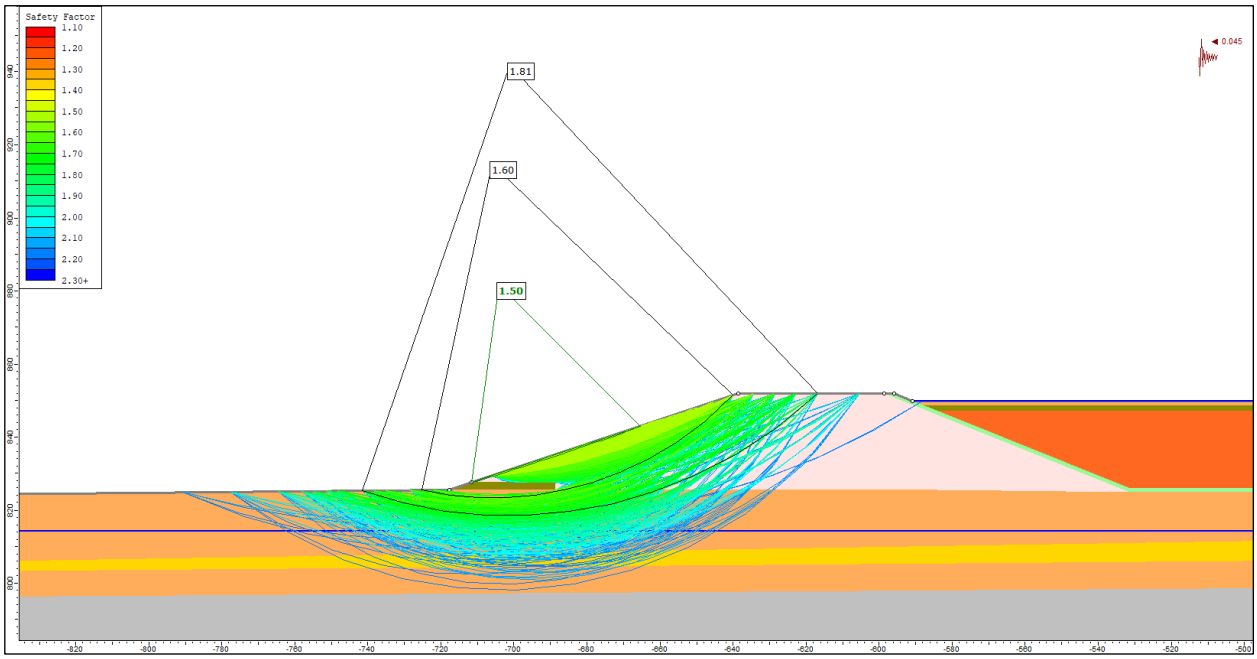


Figure A-33: EMP&WMP-01. Pseudo-static condition.

B.4.2 – EMP-01

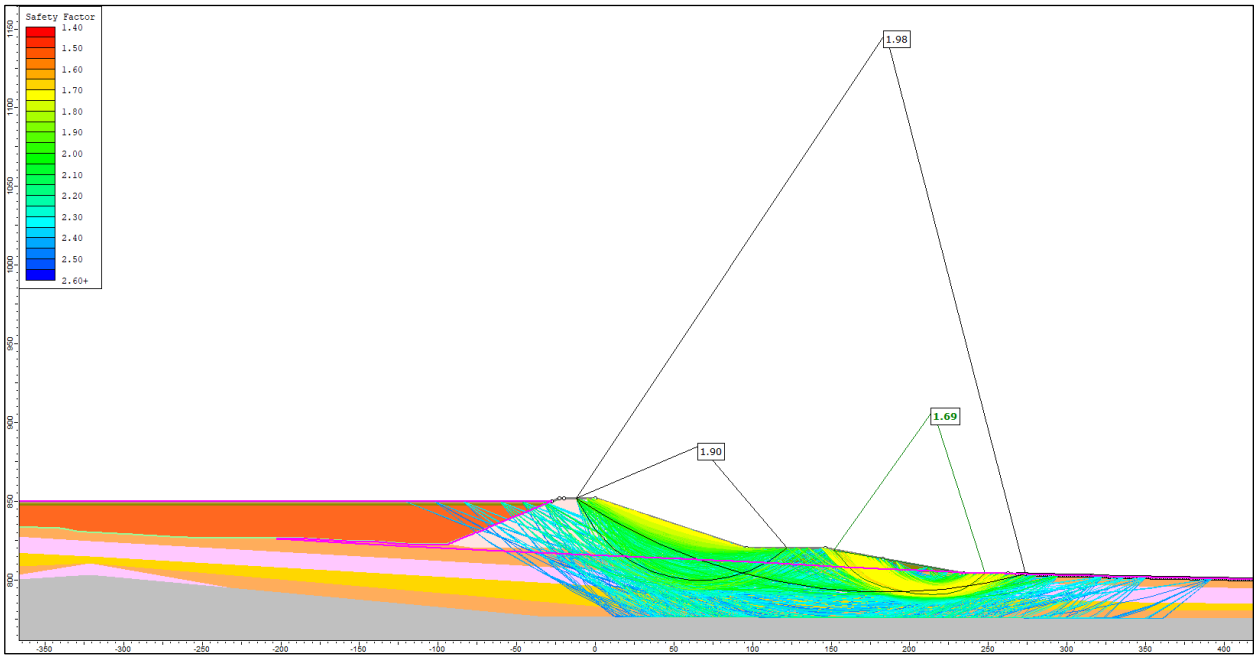


Figure A-34: EMP-01. Static condition.

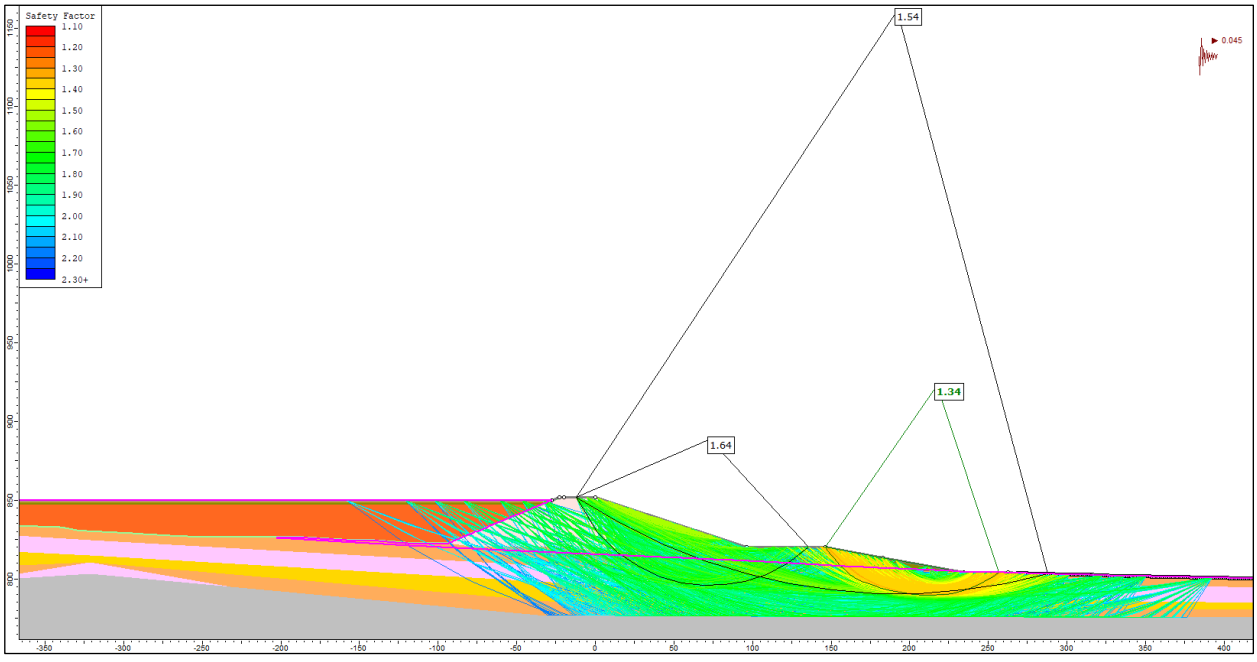


Figure A-35: EMP-01. Pseudo-static condition.

B.4.3 – EMP-02

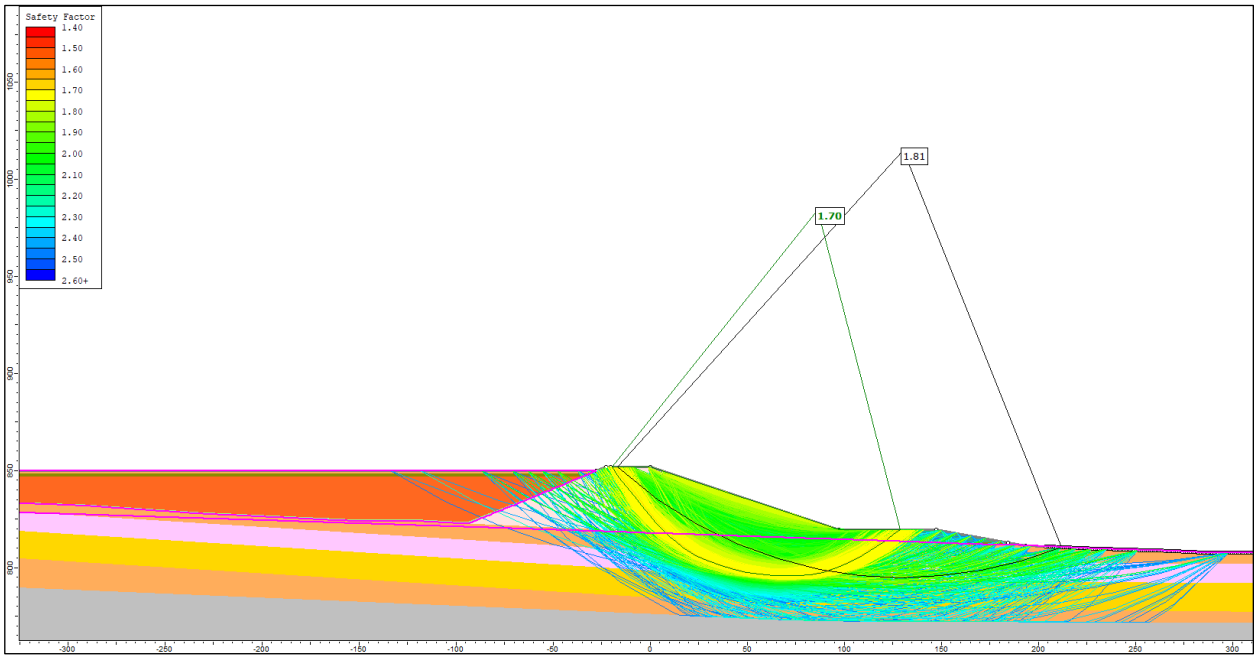


Figure A-36: EMP-02. Static condition.

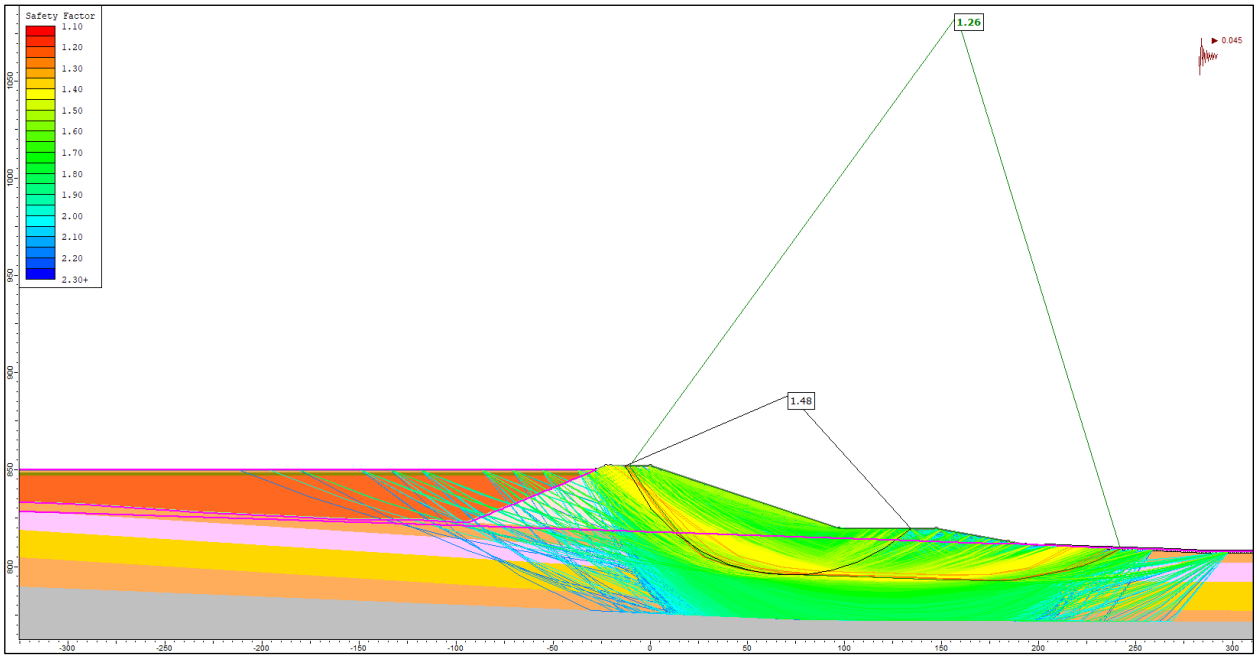


Figure A-37: EMP-02. Pseudo-static condition.

B.4.4 – EMP-03

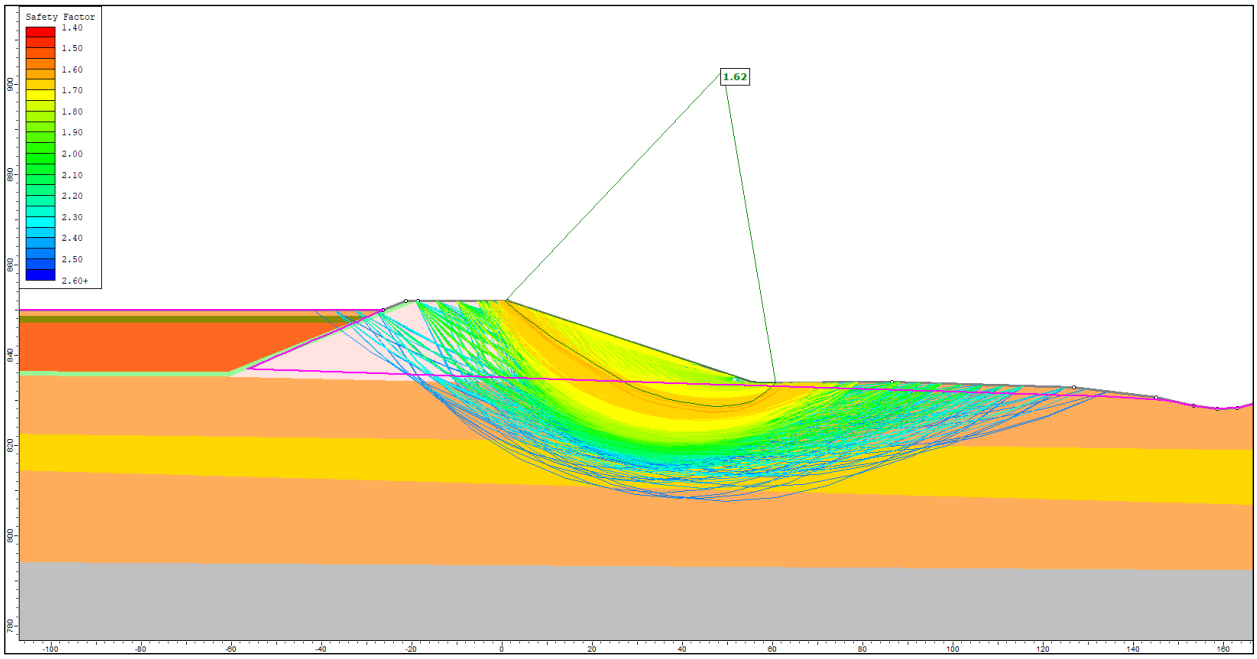


Figure A-38: EMP-03. Static condition.

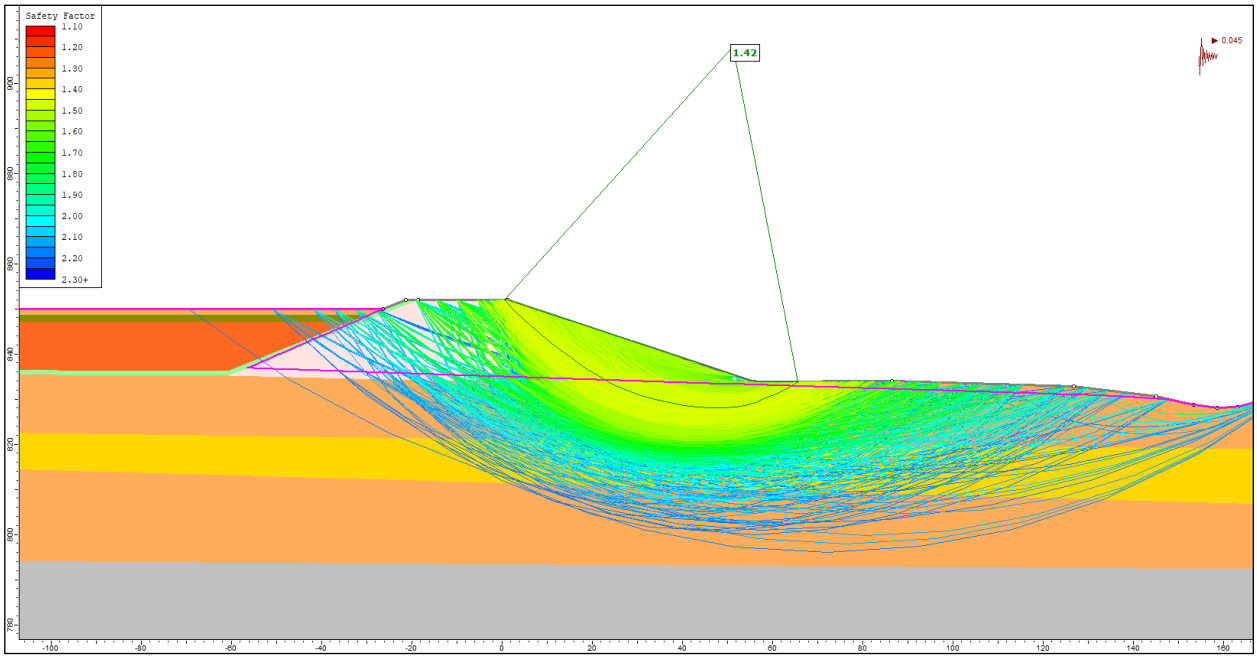


Figure A-39: EMP-03. Pseudo-static condition.

Appendix C Sensitivity Assessment

Appendix C.1 Different CH layer thickness

C.1-1 – West Management Pond (WMP)

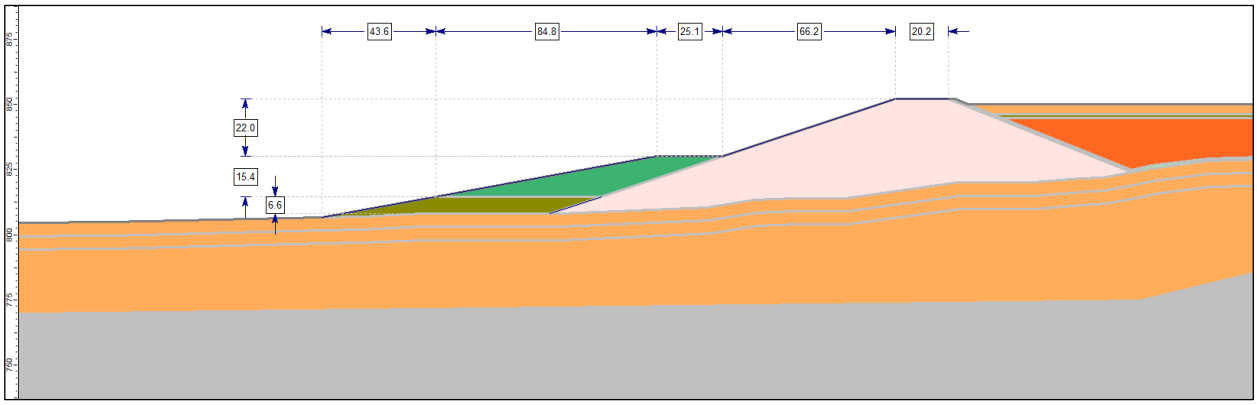


Figure A-40: WMP-01 Section. Stratigraphy Configurations. 0m CH layer thickness (base case).

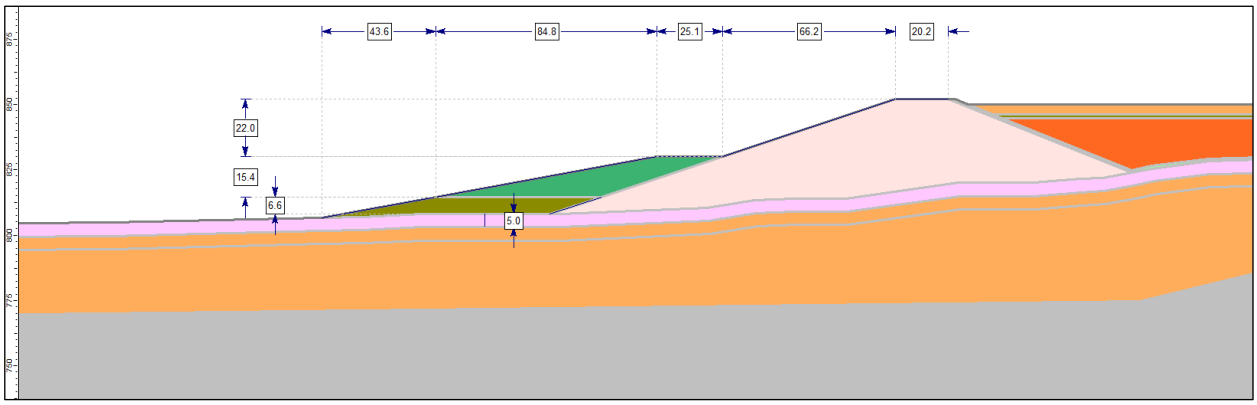


Figure A-41: WMP-01 Section. Stratigraphy Configurations. 5m CH layer thickness.

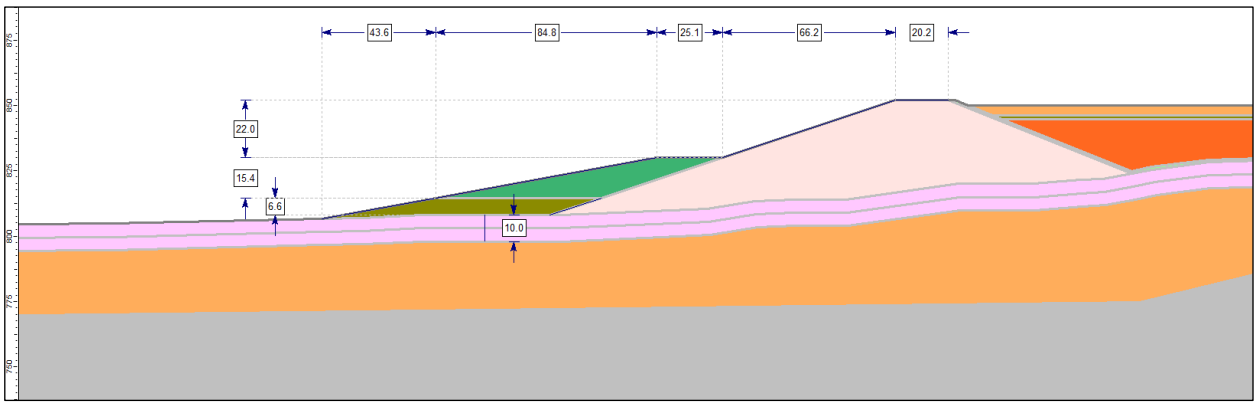


Figure A-42: WMP-01 Section. Stratigraphy Configurations. 10m CH layer thickness.

C.1-1.1 – WMP-01 – 0m CH layer thickness

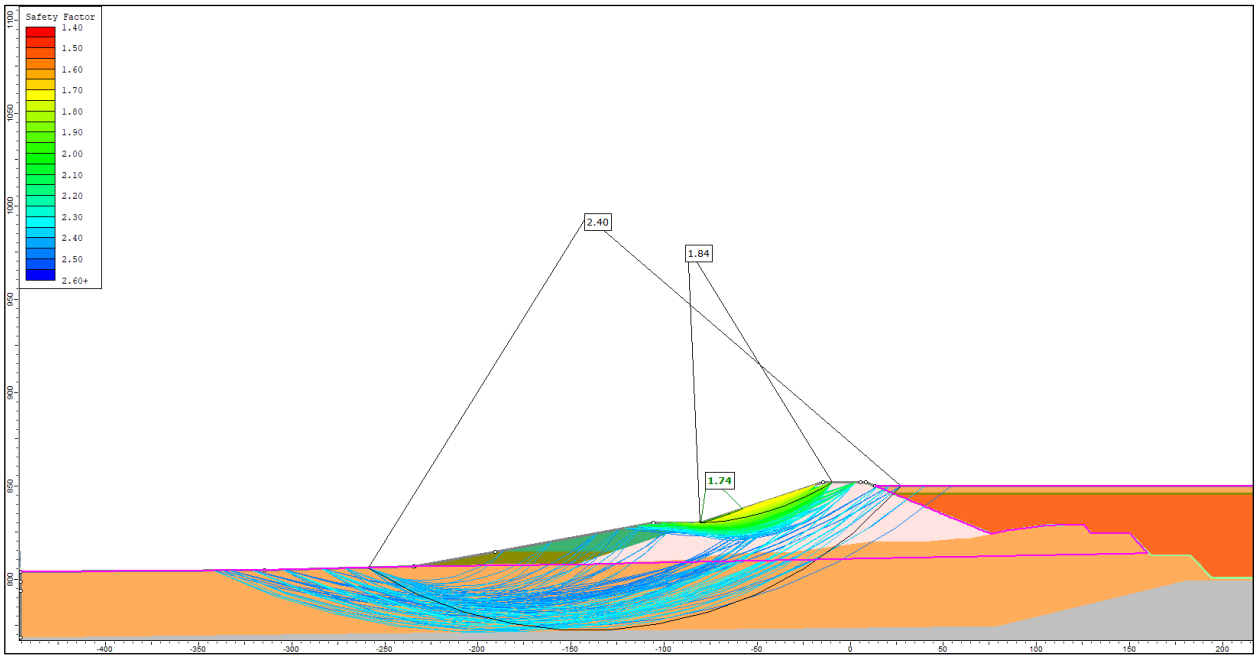


Figure A-43: WMP-01. Static condition. Sensitivity assessment. 0m CH layer thickness.

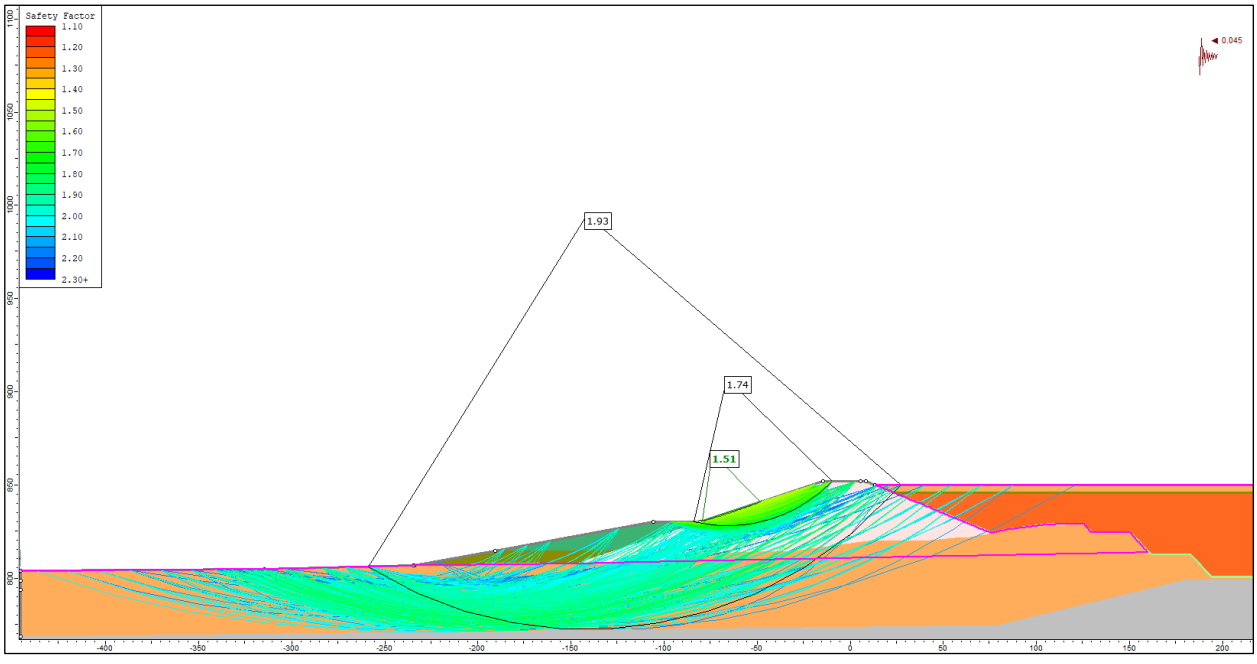


Figure A-44: WMP-01. Pseudo-static condition. Sensitivity assessment. 0m CH layer thickness.

C.1-1.2 – WMP-01 – 5m CH layer thickness

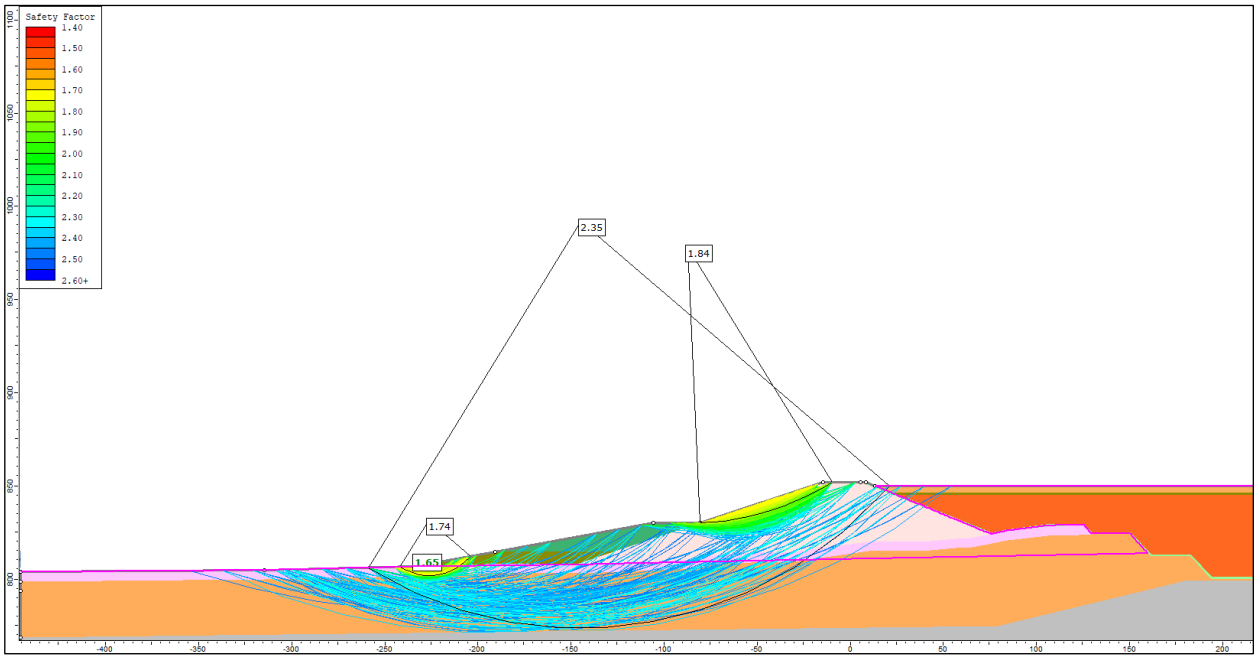


Figure A-45: WMP-01. Static condition. Sensitivity assessment. 5m CH layer thickness.

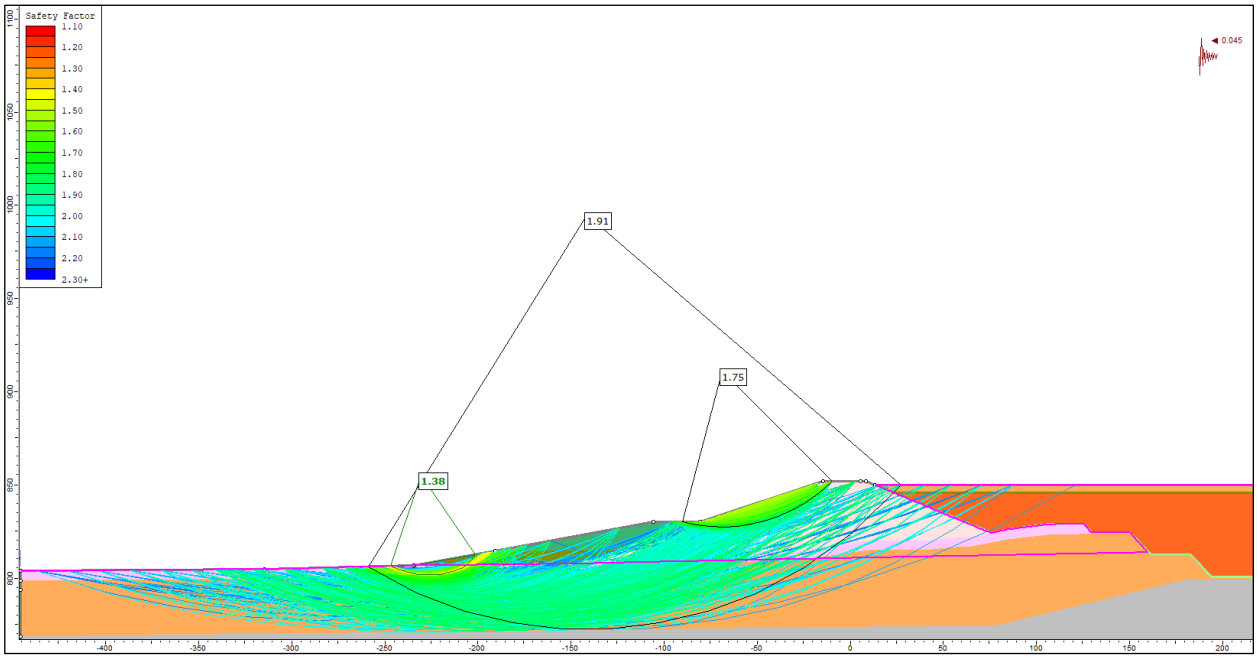


Figure A-46: WMP-01. Pseudo-static condition. Sensitivity assessment. 5m CH layer thickness.

C.1-1.3 – WMP-01 – 10m CH layer thickness

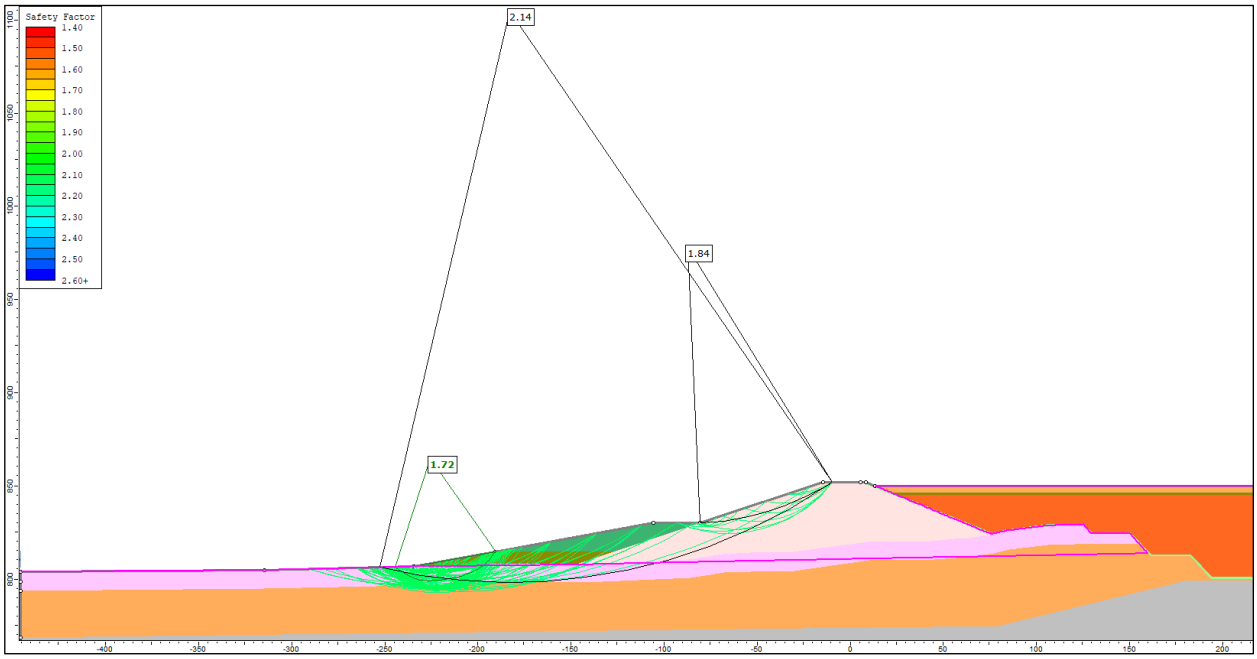


Figure A-47: WMP-01. Static condition. Sensitivity assessment. 10m CH layer thickness.

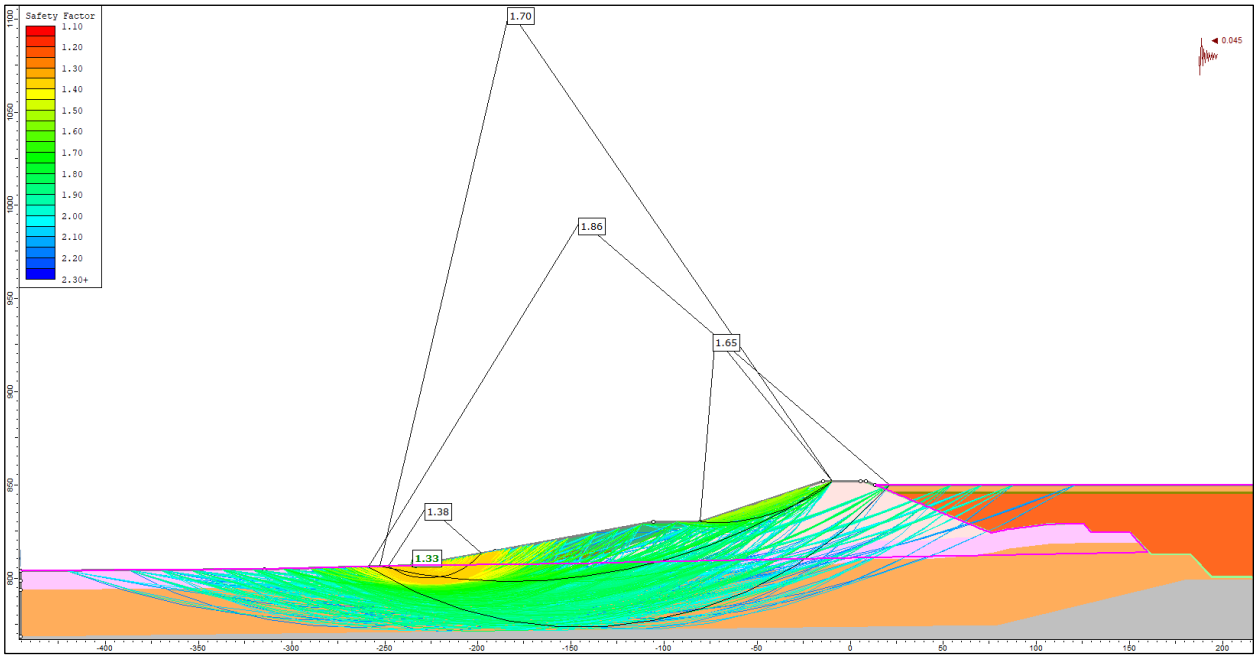


Figure A-48: WMP-01. Pseudo-static condition. Sensitivity assessment. 10m CH layer thickness.

C.1-2 – East Management Pond (EMP)

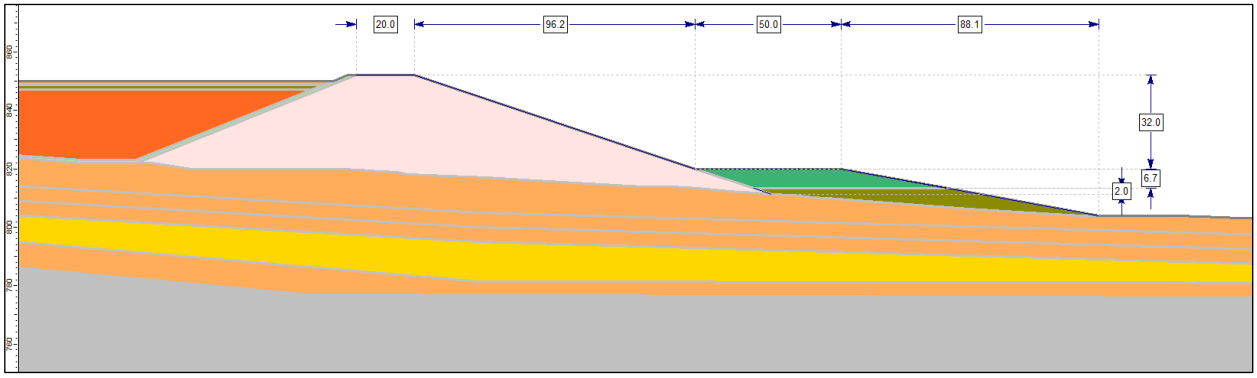


Figure A-49: EMP-01 Section. Stratigraphy Configurations. 0m CH layer thickness.

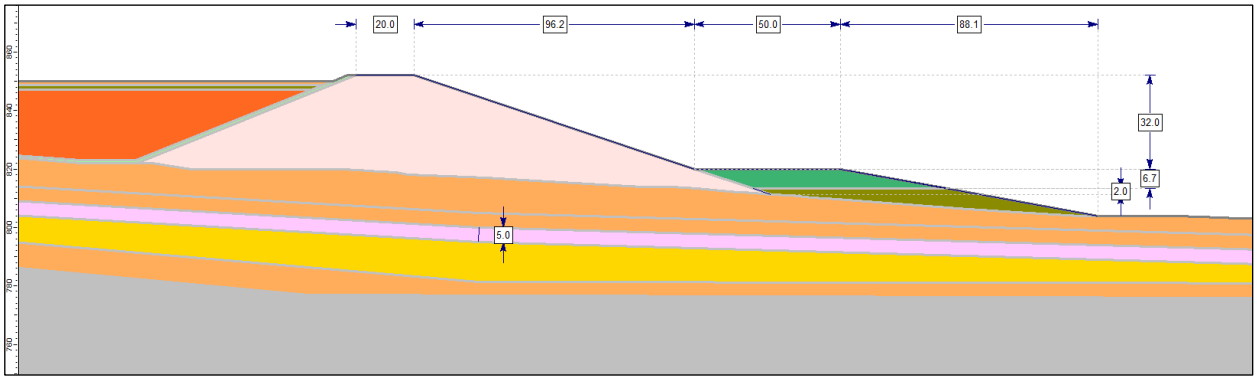


Figure A-50: EMP-01 Section. Stratigraphy Configurations. 5m CH layer thickness.

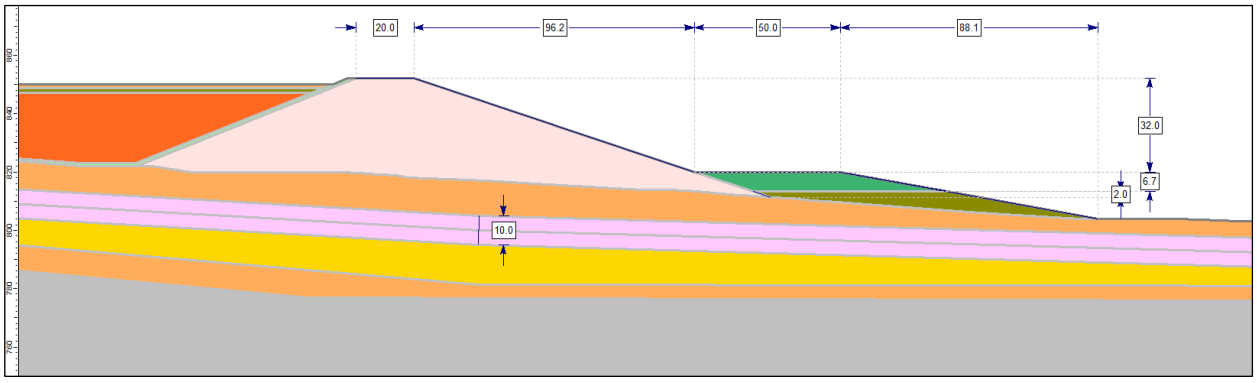


Figure A-51: EMP-01 Section. Stratigraphy Configurations. 10m CH layer thickness (base case).

C.1-2.1 – EMP-01 – 0m CH layer thickness

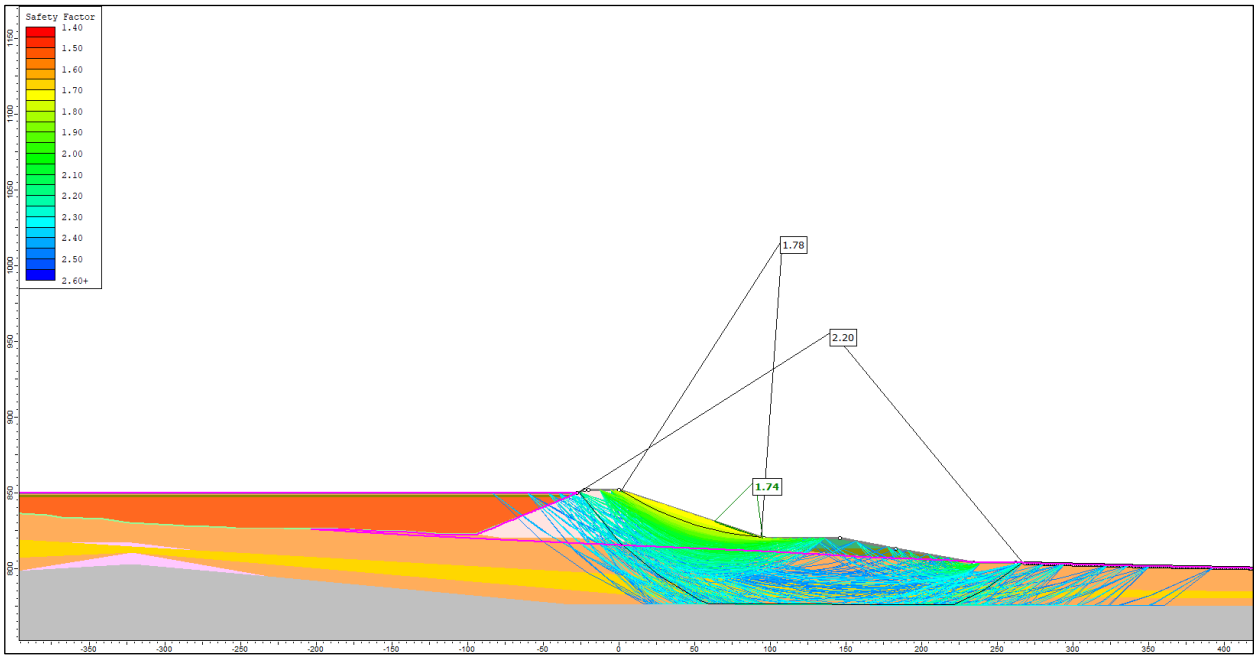


Figure A-52: EMP-01. Static condition. Sensitivity assessment. 0m CH layer thickness.

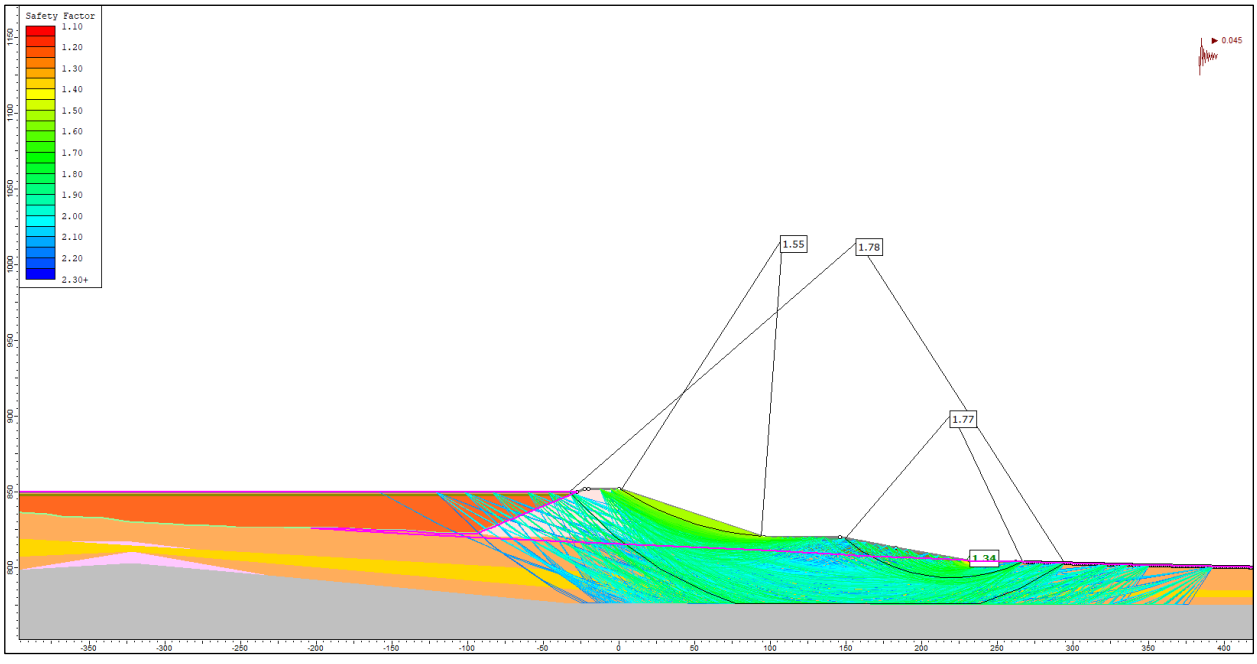


Figure A-53: EMP-01. Pseudo-static condition. Sensitivity assessment. 0m CH layer thickness

C.1-2.2 – EMP-01 – 5m CH layer thickness

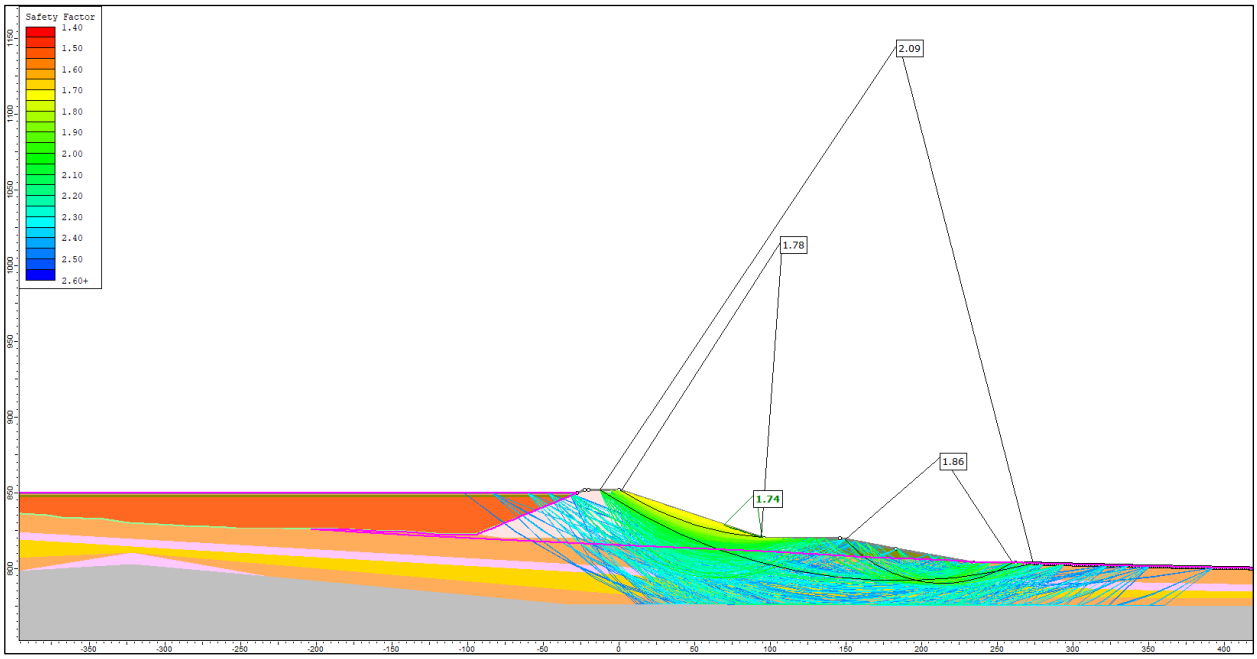


Figure A-54: EMP-01. Static condition. Sensitivity assessment. 5m CH layer thickness.

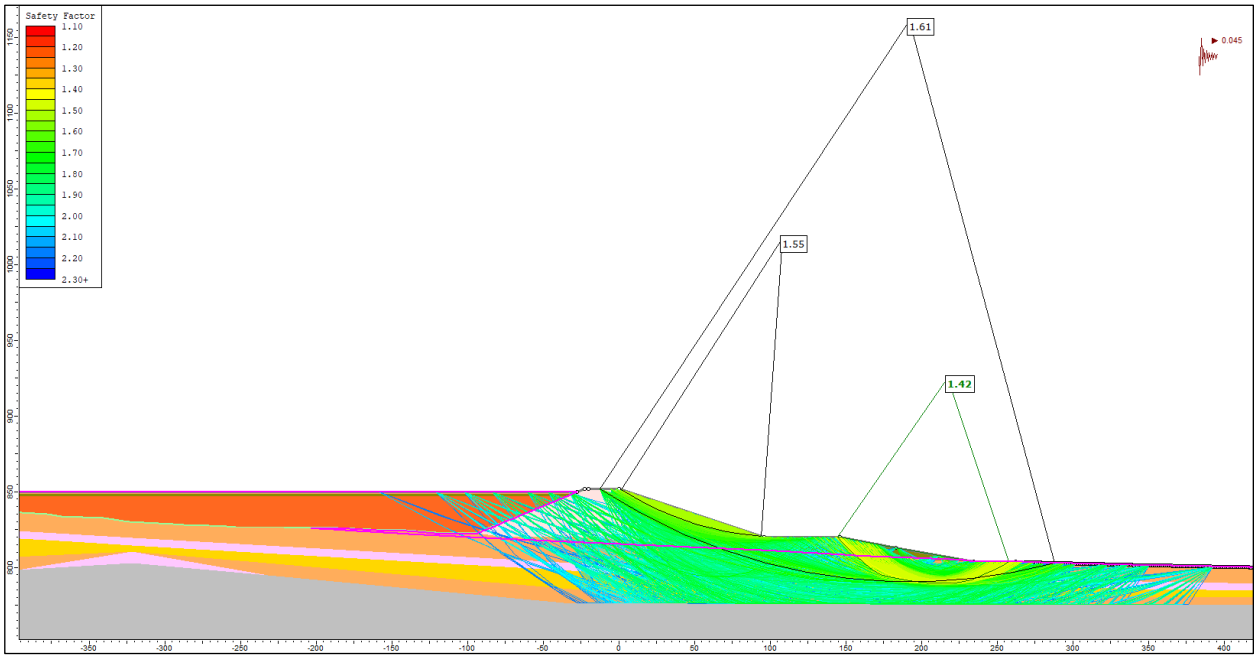


Figure A-55: EMP-01. Pseudo-static condition. Sensitivity assessment. 5m CH layer thickness.

C.1-2.3 – EMP-01 – 10m CH layer thickness

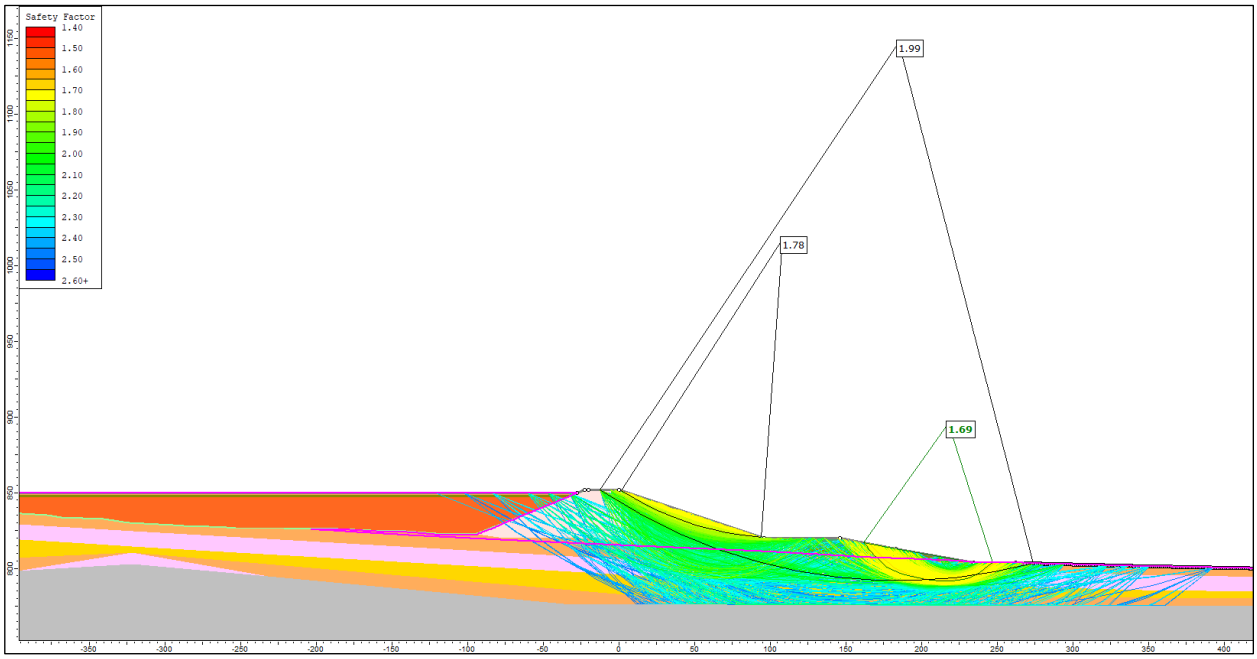


Figure A-56: EMP-01. Static condition. Sensitivity assessment. 10m CH layer thickness.

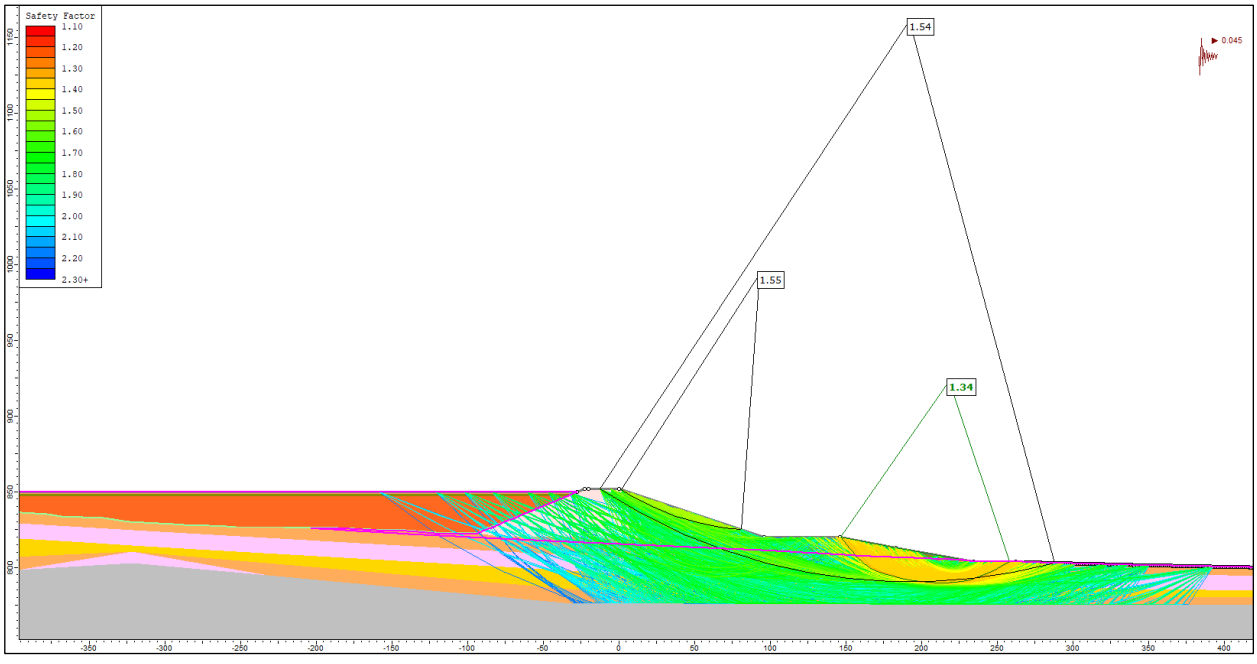


Figure A-57: EMP-01. Pseudo-static condition. Sensitivity assessment. 10m CH layer thickness.

Appendix C.2 Different dam materials configurations

C.2-1 – East Management Pond (EMP)

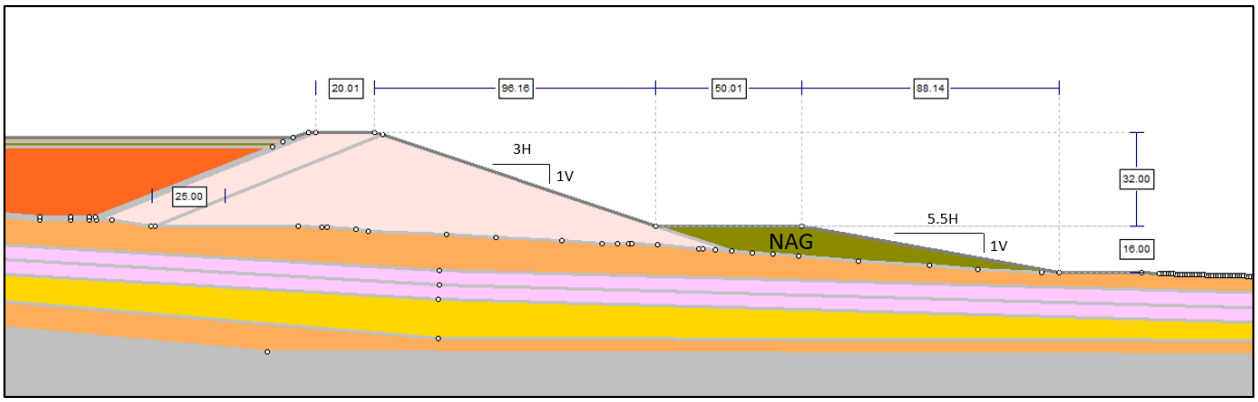


Figure A-58: EMP-01 Section. Different dam materials configurations. Alternative 1.

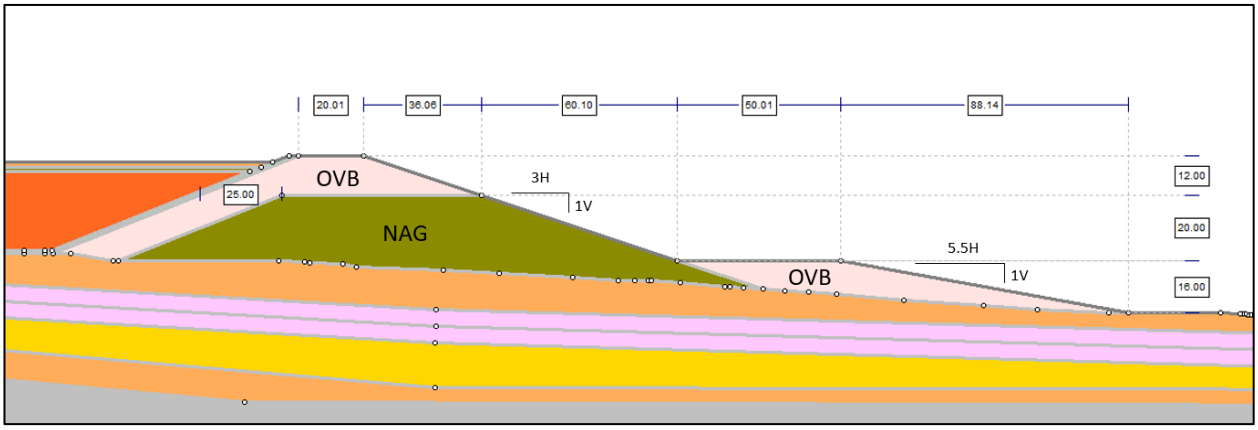


Figure A-59: EMP-01 Section. Different dam materials configurations. Alternative 2.

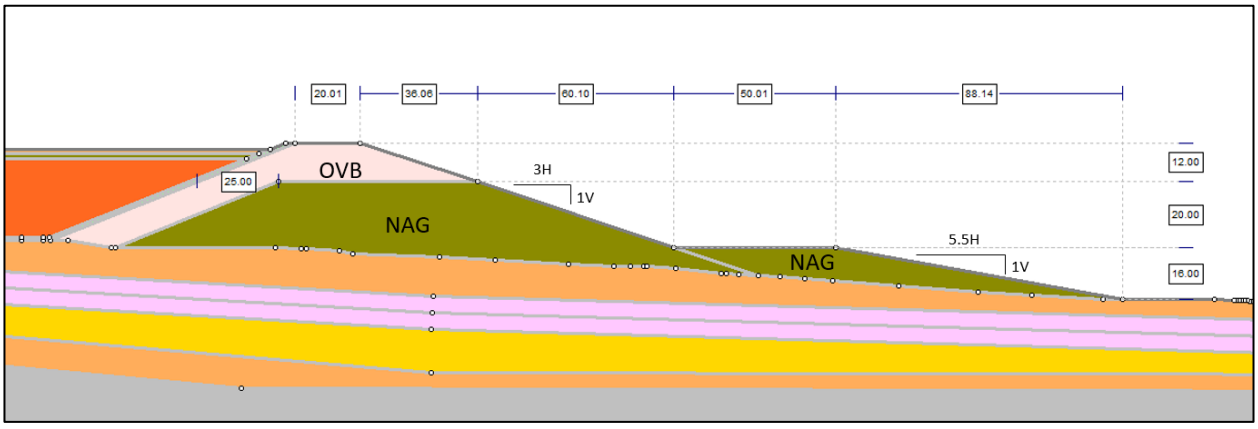


Figure A-60: EMP-01 Section. Different dam materials configurations. Alternative 3.

C.2-1.1 – EMP-01 – Dam material configuration – Alternative 1

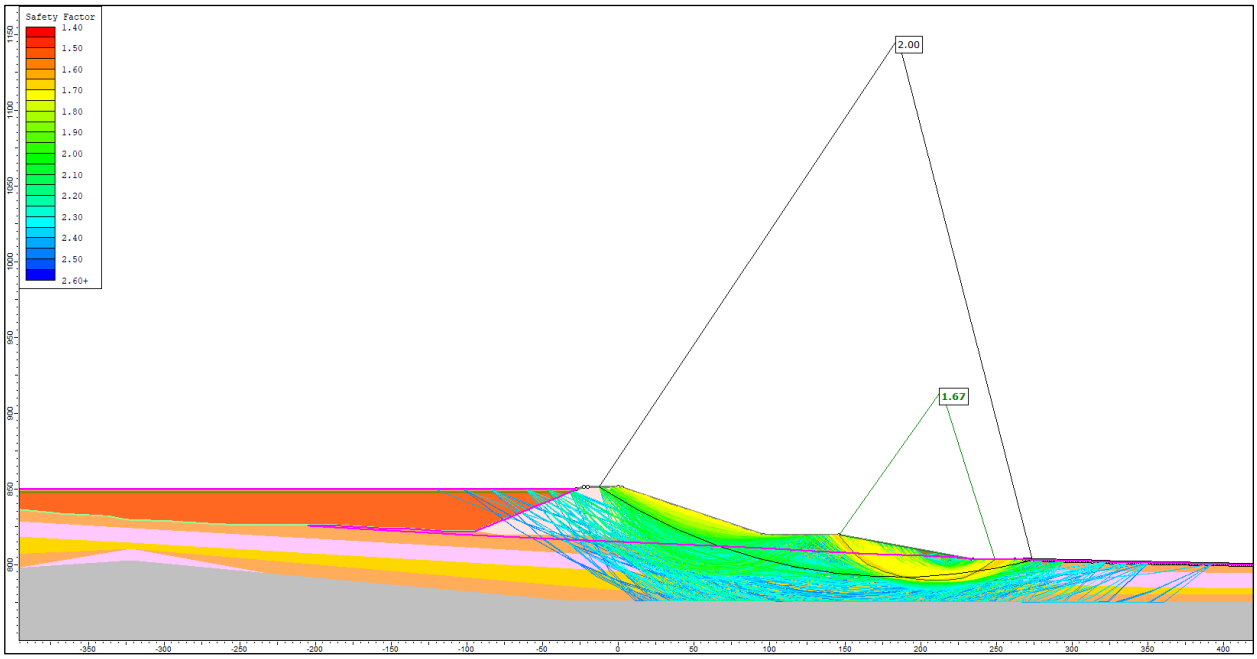


Figure A-61: EMP-01. Static condition. Sensitivity assessment. Dam materials configurations. Alt 1.

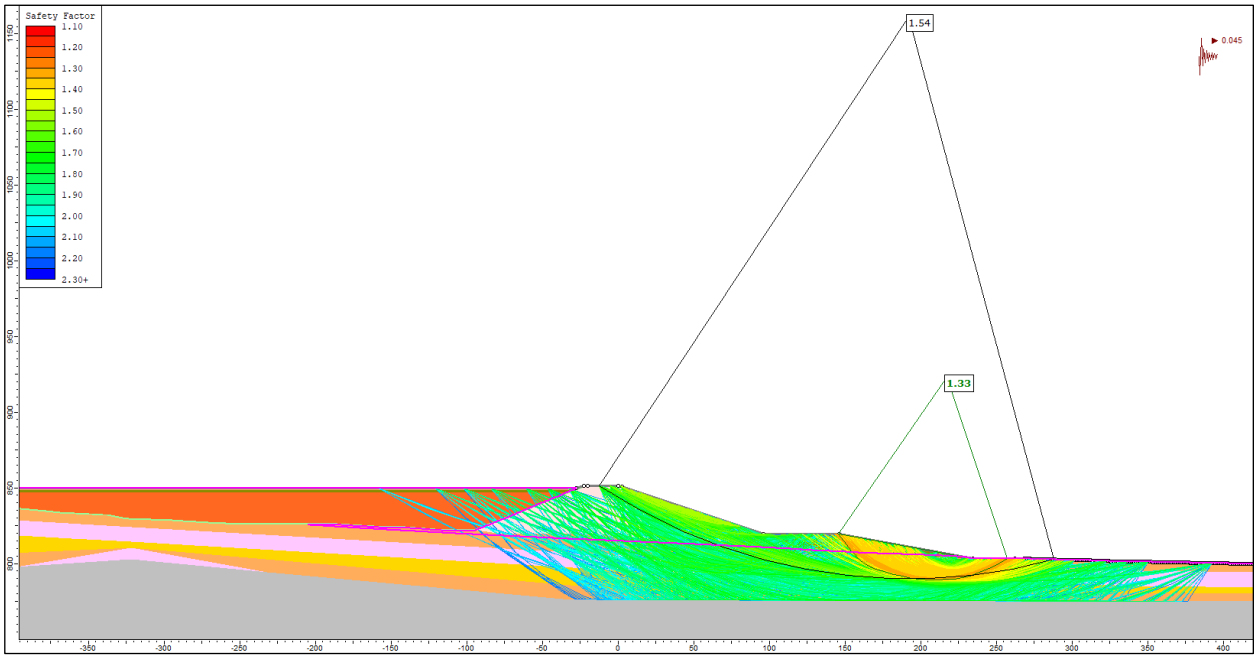


Figure A-62: EMP-01. Pseudo-static condition. Sensitivity assessment. Dam materials configurations. Alt 1.

C.2-1.2 – EMP-01 – Dam material configuration – Alternative 2

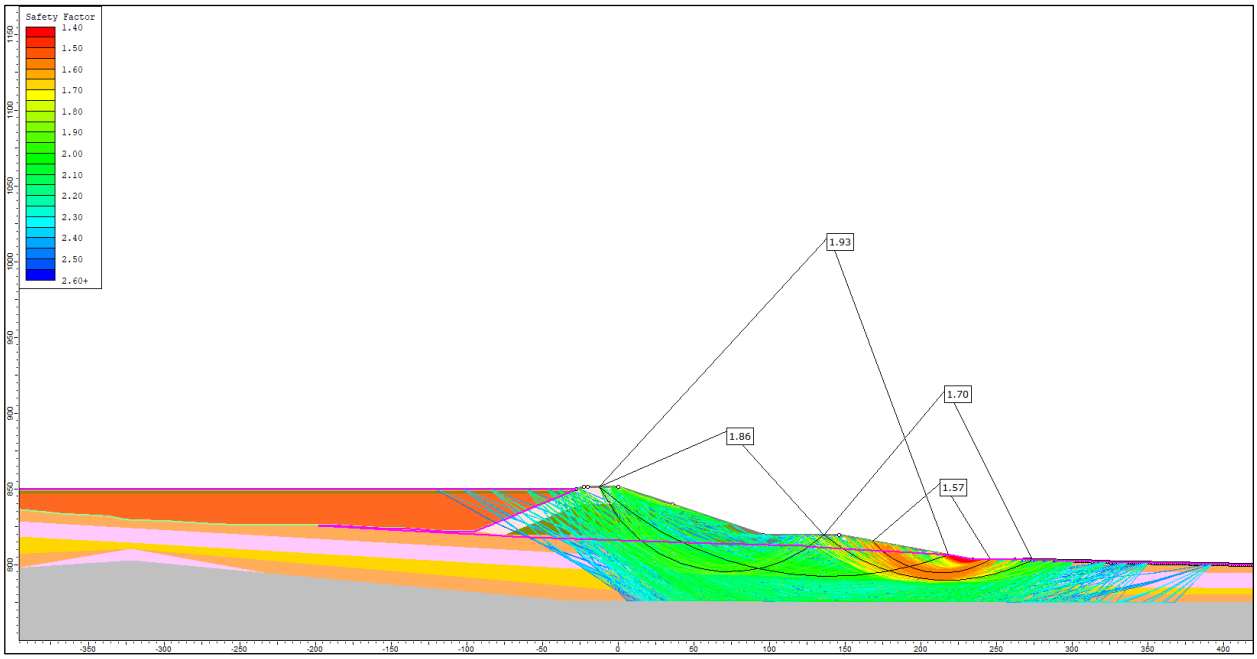


Figure A-63: EMP-01. Static condition. Sensitivity assessment. Dam materials configurations. Alt 1.

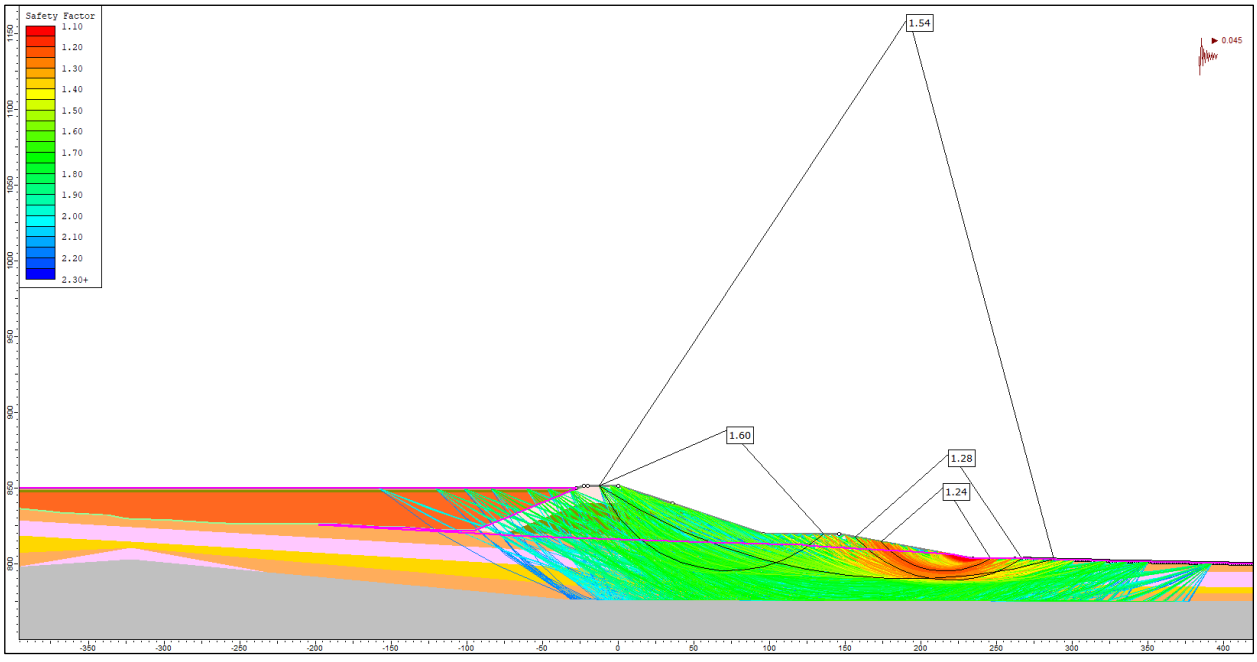


Figure A-64: EMP-01. Pseudo-static condition. Sensitivity assessment. Dam materials configurations. Alt 2.

C.2-1.3 – EMP-01 – Dam material configuration – Alternative 3

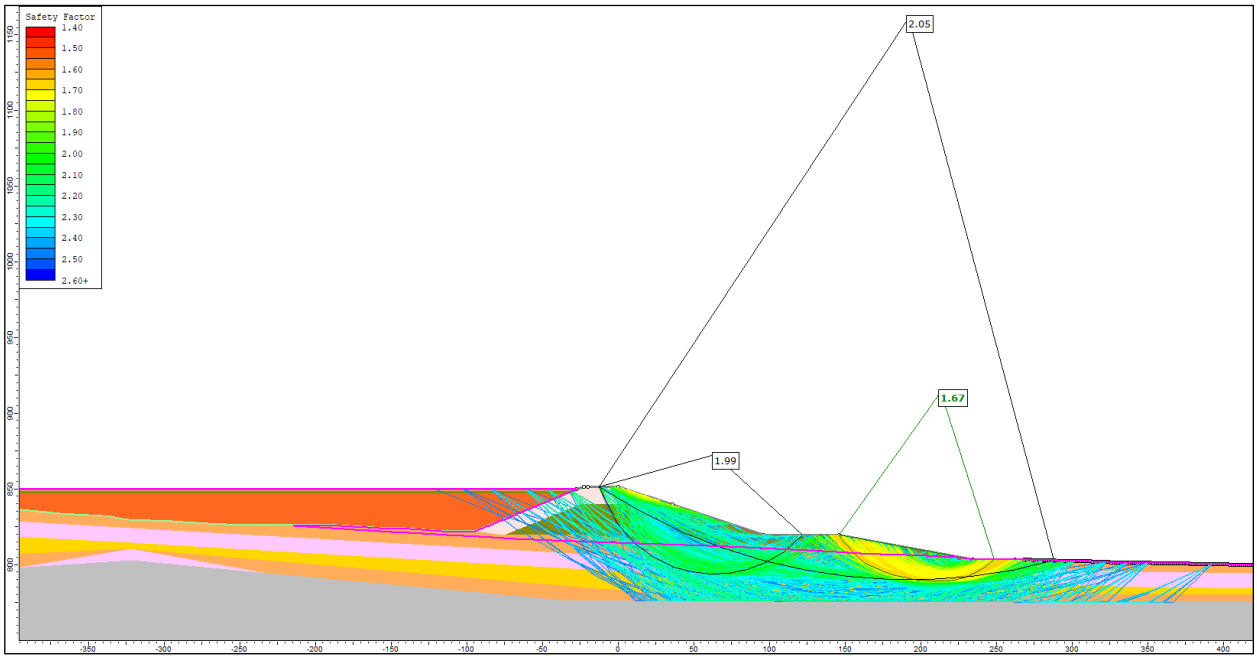


Figure A-65: EMP-01. Static condition. Sensitivity assessment. Dam materials configurations. Alt 3.

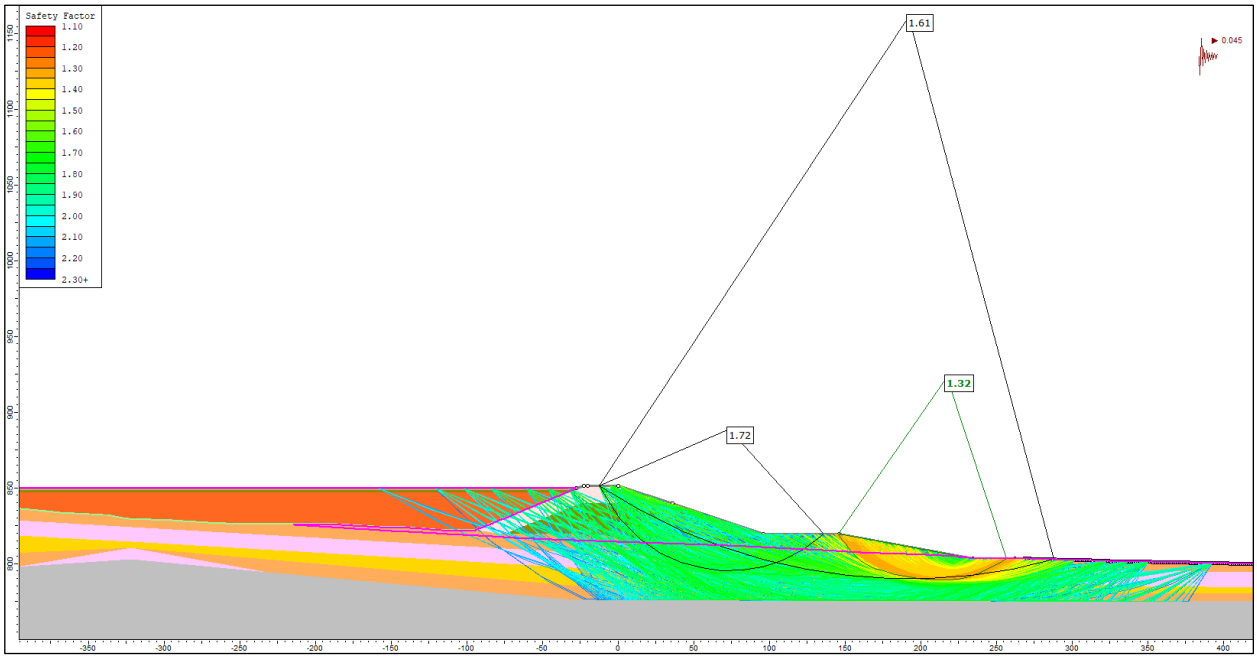


Figure A-66: EMP-01. Pseudo-static condition. Sensitivity assessment. Dam materials configurations. Alt 3.

Appendix C.3 Different stratigraphy configurations

C.3-1 – West Management Pond (WMP)

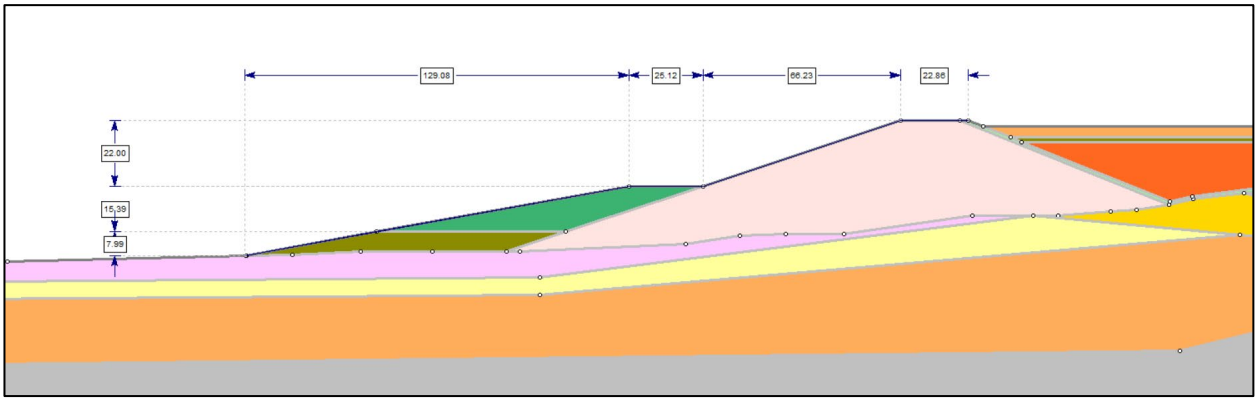


Figure A-67: WMP-01 Section. Different stratigraphy configuration.

C.3-1.1 – WMP-01 – Different stratigraphy configuration – Alternative

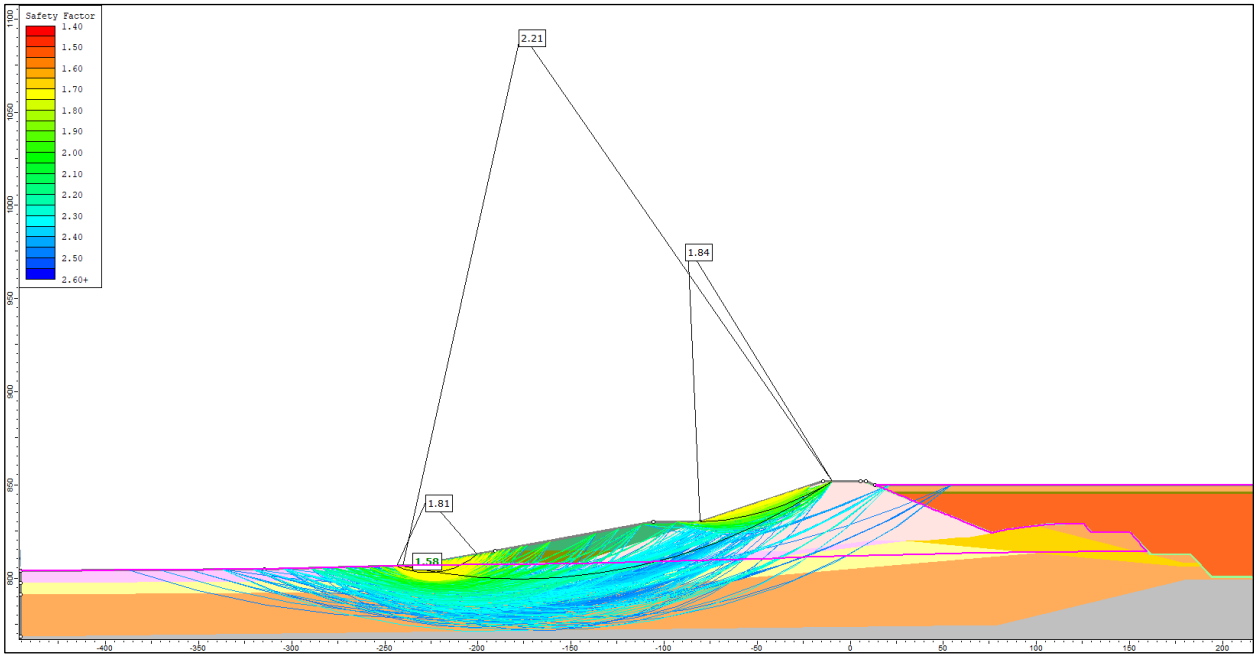


Figure A-68: WMP-01. Static condition. Sensitivity assessment. Different stratigraphy configuration.

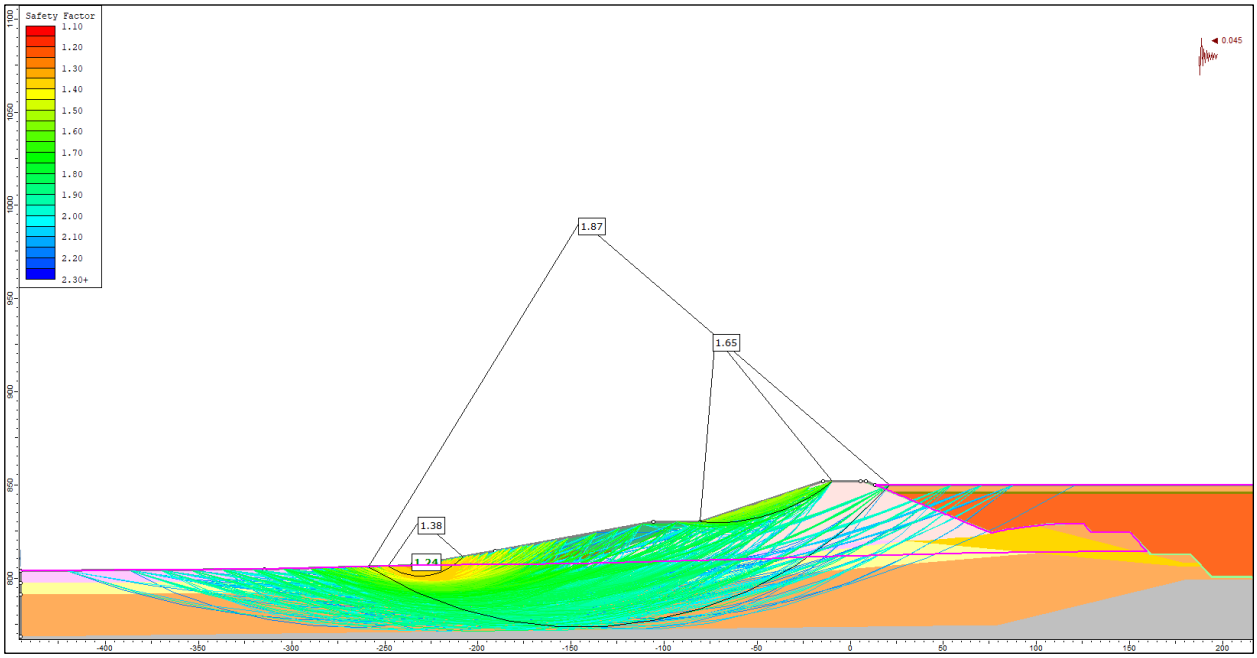


Figure A-69: WMP-01. Pseudo-static condition. Sensitivity assessment. Different stratigraphy configuration.

Appendix C.4 Liner failure

Chimney drain configurations.

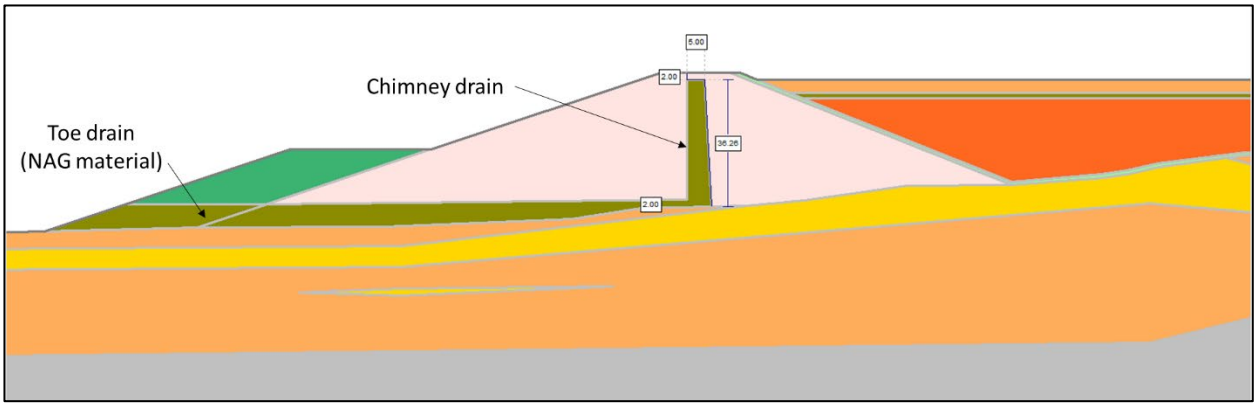


Figure A-70: WMP-01 Section. Chimney Drain Configuration.

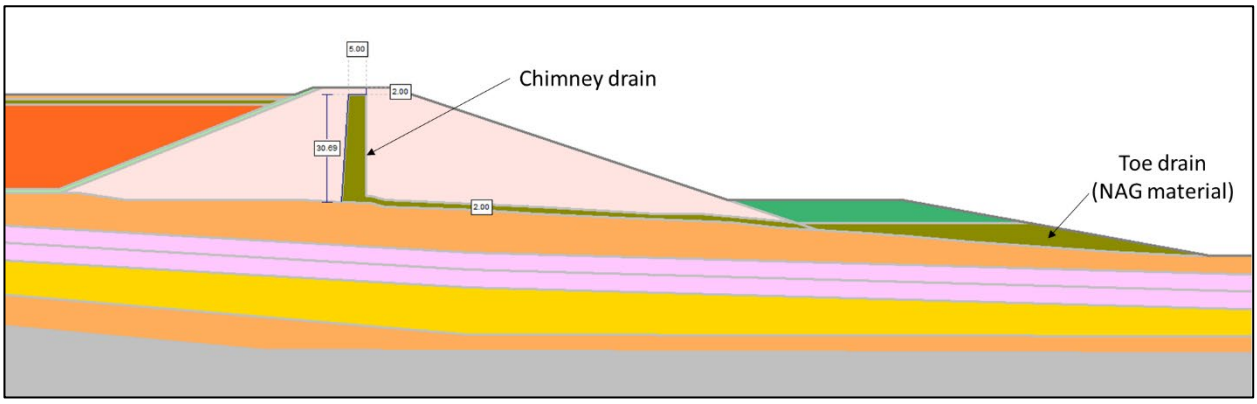


Figure A-71: EMP-01 Section. Chimney Drain Configuration.

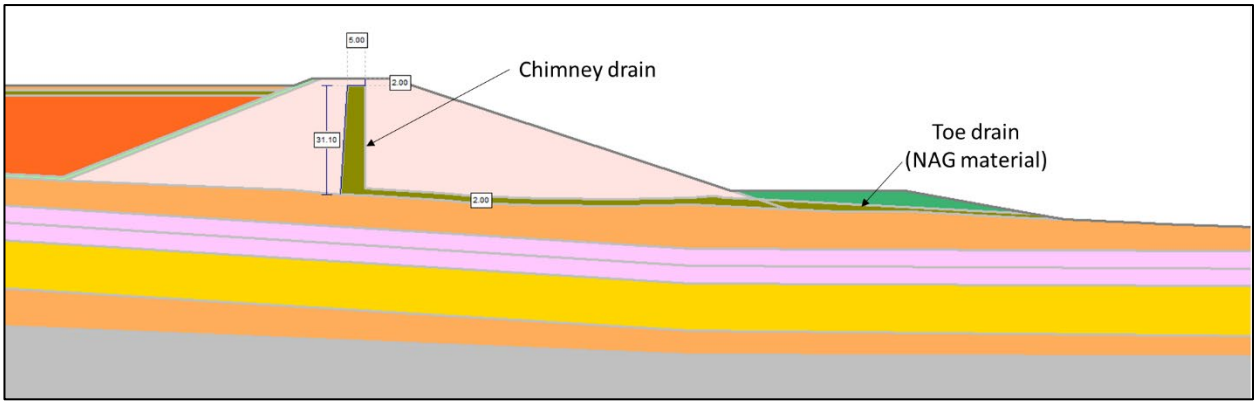


Figure A-72: EMP-02 Section. Chimney Drain Configuration.

Alternative dam material configurations.

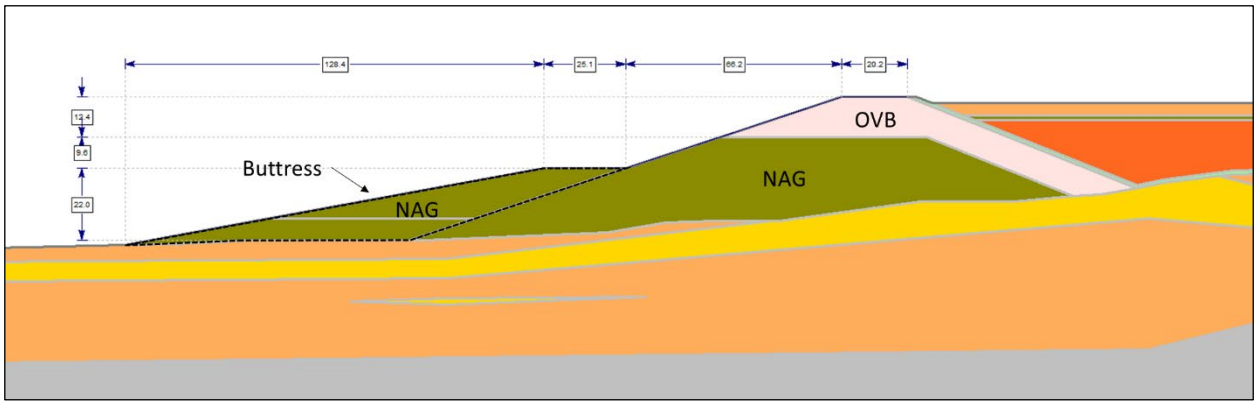


Figure A-73: WMP-01 Section. Liner Failure. Alternative Dam Materials Configuration.

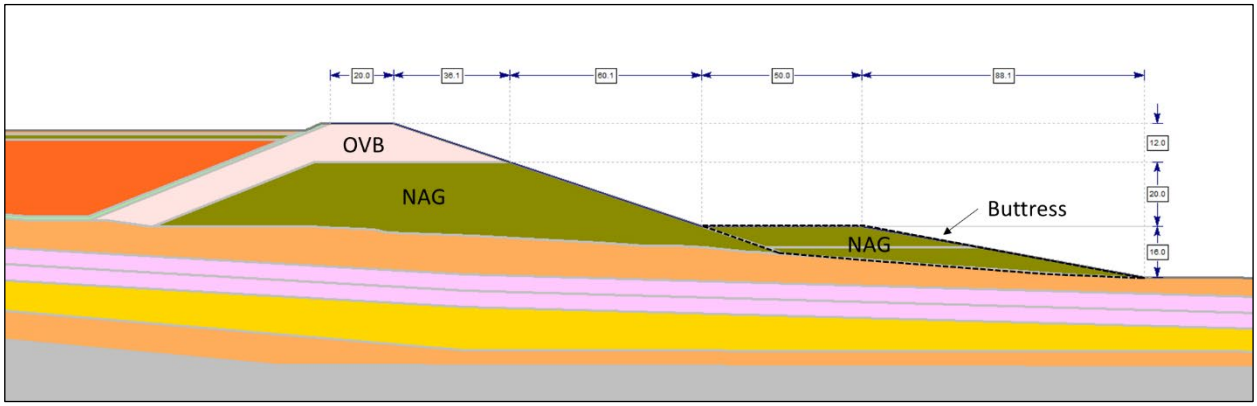


Figure A-74: EMP-02 Section. Liner Failure. Alternative Dam Materials Configuration.

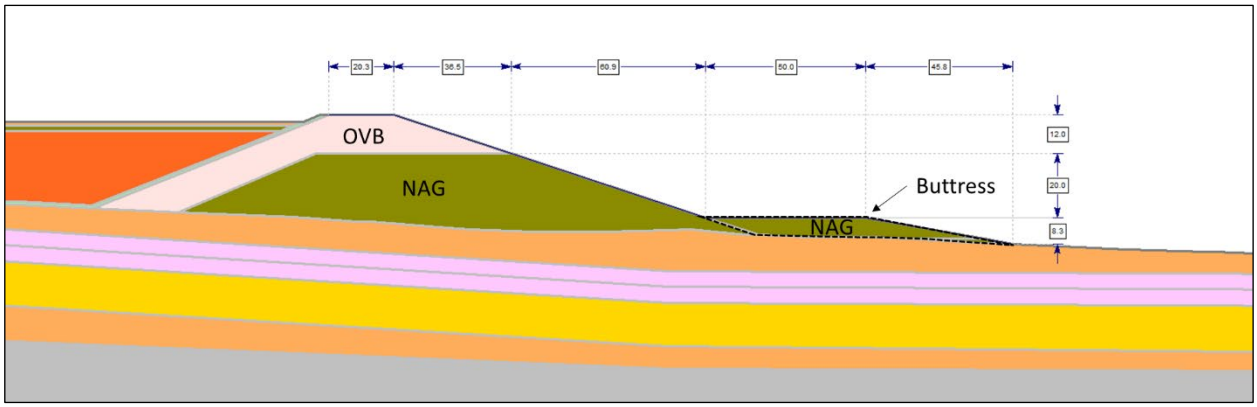


Figure A-75: EMP-02 Section. Liner Failure. Alternative Dam Materials Configuration.

C.4-1 – West Management Pond (WMP) – Section WMP-01

C.4-1.1 – WMP-01 – Liner failure

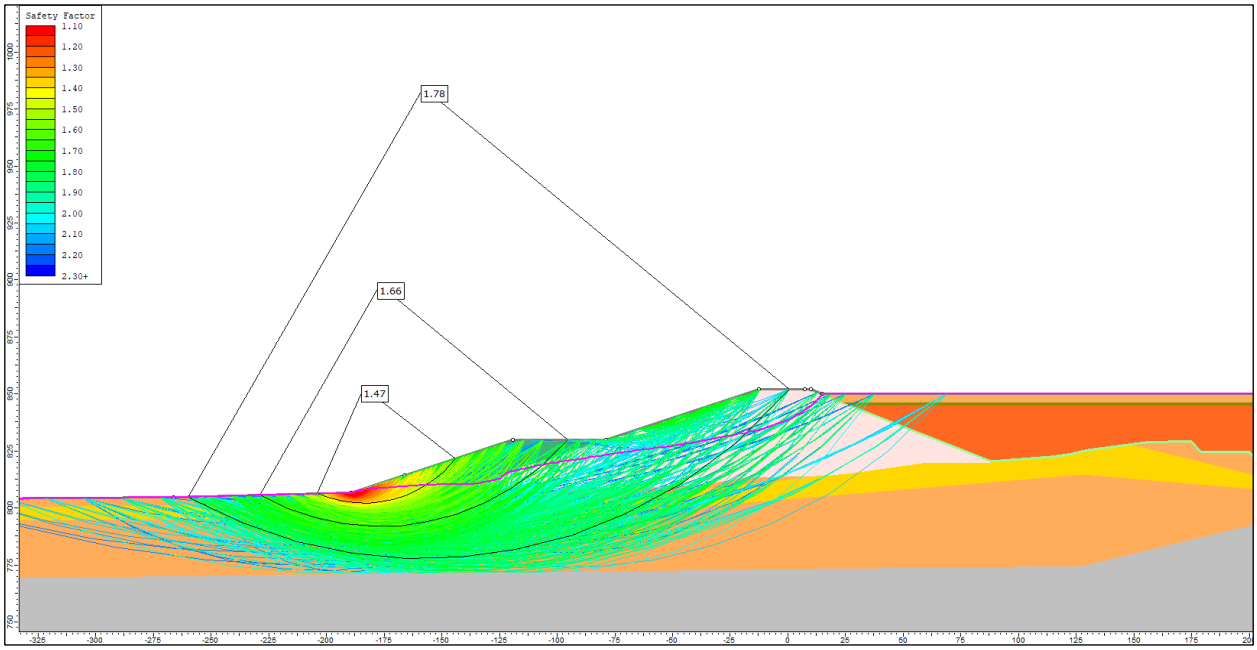


Figure A-76: WMP-01. Static condition. Sensitivity assessment. Liner Failure.

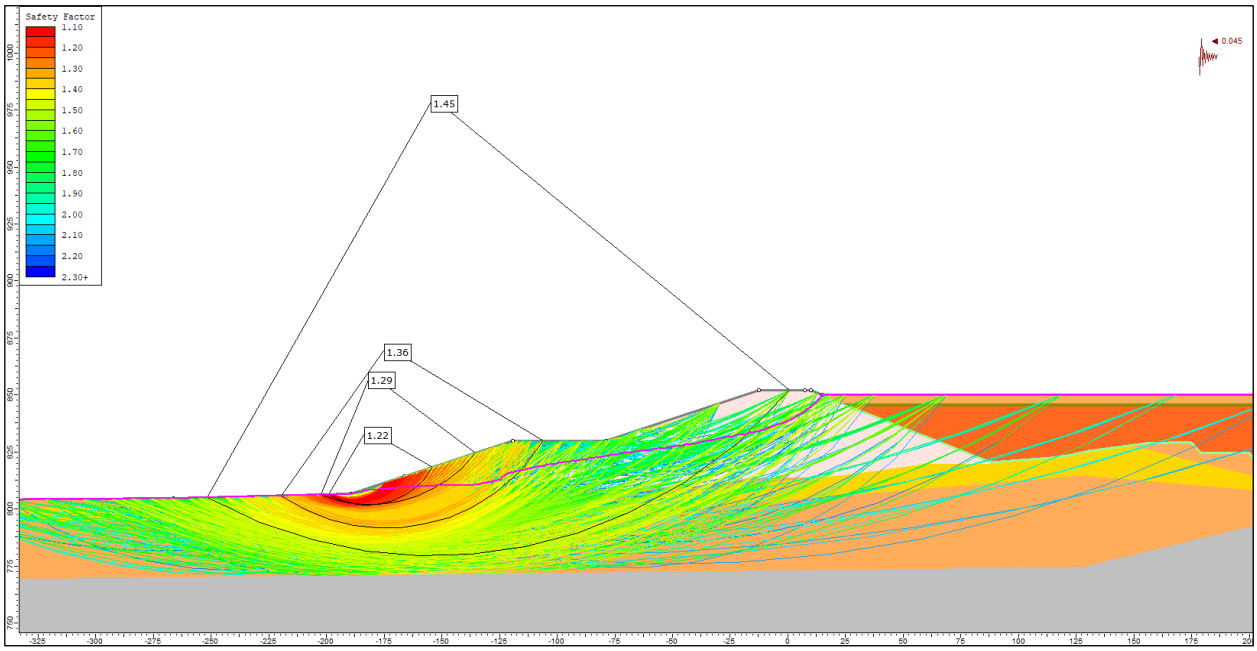


Figure A-77: WMP-01. Pseudo-static condition. Sensitivity assessment. Liner Failure.

C.4-1.2 – WMP-01 – Liner failure with chimney drain

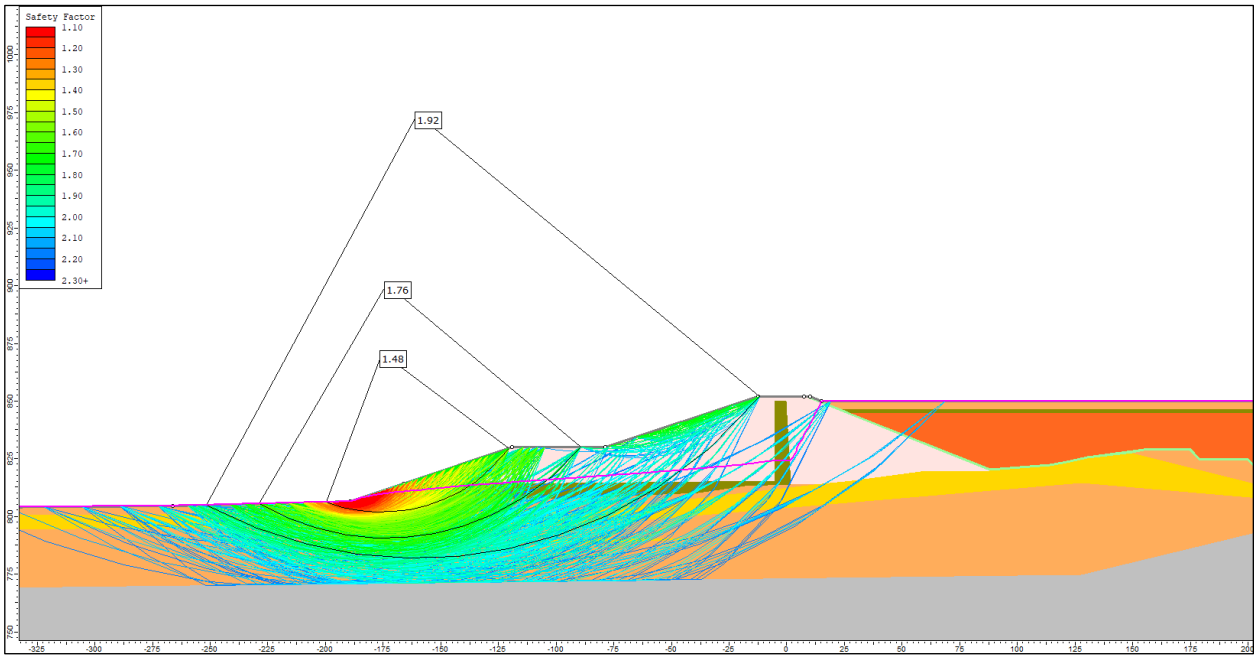


Figure A-78: WMP-01. Static condition. Sensitivity assessment. Liner Failure with Chimney Drain.

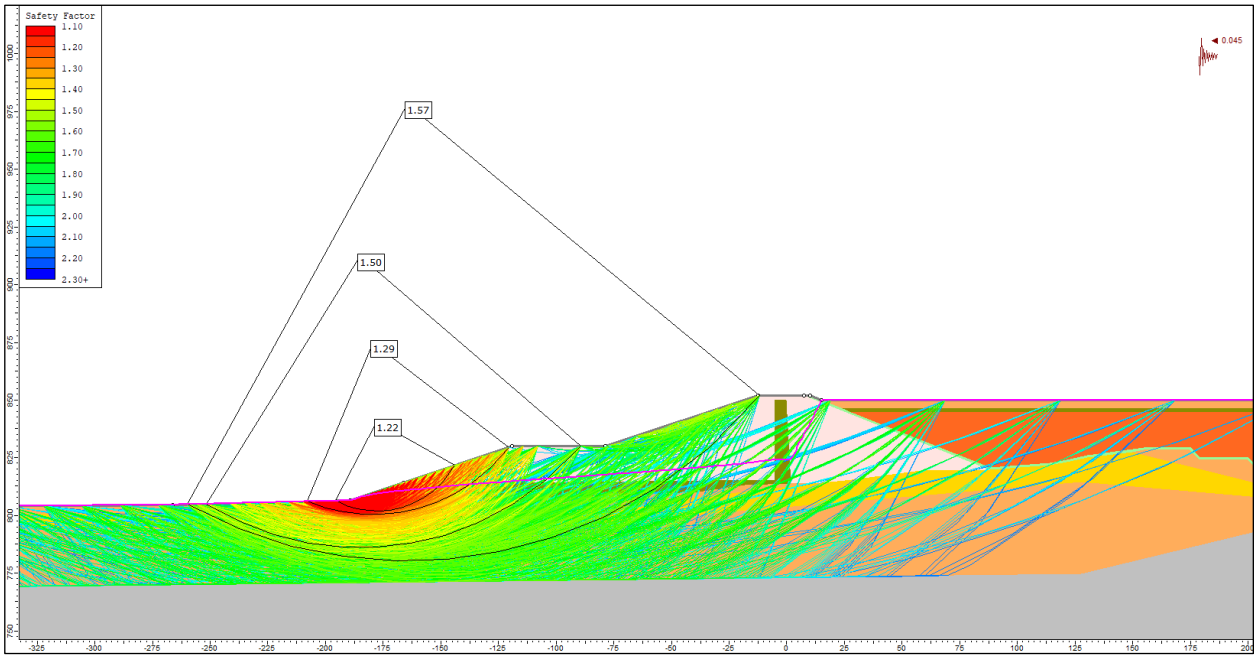


Figure A-79 : WMP-01. Pseudo-static condition. Sensitivity assessment. Liner Failure with Chimney Drain.

C.4-2 – East Management Pond (EMP) – Section EMP-01

C.4-2.1 – EMP-01 – Liner failure

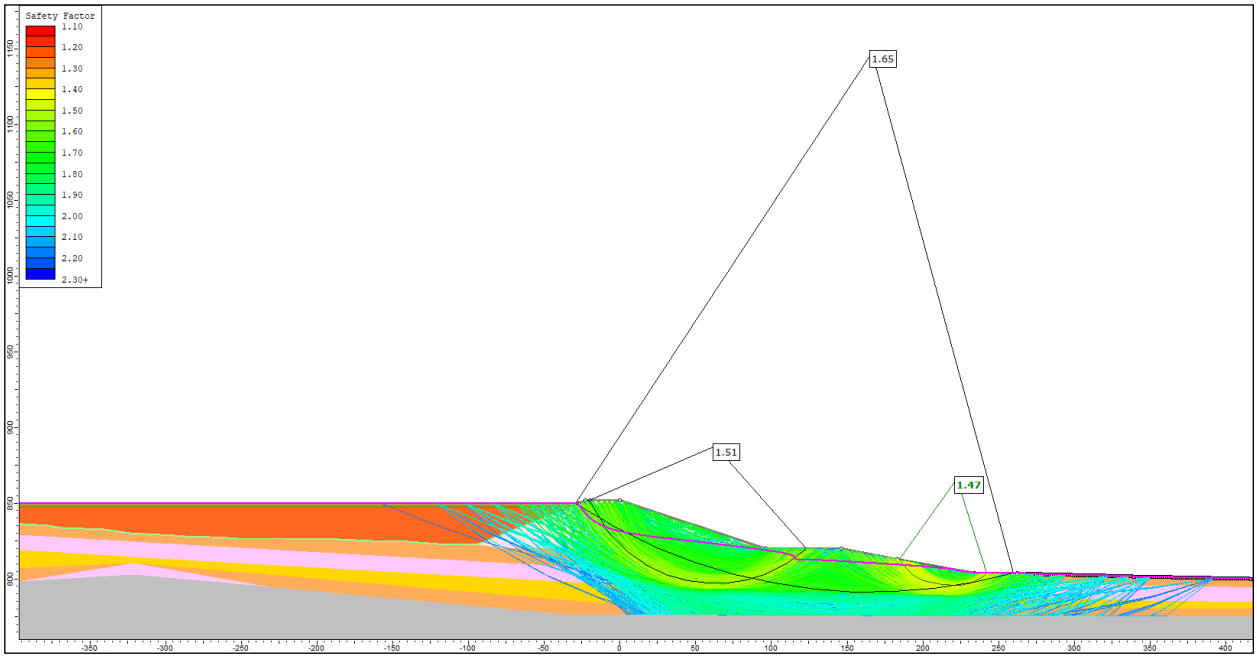


Figure A-80: EMP-01. Static condition. Sensitivity assessment. Liner Failure.

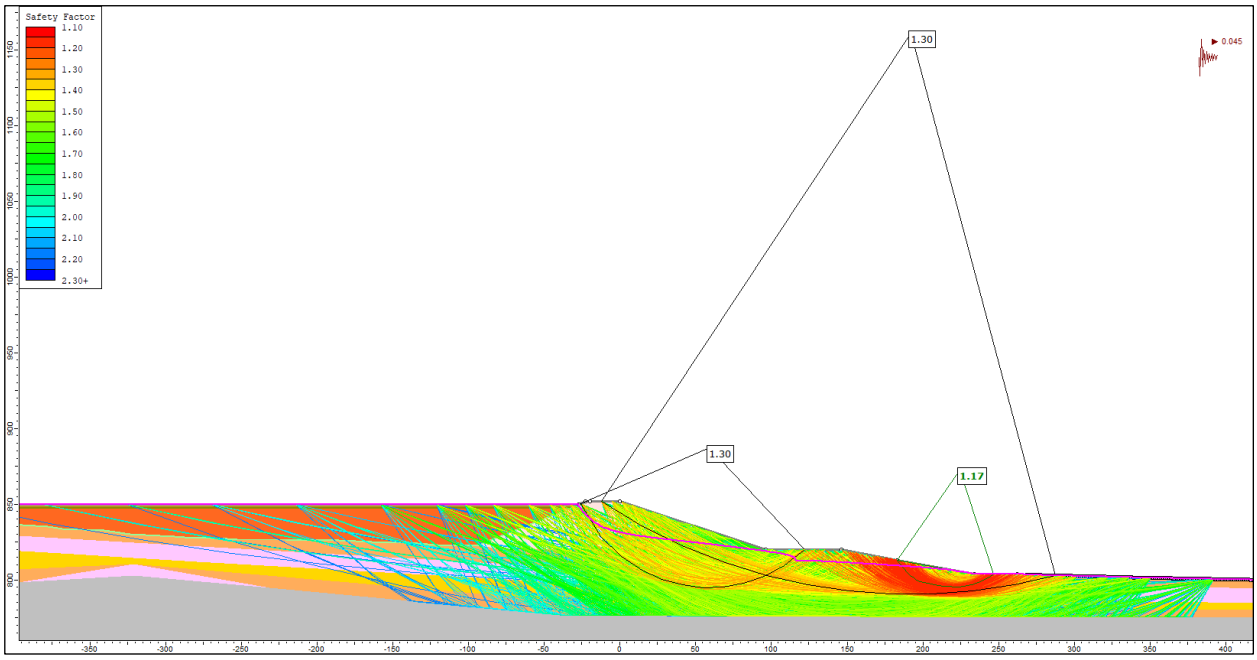


Figure A-81: EMP-01. Pseudo-static condition. Sensitivity assessment. Liner Failure.

C.4-2.2 – EMP-01 – Liner failure with chimney drain

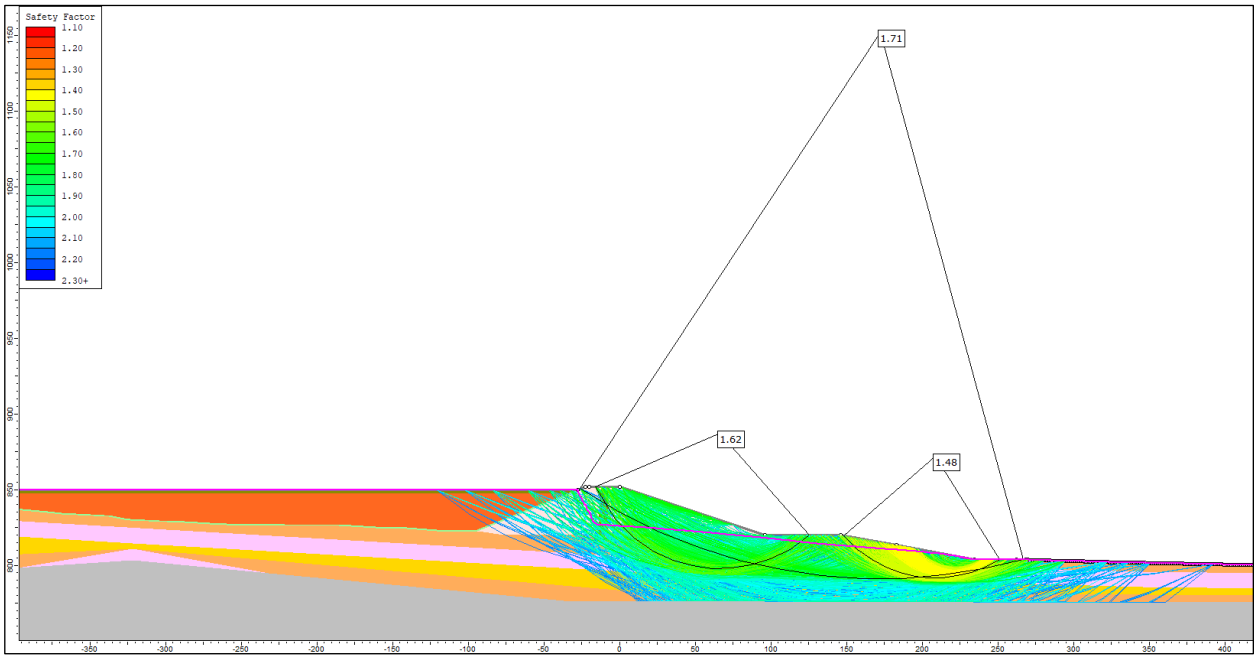


Figure A-82: EMP-01. Static condition. Sensitivity assessment. Liner Failure with Chimney Drain.

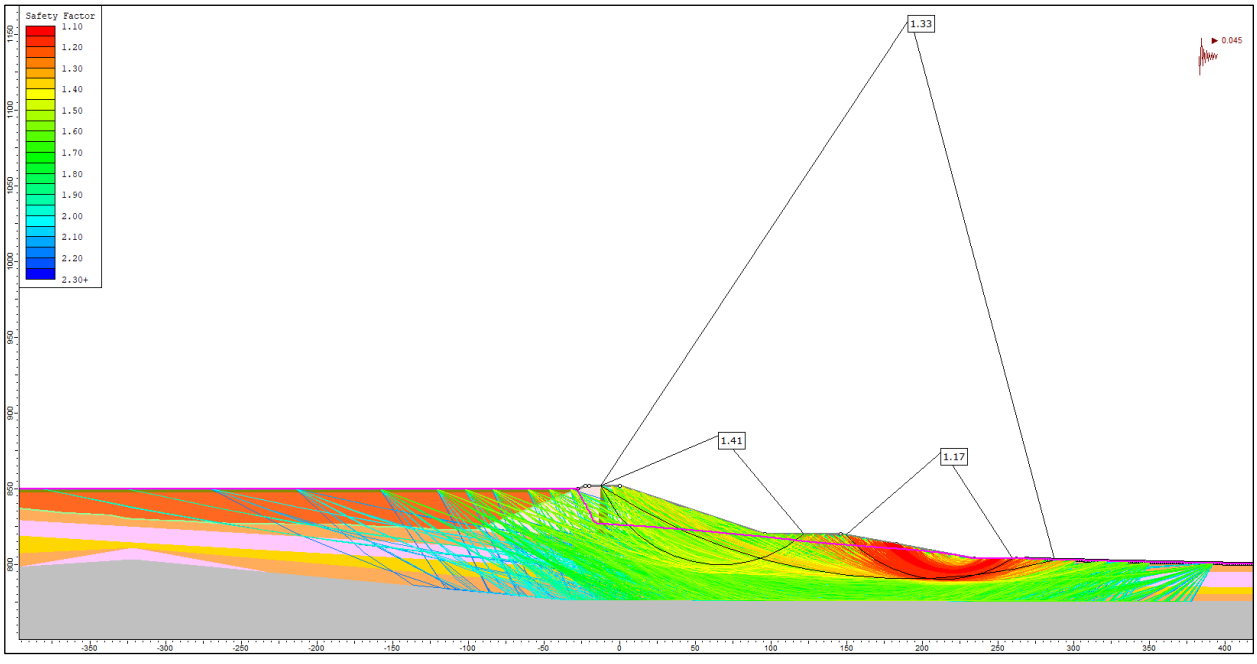


Figure A-83: EMP-01. Pseudo-static condition. Sensitivity assessment. Liner Failure with Chimney Drain.

C.4-3 – East Management Pond (EMP) – Section EMP-02

C.4-3.1 – EMP-02 – Liner failure

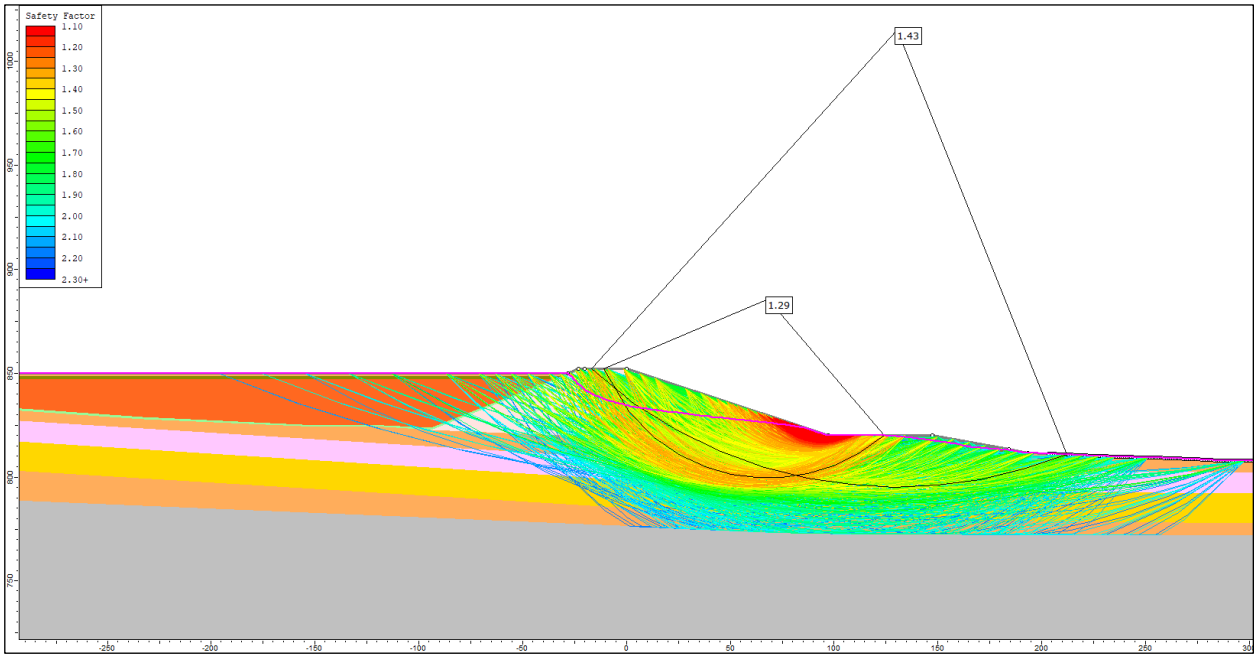


Figure A-84: EMP-02. Static condition. Sensitivity assessment. Liner Failure.

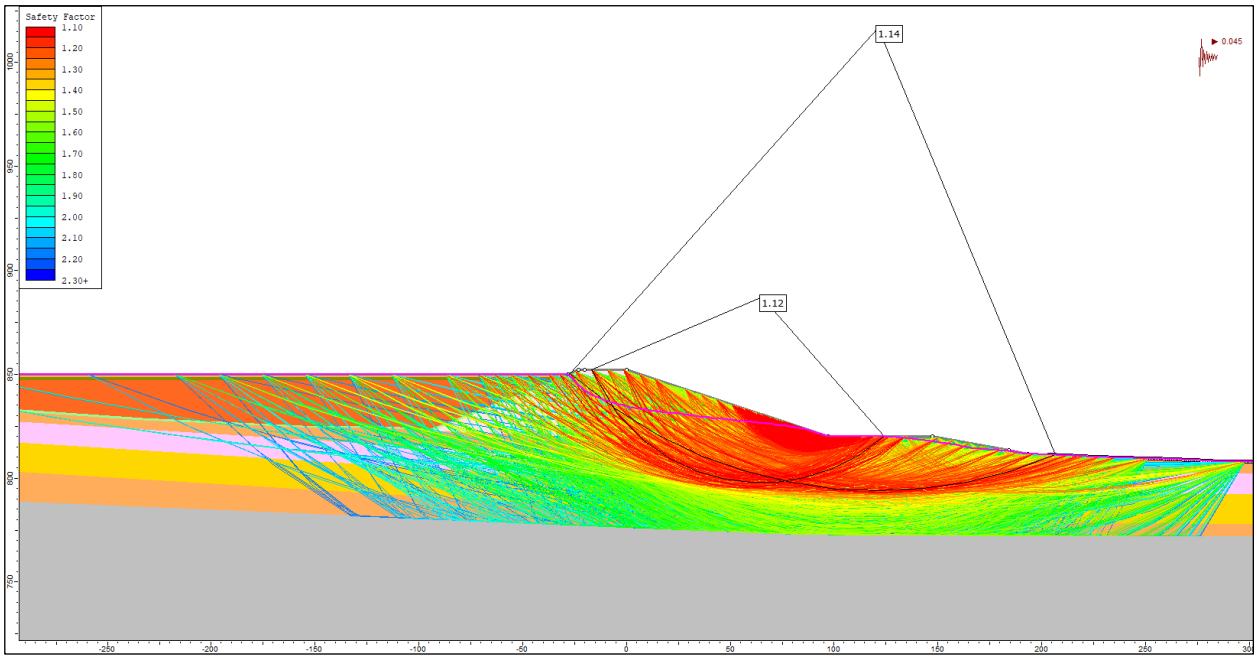


Figure A-85: EMP-02. Pseudo-static condition. Sensitivity assessment. Liner Failure.

C.4-3.2 – EMP-02 – Liner failure with chimney drain

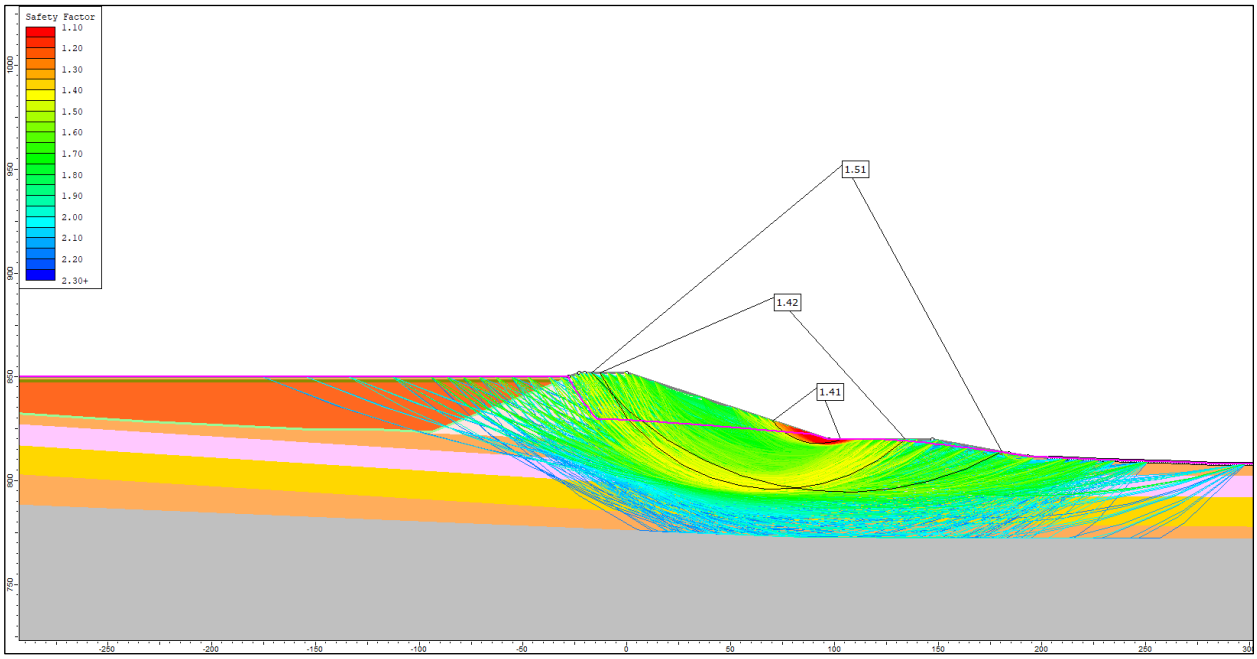


Figure A-86: EMP-02. Static condition. Sensitivity assessment. Liner Failure with Chimney Drain.

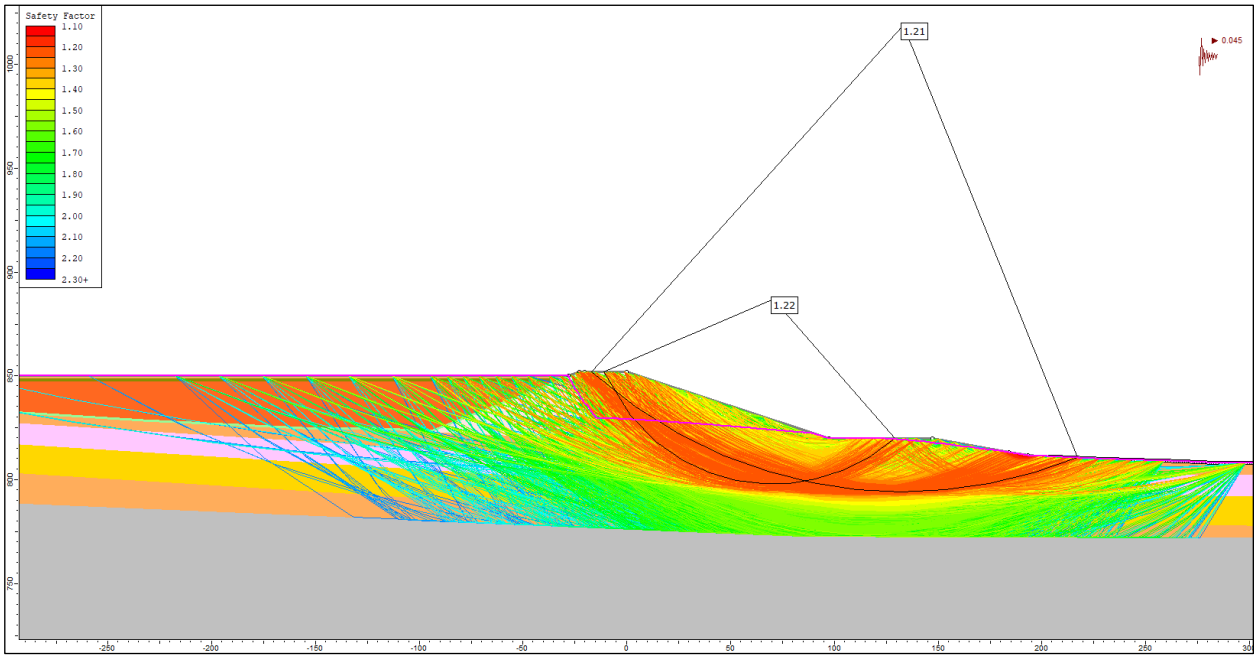


Figure A-87: EMP-02. Pseudo-static condition. Sensitivity assessment. Liner Failure with Chimney Drain.

APPENDIX 19: TENAS PROJECT DAM BREACH ASSESSMENT REPORT, SRK

FINAL

Tenas Project Dam Breach Assessment Report

Tenas Project, Telkwa, BC, Canada
Telkwa Coal Limited



SRK Consulting (Canada) Inc. ▪ 1CT027.003 ▪ April 2021

srk consulting

FINAL

Tenas Project Dam Breach Assessment Report

Tenas Project, Telkwa, BC, Canada

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File Name:
Telkwa_DamBreach_Report_FINAL_1CT027-003_04072021_revF_nf_mjm_sab.docx

Suggested Citation:
SRK Consulting (Canada) Inc. 2021. Tenas Project Dam Breach Assessment Report. FINAL. Prepared for Telkwa Coal Limited: Telkwa, BC. Project number: 1CT027.003. Issued April. 2021.

Cover Image(s):
Proposed North Management Pond area during drilling. Credit: Kyle Scale, February 17, 2021.

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The opinions expressed in this document have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. While SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

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Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

CDA	Canadian Dam Association
EA	Environmental Assessment
EMP	East Management Pond
GISTM	Global Industry Standard on Tailings Management
NAG	Non-acid generating
NMP	North Management Pond
PAG	Potentially acid generating
PMF	Probably maximum flood
Project	Tenas Project
Q200	1-in-200-year flood
SRK	SRK Consulting (Canada) Inc.
SRTM	Shuttle Radar Topography Mission
TCL	Telkwa Coal Limited
TCP	Tenas Control Pond
CPP	Coal Processing Plant
WMP	West Management Pond

Executive Summary

An inundation model was developed to simulate the effects of a dam breach event on areas downgradient of the Tenas Project's Management and Tenas Control Ponds, particularly the Village of Telkwa and the Maintenance Infrastructure Complex containing the Coal Processing Plant, Maintenance Facility and Mine Administration Building. A dam breach may also affect natural areas close to the site, including Tenas, Goathorn, and Four Creeks, and the Telkwa and Bulkley Rivers.

A cascade failure of the embankments corresponding to the West and North Management Ponds and the Tenas Control Pond was investigated, as well as the individual failure of the East Management Pond's dam. Incremental breach effects were assessed under fair-weather conditions (sunny-day), as well as under flood conditions (rainy-day). Flood depths, water velocities, and arrival times are provided, and the hazard for populations at risk is estimated.

Model inputs were developed based on the mine plan as of December 2020, topography, surface roughness estimates, regional hydrology, and methods from literature. There is much uncertainty surrounding inundation predictions, as the model does not account for sediment and debris transport, scouring, and hydraulic structures and infrastructure that may affect flow direction. Uncertainty and variability in predictions must be considered if using the results of the analysis for emergency response and action planning.

Results of the analysis estimate that up to 200 additional people may be put at risk due to the potential breach scenarios described, as compared to a no-breach scenario. The sunny-day breach scenarios have marginally higher incremental effects, as the total effects from a flood-induced scenario are largely driven by the flood itself. Effects on buildings, roadways, and bridges may be minor to moderate, and may result in temporary economic losses and reparation costs. Some damage to aquatic and terrestrial habitats will occur, but restoration is possible and this damage will be temporary in nature.

Based on the analysis, all four dams considered have been given a hazard classification of 'Very High', in accordance with Canadian Dam Association guidelines.

1 Introduction

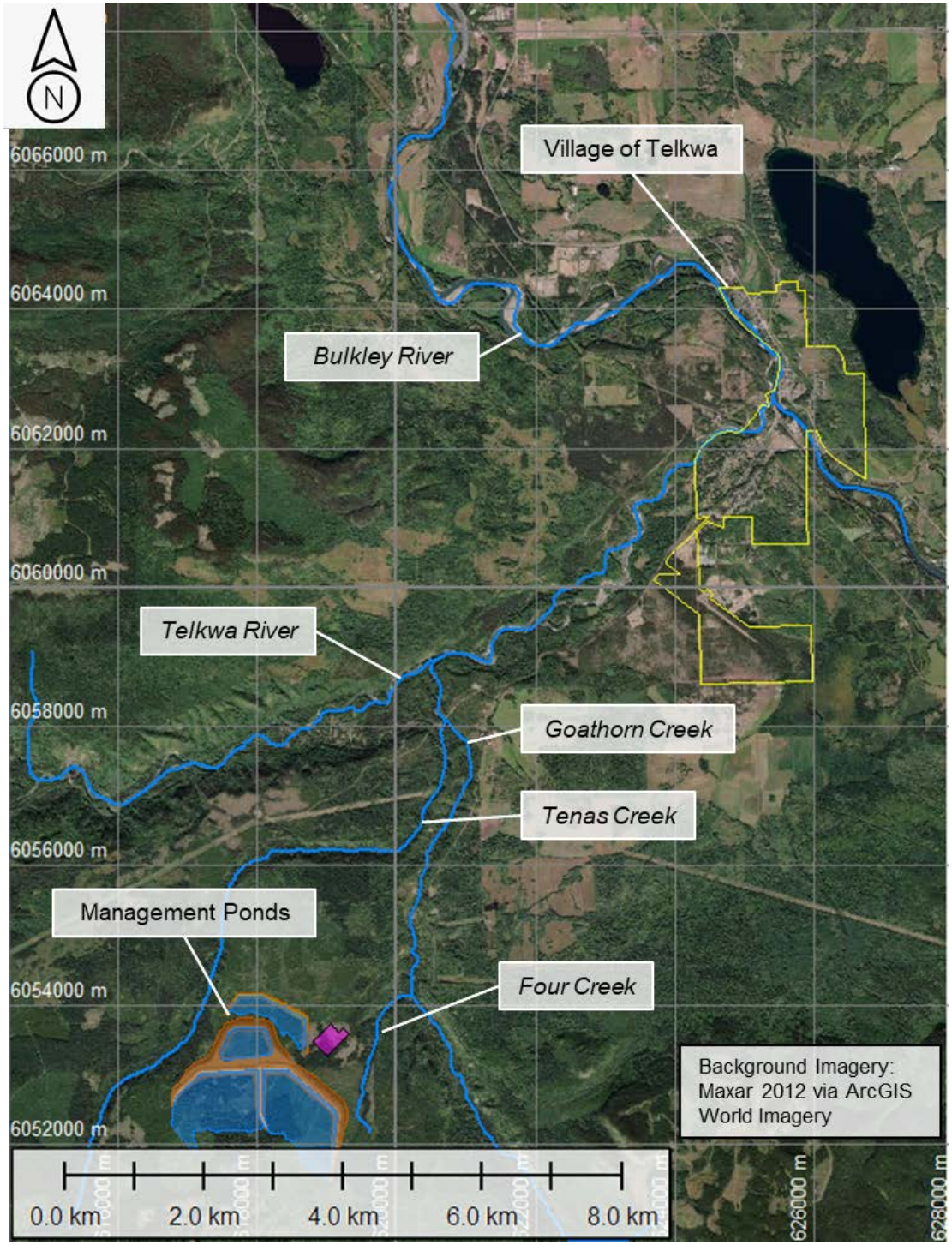
Telkwa Coal Limited (TCL) is proposing to develop the Tenas Project (the Project) in northwest British Columbia. The site is located approximately 25 kilometres (km) southwest of the town of Smithers within the Telkwa River watershed and will comprise of an open pit, backfill, external stockpiles, management ponds, control ponds, the Mine Infrastructure Complex and rail infrastructure pad. The Tenas Project's total mine life is approximately 25 years including construction, operations, decommissioning, and reclamation phases.

SRK Consulting (Canada) Inc. (SRK) has been retained to conduct a dam break assessment to evaluate the potential downstream flooding conditions resulting from failure of the dams associated with the management ponds. Results will support water management designs being completed for the Environmental Assessment Certificate (EAC) application, inform dam classification according to the Canadian Dam Association (CDA) guidelines, and will be incorporated into the Emergency Response Plan.

1.1 Site Description and Plan

The dam breach assessment extents encapsulate areas directly downgradient of the potential breach locations, areas along streams leading to the key receptors, and areas containing the key receptors. Figure 1-1 provides an aerial view of the project area, showing the site water management facilities, as well as the locations of the streams along which water released from the dams may travel. There are three creeks of interest, as well as the Telkwa River and Bulkley River. The nearby Village of Telkwa is located at the confluence of the Telkwa and Bulkley Rivers, approximately 11 km northeast of the Project's mine site.

Figure 1-1: Dam Breach Analysis Site Plan



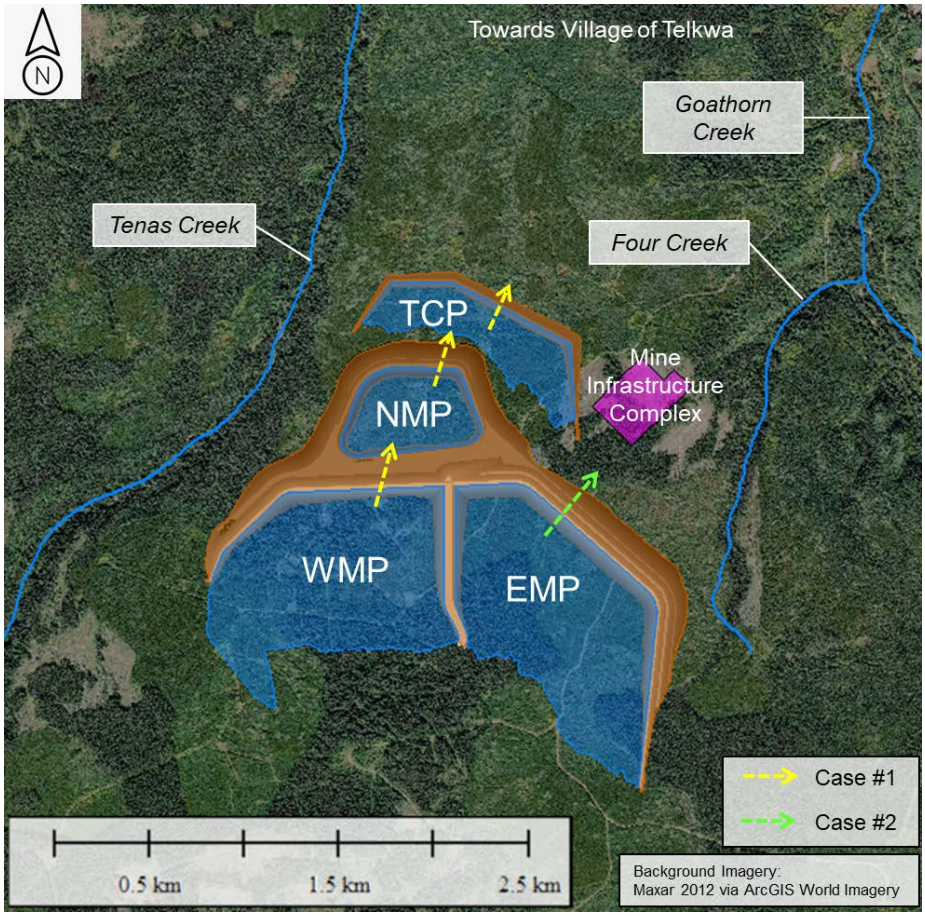
Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

There are four water management facilities of interest to the Dam Breach analysis as shown in Figure 1-2:

1. Tenas Control Pond (TCP)
2. North Management Pond (NMP)
3. East Management Pond (EMP)
4. West Management Pond (WMP)

The three management ponds serve as potentially acid generating (PAG) rock and processed rock storage facilities with approximately 2 metres (m) of water cover maintained during operations, decommissioning and reclamation and post closure phases of the Project. Non-acid generating (NAG) rock will be placed over the PAG rock as cover, followed by overburden material to an elevation above the proposed water level. The NMP is scheduled to be constructed, filled, and covered early in the life of mine, followed by the EMP, and then by the WMP. The TCP is located downstream of the management ponds and collects overflow from the ponds and surface runoff from upslope mine infrastructure.

Figure 1-2: Management and Control Pond Site Plan



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

1.2 Scope of Work

The purpose of the dam breach assessment is to estimate the incremental consequences to key receptors downstream of the ponds resulting from embankment failure, the scope of which includes:

- identification of key risk receptors,
- assessment of credible failure modes,
- calculation of dam breach parameters and hydrographs,
- simulation of breach scenarios and production of inundation and hazard maps, and
- assessment of results to determine impacts of the potential dam breach.

The following two critical failure cases were assessed in the detailed dam breach study, and are shown previously by Figure 1-2:

1. Cascade failure of the West Dam, North Dam, and Tenas Dam, for which the key receptor is the Village of Telkwa and is shown by the yellow line on Figure 1-2.
2. Failure of the East Dam northeastward towards Four Creek, for which the key receptor is the Mine Infrastructure Complex, with some consideration given to the Village of Telkwa and is shown by green line on Figure 1-2.

The breach scenarios are determined by evaluating the mine plan for the worst-case conditions for failure during the life of mine.

In recent years, there have been a large number of long runout flow slides from Rocky Mountain coal mine waste dumps. The waste dumps are constructed as end-dumped fills with an angle of repose of 38°. Dump heights range between 100 and 400 m. The dumps are normally founded on mountain slopes that are covered with a thin veneer of granular colluvial and dense stony till materials (Dawson et al., 1998). Given the design heights of waste rock within the Management Ponds, the relatively flat ground beneath the ponds themselves, and the containment within an earthen dam, the liquefaction of neither the rock stored in the ponds nor the rock used in the dam fill is likely to occur.

The rock material stored in the ponds is therefore not expected to significantly affect inundation predictions. Additionally, the quantity of overburden from the dam that can mobilize during a breach event is considered insignificant compared to the quantity of water. Therefore, sediment transport modelling was not included in the inundation study, as the effects of a dam breach will be principally governed by the release of water, rather than eroded overburden from the embankments or stored rock material.

Water in the ponds may either be pore water that saturates the voids in the waste material, or free water which covers the mine rock. In the event of a breach, the pore water is expected to flow out relatively slowly compared to the free water and will therefore have a negligible effect on the peak flow from the breach and incremental flood effects. The breach parameters were therefore calculated based only on the free water present during the worst-case scenarios.

Sensitivity analyses were also completed to understand the effects of changes to breach and modelling parameters on inundation predictions.

2 Dam Breach Inputs

2.1 Dam Information and Geometry

The dams are to be constructed with coarse NAG waste rock and locally sourced overburden which comprises well-graded sands, silts, and gravels near the surface, with larger quantities of fine sands at greater depths. The embankment foundation consists of similar soils, and the North, East, and West dams will be supported by buttresses (SRK 2021a).

The embankment geometry for each dam at the critical failure scenario was compiled based on mine plan drawings and topographic data from the 2018 LiDAR survey of the Project area, and are summarized in Table 2-1. Storage volumes were estimated based on pond stage-storage relationships, developed using site topography and embankment surfaces provided by TCL. Summary elevation-storage tables are provided in Appendix A.

Table 2-1: Water management pond dam embankment geometry

Parameter	Unit	Critical Failure Case #1			Critical Failure Case #2
		West Dam	North Dam	Tenas Dam	East Dam
Crest length	m	1511	1173	1876	3225
Typical crest width	m	9	14.5	10	9
Overall upstream slope	-	2.5H:1V	2.5H:1V	2.5H:1V	2.5H:1V
Overall downstream slope	-	3.0H:1V	3.0H:1V	3.0H:1V	3.0H:1V
Maximum embankment height	m	37	27	18	40
Outlet elevation	masl	851	830	801	851
Crest elevation	masl	852	831	802	852
Rock fill elevation in worst-case scenario	masl	847	828	N/A	845
Total storage to outlet invert	m^3	35,151,000	3,800,800	1,936,600	16,379,300
Total storage to dam crest	m^3	36,211,900	4,119,000	2,292,100	17,514,600
Rock fill volume in worst-case scenario	m^3	31,108,800	3,239,600	N/A	10,120,000

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Telkwa_DamBreach_Inputs_1CT017-003_rev04_nf.xlsm

Note: Final mine plan designs have since reduced the dam crest elevations to 850 masl for the EMP and WMP and 800 masl for the TCP. Dam breach assessments continue to use higher dam crests, resulting in a more conservative dam breach hydrograph for the purpose of dam classification.

2.2 Topography

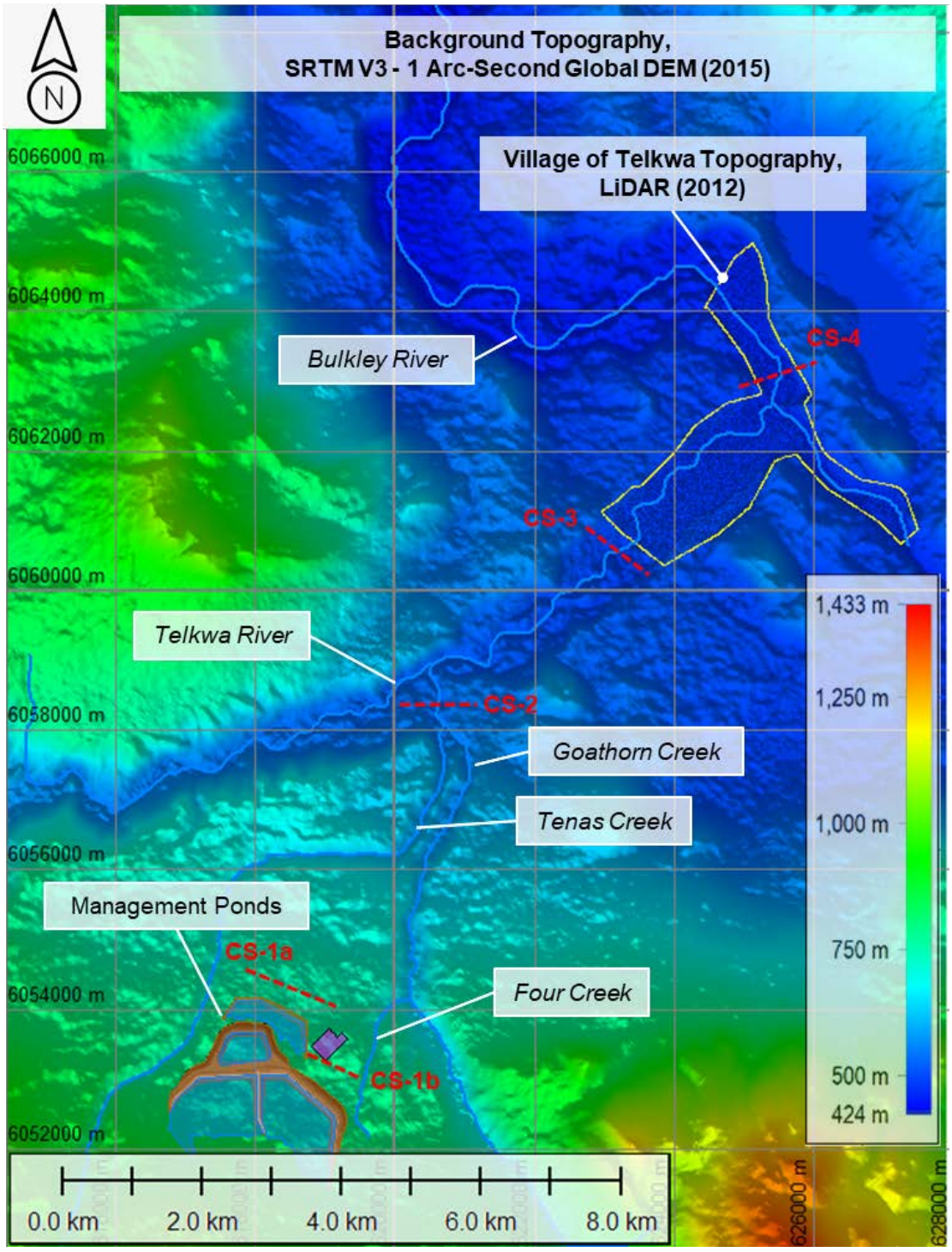
Detailed 2020 LiDAR topography for the site was provided by TCL, with a resolution of 1 m, which was used to develop pond storage-elevation curves and determine fill elevations in the facilities. To guarantee

full coverage of the computational area, the SRTM (Shuttle Radar Topography Mission) 1 arc-second global digital elevation model (DEM) Version 3.0 was used for the majority of the study area, including areas immediately downgradient of the breach locations and along streams flowing towards the Village of Telkwa (USGS, 2020).

For added resolution within the Village of Telkwa, the SRTM surface was merged with 2012 topography data which was used in a flood inundation study completed on behalf of the village by Golder Associates Inc. (2019), which has a resolution of 1 m.

The SRTM and 2012 topography data (Village of Telkwa, 2020) were reasonably well-matched, but some minor feathering was required to smoothly transition between the two surfaces. No other erroneous topographical features that would adversely affect the modelling were perceived within the data. The grid cell size chosen for the model was 50 m by 50 m, in order to accommodate the resolution of the SRTM data.

Figure 2-1: SRTM and 2012 Digital Elevation Data Extents



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

2.3 Hydrology

Peak stream flows are summarized in Table 2-2, and represent the reasonable worst-case natural flows in the five streams affected by the breaches. For streams that have tributaries that are also modelled in the list, the tributary flows are subtracted from the post-confluence total flow values, making the flows in Table 2-2 additive. This way, the streams may combine within the model without double-accounting for any flows.

Flows corresponding to the probable maximum flood (PMF) values are given for Four Creek, Goathorn Creek, and Tenas Creek, and were determined through rainfall-driven runoff modelling in HEC-HMS, consistent with methodologies outlined in the Tenas Project – Mine Site Water Management Design Technical Report (SRK 2021b) and Hydrometeorological Baseline Report (SRK 2021c). The 1-in-200 year flood events are used for the reasonable worst-case in the Telkwa and Bulkley Rivers in lieu of the PMF, and were determined with a frequency analysis of historical Water Survey of Canada records (SRK 2021c).

Table 2-2: Stream flow estimates for worst-case flood conditions

Return Period	Peak Flow (m^3/s)
Tenas Creek: PMF	168.0
Goathorn Creek: PMF	335.0
Four Creek: PMF	30.0
Telkwa River: 1-in-200 year	561.0
Bulkley River: 1-in-200 year	982.4

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Inflow Hydrographs\DamBreak_inflowHydrographs.xlsx

In addition to the in-stream flow conditions, the catchment areas and associated runoff contributions to the WMP and EMP were calculated based on inputs and assumptions consistent with SRK 2021b and 2021c, and added to the operating water cover to create the total stored water volume under worst-case conditions. Table 2-3 summarizes additional hydrological inputs applied to the breach configurations.

Table 2-3: Pond hydrological inputs

Parameter	Unit	Critical Failure Case #1 West Dam	Critical Failure Case #2 East Dam	Assumptions/Comments
1-in-100 wet year precipitation	mm	822		1-in-100 wet year precipitation
Worst-case contributing catchment area	km^2	2.4	4.2	Assumes upstream hydraulic structures have failed.
Conservative runoff coefficient	-	1	0.8	All pit runoff reports to the WMP. EMP receives majority of runoff from upstream natural catchments. Natural

Parameter	Unit	Critical Failure Case #1 West Dam	Critical Failure Case #2 East Dam	Assumptions/Comments
				runoff coefficient calculated to be 0.36 (SRK 2021c)
1-in-100 wet year inflow volume	m^3	1,600,000	2,900,000	Assumes volume from 1-in-100 wet year precipitation is added to total stored water in ponds.

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Telkwa_DamBreach_Inputs_1CT017-003_rev04_nf.xlsm

2.4 Key Downstream Receptors

Table 2-4 provides descriptions for specific downstream receptors of particular concern for the dam breach analysis, categorized according to CDA (2013) guidelines.

Table 2-4: Key receptors assessment

Category	Receptor	Critical Failure Case	Comments
Population	Residents of the Village of Telkwa and surrounding areas	1, 2	The Village of Telkwa is located approximately 11 km downstream of the water management ponds. It is the closest township to the site, and likely to be at risk due to inundation from a breach. The village is situated at the confluence of the Telkwa and Bulkley Rivers, with buildings located within the river floodplains.
	TCL Personnel	2	TCL personnel are anticipated to operate within the Mine Infrastructure Complex area at all times, and would be at risk should the East Dam fail in its northeastern section. Approximately 80 people are expected to occupy the area at the worse case during shift change.
Environmental	Trees/Habitat	1, 2	The undeveloped inundation area outside of the creek channels generally consists of forested terrain. Restoration of the habitat would be possible.
	Fish and Aquatic Habitat	1, 2	The creeks downslope of the mine site, as well as the Telkwa and Bulkley Rivers, provide a habitat for various fish and other aquatic species.
Cultural	Residents of the Village of Telkwa and surrounding areas	1, 2	Regional heritage sites and tourism in the Village of Telkwa may be affected by a breach event.
Infrastructure	Road bridge over Bulkley River (Telkwa Coalmine Rd to Riverside St crossing)	1, 2	A bridge crosses the Bulkley River and is located close to the junction of the Telkwa and Bulkley Rivers. It is the traversing location for vehicular traffic within the Village of Telkwa.

Category	Receptor	Critical Failure Case	Comments
	Railway bridge over Telkwa River	1, 2	A railway bridge crosses the Telkwa River close to the junction of the Telkwa and Bulkley Rivers. The railway serves both freight and public transport trains.
	Aveling/Telkwa Coalmine Rd	1, 2	Access road running alongside the Telkwa River to the Village of Telkwa.
	Highway 16	1, 2	Freeway alongside the Bulkley River, through the Village of Telkwa.
	Town roads	1, 2	Non-major roadways within the Village of Telkwa.
	Buildings and residential homes	1, 2	Encompasses the residential, commercial, and industrial edifices near and within the Village of Telkwa.

Sources: Compiled in text.

3 Dam Breach Model Development

The dam breach assessment was modelled using FLO-2D software (FLO-2D, 2019). The software applies the finite difference technique for overland flow routing by means of mass and momentum conservation. The outputs from the model can also be exported as shapefiles that can be viewed in GIS programs.

The development of the model comprised the following steps detailed in this section:

- Determination of the failure modes and breach locations for the critical cases
- Estimation of the volume released in the breach
- Valuation of the breach parameters and outflow hydrographs
- Routing of the downstream flood

3.1 Failure Modes and Breach Locations

In accordance with the CDA Guidelines (2013), the dam breaches and the associated discharge hydrographs are evaluated under two hydrologic conditions:

- **“Sunny-day” failure** – “a sudden dam failure that occurs during normal operations”, which may be “caused by internal erosion, piping, earthquakes, mis-operation leading to overtopping, or another event”.
- **Flood-induced or “rainy-day” failure** – “a dam failure resulting from a natural flood of a magnitude that is greater than what the dam can safely pass”.

There are several credible failure modes for embankment dams, the most common of which are overtopping failures due to inadequate spillway capacities and/or large flood event, piping failures due to concentrated internal erosion of the dam, and foundation-related failures such as slippage or settlement. The failure modes have been assumed based on knowledge of the dam structures, construction schedules, and engineering judgement and previous dam failures that have occurred.

Along the lengths of the embankments, the breach locations were chosen to achieve the highest incremental effects for the key receptors. For the West, North, and Tenas Dams, the breach location must be in the north to north-east portions to simulate the cascade failure case that eventually reports to the Village of Telkwa. The breach location for the East Dam was chosen for the greatest impact to the MIC, which is the northeastern section of the dam.

3.1.1 Sunny-Day Breach

A sunny-day failure occurs during normal operations, with the most likely failure mode for the dams being piping failure. The likelihood of foundational failures in the management pond dams is further mitigated by the structural support from the buttresses, and the spillways are to be designed to prevent overtopping from flood events that are credibly expected to occur during operations.

The most likely failure location is typically near the dam crest, and/or where the embankment slopes are steepest, as these areas would have the maximum hydraulic gradient for free water retained in the facilities. The breach is not expected to extend significantly below the elevation of the rock fill in the ponds, therefore the maximum breach height is approximated by the depth of the free water in the pond.

The sunny day breach scenarios assume that mean annual flow conditions are occurring in the catchments with flow in the streams, whose flood extents are accounted for in the topography.

3.1.2 Rainy-Day Breach

The rainy-day breach occurs under conditions of exceptional flow due to large storm events. In the event of flows exceeding the spillway design criteria, the ponds would overtop the embankments resulting in overtopping failure. Piping failure is also a possibility, but the breach in either case would originate at or close to the dam crest.

In order to assess the incremental effects of a breach, two rainy day scenarios are modelled – both will have PMF or 1-in-200 year flows (summarized in Table 2-1). One model includes the breach while the other does not. Comparing the two sets of results allows separation of breach-related effects from storm event-related effects.

3.2 Breach Volumes

The critical failure conditions for each dam in the two main failure cases are summarized in this subsection, which includes cross-sectional diagrams of the dams with free water depths relative to the dam heights.

3.2.1 Critical Failure Case #1

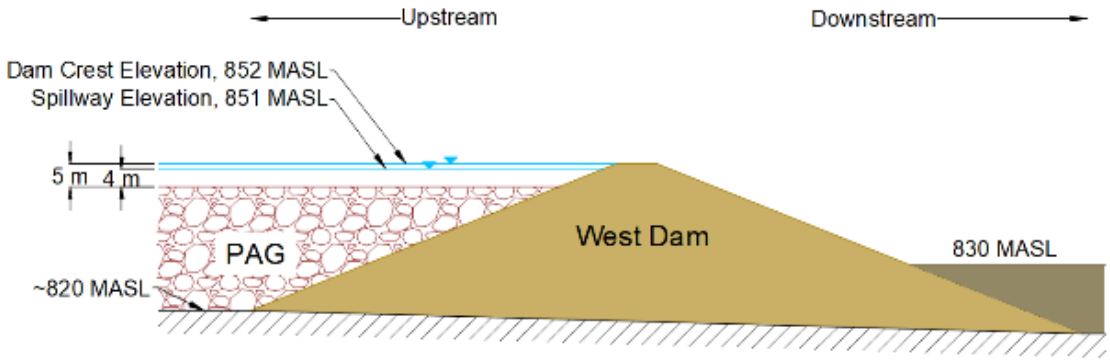
West Dam

Construction of the WMP is not expected to begin until later in the mine life, after which PAG filling and dam raising will occur incrementally until the dam is completed. According to the mine plan, the maximum volume of free water in the pond occurs after the dam has been raised to the maximum elevation.

Under typical operating conditions, the completed WMP (Figure 3-1) is not expected to have more than 2 m of water cover over the PAG waste rock, and lengthy periods of time without pump-controlled discharge from the pond is unlikely to occur. The maximum volume with the highest hydraulic gradient occurs when the stored water is at the spillway elevation. For the purpose of modelling critical conditions, an additional volume of water equal to the total runoff from upslope catchments during a 1-in-100 wet year was included in the facility addition to the 2 m typical water cover.

The total breach height in the West Dam with the additional 100-year wet runoff contributions (Table 2-3) is 4 m for the sunny day failure, corresponding to approximately 4.0 million cubic metres (Mm^3) of free water in the WMP. The breach height for the rainy-day overtopping failure is 5 m (5.1 Mm^3 stored), which occurs when the water level reaches and overtops the dam crest elevation during a large flood event.

Figure 3-1: West Dam cross-section in the critical case



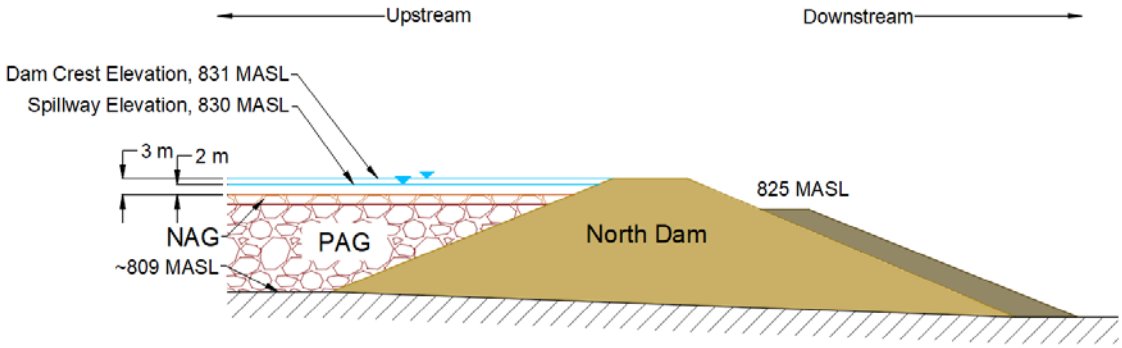
Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Dam Cross-Sections

North Dam

At the time of completion for the WMP, the filling of the NMP will have already been completed, including NAG rock cover over the PAG waste rock. For the failure case, it is assumed that the planned overburden cover will not have been placed in the facility, allowing a larger volume of water to be stored in the NMP and therefore released during the breach scenario.

The breach height for the sunny-day failure will comprise the water cover of 2 m (0.56 Mm^3), which will be 3 m (0.88 Mm^3) for the rainy-day failure.

Figure 3-2: North Dam cross-section in the critical case



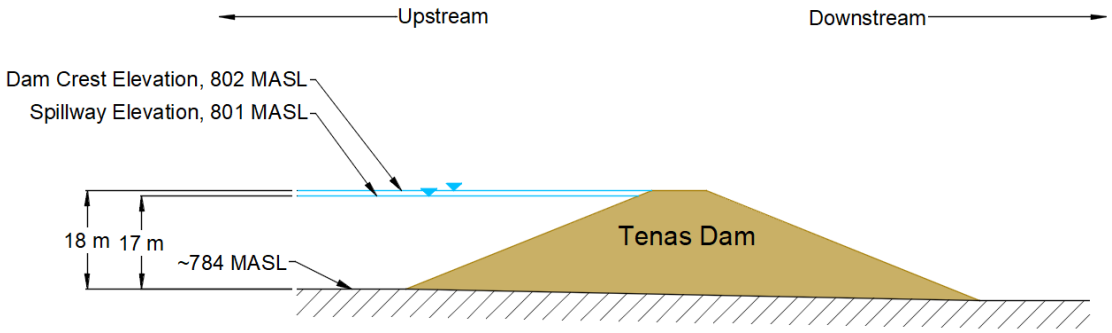
Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Dam Cross-Sections

Tenas Control Pond Dam

It is assumed that the water level in the TCP is up to the spillway elevation at the start of a sunny day failure. Since TCP is a settling pond, there will be no rock storage resulting in maximum breach height equal to the entire height of the dam.

The sunny and rainy-day breach heights are therefore 17 m (1.9 Mm^3) and 18 m (2.3 Mm^3) respectively.

Figure 3-3: Tenas Dam cross-section in the critical case



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Dam Cross-Sections

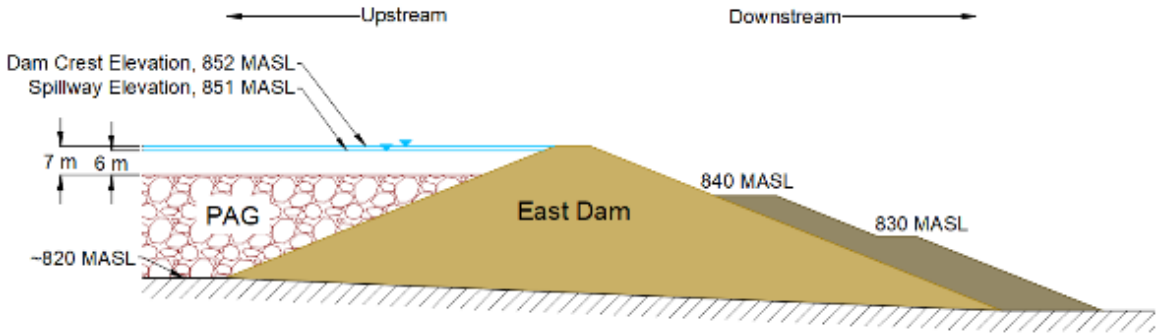
3.2.2 Critical Failure Case #2

East Dam

The second failure case assesses the failure of the East Dam towards the MIC. The approach to determining the critical failure conditions for the East Dam is the same as for the West Dam, where 2m of water cover and one year of 1-in-100 wet year runoff is stored at the time of breach (Table 2-3).

It then follows that the sunny and rainy-day breach heights are 6 m (6.3 Mm^3) and 7 m (7.4 Mm^3) respectively.

Figure 3-4: East Dam cross-section in the critical case



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Dam Cross-Sections

3.3 Dam Breach Hydrographs

The dam breach hydrographs are determined from parameters calculated using empirical equations that were developed through the assessment of case histories from past water-retaining embankment breaches. The equations from Froehlich (1995) and Froehlich (2008) were applied, and the resulting breach parameters for the sunny day breach are presented in Table 3-1, and the rainy day breach parameters are presented in Table 3-2.

The peak flows are relatively high due to the large volumes of water released. The formation times are slower (up to 2 hours) for breaches with relatively high volumes but relatively low breach heights, and faster for facilities with relatively low volumes with relatively high breach heights. The Tenas Dam can be expected to empty in as little as 12 to 30 minutes. The rainy-day peak flows are higher than the sunny-day flows, with a shorter breach formation time.

Table 3-1: Sunny day dam breach parameters

Parameter	Unit	Critical Failure Case #1			Critical Failure Case #2
		West Dam	North Dam	Tenas Dam	East Dam
Dam Type		Rock-filled	Rock-filled	Rock-filled	Rock-filled
Failure mode		Piping	Piping	Piping	Piping
Breach height	m	4	2	17	6
Free water volume	m^3	4,042,200	561,200	1,936,600	6,259,300
Individual dam breach peak flow	m^3/s	300	71	1500	570
Total breach case peak flow[1]	m^3/s		1871		570
Formation Time[2]	hr	1.8 (2.8)	1.1 (2.1)	0.2 (0.5)	1.5 (2.3)

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Telkwa_DamBreach_Inputs_1CT017-003_rev04_nf.xlsm

Notes:

[1] Peak flow for cascade failure assumed to equal peak flow from all contributing dams.

[2] Approximate value from fitting peak flow and volume to hydrograph is presented; calculated value from empirical equations in parenthesis.

Table 3-2: Rainy day dam breach parameters

Parameter	Unit	Critical Failure Case #1			Critical Failure Case #2
		West Dam	North Dam	Tenas Dam	East Dam
Dam Type		Rock-filled	Rock-filled	Rock-filled	Rock-filled
Failure mode		Overtopping	Overtopping	Overtopping	Overtopping
Breach height	m	5	3	18	7
Free water volume	m^3	5,103,100	879,400	2,292,100	7,394,600
Individual dam breach peak flow	m^3/s	430	130	1600	720

Parameter	Unit	Critical Failure Case #1			Critical Failure Case #2
		West Dam	North Dam	Tenas Dam	East Dam
Total breach case peak flow[1]	m^3/s	2160			720
Formation Time[2]	hr	1.6 (2.5)	0.9 (1.8)	0.2 (0.5)	1.4 (2.2)

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Telkwa_DamBreach_Inputs_1CT017-003_rev04_nf.xlsm

Notes:

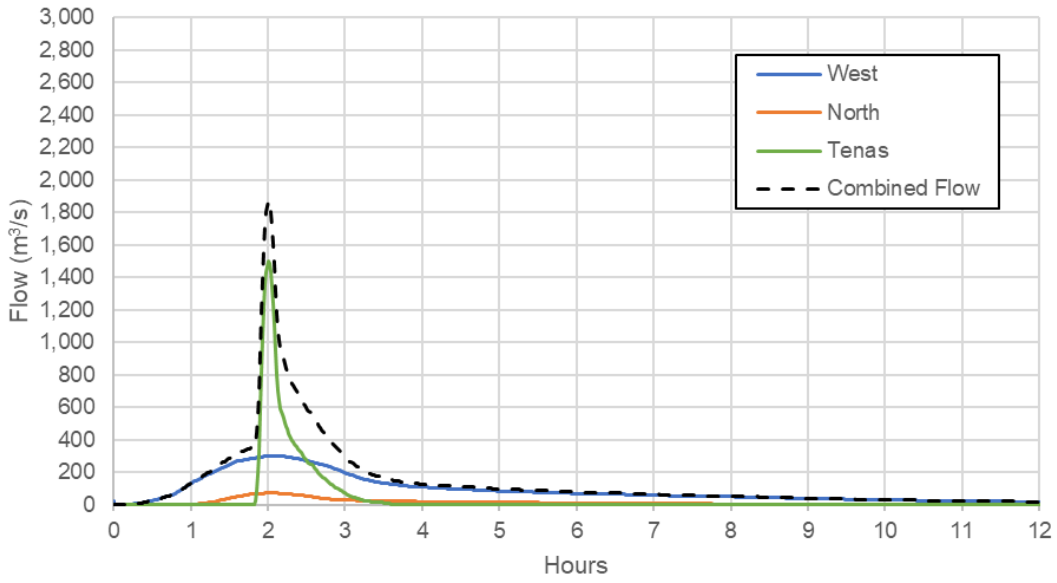
[1] Peak flow for cascade failure assumed to equal peak flow from all contributing dams.

[2] Approximate value from fitting peak flow and volume to hydrograph is presented, calculated value from empirical equations in parenthesis.

The breach hydrographs were prepared using an approximate log-normal distribution fitted to match the total volume released and calculated peak flow. The hydrographs representing the cascade failures were obtained by super-imposing the hydrographs from the contributing dams with the peaks aligned (Figure 3-5 for sunny-day; Figure 3-6 for rainy-day).

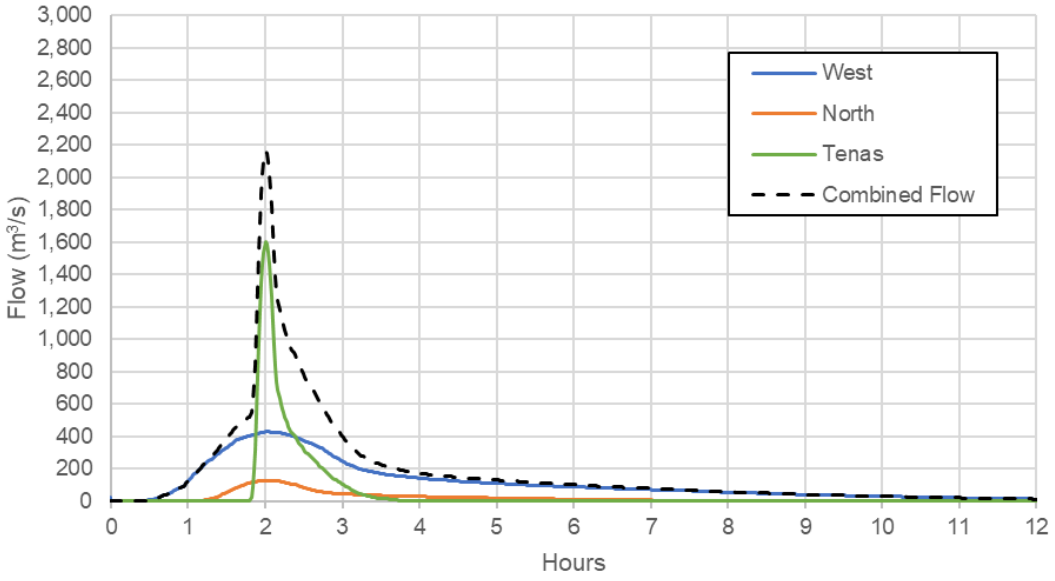
The hydrographs for the sunny and rainy-day failures for the East Dam are plotted in Figure 3-7.

Figure 3-5: Sunny day breach outflow hydrograph for Critical Failure Case #1



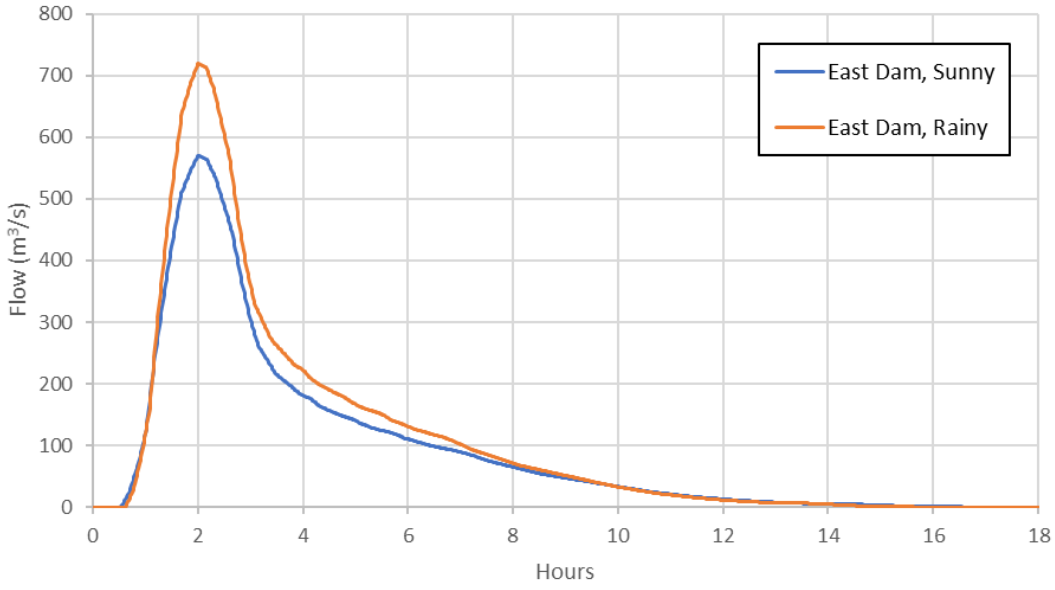
Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Breach Hydrographs\Base_Case\!Telkwa_BC_Breach_Spreadsheet_1CT027-003_rev04_nf.xlsx

Figure 3-6: Rainy day breach outflow hydrograph for Critical Failure Case #1



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Breach Hydrographs\Base_Case\!Telkwa_BC_Breach_Spreadsheet_1CT027-003_rev04_nf.xlsx

Figure 3-7: Sunny and rainy day breach outflow hydrographs for Critical Failure Case #2



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Breach Hydrographs\Base_Case\!Telkwa_BC_Breach_Spreadsheet_1CT027-003_rev04_nf.xlsx

3.4 Flood Route Modelling

3.4.1 Boundary Conditions

Preliminary simulations were run in order to estimate inundation limits, from which the size of the computational area could be adjusted. Overall, the model extents allow for the flood flows from the mine site to reach the Village of Telkwa, as well as provide buffer distance for the stream inflows to be applied. The inundation extents within the modeled area are generally determined by topography, with some effects from surface roughness. FLO-2D 'Outflow elements' are assigned to the downstream of the Bulkley River, past the Village of Telkwa.

3.4.2 Hydraulic structures

Hydraulic structures are not explicitly included in the analysis for the flood route modelling. The spillways are omitted in order to prescribe the breach locations along the dams. Bridges located in the Village of Telkwa are considered only when assessing breach effects on infrastructure.

3.4.3 Surface Roughness

The areas along the inundation pathway were classified into zones for surface roughness (Figure 3-8), quantified by Manning's n values. The values were defined using recommendations from the FLO-2D PRO Reference Manual (2019) and are summarized in Table 3-3. The overland flow roughness coefficients are considerably higher than those used for open channel flow.

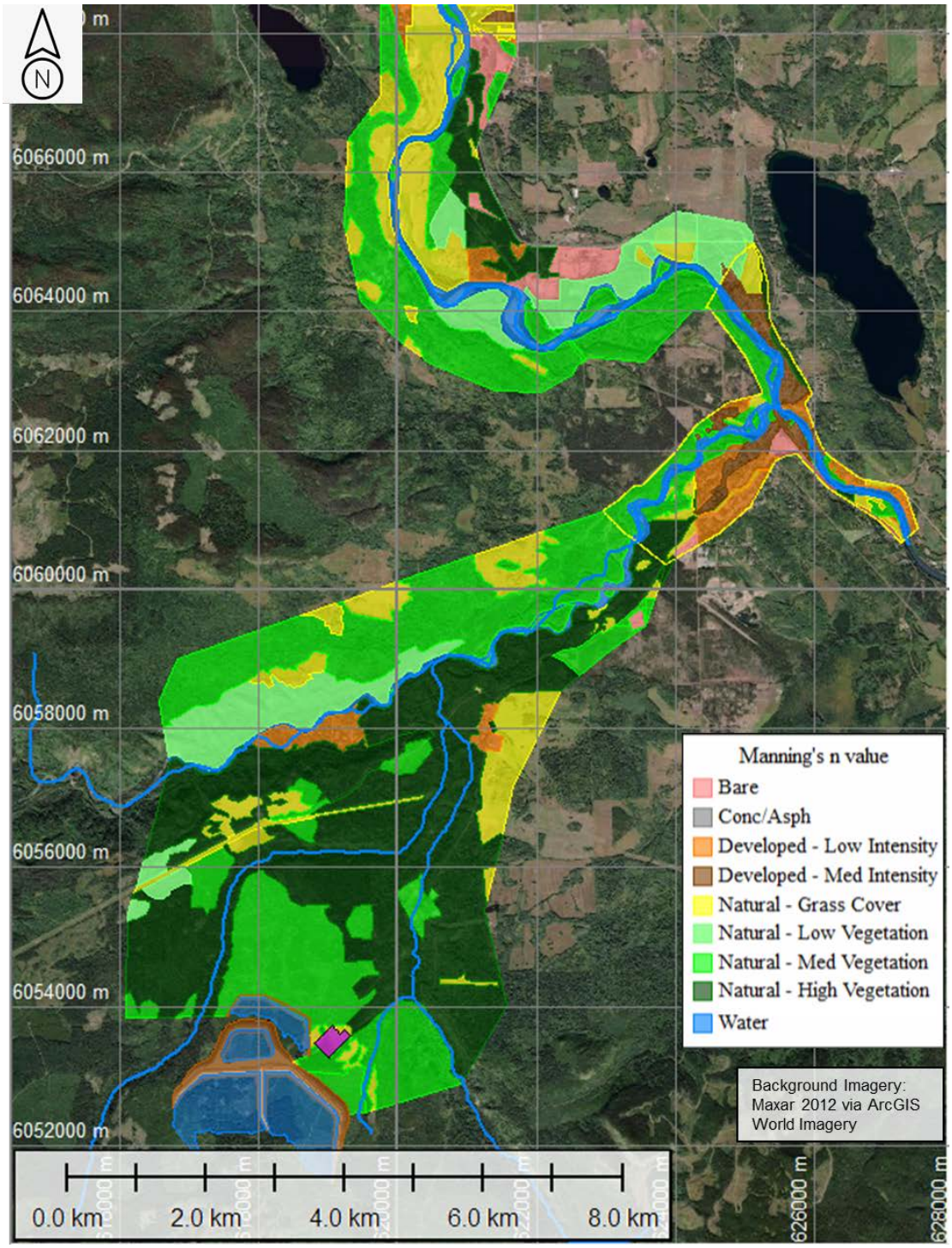
Sensitivity analyses were performed by varying the Manning's n values by +/- 50% and showed that surface roughness has little impact on the results compared to other modeled factors. The results of the sensitivity analysis are not reported in this document for brevity.

Table 3-3: Manning's n values used in the dam breach analysis

Zone Description	Manning's n value
Open ground, no debris	0.04
Concrete/Asphalt	0.02
Developed - Low Intensity	0.30
Developed - Medium Intensity	0.35
Natural - Low Vegetation	0.20
Natural - Medium Vegetation	0.30
Natural - High Vegetation	0.35
Natural - Grass Cover	0.16
Water	0.04

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Inflow Hydrographs\DamBreak_inflowHydrographs.xlsx

Figure 3-8: Surface roughness zone assignment in computational area



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

3.4.4 Model Inflow Hydrographs

The combined breach hydrograph for the cascade failure (Figure 3-5 and Figure 3-6) were applied to the northern section of the Tenas Dam. The breach hydrographs for the East Dam failure (Figure 3-7) was applied to the northeastern section of the dam.

The stream peak inflow was applied as constant values for each creek or river, at locations upstream of any confluences.

3.4.5 Control Cross-Sections

Five cross-sections (dashed red lines in Figure 2-1) were created to assess the downstream effects of the flood wave. The cross-sections are detailed in Table 3-4 and are numbered upstream to downstream (south to north). CS-1a, CS-2, CS-3, and CS-4 are used for Critical Failure Case #1, and CS-1b is used for Critical Failure Case #2. Time series plots showing flow width and depth at each cross-section for each simulation scenario are provided in the appendices with the maximum flow depth contour plots. Time series for flow velocity and discharge rates are shown with the maximum flow velocity contour plots.

Table 3-4: Cross-section IDs and locations

Cross-Section ID	Location Description	Distance Downstream of Breach Location
CS-1a	Directly downgradient of Tenas Dam breach location	0 km
CS-1b[1]	Directly downgradient of East Dam breach location	0 km
CS-2	Tenas Creek, before confluence with Telkwa River	5.7 km
CS-3	Telkwa River, at south end of Village of Telkwa	9.5 km
CS-4	Bulkley River, after confluence with Telkwa River	13.1 km

Sources: Compiled in text.

Notes:

[1] Cross-section includes Four Creek inflow.

4 Results

The results from the following scenarios are discussed in this section:

1. Critical Failure Case #1
    a. Rainy day (PMF in creeks, 200-year flood in rivers) with no breach
    b. Sunny day with cascade breach at the northern embankment of Tenas Dam
    c. Rainy day with cascade breach at the northern embankment of Tenas Dam
2. Critical Failure Case #2
    a. Sunny day breach at the northeastern embankment of East Dam
    b. Rainy day breach at the northeastern embankment of East Dam

Inundation maps for each scenario are provided in Appendix A through E, which include the following:

- Maximum flow depth – relative to starting condition
- Maximum flow velocity
- Flood hazard maps
- Arrival time (sunny day scenarios) - relative to the start of the model, and not peak flow or breach formation.

The flood hazard maps were produced for the purpose of assessing risk to human life. The hazard levels were assigned based recommendations from the Professional Practice Guidelines for flood mapping provided by the Association of Professional Engineers and Geoscientists BC (APEGBC, 2017). The hazard ratings (HRs) are a function of the depth and velocity of flood waters (Equation 4-1), and the categories are summarized in Table 4-1. Additional risks posed by the inclusion of debris in the flood waters is uncertain but assumed to be negligible for this study. The presence of debris could result in a significant increase in hazard rating.

$$\boldsymbol{HR = d * (v + 0.5) + DF}$$ **Equation 4-1**

Sources: Equation derived from HR Wallingford (2006), provided by APEGBC (2017).

Notes: *HR* = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (metres per second (m/s))
DF = debris factor (0, 0.5, or 1 depending on probability that debris will lead to significantly greater hazard – 0 used)

Table 4-1: Flood hazard level to people based on hazard rating

Hazard Rating (HR)	Hazard to People Classification
< 0.75	Very Low Hazard (Caution)
0.75 – 1.25	Danger for Some (includes children, the elderly, and the infirm)
1.25 – 2.00	Danger for Most (includes the general public)

Hazard Rating (HR)	Hazard to People Classification
> 2.00	Danger for All (includes emergency services)

Sources: Classification system developed by Surendran et al. (2008), provided by APEGBC (2017).

4.1 Critical Failure Case #1

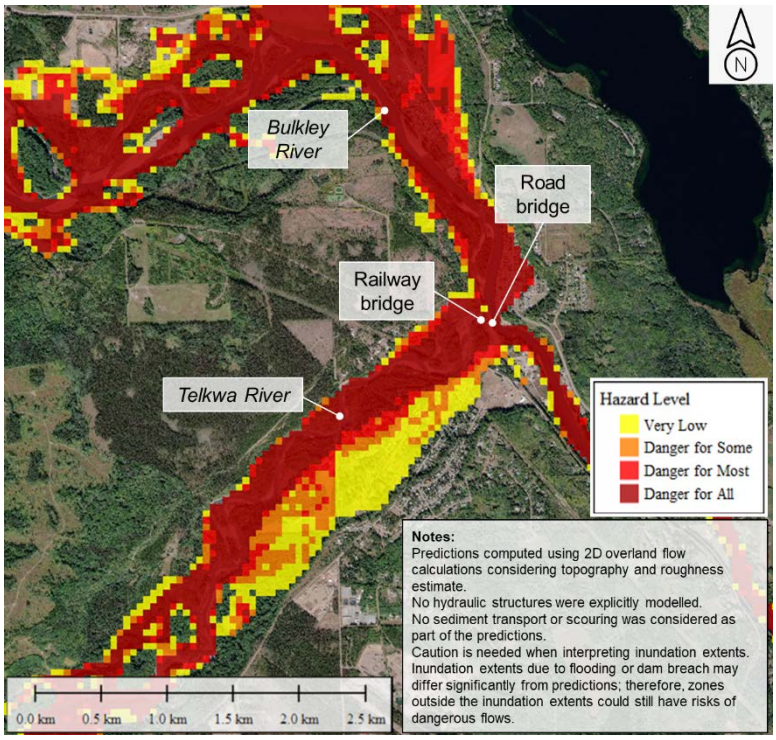
4.1.1 No Breach, Flood Event Scenario

Appendix A (Figures A.1 to A.3) provides inundation maps for maximum flow depths, maximum flow velocities, and flood hazard resulting from PMF conditions in the creeks and 200-year flood in the rivers (PMF/Q200). Maps for both the full study area and specifically the Village of Telkwa are shown. The CPP area is unaffected by stream flow during a rainy-day scenario with no breach.

According to the prediction as shown in Figure 4-1, the southern portion of the Village of Telkwa would be largely inundated during a PMF/Q200 event, but depth predictions do not generally exceed 1 m, nor do the predicted flows exceed 0.2 m/s, making the hazard mostly ‘Very Low’ or a ‘Danger for Some’ along the Telkwa River section. The risk to humans and infrastructure in the northern section of Telkwa is greater, where flows are predicted to be as high as 5 m, though velocities are relatively low at below 0.3 m/s in most areas.

Flows depths in the rivers near both the road bridge and railway bridge are predicted to exceed average depths by up to 9 m, with velocities close to 4 m/s. Therefore, bridge damage may occur during a PMF/Q200 event without a dam breach.

Figure 4-1: Rainy day, no breach maximum flood hazard in the Village of Telkwa



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

Notes: Background Imagery courtesy of Maxar 2012 via ArcGIS World Imagery

The inundation maps in Appendix A show that despite significantly higher flows in the streams, the flow is generally confined to within the existing creek or riverbanks in areas with less human development, such as towards the proposed mine site. There is some minor flooding in the clearing close to the confluence of Goathorn Creek with Tenas Creek, where there is some development and infrastructure

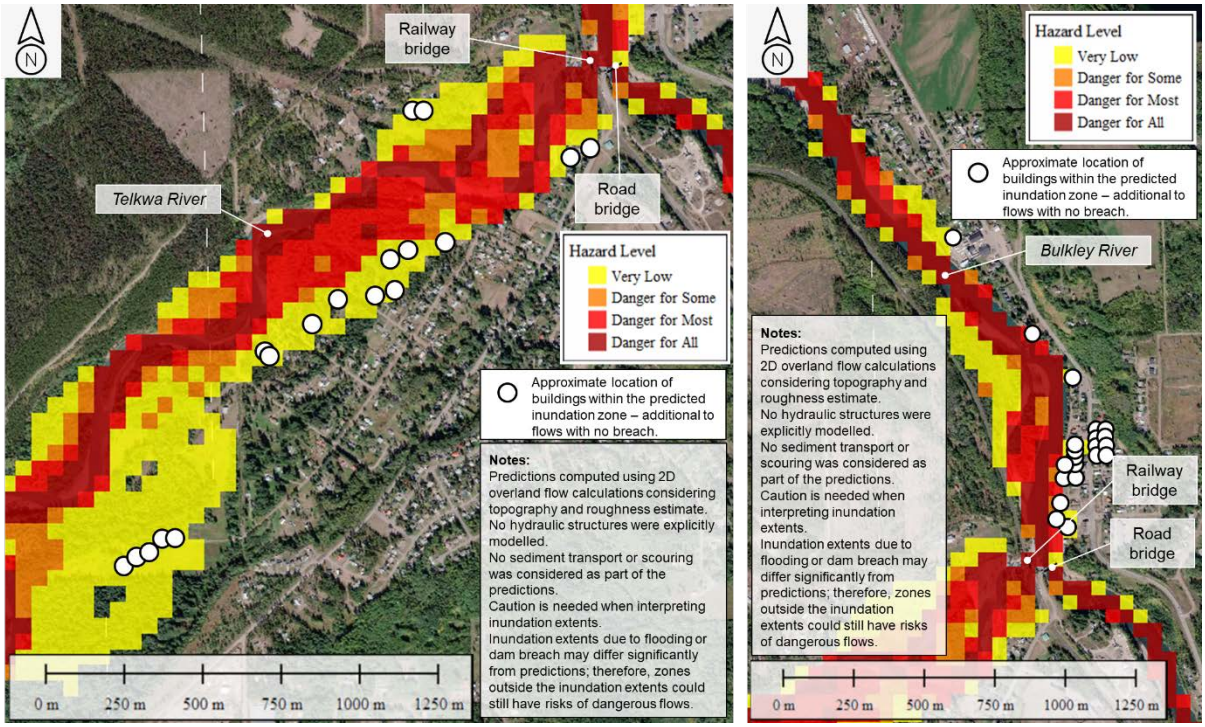
4.1.2 Sunny-Day Breach Scenario

Appendix B (Figures B.1 to B.4) provides inundation maps for maximum flow depths, maximum flow velocities, flood hazard, and arrival time for the sunny day cascade breach.

The predicted inundation area is not as extensive as that of the no breach rainy-day scenario, with most flows being confined to the existing riverbanks. There is some low hazard flooding (> 1 m depth, approximately 0.3 m/s velocity) of the predominantly uninhabited area at the southern tip the Village of Telkwa, as well as some contained inundation in the northern section (Figure 4-2). It is estimated that approximately 120 people would be affected during the sunny-day breach with the assumption of 3 persons per building, though the predicted flood hazard is considered is ‘Very Low’ for the vast majority of those at risk.

Bridge damage may occur, but the likelihood is much lower than those of the PMF/Q200 scenario as the predicted water depth at the bridges is greater than 3 m, with a velocity of greater than 2 m/s.

Figure 4-2: Sunny-day cascade breach flood hazard in Telkwa south (left) and north (right)



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

Notes: Background Imagery courtesy of Maxar 2012 via ArcGIS World Imagery.
Building count is an approximation used to estimate the population at risk.

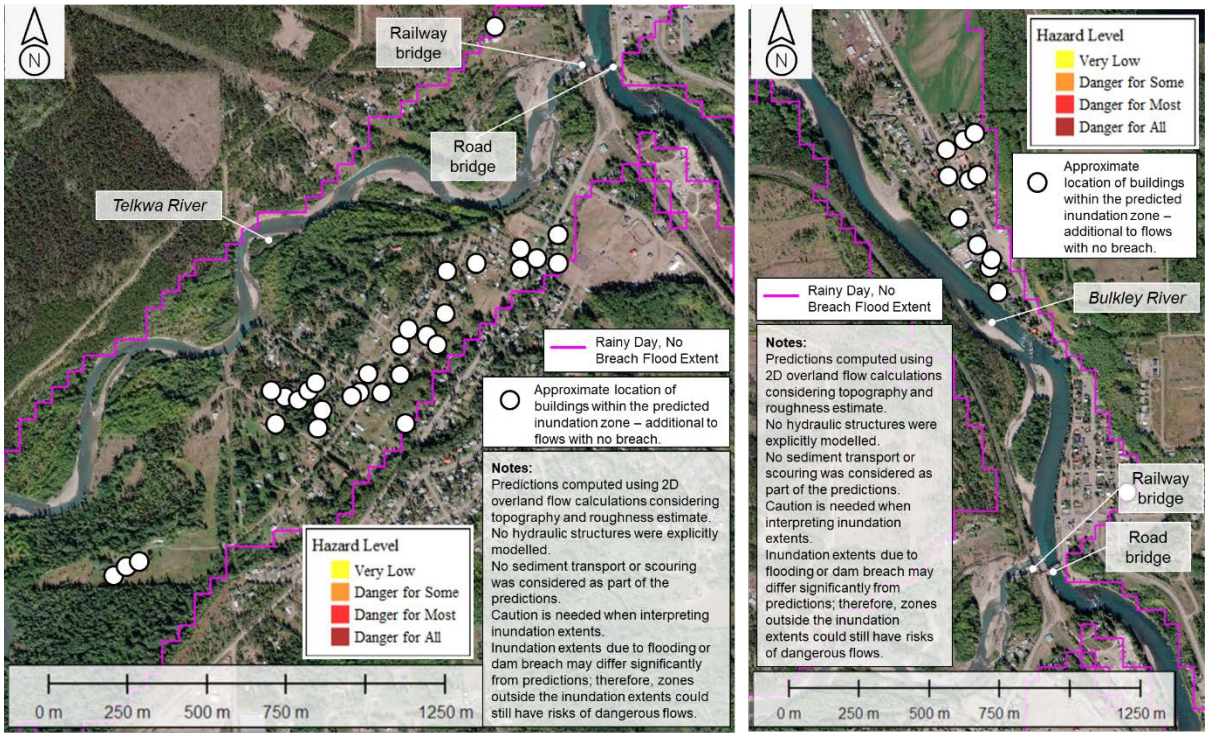
The greatest inundation effects of the sunny day breach occur in the natural area immediately north of the breach location, but there the risk to human life is lower since there is little to no permanent or temporary occupancy of that area.

4.1.3 Rainy Day Breach Scenario

Appendix C (Figures C.1 to C.3) provides inundation maps for maximum flow depths, maximum flow velocities, and flood hazard for the rainy-day cascade breach.

The inundation extents are very similar to the rainy-day with no breach scenario, and therefore the effects of the events are similar. Figure 4-3 shows locations of incremental hazard level resulting from the prediction of rainy-day breach as compared to the rainy-day, no breach scenario. The predictions suggest that approximately 150 people will be within an increased hazard level as compared to the rainy-day, no breach scenario.

Figure 4-3: Rainy-day cascade breach flood zones of increased hazard in Telkwa south (left) and north (right)



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

Notes: Background Imagery courtesy of Maxar 2012 via ArcGIS World Imagery.
Building count is an approximation used to estimate the population at risk.

The flooding is most extensive in the area directly downgradient of the breach location and is greater than of the sunny day breach. However, the population at risk directly downgradient of the breach is minimal compared to the town of Telkwa.

4.1.4 Discussion of Results

The incremental effects of the sunny-day breach are evaluated with respect to average flow conditions while the incremental effects of the rainy-day breach are compared to the rainy-day with no breach scenario. The resulting incremental population at risk is similar for both the sunny and rainy-day scenarios. The buildings that may be affected with a sunny day breach are predominantly located within the floodplains or near the banks of the river and are expected to experience flooding with a relatively low hazard level.

Though the incremental effects of the rainy-day scenarios introduce limited additional extent to the predicted inundation zone as compared to the rainy-day with no breach event, the hazard level in select areas increases to ‘Danger for Some’ and ‘Danger for Most’ from lower levels of hazard. The predicted incremental effects of the rainy-day breach (according to hazard rating) are more pronounced in locations

further away from the river banks, where there are slight increases in flow depth (up to 1 m) and velocity (up to 0.1 m/s).

The arrival times for either case (Table 4-2) are driven in part by the stream flows that convey the water released from the breach towards the Village of Telkwa. The predicted flood wave from the rainy-day breach arrives, on average, three hours earlier than that of the sunny day breach due to the PMF and 200-year flows from contributing streams and rivers.

Table 4-2: Time of arrival of the flood wave to the Village of Telkwa in Critical Failure Case #1

Time of Arrival	Sunday Day Breach	Rainy Day Breach
	6 to 7 hours	3 to 4 hours

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Telkwa_DamBreach_Inputs_1CT017-003_rev04_nf.xlsm

Notes: Time of arrival corresponds to time since start of the model, and not necessarily time of formation for the breach. Peak flows from the dam breach are reached approximately 2 hours after model start time.

4.2 Critical Failure Case #2

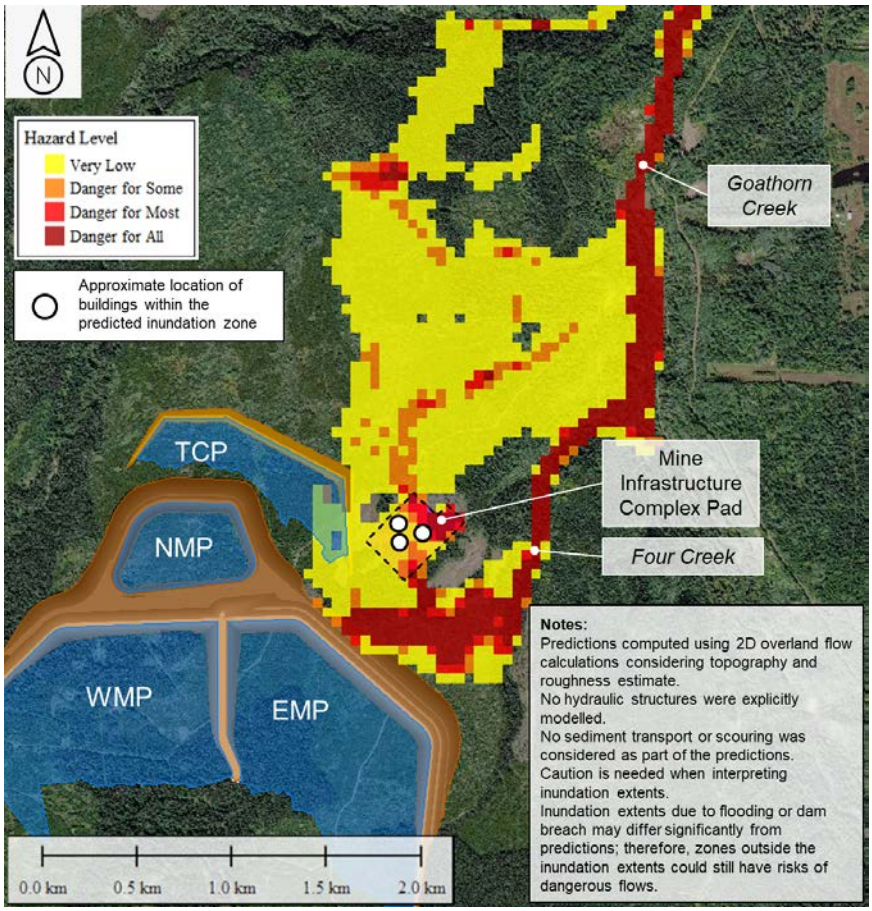
4.2.1 Sunny-Day Breach Scenario

Appendix D (Figures D.1 to D.4) provides inundation maps for maximum flow depths, maximum flow velocities, flood hazard, and time of arrival for the sunny day breach of the East Dam.

The sunny day breach of the East Dam affects firstly the TCL personnel working at the MIC, of which there are approximately 28 present for 24 hours a day and up to 80 personnel present at shift changes that occur twice a day for about 1 hour each. The predicted inundation hazard is ‘Very Low’ for the southwestern half of the MIC’s Pad, where two of the buildings will be located (Figure 4-4), and may be ‘Dangerous to Some’ towards the northeastern part of the MIC’s Pad, where there is another building. The CPP sedimentation pond is also located at the northeast portion of the MIC’s Pad. The inundation depth (Figure D.1 in Appendix D) is fairly uniform at 0.4 m throughout the Pad. The increased hazard in some areas of the MIC’s Pad are mainly due to slightly higher flows (Figure D.2 in Appendix D) driven by upgradient topography.

Aside from the MIC, the free water contained in the EMP is comparable to that released from the three ponds in the cascade failure, and the majority of the water bypasses the Pad and instead flows directly towards Four Creek and Goathorn Creek. As such, an East Dam sunny day breach affects the Village of Telkwa to a lesser but similar degree as the cascade sunny day breach. Furthermore, the clearing around the confluence of Goathorn Creek and the Telkwa River is also inundated.

Figure 4-4: Sunny-day East Dam breach flood hazard at the MIC Pad



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

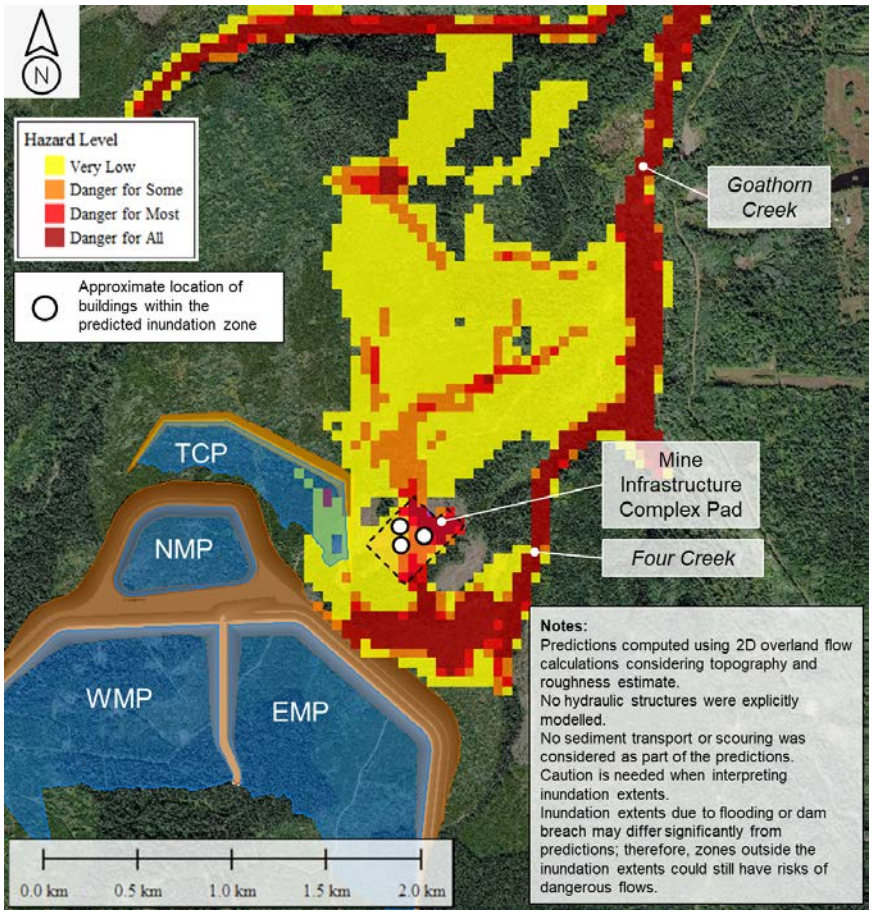
Notes: Background Imagery courtesy of Maxar 2012 via ArcGIS World Imagery.

4.2.2 Rainy-Day Breach Scenario

Appendix E (Figures E.1 to E.3) provides inundation maps for maximum flow depths, maximum flow velocities, and flood hazard for the rainy-day breach of the East Dam.

The rainy-day breach of the East Dam covers the same area of the CPP, but with an elevated hazard in the northeastern areas, including some locations with ‘Danger for Some’ or ‘Danger for Most’. Likewise, the effect at the Goathorn and Telkwa confluence and the effects in the Village of Telkwa are slightly less significant, but similar to the rainy-day cascade failure.

Figure 4-5: Rainy day East Dam breach flood hazard at the MIC Pad



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

Notes: Background Imagery courtesy of Maxar 2012 via ArcGIS World Imagery.

4.2.3 Discussion of Results

The sunny and rainy-day scenarios both inundate the CPP, with the difference being the hazard level, with the rainy-day scenario generating greater risk to personnel. The time of arrival (Table 4-3) of the flood wave to the MIC is approximately 1.5 hours for both scenarios, relative to model start time. It takes the flood wave about an hour longer to reach the Village of Telkwa in the sunny day East Dam breach than with the sunny day cascade breach, though the arrival time is similar during a rainy-day for both breach events. Based on the flooding extents, it is possible that greater than 200 additional people may be put at risk during a breach of the East Dam, compared with if there was no breach.

Table 4-3: Time of arrival of the flood wave in Critical Failure Case #2

Time of Arrival	Sunday Day Breach	Rainy Day Breach
To the MIC	<1.5 hours	<1.5 hours
To the Village of Telkwa	7 to 8 hours	3 to 4 hours

Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\800_Dam_Break\Inputs\Telkwa_DamBreach_Inputs_1CT017-003_rev04_nf.xlsm

Notes: Time of arrival corresponds to time since start of the model, and not necessarily time of formation for the breach. Peak flows from the dam breach are reached approximately 2 hours after model start time.

4.3 Sensitivity Analysis

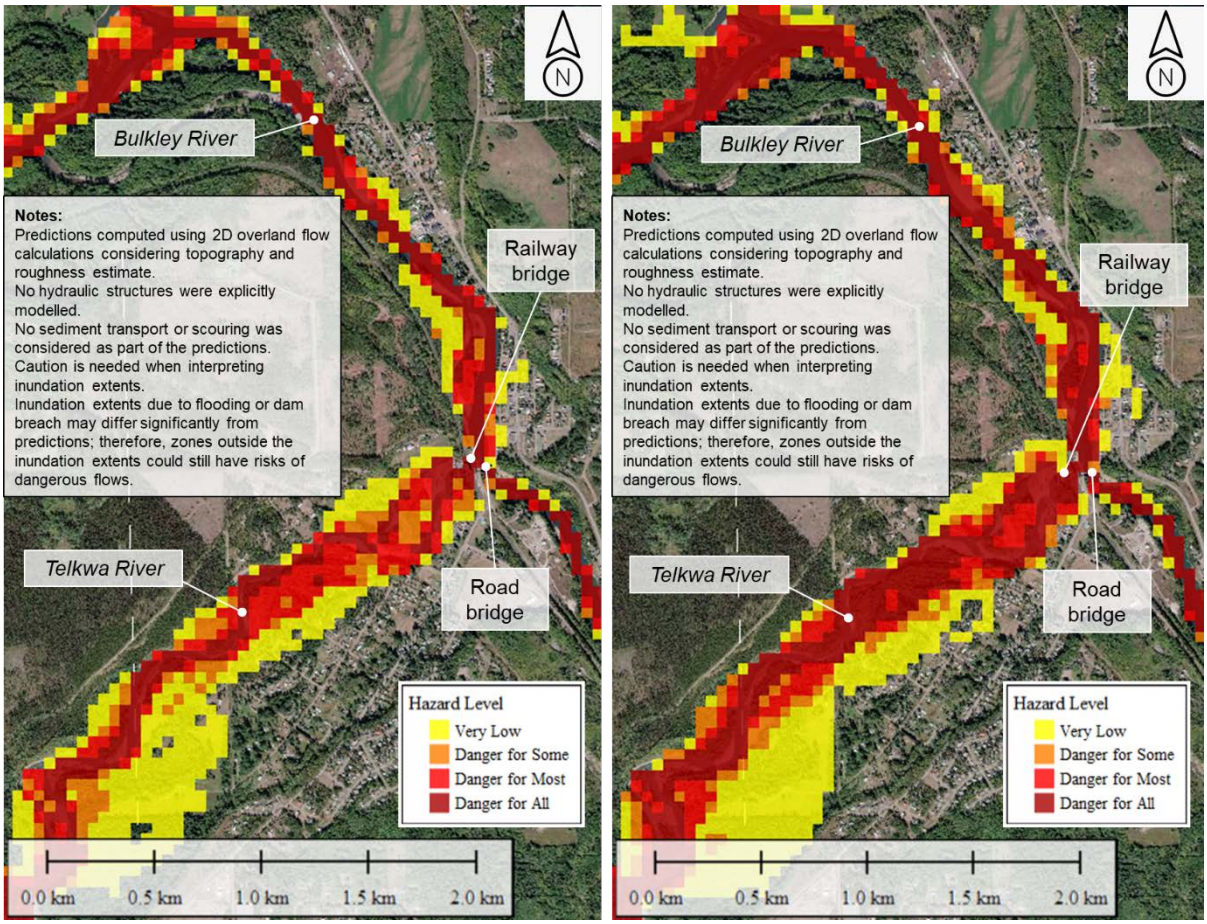
A sensitivity analysis was performed by simulating the sunny day cascade breach with 50% higher peak flows in the breach outflow hydrographs. The Telkwa River and post-confluence section of the Bulkley River show higher flows within the streams. The inundated area along the floodplains can extend up to approximately 100 m farther, nearly doubling the population at risk for the sunny day case.

The flow depths for the inundated areas of the Village of Telkwa are between 0.5 to 0.75 m greater, and the velocities are approximately 1 m/s faster. For the sunny day case, the depth and velocity increases are still unlikely to cause damage at the bridges. Some scouring and damage to the bridge is likely during the rainy-day event, regardless of whether a dam breach occurs since the majority of flow comes from precipitation rather than the reservoirs.

The flow hazards are compared in Figure 4-6 and show changes proportional to the according to the increasing depth and velocity. Hazard levels enter into the ‘Danger for Most’ and ‘Danger for All’ for those within the previous inundation area, and newer areas become assigned with a ‘Very Low’ or ‘Danger for Some’ rating.

Consideration should be given to uncertainties in model predictions if referring to them during emergency response planning. Variation in breach peak flows and volumes may cause underpredictions of inundation extent, which should be accounted for.

Figure 4-6: Telkwa hazards using original peak flows (left) and higher peak flows (right)



Sources: \\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\!080_Deliverables\Dam Breach Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx

Notes: Background Imagery courtesy of Maxar 2012 via ArcGIS World Imagery.

5 Consequence Identification and Dam Classification

The dam consequence classifications are assessed according to CDA Guidelines (2013) and supported by the Global International Standards on Tailings Management (GISTM) (ICMM, 2020).

Table 5-1 is a reproduction of the CDA-recommended consequence classification criteria and Table 5-2 is a reproduction of the GISTM criteria. The classification systems are based on the incremental consequences of a dam failure, as opposed to total consequences. The incremental consequences of failure are defined as the total damage from an event with dam failure, less the damage that would have resulted from the same event (e.g. a large earthquake or a large flood event) had the dam not failed. During the dam classification process, each of the four hazard rating components in Table 5-1 are considered individually, and the overall dam hazard rating is defined by the component with the highest (i.e. most severe) rating. The GISTM descriptions are used as a supplemental reference as the incremental losses are defined in more detail, though the ponds are not tailings management facilities.

Table 5-1: CDA (2013) Dam Classifications

Dam Class	Population at Risk[1]	Incremental Losses		
		Loss of Life[2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No long-term loss	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	No significant loss or deterioration of fish or wildlife habitat	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very High	Permanent	100 or fewer	Loss of marginal habitat only	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)
Extreme	Permanent	More than 100	Restoration or compensation in kind highly possible	Extreme losses affecting critical infrastructure or service (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)

Notes:

[1] Definitions for population at risk:

None: There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary: People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent: The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); Three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

[2] Implications for loss of life:

Unspecified: The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Table 5-2: GISTM (2020) Dam Classifications

Dam Class	Population at Risk	Incremental Losses			
		Loss of Life[1]	Environment	Health, Social and Cultural	Infrastructure and Economics
Low	None	None expected	Minimal short-term loss or deterioration of habitat or rare and endangered species.	Minimal effects and disruption of business and livelihoods. No measurable effect on human health. No disruption of heritage, recreation, community or cultural assets.	Low economic losses: area contains limited infrastructure or services. <US$1M.
Significant	1-10	Unspecified	No significant loss or deterioration of habitat. Potential contamination of livestock/fauna water supply with no health effects. Process water low potential toxicity. Tailings not potentially acid generating and have low neutral leaching potential. Restoration possible within 1 to 5 years.	Significant disruption of business, service or social dislocation. Low likelihood of loss of regional heritage, recreation, community, or cultural assets. Low likelihood of health effects.	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. <US$10M.
High	10-100	Possible (1 - 10)	Significant loss or deterioration of critical habitat or rare and endangered species. Potential contamination of livestock/ fauna water supply with no health effects. Process water moderately toxic. Low potential for acid rock drainage or metal leaching effects of released tailings. Potential area of impact 10 km^2 – 20 km^2. Restoration possible but difficult and could take > 5 years.	500-1,000 people affected by disruption of business, services or social dislocation. Disruption of regional heritage, recreation, community or cultural assets. Potential for short term human health effects.	High economic losses affecting infrastructure, public transportation, and commercial facilities, or employment. Moderate relocation/compensation to communities. <US$100M.
Very High	100-1,000	Likely (10 - 100)	Major loss or deterioration of critical habitat or rare and endangered species. Process water highly toxic. High potential for acid rock drainage or metal leaching effects from released tailings. Potential area of impact > 20 km^2. Restoration or compensation possible but very difficult and requires a long time (5 years to 20 years).	1,000 people affected by disruption of business, services or social dislocation for more than one year. Significant loss of national heritage, community or cultural assets. Potential for significant long-term human health effects.	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities, for dangerous substances), or employment. High relocation/ compensation to communities. < US$1B.
Extreme	> 1,000	Many (> 100)	Catastrophic loss of critical habitat or rare and endangered species. Process water highly toxic. Very high potential for acid rock drainage or metal leaching effects from released tailings. Potential area of impact > 20 km^2. Restoration or compensation in kind impossible or requires a very long time (> 20 years).	5,000 people affected by disruption of business, services or social dislocation for years. Significant National heritage or community facilities or cultural assets destroyed. Potential for severe and/or long- term human health effects.	Extreme economic losses affecting critical infrastructure or services, (e.g., hospital, major industrial complex, major storage facilities for dangerous substances) or employment. Very high relocation/compensation to communities and very high social readjustment costs. >US$1B.

Notes: [1] Implications for loss of life:

Unspecified: The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season

5.1 Population at Risk/Loss of Life

5.1.1 West, North, and Tenas Dams

The sunny and rainy-day failures both contribute to flood-related dangers to residents in the Village of Telkwa. There are many residencies located within the floodplains of a sunny day breach, or for which a rainy-day breach would increase risk. In the event of a cascade breach, approximately 150 people may be affected, possibly more to account for model uncertainty.

A ‘Very High’ consequence rating is recommended for all three dams.

5.1.2 East Dam

The breach of the East Dam may put all personnel at the CPP at risk, as well as those along at the junction of Goathorn Creek and the Telkwa River, and in the Vilage of Telkwa. Up to 200 people are predicted to be affected by the EMP failure.

A ‘Very High’ consequence rating is recommended for the East Dam.

5.2 Environmental and Cultural

5.2.1 West, North, and Tenas Dams

The greatest impact to the terrestrial environment is located in an area under 10 square kilometres (km^2) directly downslope of the Tenas Dam. The area is forested; habitat loss will be moderate and possible to restore after either the sunny or rainy-day event. Aquatic life in the streams will not experience significant effects from sediment deposition related to the breach in the long term, but the sudden high flows may temporarily damage fish habitat in the sunny-day breach. The effect of the rainy-day breach on aquatic habitat is low given the PMF/Q200 conditions already present.

PAG material and coal rejects are stored in the management ponds, and therefore there is potential for species from acid rock drainage (ARD) to be present in the free water released in a breach. As a mitigating factor, the NMP will have a NAG cover in the critical breach scenario, and the TCP does not contain waste material other than sediments accumulated during the operational period.

There are no known culturally significant artifacts in the area, though some sites significant to regional heritage sites are located within the Village of Telkwa.

A ‘Very High’ consequence rating is recommended for the West Dam as it is the primary source of water released in the breach and may also have poorer water quality. A ‘High’ consequence rating is recommended for the North and Tenas Dams.

5.2.2 East Dam

The primary impact to the terrestrial environment from the breach of the East Dam is also directly downslope of the breach. However, the majority of water released travels directly to Goathorn and Four Creeks, making the inundation of the forested area relatively low impact.

The impact to aquatic environment in the creeks may be moderate to significant due to the high addition of water, but the habitat can likely be restored. Similar to the WMP, there may be some impact from ARD.

A ‘High’ to ‘Very High’ consequence rating is recommended for the East Dam.

5.3 Infrastructure and Economics

5.3.1 West, North, and Tenas Dams

The road bridge and the railway bridge are both located at the junction of the Telkwa and Bulkley Rivers. The railway bridge is most at risk, as it is directly in the path of the flood wave. The road bridge is located over Bulkley River prior to the confluence but is likely to be affected due to backflow up the Bulkley River due to displacement caused by the flood wave. The rainy-day breach is unlikely to cause significantly more damage to the bridges than the PMF/Q200 flows due to similar predicted depths and velocities in the area, and the sunny day breach may cause minor or moderate damage.

Freeways, major access roads, and local roads may be temporarily unusable due to inundation or debris accumulation. Costs may be incurred from reparations for damage due to scouring, and debris removal.

Disruption to businesses and tourism such as those related to fishing would have an effect on local economy. Property damage requiring compensation to buildings located within the inundation area, but very high economic losses are not considered likely.

A ‘High’ consequence rating is recommended for all three dams.

5.3.2 East Dam

The impact of the East Dam breach on infrastructure and economics is similar to that of the cascade breach.

A ‘High’ consequence rating is recommended for the East Dam.

5.4 Recommended Dam Classification

Based on the consequence evaluations provided in the previous subsections, a consequence of ‘Very High’ for all four dams is recommended.

6 Conclusions and Recommendations

A dam breach assessment was completed to simulate flooding for two critical failure cases. The first critical case considers a cascade failure of the West Management Pond, North Management Pond, and Tenas Control Pond. The second critical case considers the failure of the East Management Pond. Sensitivity analyses were completed to check the variation due to changes in breach and modelling parameters.

Three scenarios were modelled to assist in evaluation of the potential effect of a dam breach on the downstream receptors for rainy-day and sunny-day conditions:

- The downstream creeks and rivers experiencing a large flood event with no dam breach (assuming 1 in 200-year flood for rivers and PMF for creeks)
- A Sunny-Day dam breach scenario (fair-weather scenario); and,
- A Rainy-Day dam breach scenario (flood-induced scenario).

The assessment suggests that the population at risk is up to approximately 200 for the sunny-day failure scenarios considered, with the majority of the buildings affected within the ‘Very Low’ to ‘Danger for Some’ hazard zones.

The assessment suggests there is significant risk to the majority of the population of the Village of Telkwa during a potential rainy-day event, but the danger is predominantly caused by the high flows due to the flood event rather than the dam breach. The predicted incremental population at risk is similar to the sunny-day breach scenario, but the resulting hazard is predominantly ‘Danger for some’ and ‘Danger for Most’.

Terrestrial and aquatic habitats may be damaged during a breach event; however, clean up and restoration is possible.

Moderate damage to downstream infrastructure such as bridges, roadways, and some buildings may occur during a potential sunny-day breach, while the incremental effects of the rainy-day breach are generally less significant compared to the flood scenario with no breach.

Based on the dam breach assessment results, a ‘Very High’ consequence classification is recommended for the four embankments.

There are several sources of uncertainty that may impact model predictions. The inundation extents, depths, velocities, and arrival times from a breach event may vary significantly from that which is presented in this report. The overland flow calculations account for topography and estimates of surface roughness, but do not consider sediment transport or scouring. Hydraulic structures and infrastructure such as roadways and ditches were not explicitly modelled (though some larger features appar in the topography), therefore flow redirection unforeseen by the model presented in this report may occur.

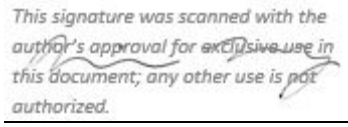
Caution is needed when interpreting inundation predictions for the development of emergency response and action plans. A thorough review of topography, geology, hydraulic structures, and emergency travel routes should be undertaken when developing emergency response plans.

At the time of the study, there was limited detailed information on the grain size of the stored rock, which is currently assumed to be coarse in nature. The potential impacts of the liquefaction of coal rejects and waste material should be considered in later stages of design.

Note - the dam crest elevations and spillway inverts on the West and East Management dams as well as the Tenas Control Pond have been reduced after completion of the dam breach assessment. Both the EMP and WMP dam crests have been lowered to 850 masl, with spillways at 848 masl, and the Tenas Control Pond dam crest has been lowered to 800 masl with spillway invert of 798 masl. Due to the shapes of the ponds and associated stage-storage relationships, lower elevation crests and inverts correspond to smaller incremental volumes of water for a given water cover thickness, which would be expected to reduce the volume of water released during a dam breach. For example, the final storage volume in the TCP at the dam crest was reduced from 2.3 Mm^3 to 1.6 Mm^3. As such, the results of this study were accepted as conservative for the purpose of dam classification and emergency response planning at this stage of the Project. An updated dam breach assessment is recommended for final design of all dams.

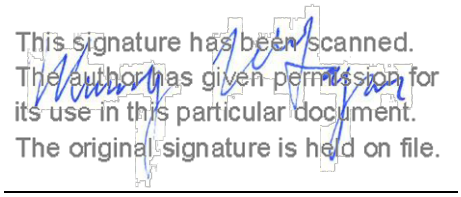
Closure

This report, Tenas Project Dam Breach Assessment Report, was prepared by



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Samantha Barnes, P.Eng
Senior Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A Pond Elevation-Storage Tables

Table A-1: Summary Elevations

Pond	Dam Crest (MASL)	Spillway Invert (MASL)
Tenas Dam	802	801
North Dam	831	830
East Dam	852	851
West Dam	852	851

Table A-2: Pond Elevation-Storage

Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
752	-	-	0	-
752.5	-	-	0	-
753	-	-	0	-
753.5	-	-	120	-
754	-	-	820	-
754.5	-	-	2190	-
755	-	-	4210	-
755.5	-	-	6850	-
756	-	-	10210	-
756.5	-	-	14510	-
757	-	-	20040	-
757.5	-	-	26840	-
758	-	-	35430	-
758.5	-	-	46210	-
759	-	-	58790	-
759.5	-	-	72960	-
760	-	-	88660	-
760.5	-	-	105820	-
761	-	-	124250	-
761.5	-	-	144010	-

Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
762	-	-	165080	-
762.5	-	-	187560	-
763	-	-	211480	-
763.5	-	-	236810	-
764	-	-	263540	-
764.5	-	-	291650	-
765	-	-	321140	-
765.5	-	-	351980	-
766	-	-	384160	-
766.5	-	-	417610	-
767	-	-	452220	-
767.5	-	-	487960	-
768	-	-	524810	-
768.5	-	-	562730	-
769	-	-	601750	-
769.5	-	-	641870	-
770	-	-	683050	-
770.5	-	-	725300	-
771	-	-	768590	-
771.5	-	-	812880	-
772	-	-	858170	-
772.5	-	-	904460	-
773	-	-	951750	-
773.5	-	-	1000050	-
774	-	-	1049390	-
774.5	-	-	1099780	-
775	-	-	1151240	-
775.5	-	-	1203790	-

Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
776	-	-	1257480	-
776.5	-	-	1314720	-
777	-	-	1373180	-
777.5	-	-	1432730	-
778	-	-	1493350	-
778.5	-	-	1555000	-
779	-	-	1617700	-
779.5	-	-	1681430	-
780	-	-	1746210	-
780.5	-	-	1812020	-
781	-	-	1878850	-
781.5	-	-	1946720	-
782	-	-	2015620	-
782.5	-	-	2085550	-
783	-	-	2156520	-
783.5	-	-	2228590	-
784	0	-	2301860	-
784.5	-	-	2376500	-
785	0	-	2452530	-
785.5	-	-	2530030	-
786	230	-	2609060	-
786.5	-	-	2689720	-
787	1390	-	2772020	-
787.5	-	-	2855930	-
788	4610	-	2941440	-
788.5	-	-	3028550	-
789	15300	-	3117300	-
789.5	-	-	3207700	-

Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
790	39250	-	3299860	-
790.5	-	-	3394020	-
791	79570	-	3490540	-
791.5	-	-	3589430	-
792	141540	-	3690700	-
792.5	-	-	3794530	-
793	226940	-	3901050	-
793.5	-	-	4009970	-
794	337760	-	4120670	-
794.5	-	-	4232960	-
795	475070	-	4346740	-
795.5	-	-	4461890	-
796	642340	-	4578070	-
796.5	-	-	4695150	-
797	839060	-	4813100	-
797.5	-	-	4931940	-
798	1064650	-	5051910	-
798.5	-	-	5173060	-
799	1323980	-	5295380	-
799.5	-	-	5418890	-
800	1615300	-	5543790	-
800.5	-	-	5678350	-
801	1936630	-	5814320	-
801.5	-	-	5951470	-
802	2292120	-	6089750	-
802.5	-	-	6229100	-
803	-	-	6369490	-
803.5	-	-	6510930	-

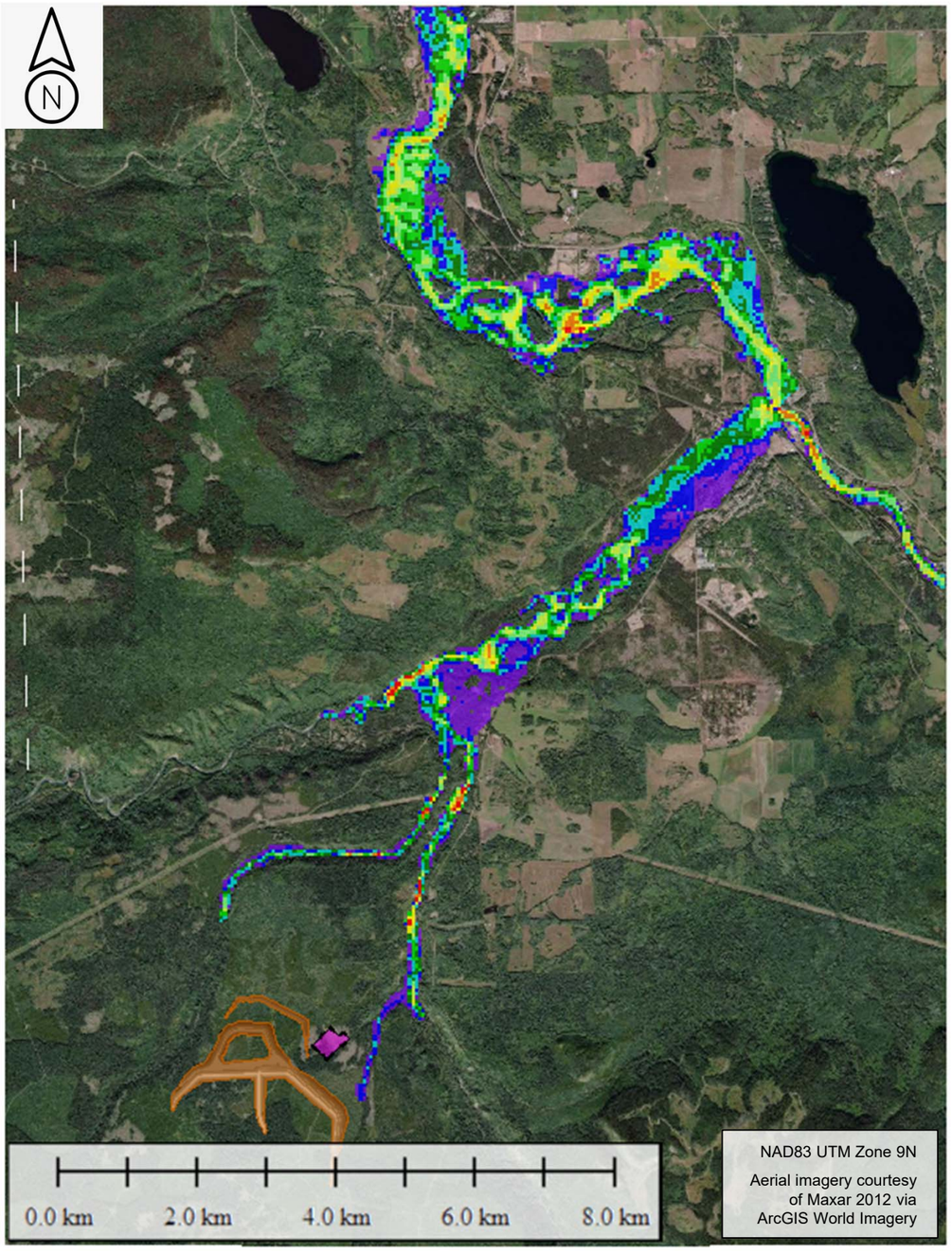
Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
804	-	-	6653510	-
804.5	-	-	6797290	-
805	-	-	6942380	-
805.5	-	-	7088900	-
806	-	-	7236800	-
806.5	-	-	7386060	-
807	-	-	7536660	-
807.5	-	-	7688540	-
808	-	-	7841640	-
808.5	-	-	7995900	-
809	-	0	8151210	-
809.5	-	0	8307540	-
810	-	100	8464840	-
810.5	-	3350	8623050	-
811	-	9050	8782160	-
811.5	-	17320	8942140	-
812	-	28380	9103130	-
812.5	-	60090	9272160	-
813	-	97360	9442170	-
813.5	-	139980	9612990	-
814	-	187870	9784550	-
814.5	-	246300	9956810	-
815	-	308920	10129790	-
815.5	-	375800	10303530	-
816	-	446910	10478180	-
816.5	-	525550	10654290	-
817	-	607390	10831700	-
817.5	-	692780	11010460	-

Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
818	-	782000	11190670	-
818.5	-	881020	11373620	-
819	-	983990	11558470	-
819.5	-	1090650	11745410	-
820	-	1200820	11934520	0
820.5	-	1316720	12127470	30
821	-	1435070	12323580	290
821.5	-	1555470	12523420	1000
822	-	1677560	12727910	2480
822.5	-	1800970	12940130	10530
823	-	1925590	13156820	22600
823.5	-	2051430	13378200	41410
824	-	2178490	13604830	68270
824.5	-	2306790	13859700	107850
825	-	2436310	14120330	154440
825.5	-	2567070	14386370	208130
826	-	2699070	14657870	269100
826.5	-	2832320	14937970	340900
827	-	2966830	15222750	419380
827.5	-	3102590	15512330	504360
828	-	3239610	15806980	595770
828.5	-	3377900	16110870	699130
829	-	3517480	16420000	809270
829.5	-	3658430	16734000	926100
830	-	3800820	17052600	1049630
830.5	-	3958230	17377830	1186010
831	-	4119020	17707750	1329520
831.5	-	-	18042250	1480120

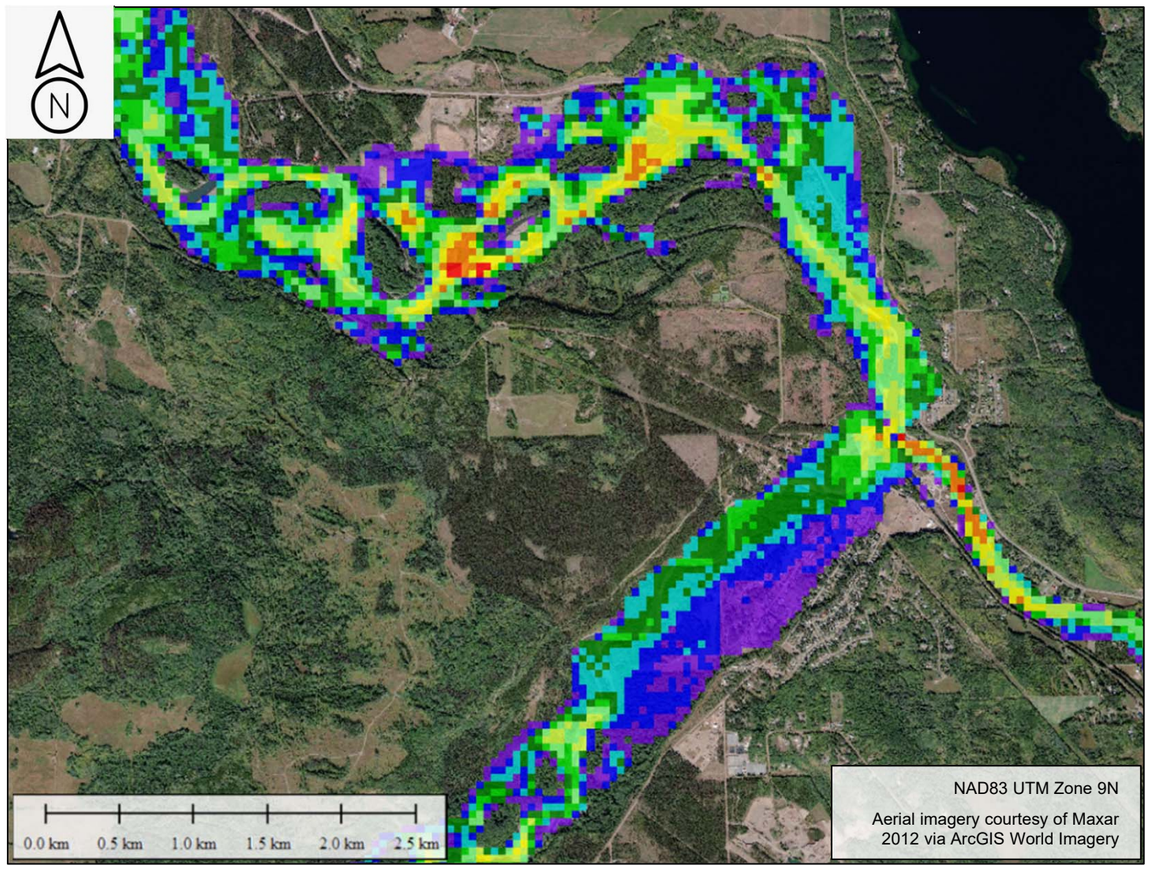
Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
832	-	-	18381250	1637840
832.5	-	-	18725690	1814790
833	-	-	19074760	2000420
833.5	-	-	19428620	2195030
834	-	-	19787250	2399090
834.5	-	-	20152300	2624750
835	-	-	20522760	2860010
835.5	-	-	20898780	3105010
836	-	-	21280620	3360180
836.5	-	-	21680910	3638570
837	-	-	22088220	3924560
837.5	-	-	22501930	4218040
838	-	-	22921640	4519080
838.5	-	-	23350070	4842510
839	-	-	23782090	5173270
839.5	-	-	24217500	5511860
840	-	-	24656140	5858990
840.5	-	-	25098080	6235900
841	-	-	25543000	6620240
841.5	-	-	25990800	7012170
842	-	-	26441330	7412210
842.5	-	-	26895020	7838400
843	-	-	27351210	8273270
843.5	-	-	27809910	8717050
844	-	-	28271280	9170230
844.5	-	-	28735900	9642140
845	-	-	29203530	10120030
845.5	-	-	29674290	10603850

Elevation (MASL)	TCP Capacity (m^3)	NMP Capacity (m^3)	WMP Capacity (m^3)	EMP Capacity (m^3)
846	-	-	30148330	11093720
846.5	-	-	30626710	11592430
847	-	-	31108760	12097650
847.5	-	-	31594500	12609350
848	-	-	32084230	13127630
848.5	-	-	32584730	13653550
849	-	-	33089250	14185650
849.5	-	-	33597680	14723940
850	-	-	34110120	15268570
850.5	-	-	34628310	15820960
851	-	-	35151030	16379260
851.5	-	-	35678570	16943470
852	-	-	36211940	17514560

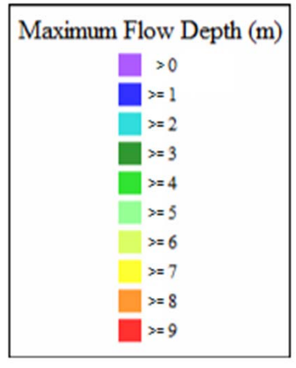
Appendix B No Breach, Rainy Day Scenario



a) Overall Site Plan



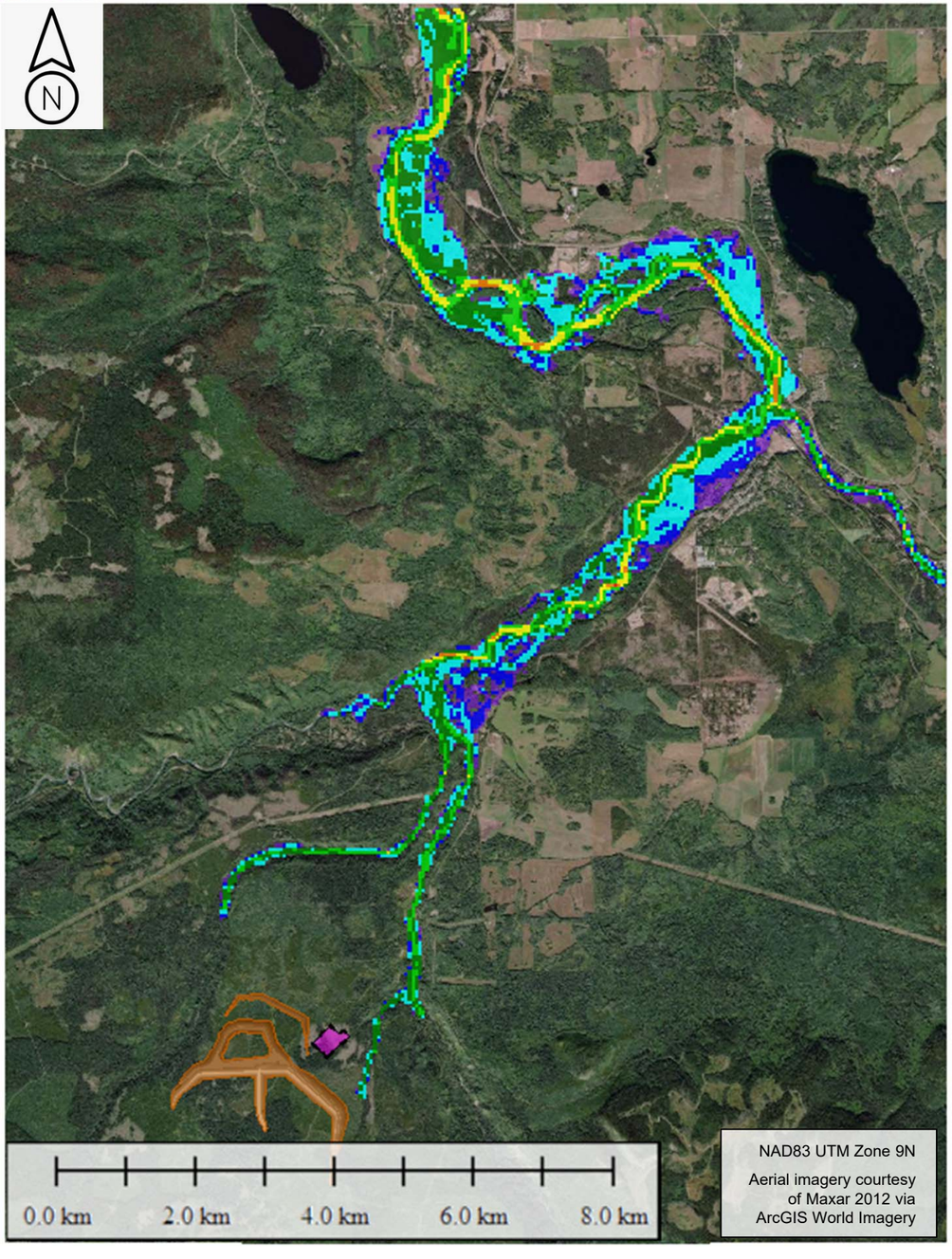
b) Village of Telkwa Area



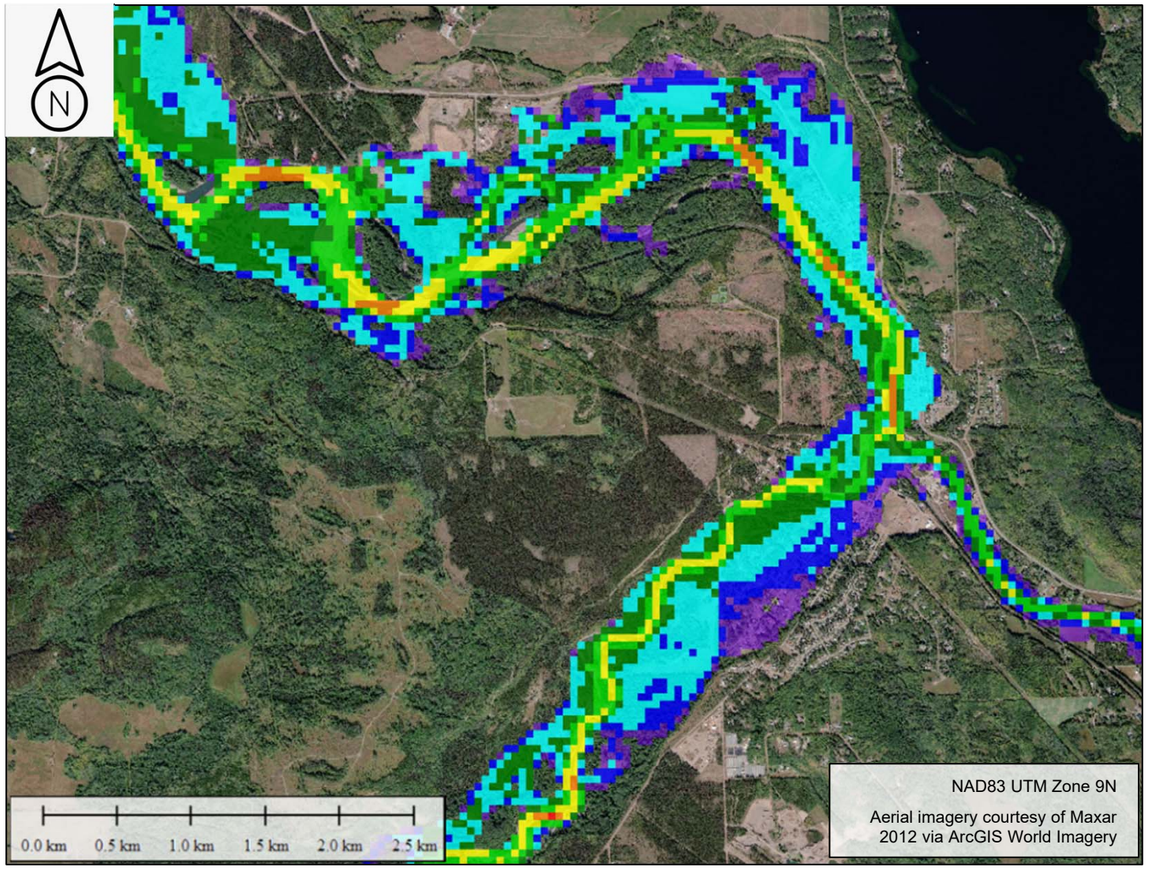
Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

srk consulting	TELKWA COAL LIMITED	Dam Break Assessment	
Job No: 1CT027.003 Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx	Tenas Project – EA Water Management	**No Breach, Rainy Day (PMF/Q200) Maximum Flow Depth**	
		Date: Jan. 2021	Prepared by: NF
			Figure: **B.1**

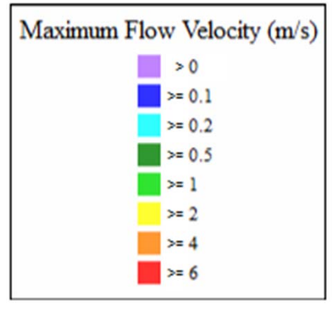
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a) Overall Site Plan



b) Village of Telkwa Area



Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
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Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

srk consulting

Job No: 1CT027.003

Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx

TELKWA COAL LIMITED

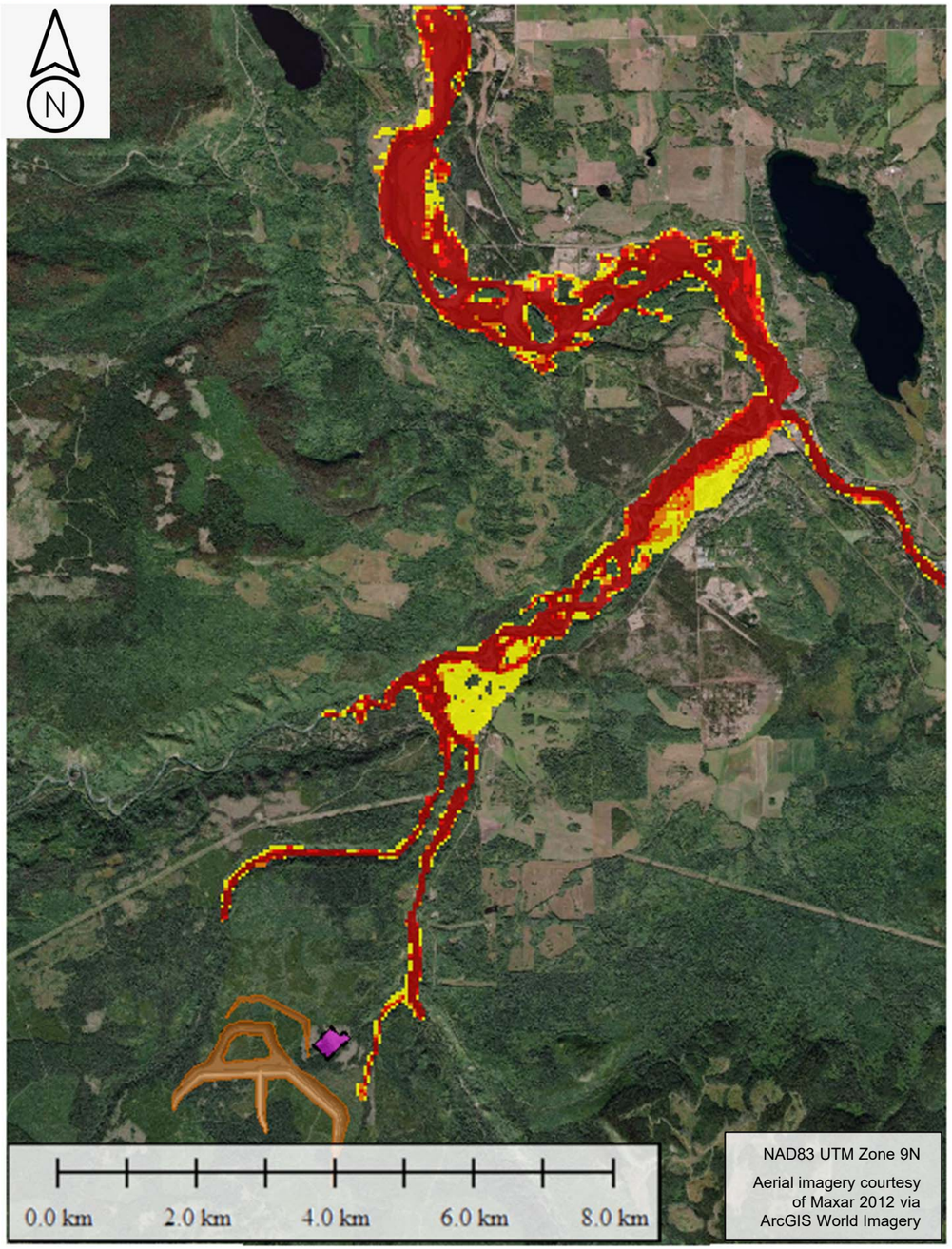
Tenas Project – EA Water Management

Dam Break Assessment

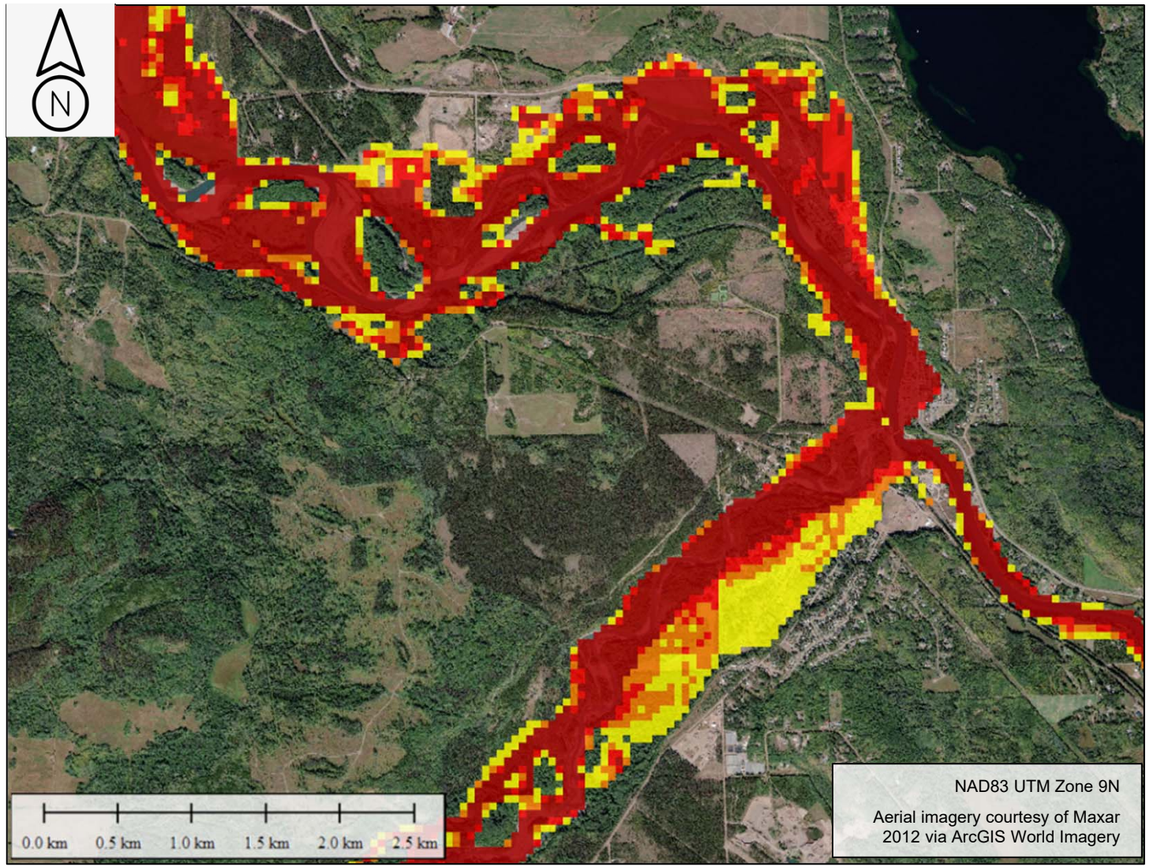
No Breach, Rainy Day Maximum Flow Velocity

Date:	Prepared by:	Figure:
Jan. 2021	NF	**B.2**

\\srk.ad\dfs\na\van\Projects\01_SITES\Telkwa Coal\1CT027.003_2020 EA Water Management\080_Deliverables\Dam Break Assessment Memo\040_Figures\Telkwa_DamBreak_Figs_1CT027-003_rev00_nf.pptx



a) Overall Site Plan



b) Village of Telkwa Area

Hazard Rating	Risk to People
Very Low	Caution
Danger for Some	Includes children, the elderly, and the infirm
Danger for Most	Includes the general public
Danger for All	Includes emergency services

Hazard Level
- Very Low
- Danger for Some
- Danger for Most
- Danger for All

Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

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Job No: 1CT027.003
Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx

TELKWA COAL LIMITED

Tenas Project – EA Water Management

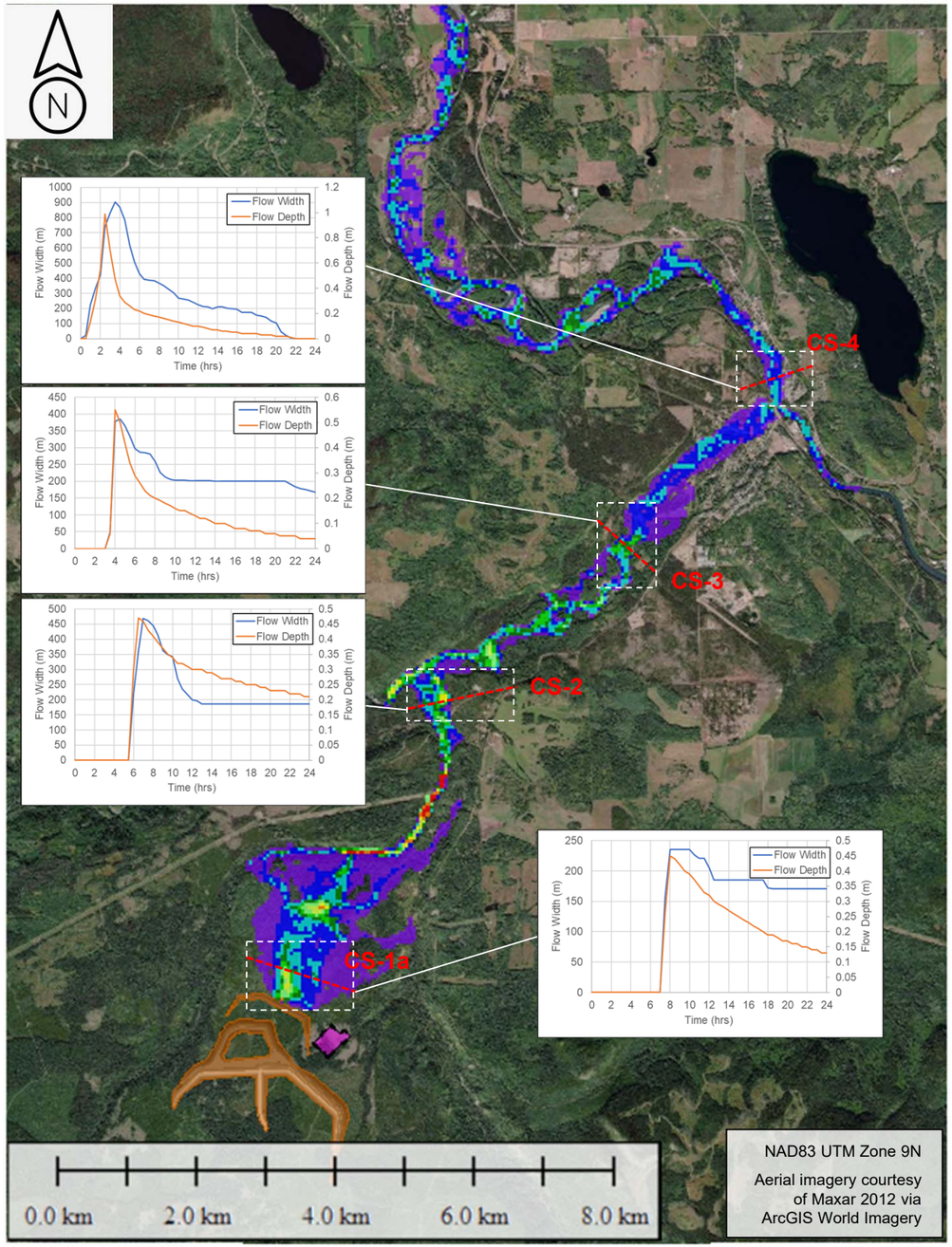
Dam Break Assessment

No Breach, Rainy Day Flood Hazard

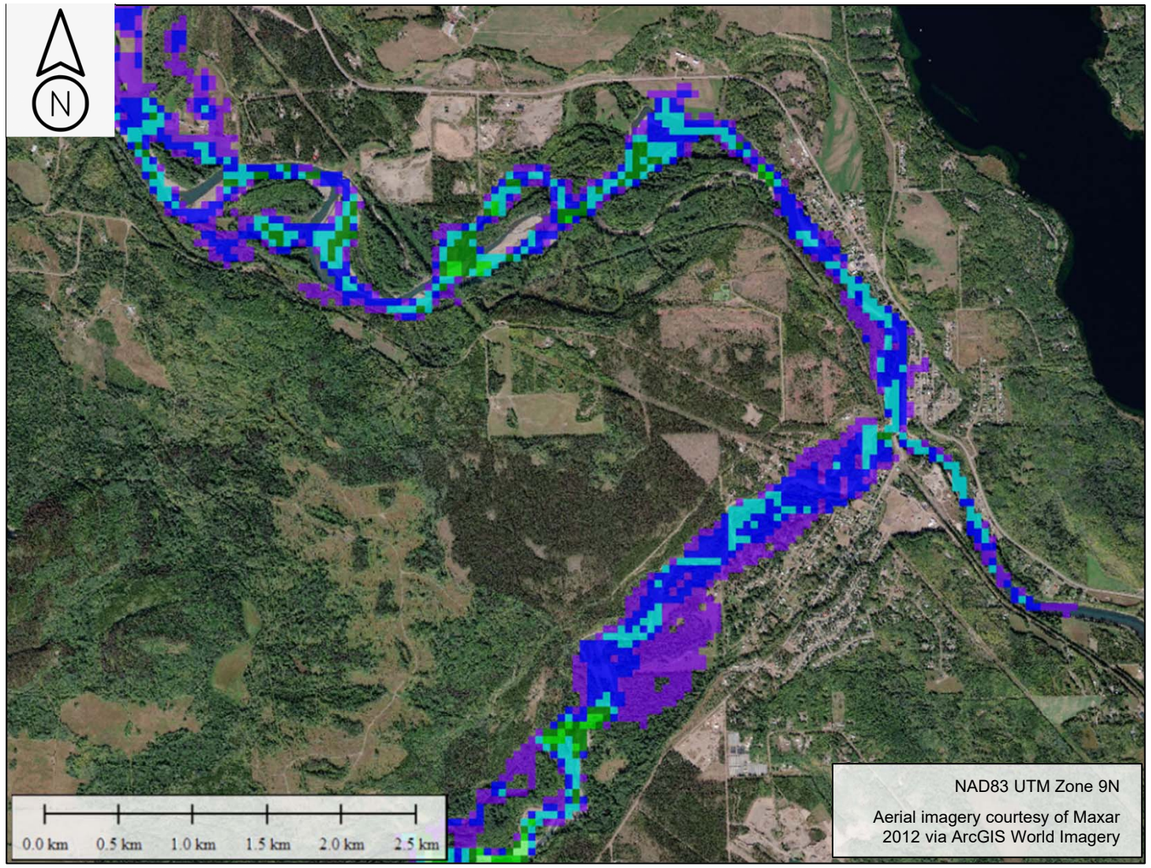
Date:	Prepared by:	Figure:
Jan. 2021	NF	**B.3**

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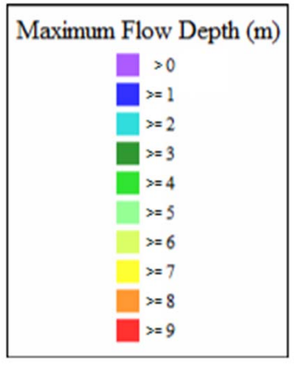
Appendix C West/North/Tenas Breach, Sunny Day Scenario



a) Overall Site Plan



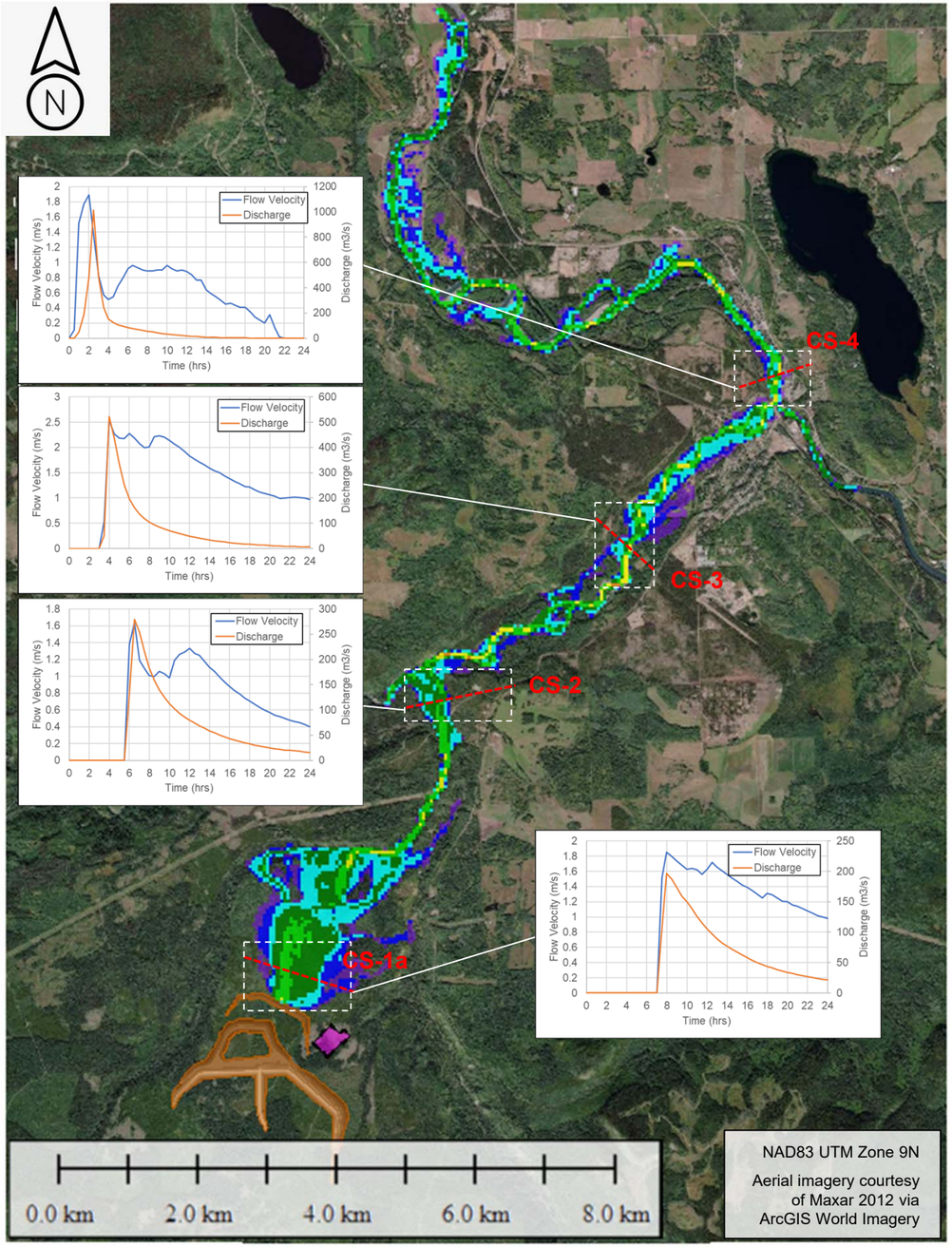
b) Village of Telkwa Area



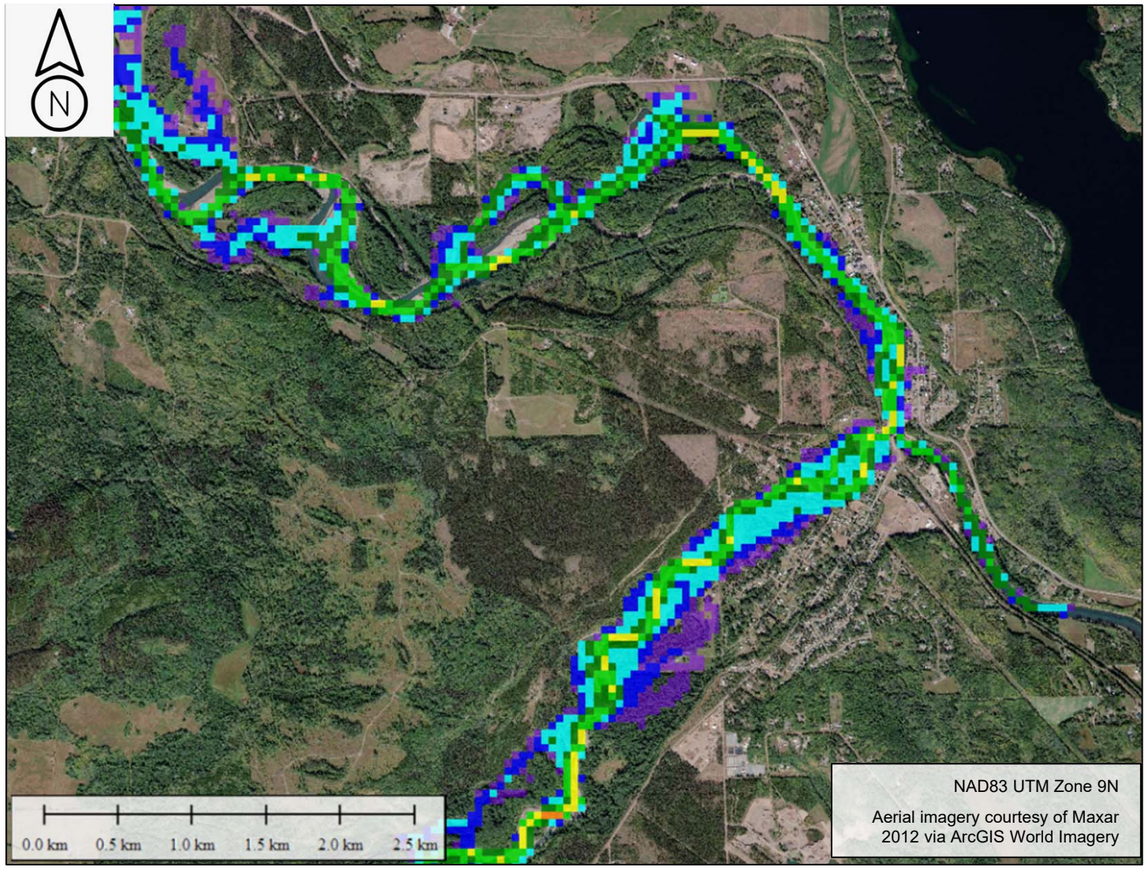
Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

srk consulting	TELKWA COAL LIMITED	Dam Break Assessment
Job No: 1CT027.003 Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx	Tenas Project – EA Water Management	**West/North/Tenas Breach, Sunny Day Maximum Flow Depth**
		Date: Jan. 2021 | Prepared by: NF | Figure: **C.1**

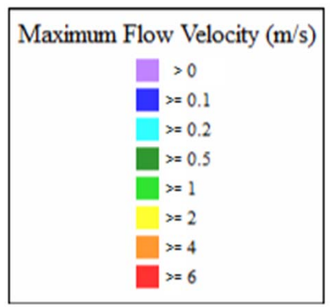
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a) Overall Site Plan



b) Village of Telkwa Area



Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

srk consulting

TELKWA COAL LIMITED

Job No: 1CT027.003

Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx

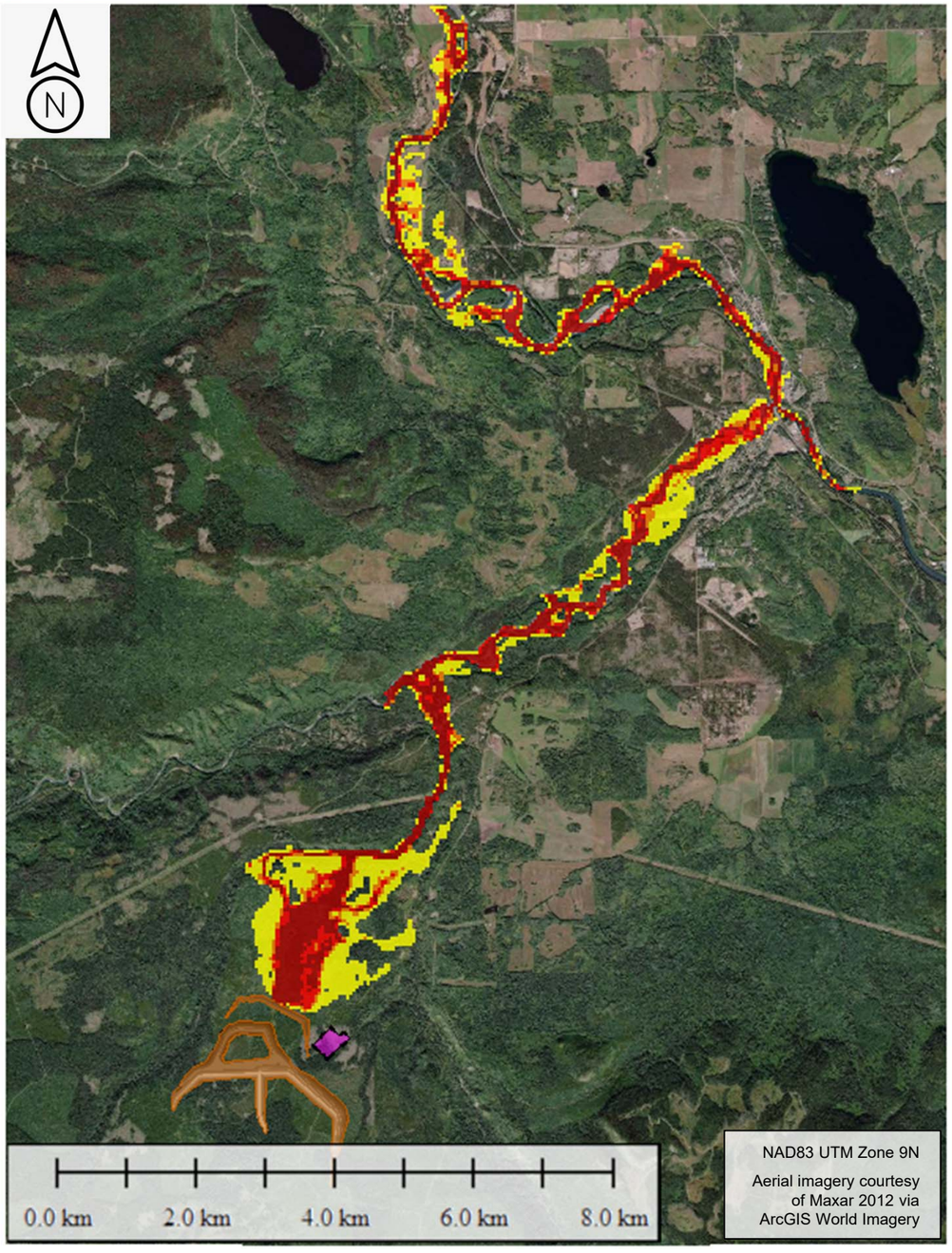
Tenas Project – EA Water Management

Dam Break Assessment

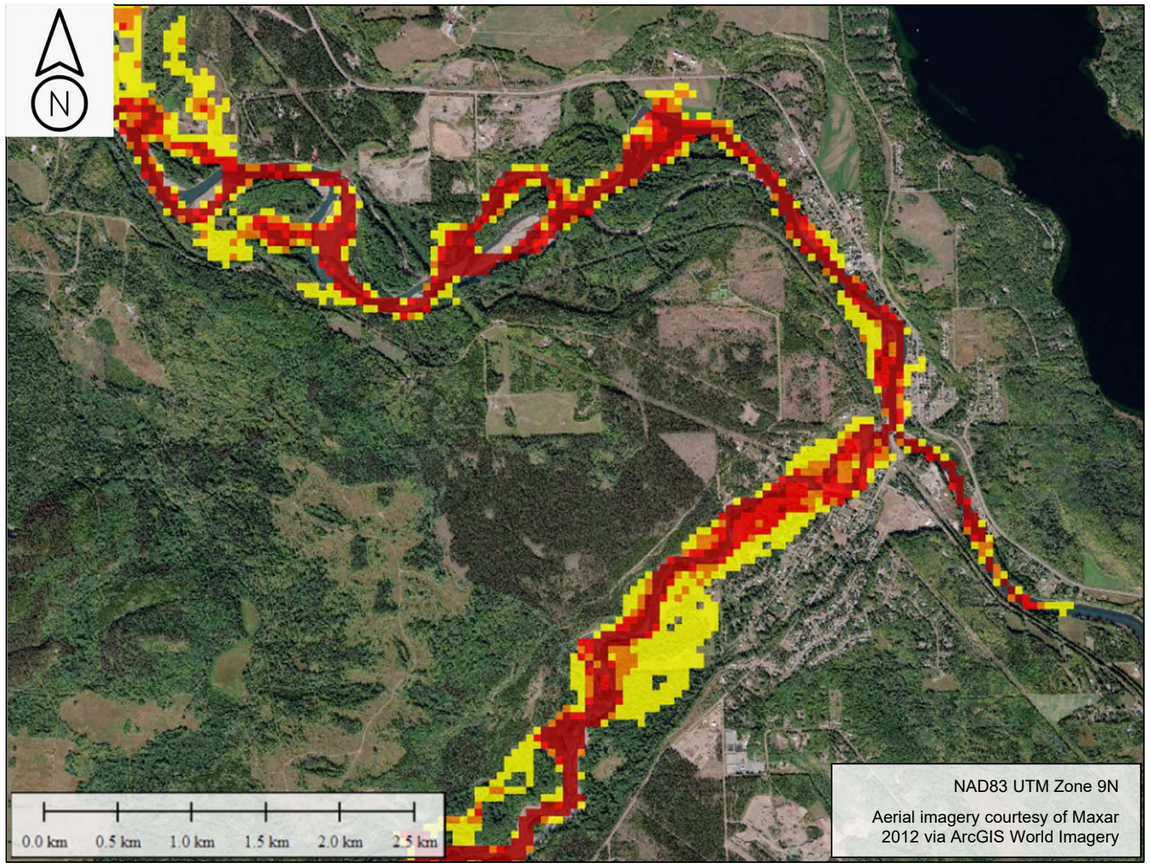
West/North/Tenas Breach, Sunny Day
Maximum Flow Velocity

Date:	Prepared by:	Figure:
Jan. 2021	NF	**C.2**

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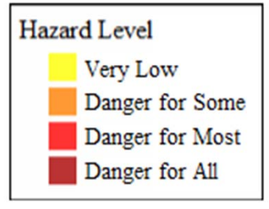


a) Overall Site Plan



b) Village of Telkwa Area

Hazard Rating	Risk to People
Very Low	Caution
Danger for Some	Includes children, the elderly, and the infirm
Danger for Most	Includes the general public
Danger for All	Includes emergency services



Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

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Dam Break Assessment

West/North/Tenas Breach, Sunny Day Flood Hazard

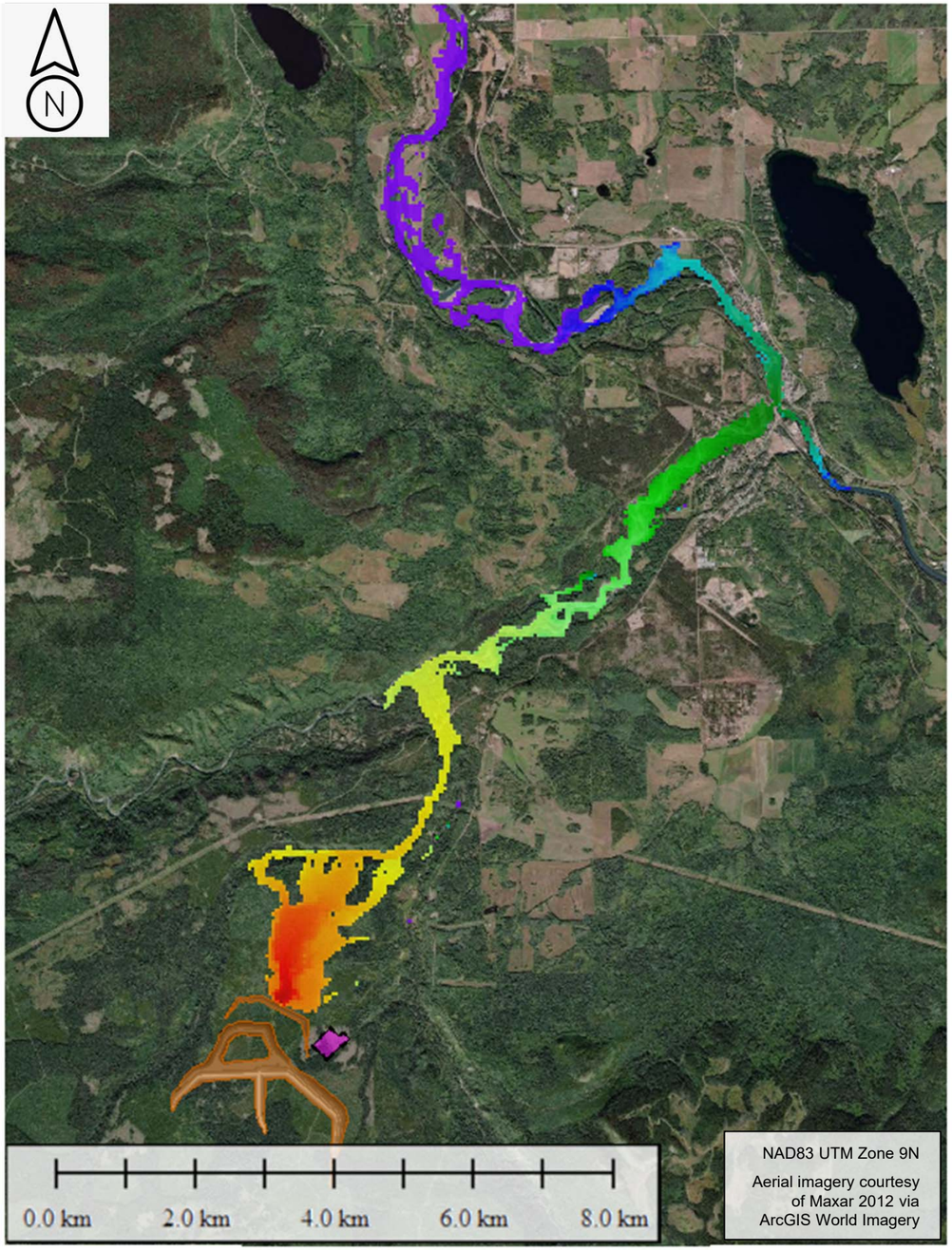
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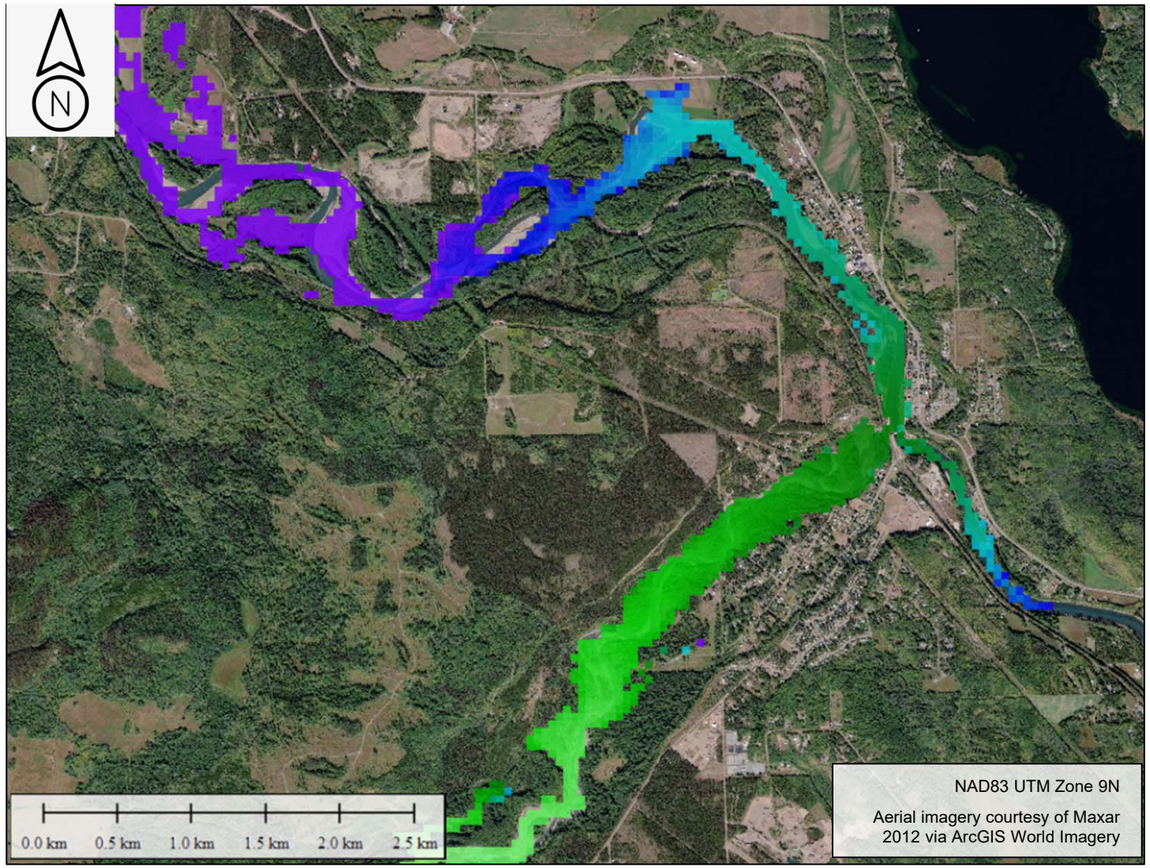
Tenas Project – EA Water Management

Date: Jan. 2021 | Prepared by: NF | Figure: **C.3**

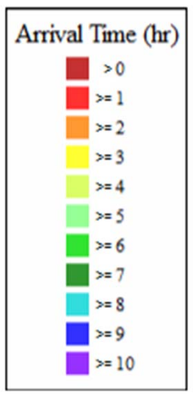
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a) Overall Site Plan



b) Village of Telkwa Area



Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

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Tenas Project – EA Water Management

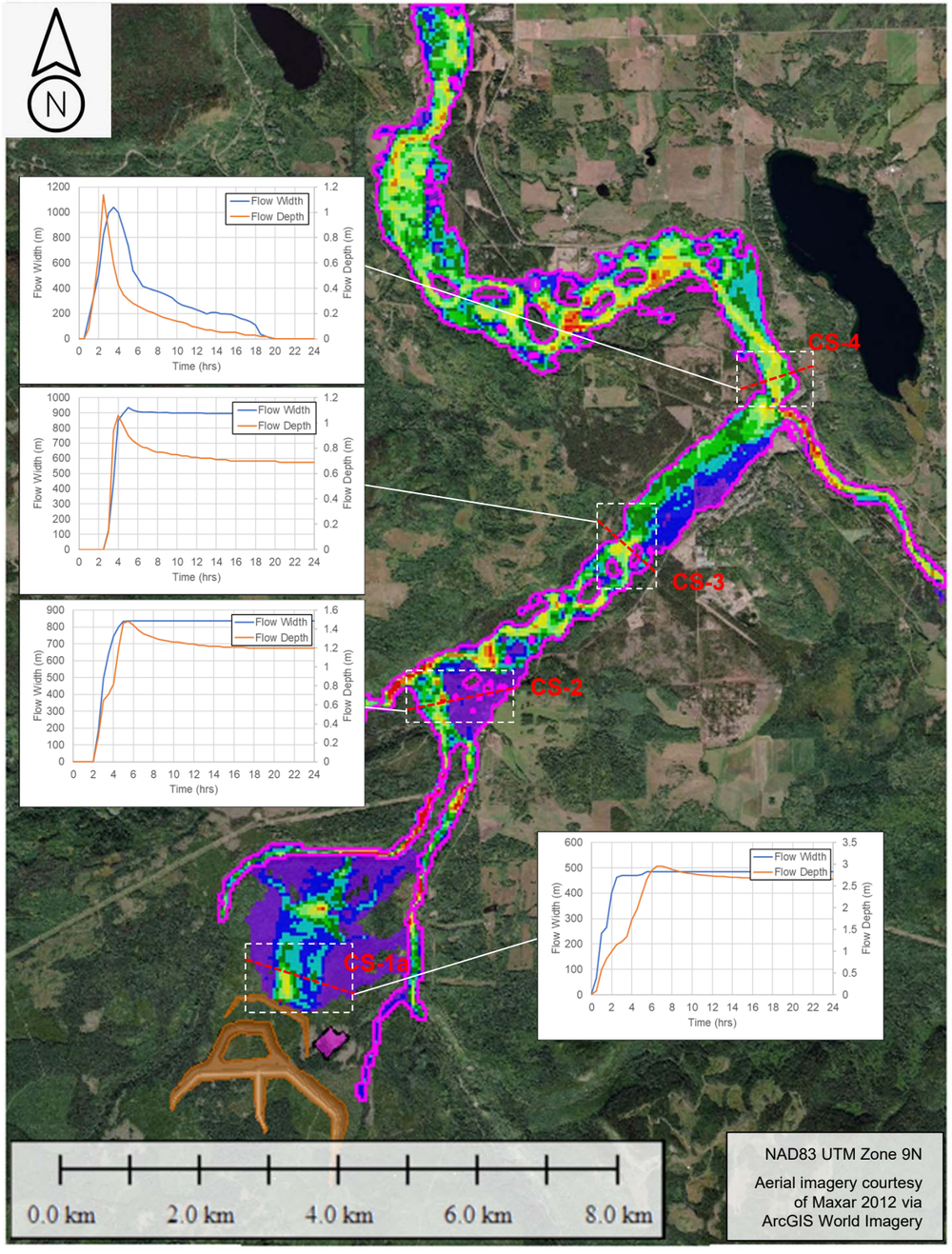
Dam Break Assessment

West/North/Tenas Breach, Sunny Day Arrival Time

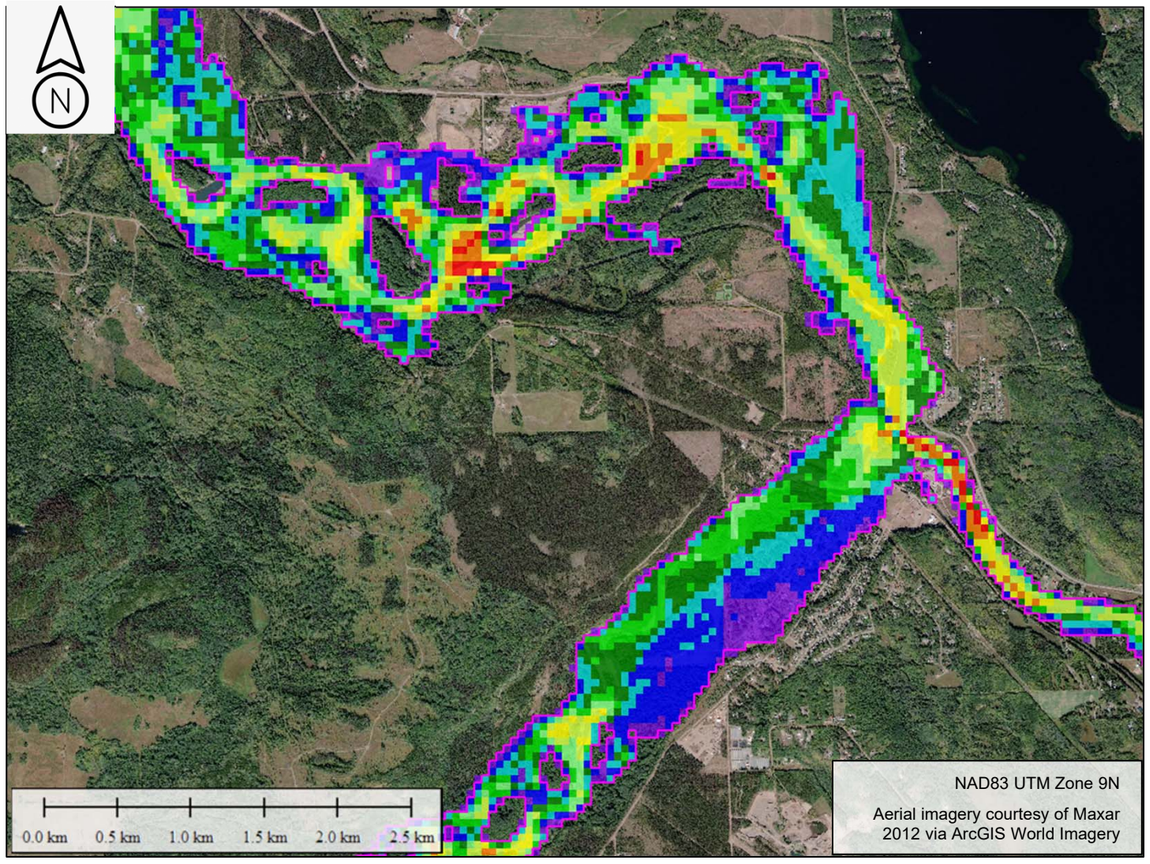
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Appendix D West/North/Tenas Breach, Rainy Day Scenario



a) Overall Site Plan



b) Village of Telkwa Area

Maximum Flow Depth (m)

- > 0
- >= 1
- >= 2
- >= 3
- >= 4
- >= 5
- >= 6
- >= 7
- >= 8
- >= 9

Rainy Day, No Breach Flood Extent

Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

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Job No: 1CT027.003

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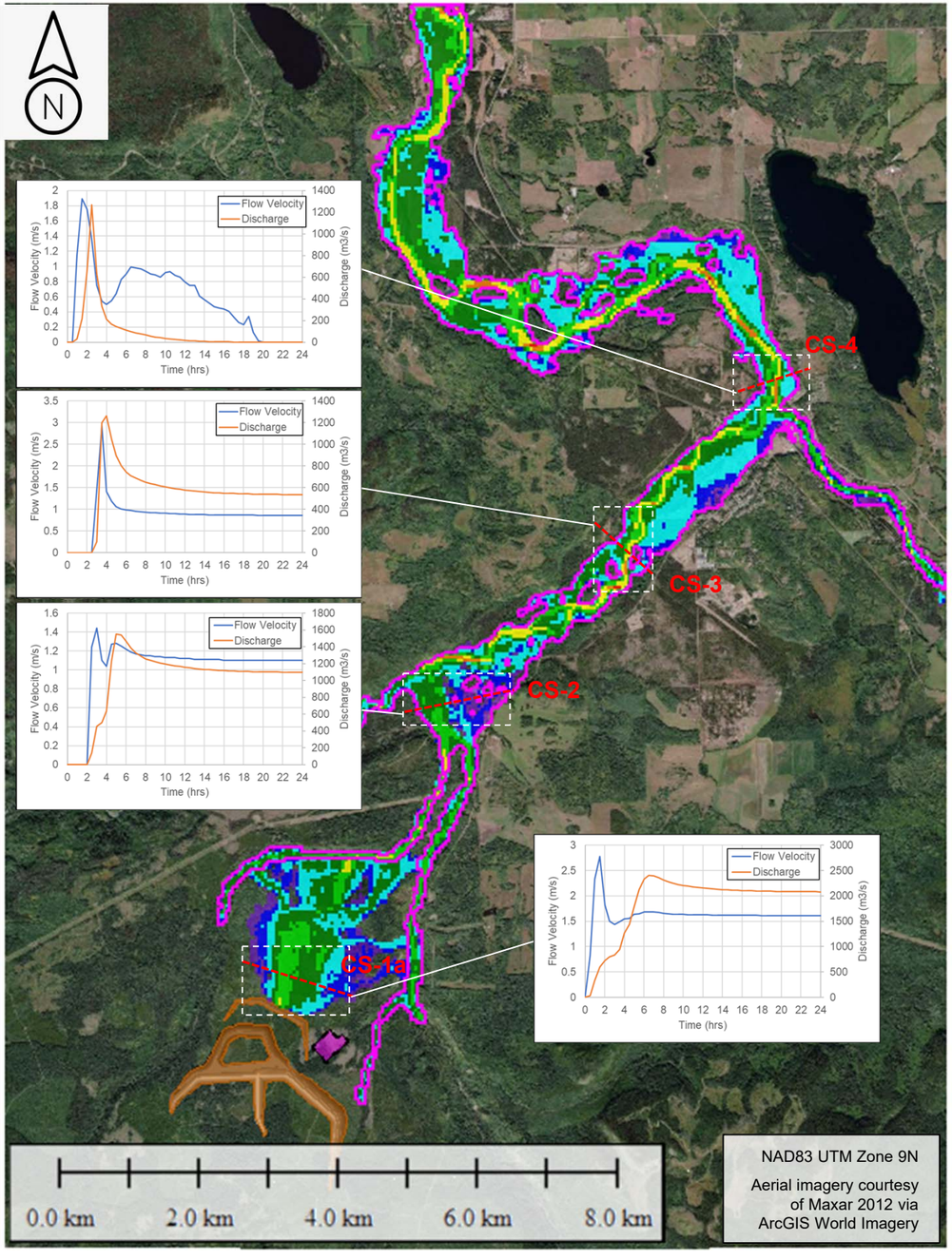
Tenas Project – EA Water Management

Dam Break Assessment

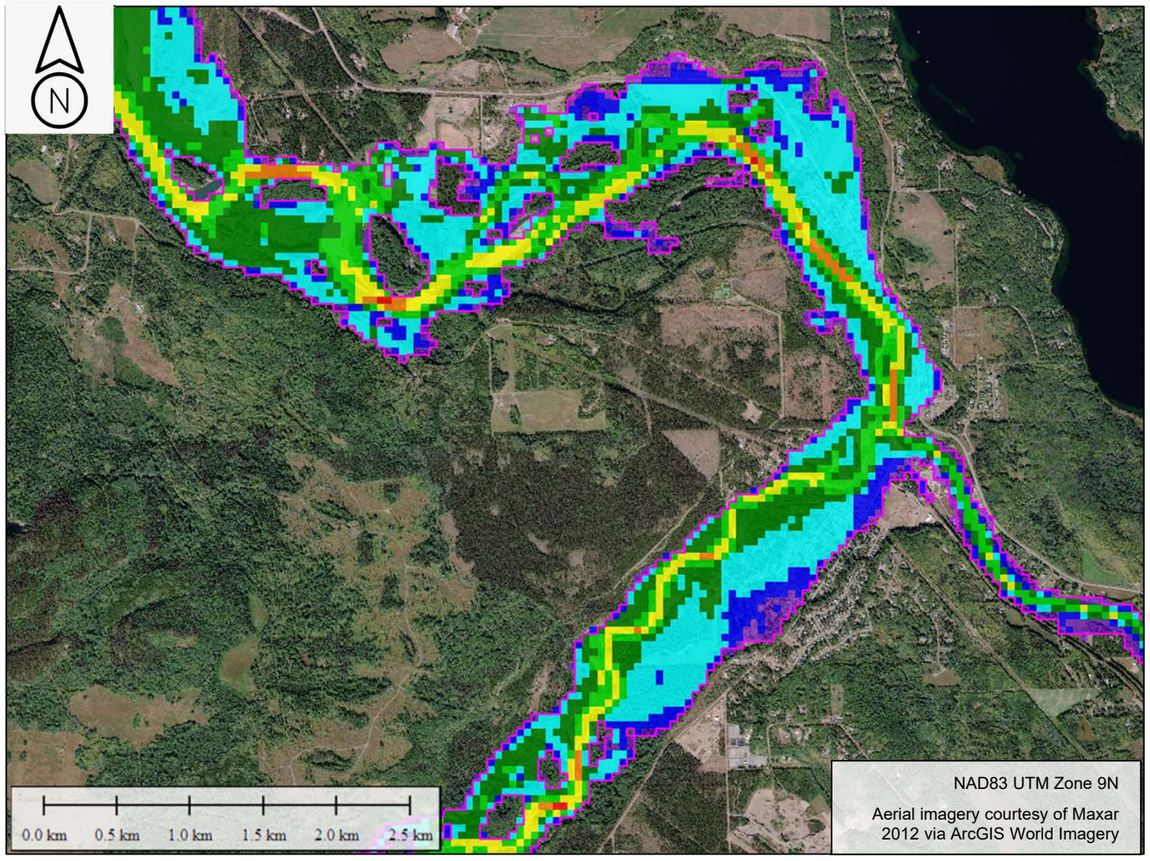
West/North/Tenas Breach, Rainy Day Maximum Flow Depth

Date:	Prepared by:	Figure:
Jan. 2021	NF	**D.1**

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a) Overall Site Plan



b) Village of Telkwa Area

Maximum Flow Velocity (m/s)
- > 0
- >= 0.1
- >= 0.2
- >= 0.5
- >= 1
- >= 2
- >= 4
- >= 6

Rainy Day, No Breach Flood Extent

Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
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Job No: 1CT027.003
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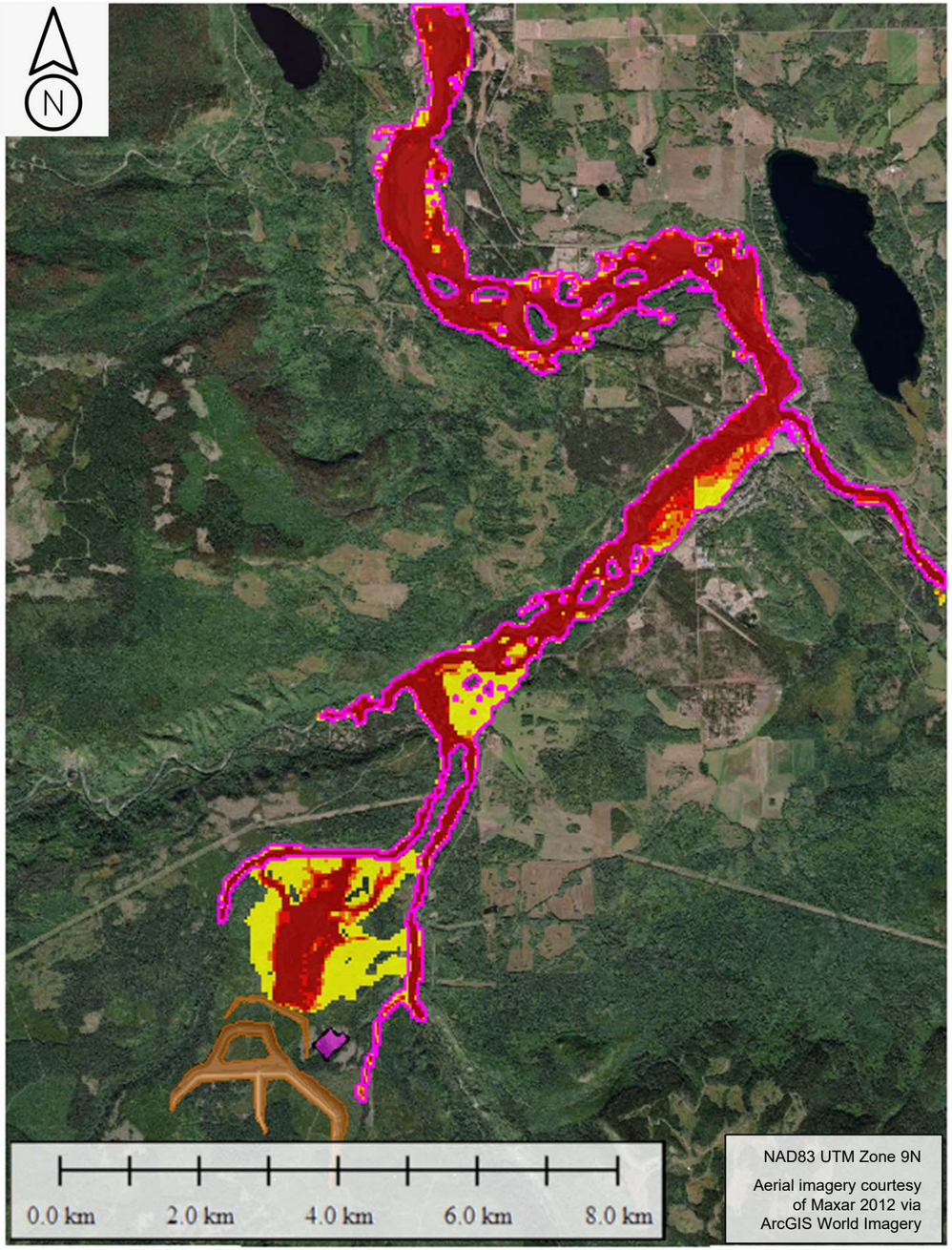
Tenas Project – EA Water Management

Dam Break Assessment

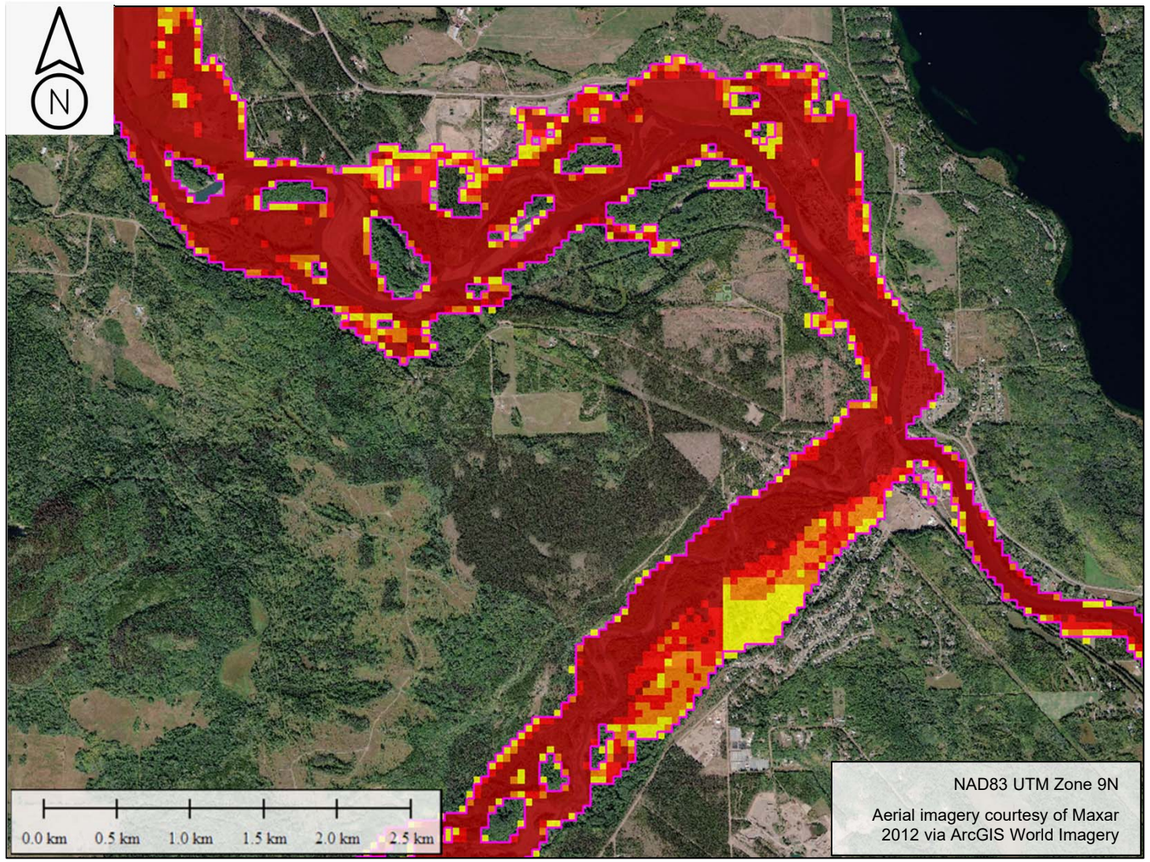
West/North/Tenas Breach, Rainy Day Maximum Flow Velocity

Date:	Prepared by:	Figure:
Jan. 2021	NF	**D.2**

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a) Overall Site Plan



b) Village of Telkwa Area

Hazard Rating	Risk to People
Very Low	Caution
Danger for Some	Includes children, the elderly, and the infirm
Danger for Most	Includes the general public
Danger for All	Includes emergency services

Rainy Day, No Breach Flood Extent

Hazard Level
- Very Low
- Danger for Some
- Danger for Most
- Danger for All

Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
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Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx

Tenas Project – EA Water Management

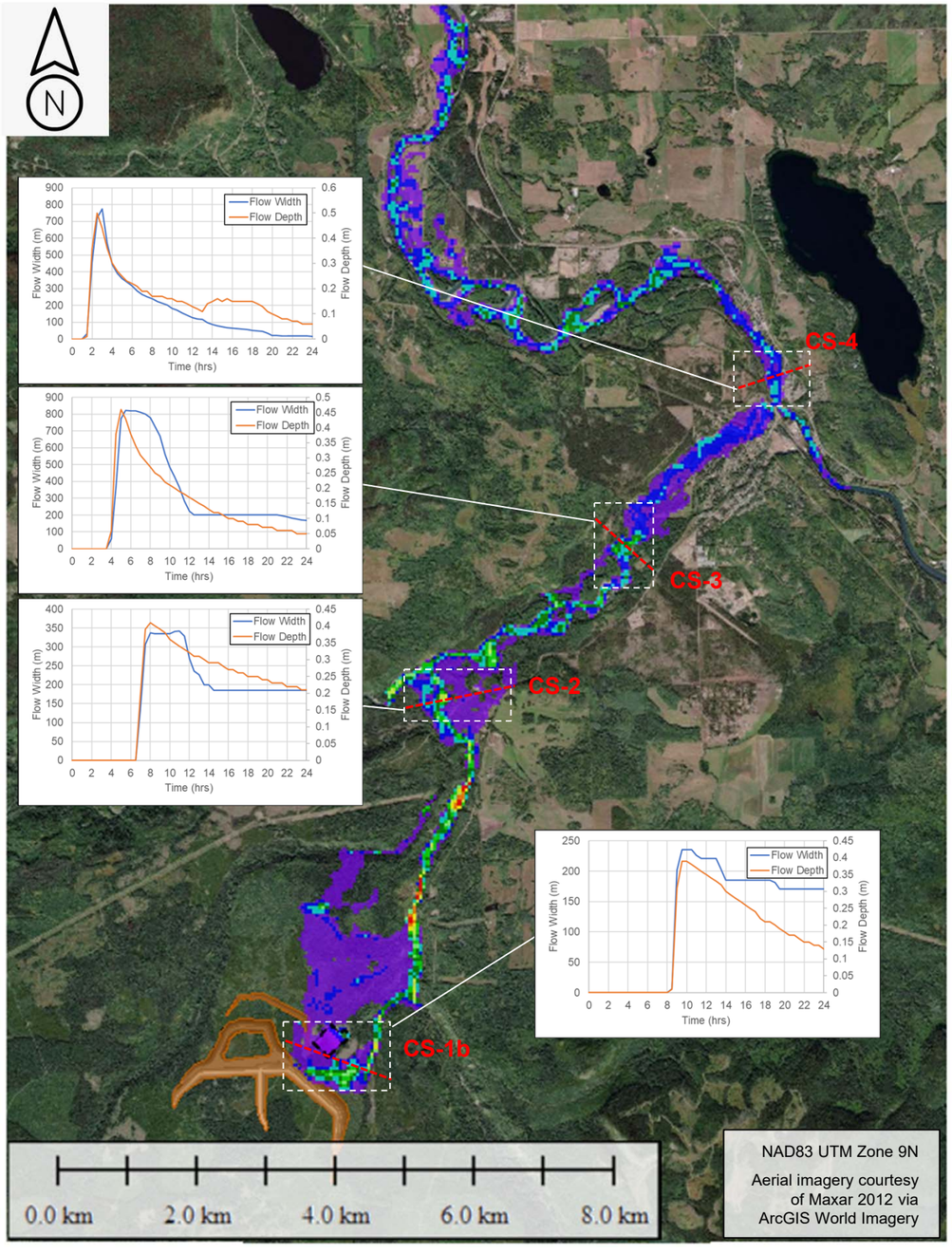
Dam Break Assessment

West/North/Tenas Breach, Rainy Day Flood Hazard

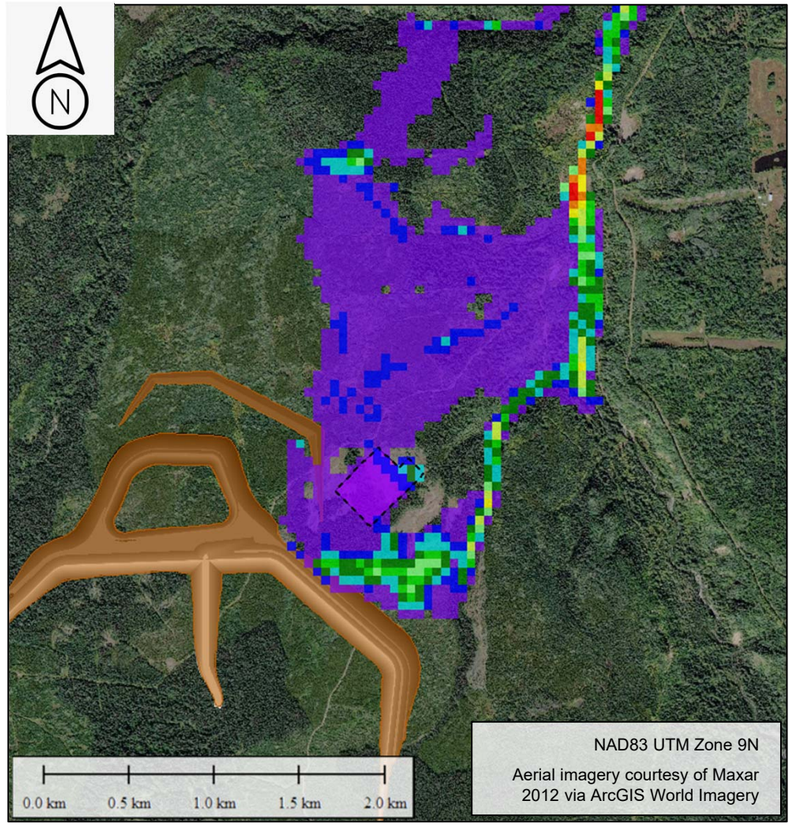
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Jan. 2021	NF	**D.3**

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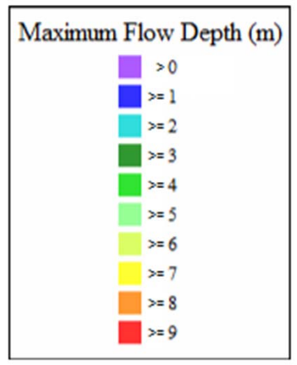
Appendix E East Dam Breach, Sunny Day Scenario



a) Overall Site Plan



b) Village of Telkwa Area



Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
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Job No: 1CT027.003

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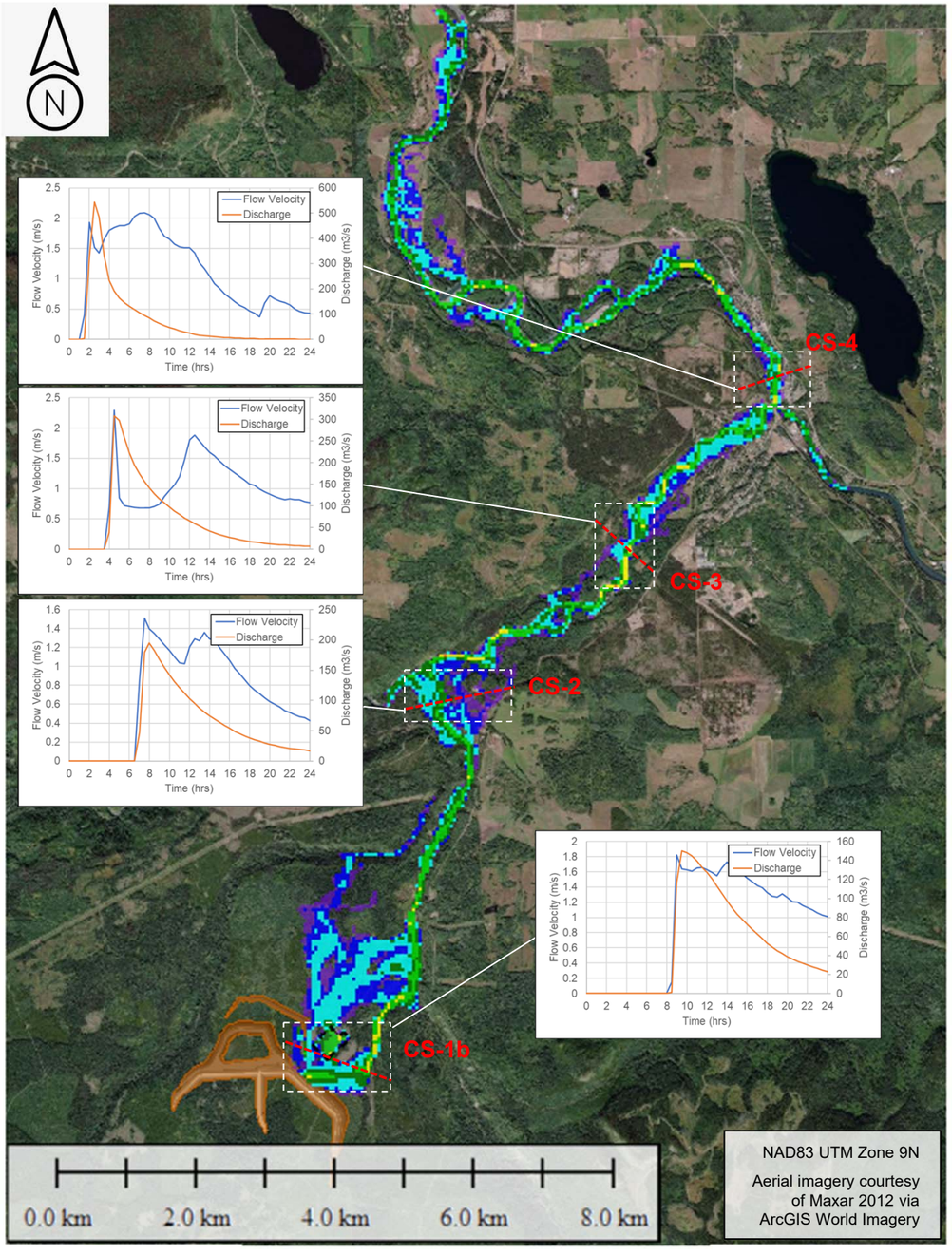
Tenas Project – EA Water Management

Dam Break Assessment

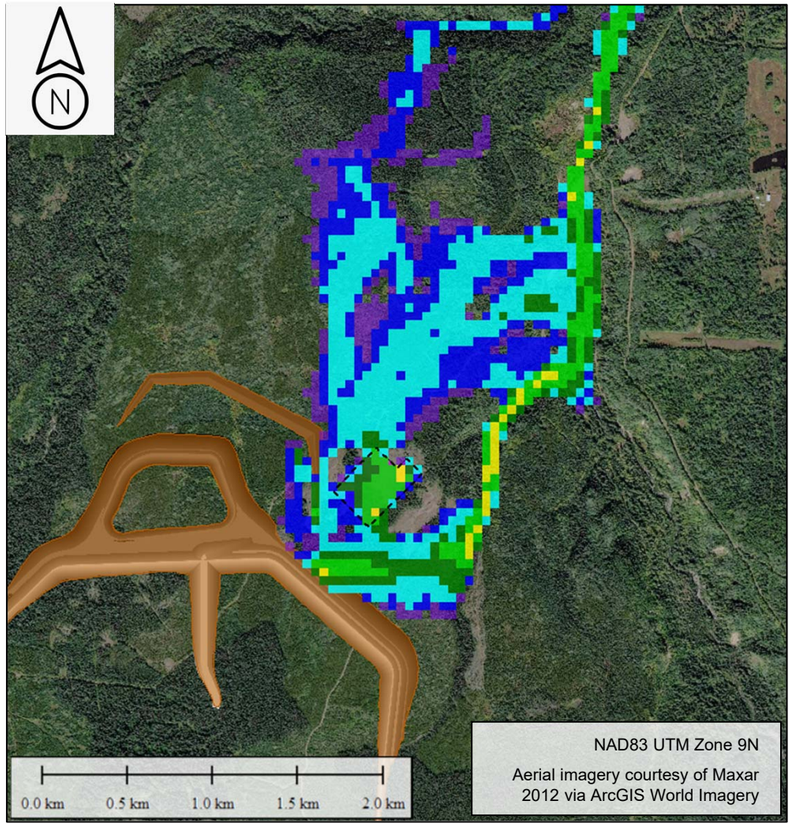
East Dam Breach, Sunny Day Maximum Flow Depth

Date:	Prepared by:	Figure:
Jan. 2021	NF	**E.1**

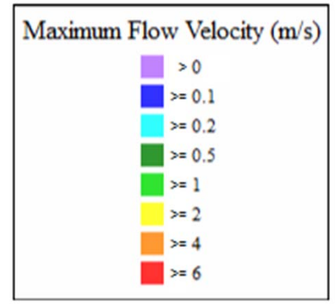
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a) Overall Site Plan



b) Village of Telkwa Area



Notes:
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No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

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Job No: 1CT027.003

Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx

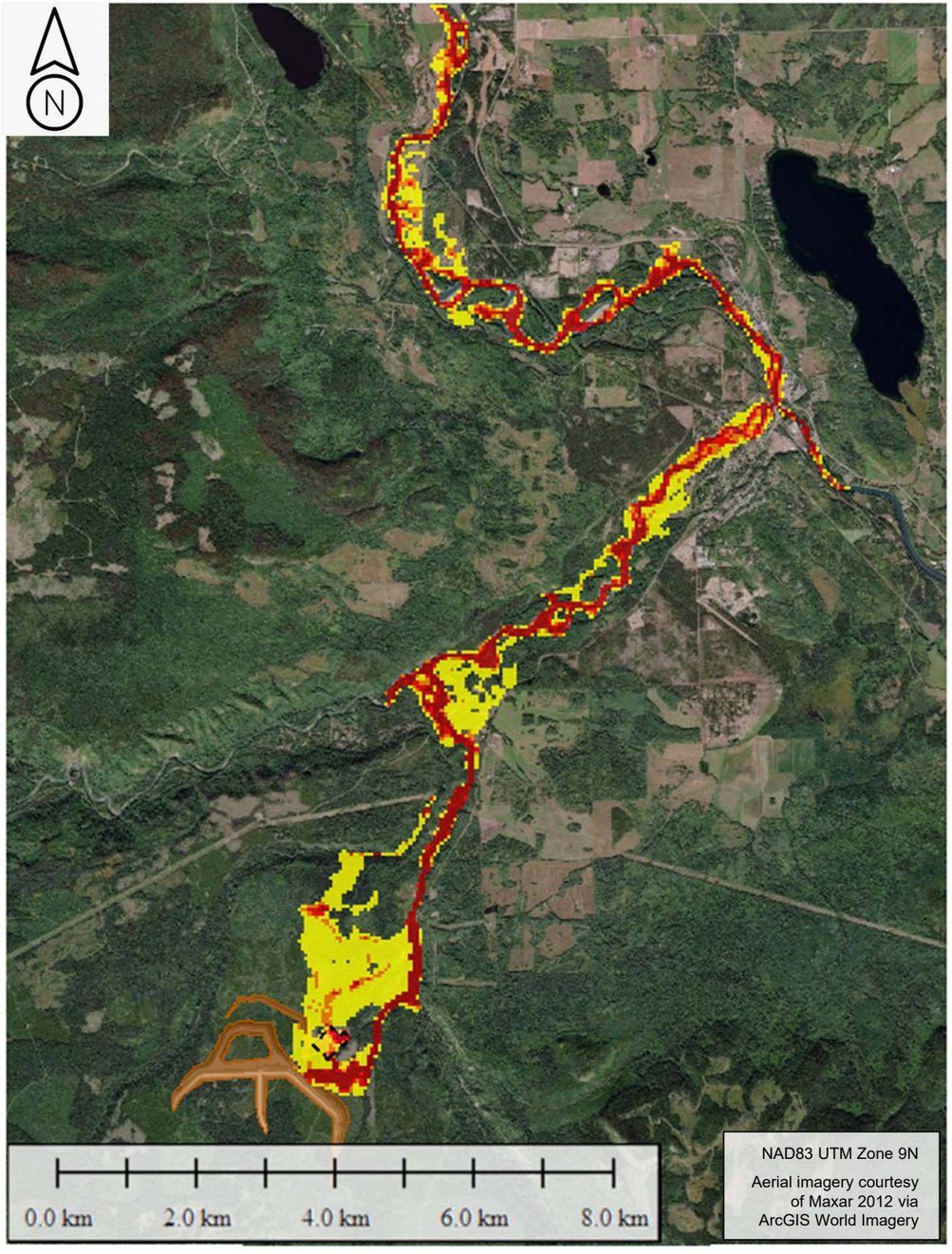
Tenas Project – EA Water Management

Dam Break Assessment

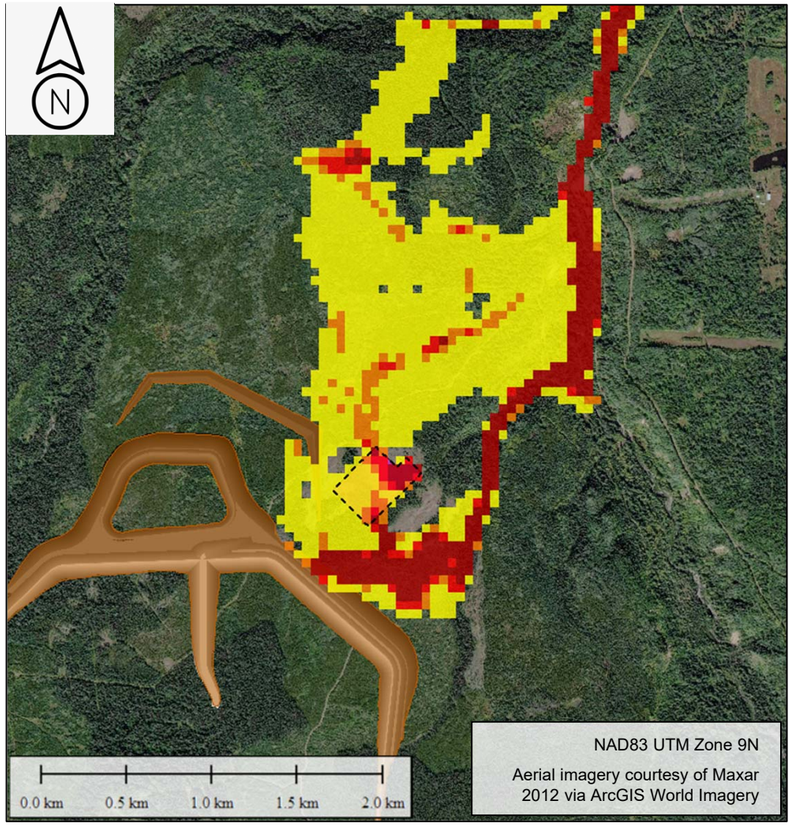
East Dam Breach, Sunny Day Maximum Velocity

Date:	Prepared by:	Figure:
Jan. 2021	NF	**E.2**

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a) Overall Site Plan



b) Village of Telkwa Area

Hazard Rating	Risk to People
Very Low	Caution
Danger for Some	Includes children, the elderly, and the infirm
Danger for Most	Includes the general public
Danger for All	Includes emergency services

Hazard Level
- Very Low
- Danger for Some
- Danger for Most
- Danger for All

Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

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Job No: 1CT027.003

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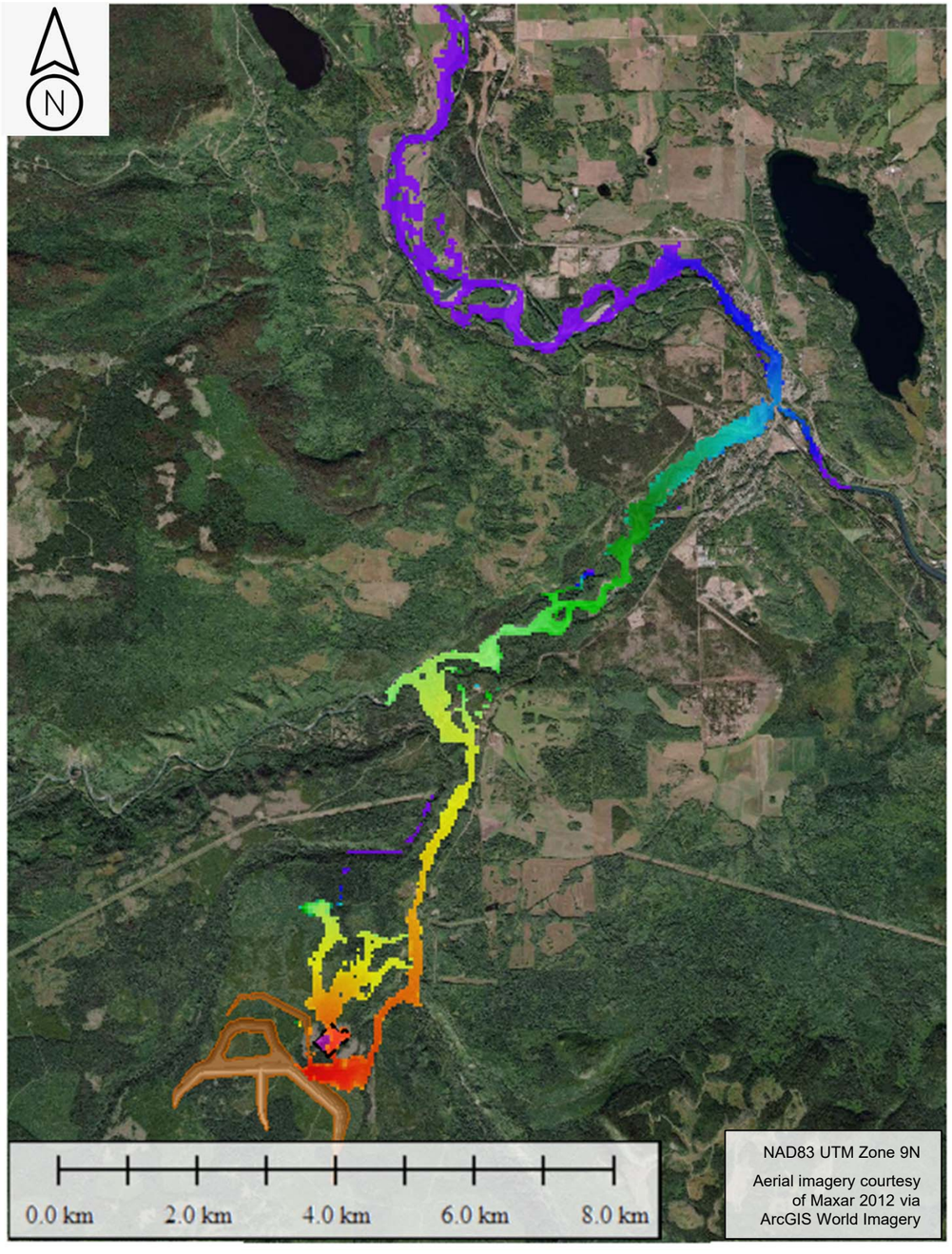
Tenas Project – EA Water Management

Dam Break Assessment

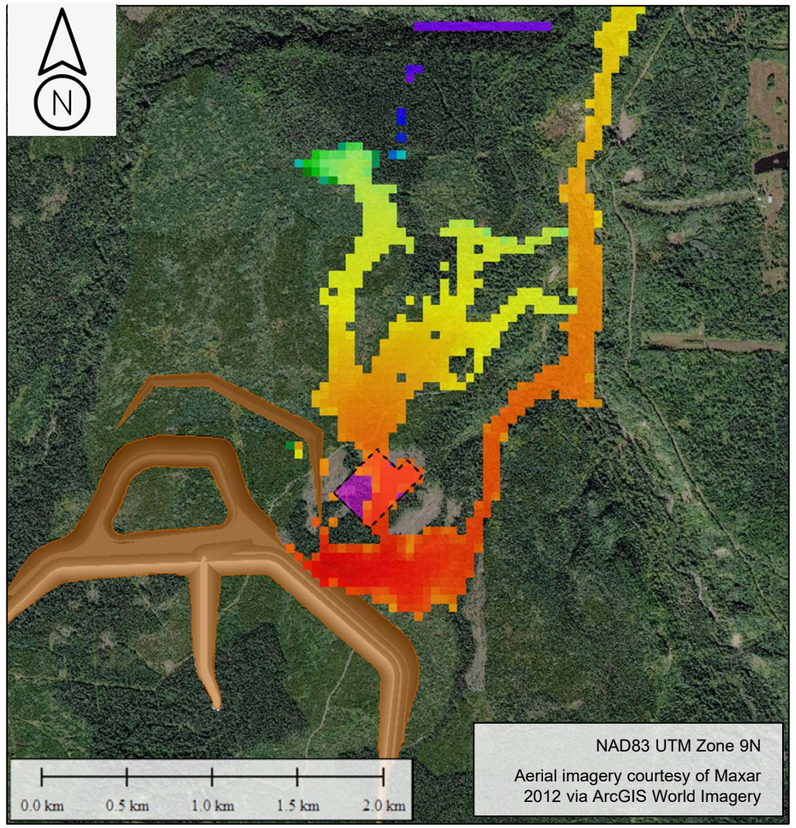
East Dam Breach, Sunny Day Flood Hazard

Date:	Prepared by:	Figure:
Jan. 2021	NF	**E.3**

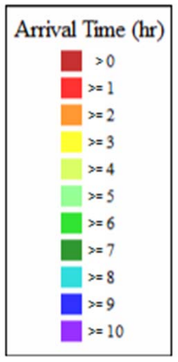
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a) Overall Site Plan



b) Village of Telkwa Area

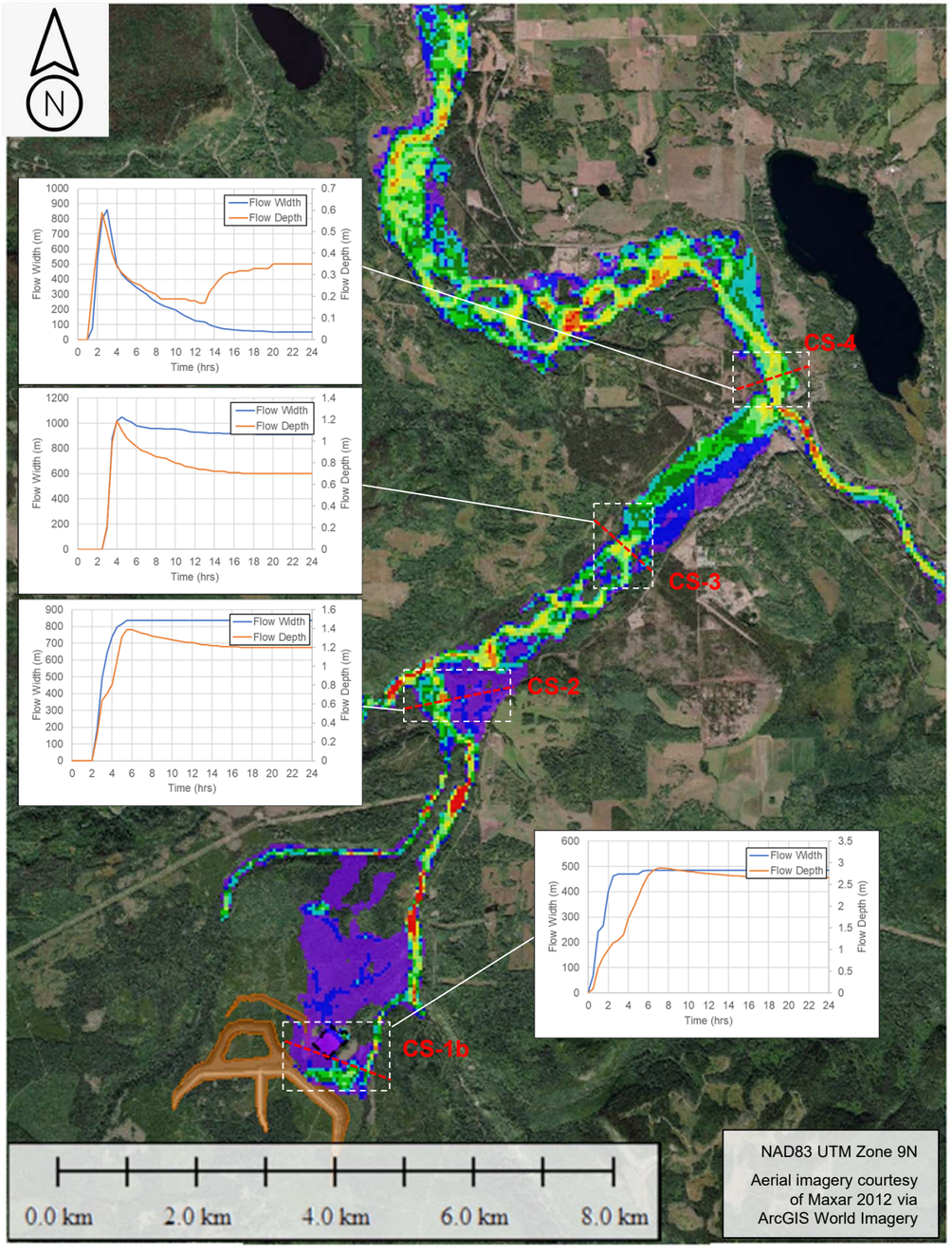


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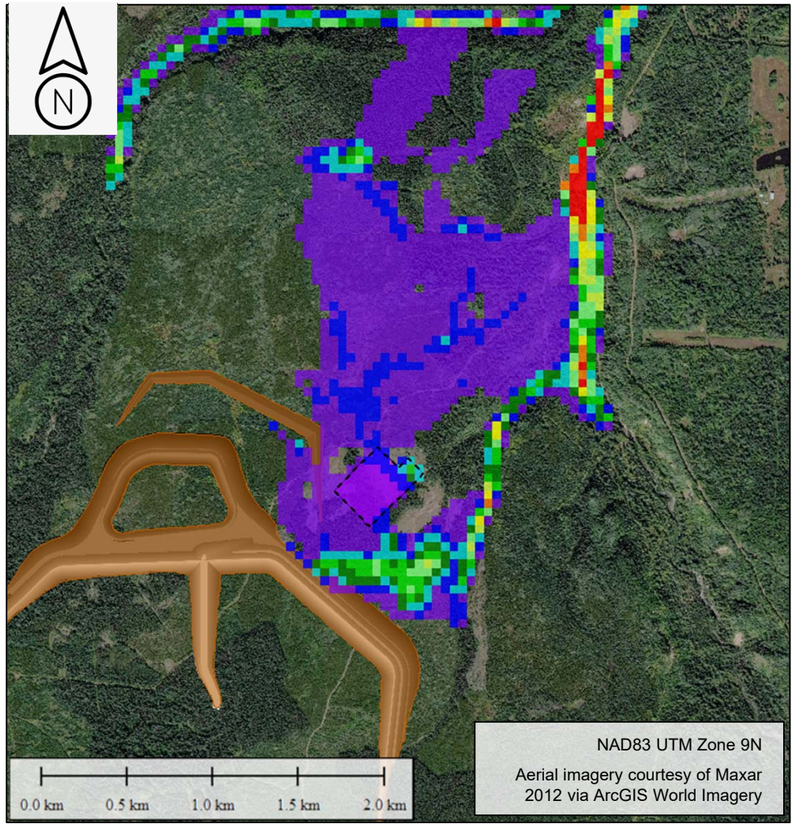
srk consulting	TELKWA COAL LIMITED	Dam Break Assessment
Job No: 1CT027.003 Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx	Tenas Project – EA Water Management	**East Dam Breach, Sunny Day Arrival Time**
		Date: Jan. 2021 / Prepared by: NF / Figure: **E.4**

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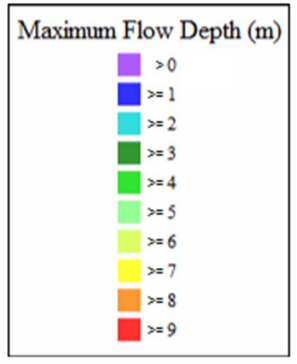
Appendix F East Dam Breach, Rainy Day Scenario



a) Overall Site Plan



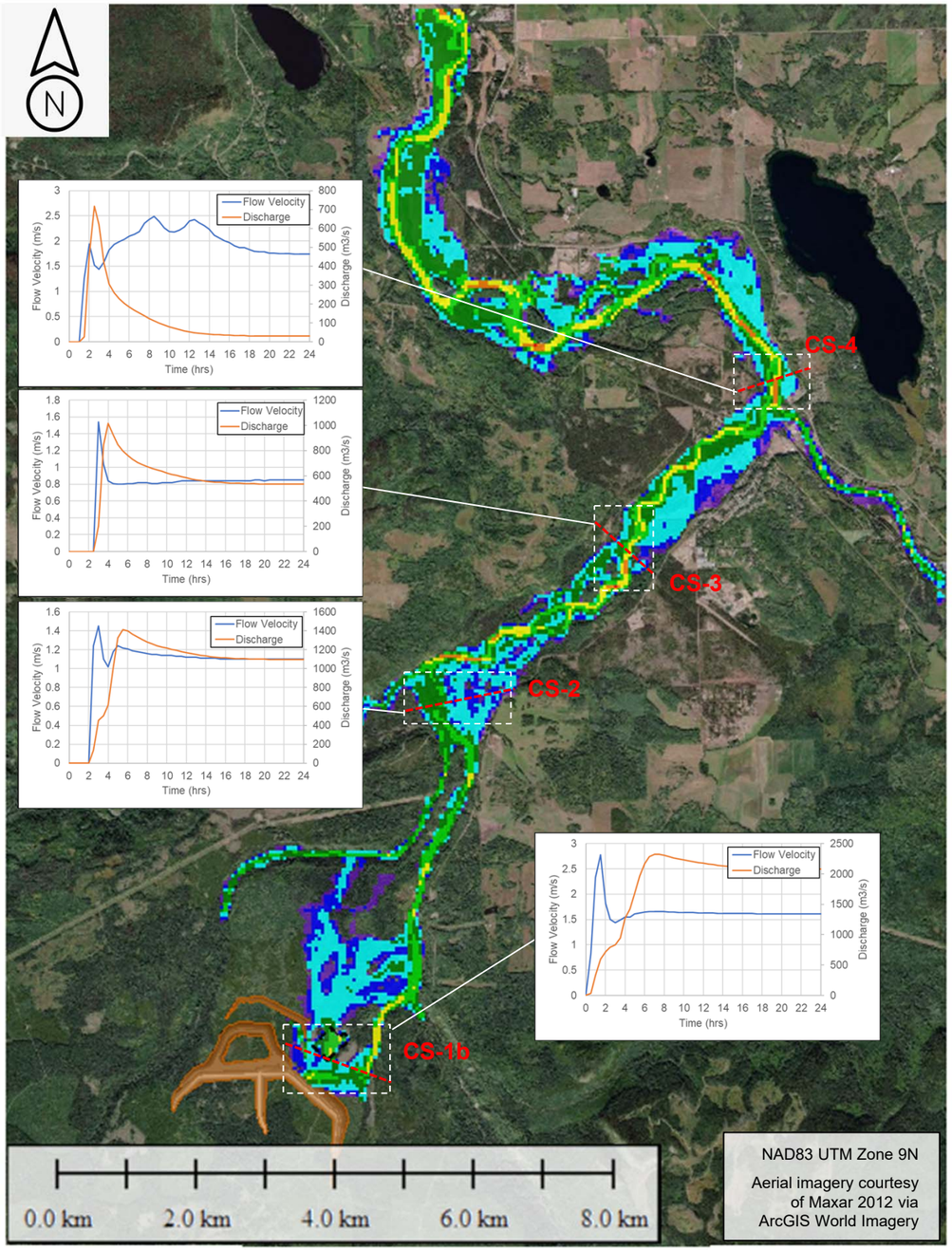
b) Village of Telkwa Area



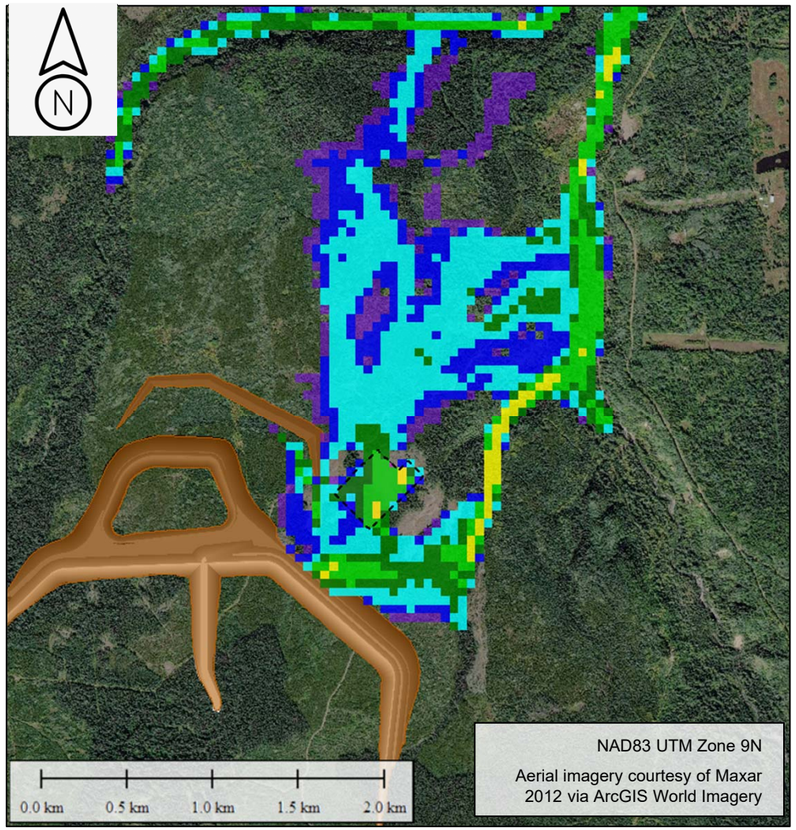
Notes:
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No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
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Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

srk consulting	TELKWA COAL LIMITED	Dam Break Assessment	
Job No: 1CT027.003 Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx	Tenas Project – EA Water Management	**East Dam Breach, Rainy Day Maximum Flow Depth**	
		Date: Jan. 2021	Prepared by: NF
		Figure: **F.1**	

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a) Overall Site Plan



b) Village of Telkwa Area

Maximum Flow Velocity (m/s)
- > 0
- >= 0.1
- >= 0.2
- >= 0.5
- >= 1
- >= 2
- >= 4
- >= 6

Notes:
Predictions computed using 2D overland flow calculations considering topography and roughness estimate.
No hydraulic structures were explicitly modelled.
No sediment transport or scouring was considered as part of the predictions.
Caution is needed when interpreting inundation extents.
Inundation extents due to flooding or dam breach may differ significantly from predictions; therefore, zones outside the inundation extents could still have risks of dangerous flows.

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Job No: 1CT027.003

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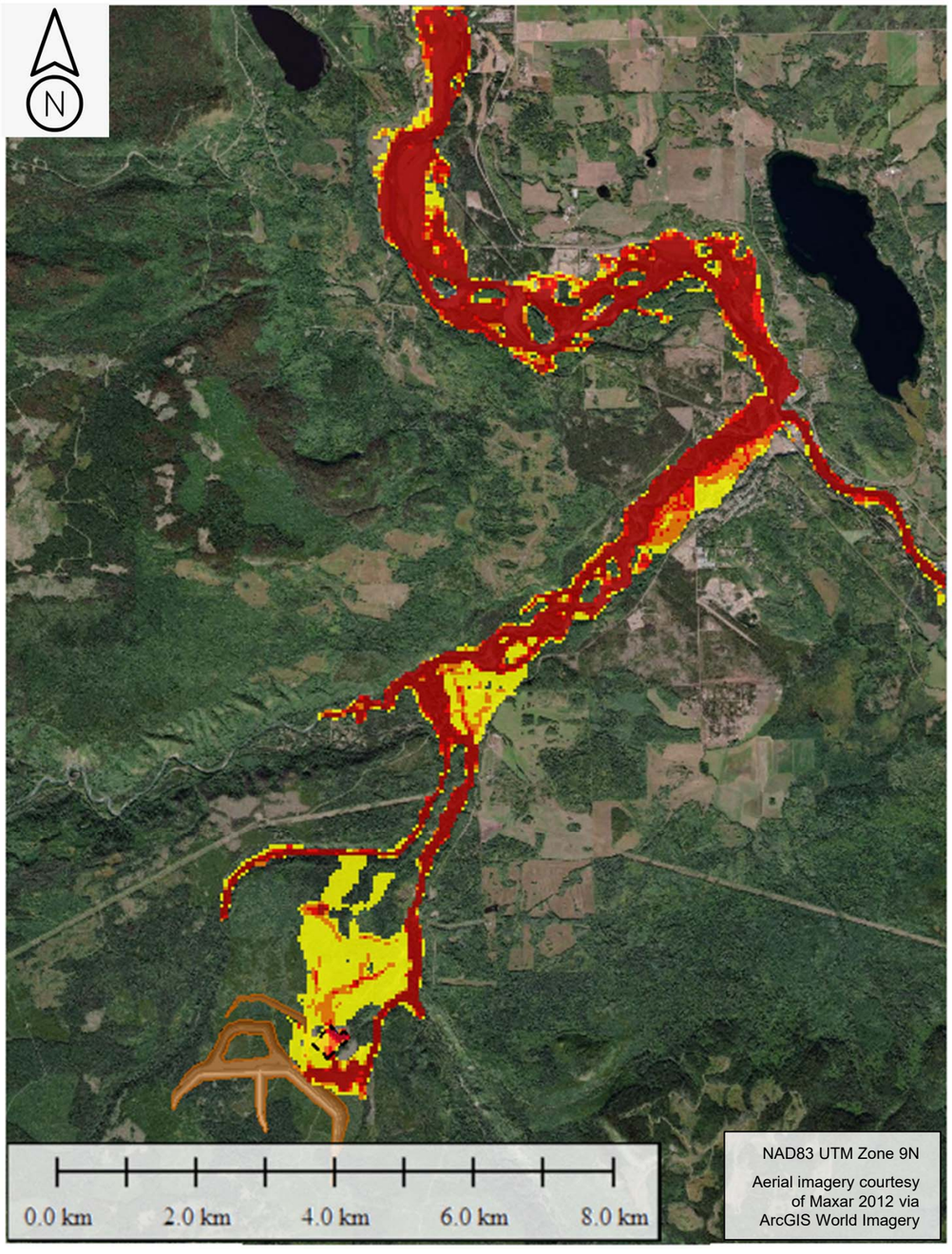
Tenas Project – EA Water Management

Dam Break Assessment

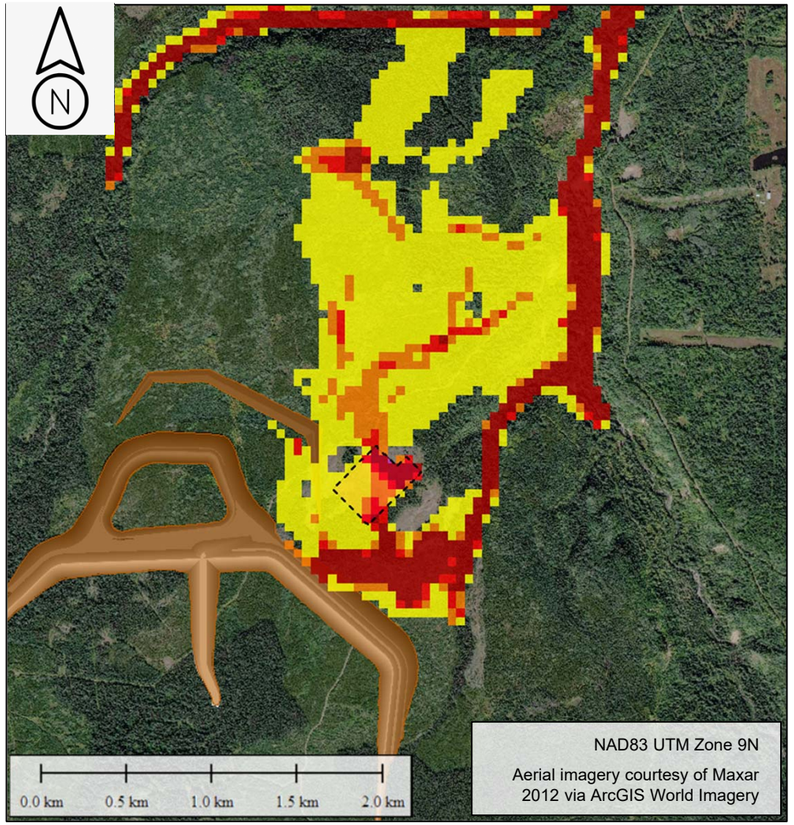
East Dam Breach, Rainy Day Maximum Flow Velocity

Date: Jan. 2021 | Prepared by: NF | Figure: **F.2**

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a) Overall Site Plan



b) Village of Telkwa Area

Hazard Rating	Risk to People
Very Low	Caution
Danger for Some	Includes children, the elderly, and the infirm
Danger for Most	Includes the general public
Danger for All	Includes emergency services

Hazard Level
- Very Low
- Danger for Some
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- Danger for All

Notes:
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TELKWA COAL LIMITED

Dam Break Assessment

East Dam Breach, Rainy Day Flood Hazard

Job No: 1CT027.003
Filename: Telkwa_DamBreak_Appendices_1CT027-003.pptx

Tenas Project – EA Water Management

Date: Jan. 2021 | Prepared by: NF | Figure: **F.3**

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APPENDIX 20: PAG MANAGEMENT ALTERNATIVES ASSESSMENT, SRK

SRK Consulting (Canada) Inc.
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Vancouver, BC V6E 3X2
Canada

+1 604 681 4196 office
+1 604 687 5532 fax

vancouver@srk.com
www.srk.com

Technical Memo

20 April 2022

To	Dan Farmer
From	Michael Dabiri
Cc	Samantha Barnes, Tom Sharp
Subject	PAG Management Alternatives Assessment
Client	Telkwa Coal Ltd
Project	1CT027.003

1 Introduction

This technical memorandum presents the processes and criteria used to select preferred alternatives, and “Alternative Means", for management of Potentially Acid Generating (PAG) materials, as well as potential Metal Leaching (ML) from non-PAG materials, at the Tenas Project (Project).

This alternatives assessment for the Project meets the information requirements as outlined in the British Columbia (BC) Environmental Assessment Office (EAO) Application Information Requirements (AIR) for the Project (EAO 2022). The assessment complies with the BC *Environmental Assessment Act* (GovBC 2002) and the EAO guidance for information requirements for tailings management (EAO 2015), and with the Operational Policy Statement Addressing “Purpose of” and “Alternative Means” under the *Canadian Environmental Assessment Act* (Canadian Environmental Assessment Agency [CEAA] 2012).

“Alternative means” are the various technically and economically feasible ways under consideration by the proponent that would allow the Project to be carried out. The proposed Project reflects the analysis of alternatives throughout the history of the mine site as information on coal resources was supplemented over time. This analysis of the alternative means considers the major decisions for the management of PAG materials.

The assessment presents and compares best practices and best available technologies for processed rock (tailings) and PAG rock management for the specific conditions of the Project. It takes into consideration safety (including dam safety), technical and financial aspects, and implications for environmental, health, social, heritage and economic values.

This memo presents background material on the history of the mine, geochemical material characterizations, the method for the review of alternative means, and an assessment of alternative means to manage mined and processed rock.

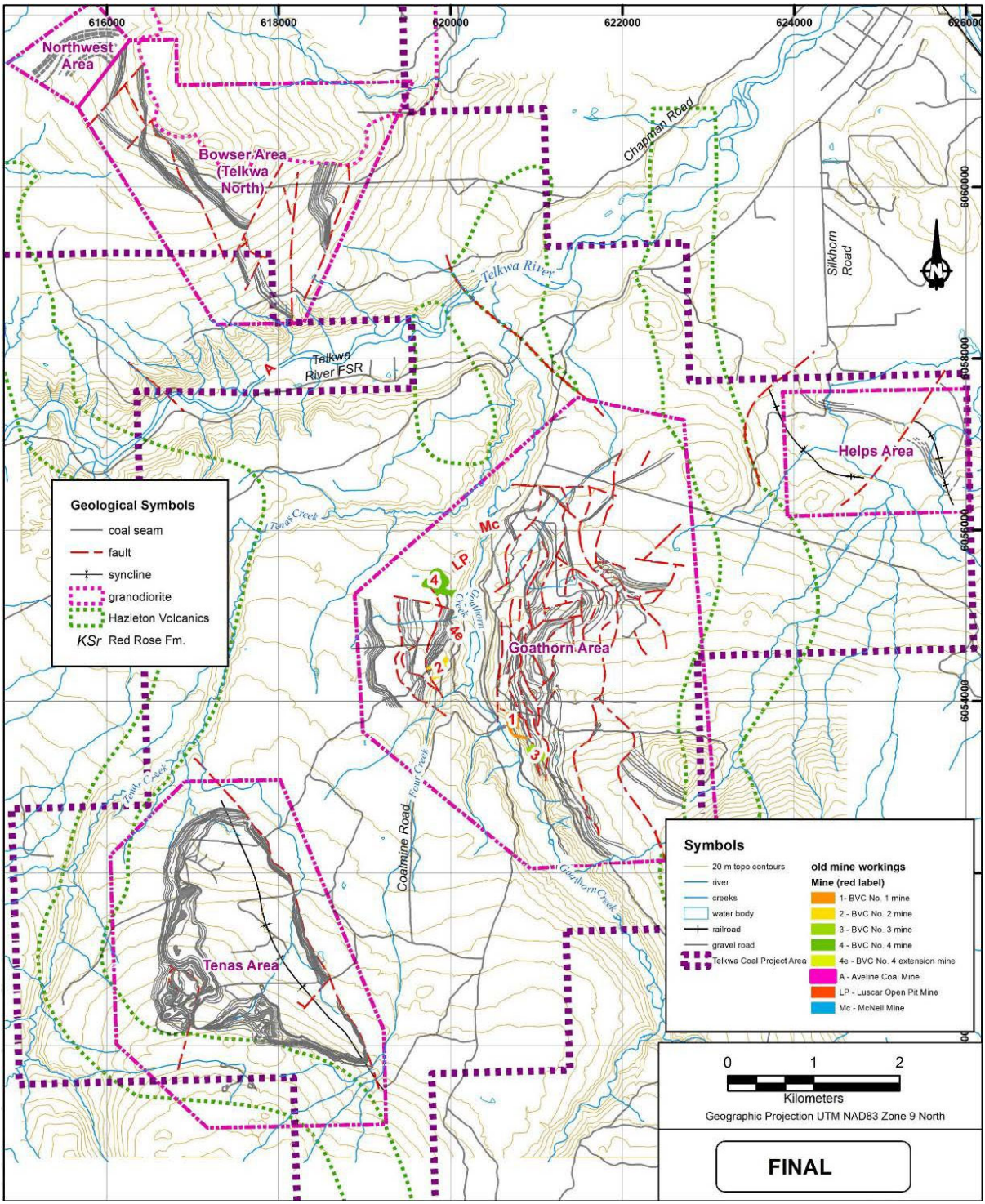
1.1 Background

Coal was discovered in the Telkwa area around the year 1900. Mining is reported to have begun as early as 1918, with small-scale operations supplying thermal coal locally for heating. Approximately 400,000 tonnes of coal were reportedly produced from 1918 to 1985. Through the 1980s and 1990s, the Telkwa property, which includes the Telkwa North, Tenas, and Goathorn Creek deposits (see **Figure 1-1**), changed hands several times with no coal production, before the coal licenses and property were acquired by Telkwa Coal Limited (TCL) in 2017 and 2018.

Geochemical characterization studies performed by previous owners of the project to support economic and environmental assessments in the 1990s showed that Metal Leaching/Acid Rock Drainage (ML/ARD) potential management needed to be considered for the project. The resulting management plans prescribed segregation of highly reactive rock components for subaqueous disposal in backfilled pits and blending of PAG and non-PAG components to create non-PAG mine rock dumps and backfilling of the open pit.

More recently, pre-feasibility studies were completed for large mine designs (encompassing the three (3) deposits, SRK 2017b) and small mine designs (encompassing only the Tenas deposit, SRK 2017a), which included initial expit non-PAG rock piles and in-pit disposal of PAG rock. Due to the requirement for long-term treatment of ARD, this configuration was abandoned for the subsequent Project feasibility study (SRK 2019a) in favour of subaqueous disposal of all PAG materials in purpose-built “PAG cells also known as management ponds”.

Figure 1-1: Telkwa Project Geology and Deposits



***Source**: SRK 2019a*

1.2 Environmental Assessment (EA) Mine Plan

The proposed Project will produce metallurgical coal at a planned annual production rate of between 775,000 and 825,000 tonnes over a life of mine of about 25 years at a maximum production rate of 2,500 tonnes of processed coal per day. Coal is processed by a dense medium cyclone (DMC)/flotation Coal Processing Plant (CPP) with a 145 tonnes per hour (tph) capacity, with fine processed rock (fine processed rock, defined as materials smaller than 0.5 millimetres [mm]) dewatered to 40 percent (%) solids content by a belt filter press, before being combined with the coarse reject and stockpiled for disposal. A schematic of the CPP is shown in **Figure 1-2.**

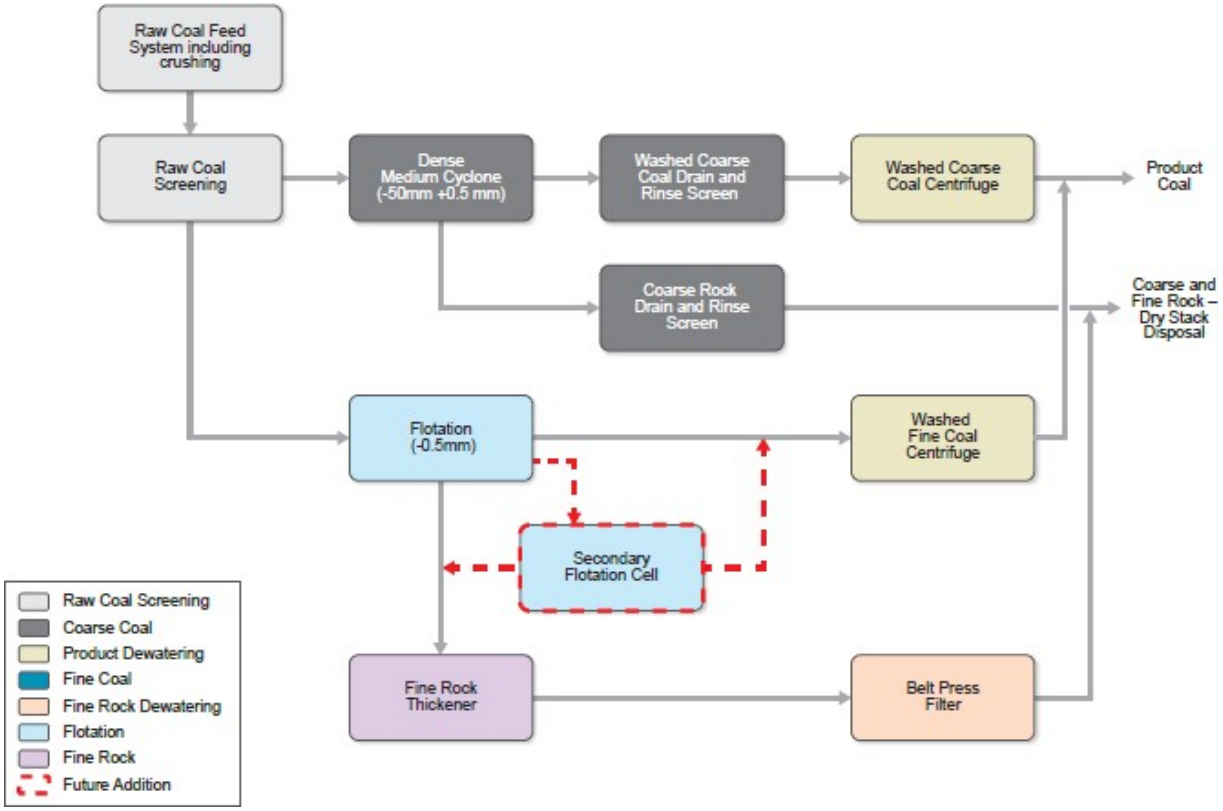
The Tenas Environmental Assessment (EA) Open Pit contains both PAG and non-PAG materials (see **Section 2**). The current mine plan involves separating mine rock based on its potential to generate acid, as it is extracted. A zone model has been developed for rock units within the open pit, and supplemental geochemical testing will be conducted during the Operation Phase to confirm mine rock properties. Non-economic materials from the project are expected to include:

- Non-PAG reclamation materials (surface soils) and overburden from open pit mining and haul road development (24.22 million banked cubic metres [MBCM]);
- PAG[1] mine rock from open pit mining (31.83 MBCM);
- Non-PAG rock from open pit mining including rehandle (29.52 MBCM); and
- Coarse and fine processed rock. These materials are also expected to be PAG (total 3.28 MBCM).

In addition, portions of the open pit walls are expected to be PAG. The mine production schedule is summarized in **Figure 1-3**. The risk of neutral ML from non-PAG rock is also considered in this assessment.

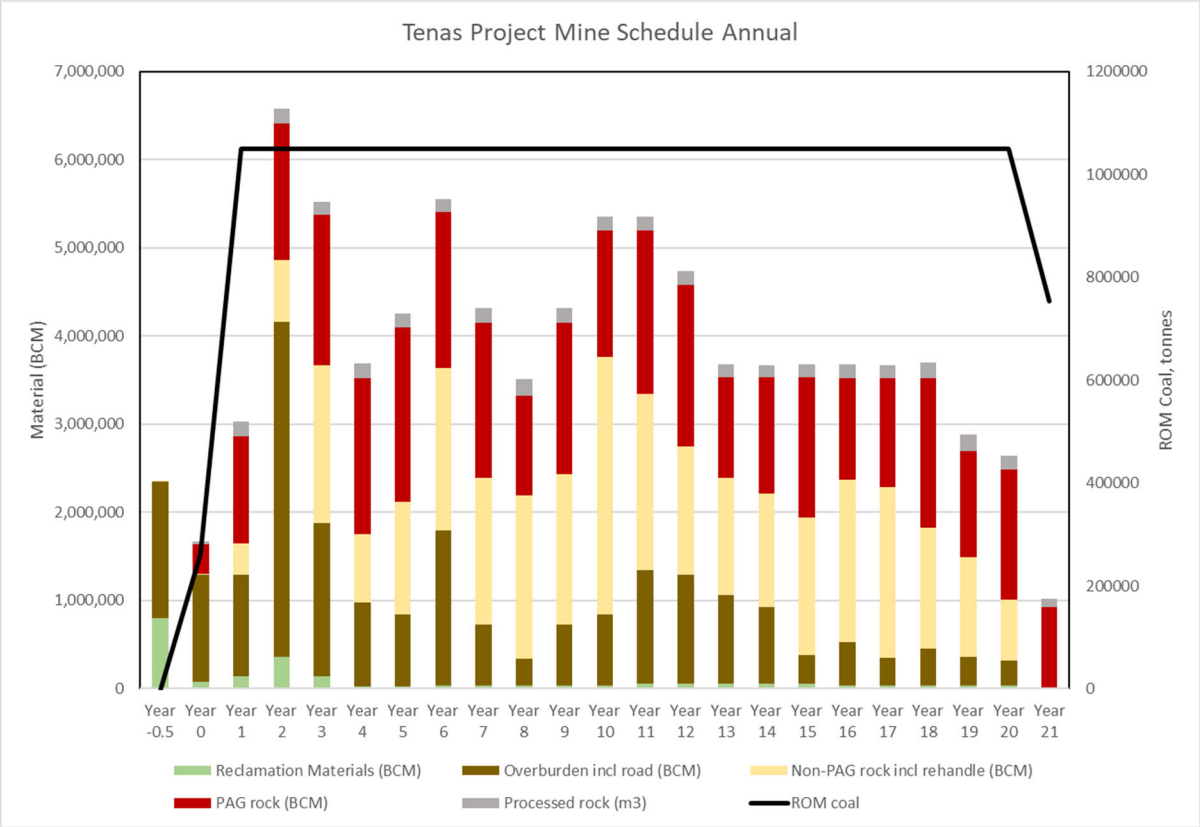
[1] PAG defined as rock with a neutralization potential ratio (NPR) less than 2, see **Section 2.**

Figure 1-2: DMC/Flotation CPP Schematic



***Sources**: SRK 2019a*

Figure 1-3: Tenas Project Annual Production Schedule



2 Geochemical Material Characterization

2.1 Background

A comprehensive historical geochemical characterization program was completed for the Telkwa Project (Norecol Dames and Moore 1999) which included geochemical testing of over 700 samples. A supplemental geochemical characterization program was conducted in 2019 (SRK 2019b) which included additional testing of 173 selected samples from the 1999 program, as well as collection and testing of 19 additional samples of processed rock, overburden, and construction rockfill.

Based on these characterizations, mine rock for the Project is characterized as non-PAG or PAG by acid base accounting (ABA), which measures the ratio of the Neutralization Potential (NP) to the Acid Potential (AP) of the material (i.e., the Neutralization Potential Ratio [NPR]). When the mineralogical contributors to NP and AP are well understood (i.e., NP is like that provided by calcite, AP is from oxidation of pyrite and these minerals have the same availability), regulatory guidance allows that NPR of 2 can be used to define PAG versus non-PAG (MEND 2009). The results of the supplemental mine rock geochemical characterization for the Project showed a strong positive relationship between modified-NP and presence of calcium plus magnesium, which provides confidence in the ABA calculations (SRK 2019b). In addition, there was a strong correlation based on modified-NP and NP calculated based on minerology NP-XRD (SRK 2022). Based on this relationship, an NPR of 2 is selected to identify rock as PAG or non-PAG, consistent with the guidelines.

The results of geochemical characterization are summarized for the different mine rock types in **Table 2-1**, and described in the following sections.

Table 2-1: Non-Economic Material Geochemical Characterization

Material Type	Geochemical Characterization
Mine Rock	Ten (10) zones: 3 non-PAG, 7 PAG, 2 of which are not mined by the EA open pit (zones 7 and 8)
Processed rock (coarse and fine)	PAG
Reclamation materials (surface soils) and Overburden	non-PAG
Open Pit Walls	8 zones: 3 non-PAG, 6 PAG

Sources: *Compiled in text.*

Notes: *EA=environmental assessment; PAG=potentially acid generating; PAG distinction based on NPR ≤2*

2.2 Mine Rock

Seven (7) non-economic rock zones were defined in the 1990s by reference to the coal seams, with four (4) added (0, 1a, 7, and 8) to represent the entire Tenas Deposit and reflecting EA zone geochemical model, as summarized by **Table 2-2** and shown in **Figure 2-1**.

Table 2-2: Acid Rock Drainage (ARD) Management Zone Definitions (Potentially Acid Generating (PAG) Material Highlighted in Yellow)

Zone	Stratigraphic Location	Average Weighted NPR
0	Till and overburden – topography to bedrock surface	17.5
1	Bedrock surface to top of Seam e (minus Zone 1a)	3.5
1a	Select area above Seam e to bottom of Seam e	0.8
2 & 3	Bottom of Seam e to bottom of Seam c	0.9
4	Bottom of Seam c to top of Seam b	2.7
5	Top of Seam b to top of Seam 1U	1.4
55	Top of Seam 1U to bottom of Seam 1L	2.3
6	Bottom of Seam 1L to bottom of Seam 1Lc	1.4
7**	Below Seam 1Lc to the bottom of Seam 1Ld	1.7
8**	Below Seam 1Ld	5.5

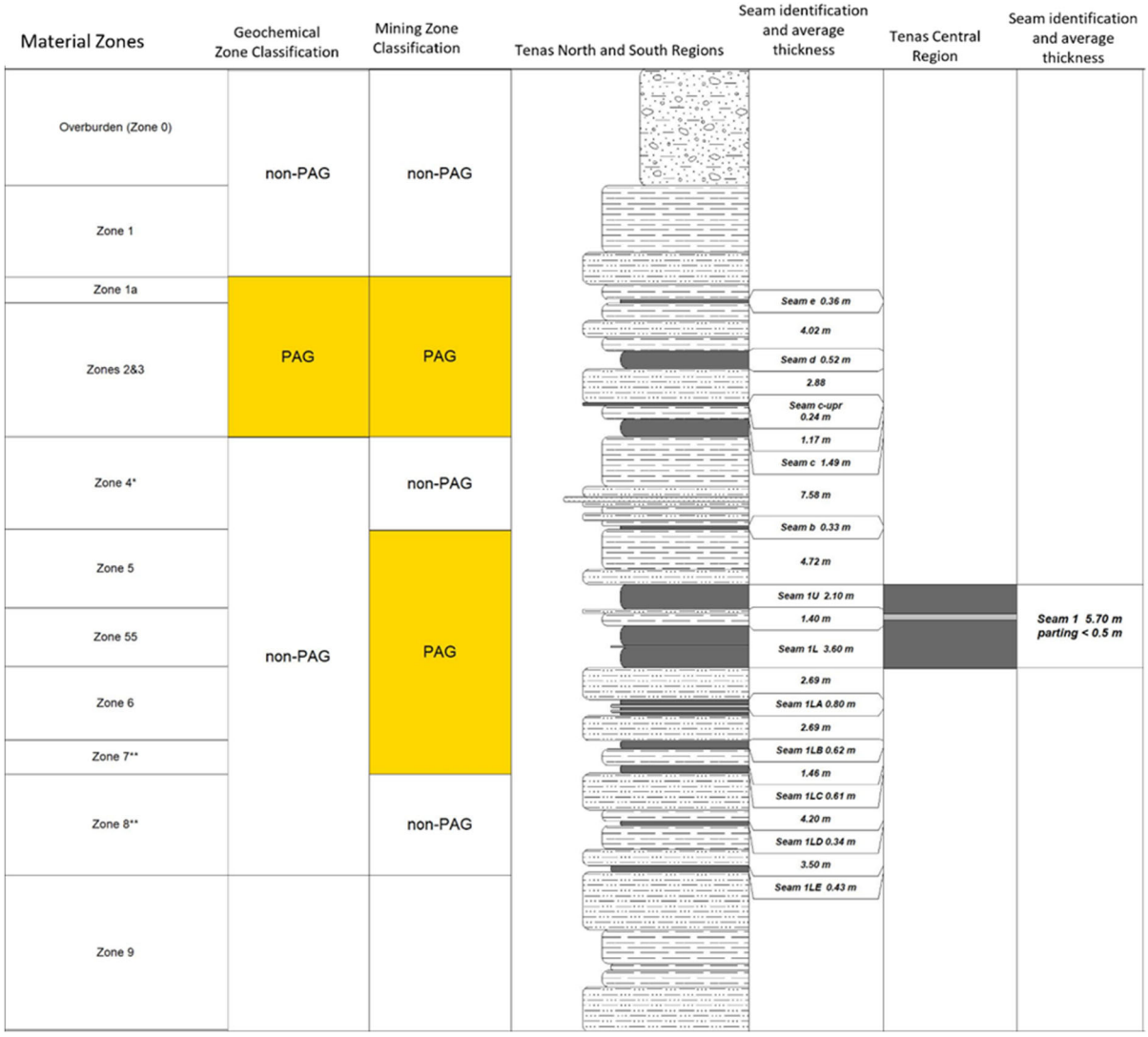
Sources: SRK 2019b)

Notes: *EA=environmental assessment; NPR=neutralization potential ratio; PAG=potentially acid generating*

(1) Zone 4 is spatially segregated as non-PAG and PAG, with the larger portion of the zone (75%) being non-PAG,

***these two zones are currently not being excavated by the EA Open Pit*

Figure 2-1: Tenas Project Lithology



According to SRK (2019b), seven (7) (Zones 1a, 2/3, 5, 55, 6 and 7) out of the 11 zones have average NPRs less than 2 and are classified as PAG, even though all zones, except for Zone 1a, have a component of non-PAG rock (i.e., the non-PAG rock is included in the PAG estimates as part of the mine plan). Zones 1 and 8 are classified as non-PAG. Zone 4 contains quantities of both PAG and non-PAG mine rock but is classified as non-PAG based on the overall weighted average of the Zone, however in mine planning the portions of this zone identified as PAG were managed as other PAG rock zones.

In summary, the following zones were identified to be PAG and non-PAG:

- **Non-PAG** – Zones 0 (includes overburden and reclamation materials/surface soils), 1, 4 and 8 (not excavated in EA mine plan); and
- **PAG** – Zones 1a, 2/3, 5, 55, 6 and 7 (not excavate in the EA mine plan).

The sulfide oxidation rates in the humidity cell samples were used to estimate the lag time for acid generation (SRK 2019b). The evaluation indicated that for the bulk properties of PAG rock, the lag

time varies from 2 to 12 years for the different zones. A minimum lag time of 0.6 years was estimated for PAG rock units with minimum NPRs in Zone 4 under laboratory conditions. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

Geochemical testing has indicated elevated concentrations of aluminum, cadmium, nitrite, cobalt, and selenium may be present in leachate at both acidic and neutral/alkaline pH. Aluminum is projected to have high concentrations in suspended form. Note that sediment control for the project is outside of the scope of this assessment.

2.3 Processed Rock

Processed rock samples tested were generally found to be PAG and contained more sulphur than interburden mine rock. Depletion calculations on the humidity cell tests (SRK 2019b) indicate that NP will be consumed prior to sulfide in all samples, with the NP predicted to be depleted after 1.3 years based on laboratory conditions. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

2.4 Reclamation Materials (Surface Soils) and Overburden

All the overburden and reclamation material (surface soil) samples tested had NPRs greater than 2 and were classified as non-PAG (SRK 2019b).

2.5 Open Pit Walls

At Post-closure, an end-pit lake will form in portions of the backfilled open pit. However, unsubmerged open pit walls (highwall and footwall) will remain above the end-pit lake composed mainly of PAG Zone 6 rock. While loading rates are expected to be lower than those of PAG mine rock or processed rock due to the lower reaction surface areas, these exposed surfaces should be expected to become acid-generating within 2 to 12 years based on laboratory conditions and contribute ML/ARD to the end-pit lakes if not management plan is provided. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

3 Methods

As defined in the AIR (EAO 2022), this framework constitutes an assessment of alternative means for material management, that are technically and economically feasible, of both PAG and non-PAG materials. PAG materials include processed rock (coarse coal rejects, fine coal rejects, and tailings) and mine generated PAG material (EAO 2015).

The following four (4) steps, consistent with CEAA (2012), were adopted to determine the preferred PAG management alternative for the Project:

1. Identify technically and economically feasible alternatives.
2. Characterize the options, including their potential effectiveness at reducing ML/ARD and expected effects on the environment and communities.
3. Select the approach for the analysis of alternatives means.
4. Assess the environmental effects of the preferred alternative, or alternatives if multiple are being carried forward.

Potential alternatives were first screened for cost effectiveness and technical applicability. Alternatives that met the screening criteria are further assessed based on their environmental and community effects. This assessment is carried out qualitatively, at a level sufficient to distinguish the relative merits of the different alternatives based on consideration for the advantages and disadvantages of each.

4 Performance Objectives and Criteria

PAG management alternatives are evaluated with respect to their effectiveness in mitigating long-term project risks and their potential effects on VCs. Feedback obtained from community outreach and consultations were considered in defining the VCs and establishing these objectives. The following criteria are considered for this assessment:

- Cost effectiveness;
- Technically applicability, including system integrity and reliability;
- Effects on the natural environment;
- Community effects and input including human health; and

These criteria are discussed further in the following subsections.

4.1 Cost Effectiveness

The cost effectiveness performance objective compares the relative capital and life cycle (including Post-closure) costs of each alternative, relative to the corresponding long-term benefits. Cost considerations include pre-mining (capital) construction, operating and sustaining costs, closure, and Post-closure operations, maintenance, and surveillance costs, as well as amenability for financing and financial risk.

Preference is given to lower-maintenance alternatives and alternatives that enable deferral of construction costs into cash-flow positive periods of the mine life.

4.2 Technical Applicability, System Integrity, and Reliability

The technical performance objective addresses the following technical risks associated with the alternative:

- Suitability for the proposed mine plan, climate, terrain, and design;
- Precedence of successful implementation in similar conditions;
- Risk of long-term degradation or failure of the system;
- Feasibility and ease of implementing contingency measures should the system degrade or fail; and
- Reliance on long-term operations, surveillance, and maintenance.

4.3 Effects on the Natural Environment

This performance objective describes the expected effectiveness of the alternative in reducing impacts to the natural environment, and primarily refers to water quality in effluent and the receiving environment, and the resulting effects on aquatic life.

However, additional considerations include effects on natural hydrological regimes, footprint area, post-reclamation land use, air quality, and terrestrial fauna and flora.

4.4 Community Effects and Input Including Human Health

This performance objective evaluates the effects of the alternative on the local communities and considers feedback from ongoing engagement activities with the community of Telkwa and the Wet'suwet'en First Nation.

Community effects include aspects of cultural heritage as well as Aboriginal and treaty rights, and includes traditional land use, access to quality resources, community well-being (including access to education, infrastructure, and services), archaeological resources, outdoor recreation, noise and vibration, and human health.

5 Metal Leaching/Acid Rock Drainage (ML/ARD) Alternatives Assessment

This section describes the alternatives assessment for ML/ARD management for the following materials:

- Processed rock (coarse and fine);
- Open pit walls; and
- Mine rock (non-PAG and PAG).

Sulphide oxidation occurs when minerals containing sulphide and elemental sulphur are exposed to the weathering effects of oxygen and water. ARD results from premature depletion of acid neutralizing minerals and results in elevated metal solubility and faster sulphide weathering rates under acidic conditions, however, ML can also occur at circum-neutral pH. “Metal” in this context includes any constituents of potential concern (COPC) and is not limited to elements or parameters classified as metals. Measures to reduce ML/ARD generally require one or more of the following mechanisms shown in **Table 5-1**.

Table 5-1: Metal Leaching/Acid Rock Drainage (ML/ARD) Mitigation Mechanisms

Mechanism	Examples
Limiting oxygen availability	Subaqueous deposition, saturation covers, oxygen diffusion barriers
Limiting water availability[1]	Dry (shedding) covers
Neutralization of PAG materials[2]	PAG/non-PAG blending (“ideal blend”), tailings de-sulphurization
Neutralization of ARD after onset	Active treatment, passive treatment (bioreactors), “non-ideal” PAG/non-PAG blending
Removal of neutral metals after onset	Active treatment, passive treatment (bioreactors, wetlands)

Sources: *Modified from the GARD guide (2010)*

Notes: *ARD=acid rock drainage; PAG=potentially acid generating*

[1] Water is both a reactant and a transport mechanism for ML/ARD

[2] Neutralization of PAG materials may be achieved by removing or isolating sulphide materials, maximizing the availability of alkaline materials or porewater, or controlling bacteria and/or biogeochemical processes.

5.1 Alternative Characterization and Screening

Proposed alternative means for mitigating ML/ARD from PAG materials (processed rock, mine rock, and open pits), as well as non-PAG mine rock, evaluated for the Project are described in the following subsections and summarized in **Table 5-2**. These alternatives were screened for technical applicability and economic feasibility, as summarized in **Table 5-3**. Where more than one (1) alternative was technically feasible, the alternatives were evaluated with the environmental and social criteria to determine a final preferred alternative, as summarized in **Table 5-4**.

5.1.1 Fine Processed Rock (Tailings)

Processed rock storage (both fine and coarse) was discussed in each of the PAG management alternatives above and is discussed in further detail below. Note that total processed rock (coarse and fine) represents 8% of the total PAG materials, and 4% of the total mine rock (excluding overburden and reclamation materials (surface soils)), with fine processed rock making up a small percentage of project materials (2% of total PAG materials and 1% of total mine rock). The following

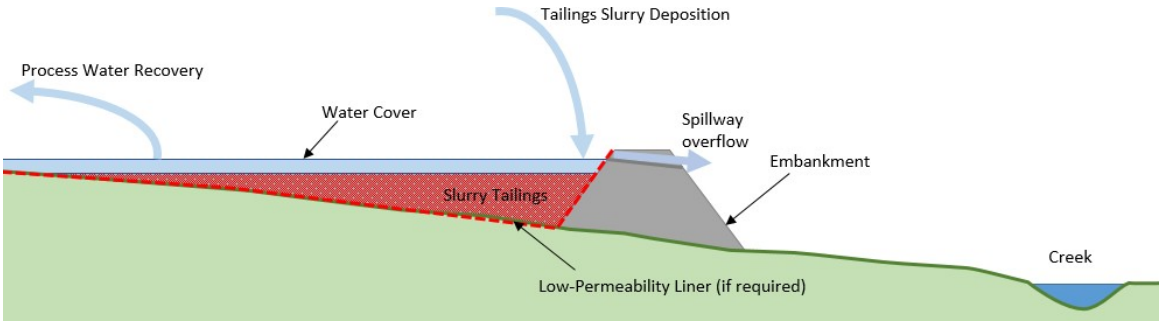
alternatives for fine processed rock are considered:

- Slurry, deposited in a conventional tailings impoundment, or
- Dewatered, and either stacked on-surface or co-disposed with coarse processed rock and/or mine rock (disposal options are discussed further in **Section 5.1.2**)

5.1.2 Conventional Tailings Impoundment

The mine plan described in the Manalta Telkwa Project Environmental Assessment (Manalta 1998) included a separate impoundment to store tailings. In this alternative, tailings are deposited subaqueously in a lined impoundment to prevent the onset of ARD. Water reclaimed from this facility supplies the coal processing plant process. This is shown schematically in **Figure 5-1**.

Figure 5-1: Processed Rock (Tailings) Impoundment Schematic



Notes: *Schematic. Not to scale.*

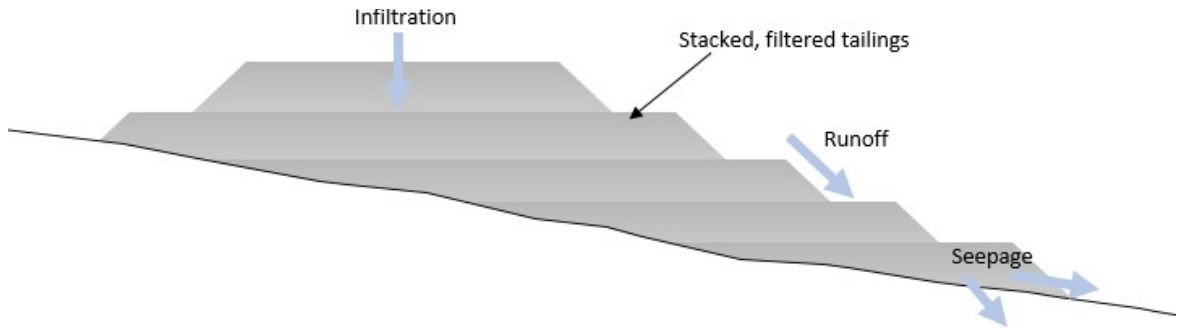
Dewatered Tailings Stack (Filter Press)

A dewatered processed rock (tailings) stack, separate from the PAG rock storage facility, was proposed as part of the Project feasibility study (SRK 2019a). Fine processed rock is dewatered to 40% solids by weight as part of the process, combined with the coarse processed rock, and trucked and placed in compacted lifts in a dedicated storage facility. Dewatering the fine processed rock allows the fine processed rock to be placed and stacked in a compacted pile without the need for an impoundment. It also increases the volume of water recovered, reducing freshwater makeup demands from either onsite or offsite sources.

Oxygen flux in fine materials is more likely to occur by diffusion rather than advection thereby significantly reducing oxygen availability for oxidation of sulphide minerals compared to coarser mine rock. In addition, fine materials can be partially saturated to a level at which the rate of air entry is the same as if the material were fully saturated with water. The moisture content at which this typically occurs is about 60%. Therefore, if the materials are sufficiently fine and well-compacted, the moisture content of the pile may be sufficient to prevent ML/ARD from occurring. Moisture content in the near surface would not be expected to be this high, and as such some ML/ARD should be expected to occur unless additional measures are implemented (e.g., soil cover, blending with neutralizing material).

For filtered tailings, a separate water management facility is typically required for site water management and to provide a source of process water supply.

Figure 5-2: Dry Stack Fine Processed Rock – Schematic



Notes: *Schematic. Not to scale.*

5.1.3 Coarse Processed Rock

The following alternatives were considered for coarse processed rock:

- Surface disposal (stack), in segregated coarse and fine processed rock piles;
- Surface disposal (stack), in blended coarse and fine processed rock piles; and
- Blended coarse and fine processed rock, co-disposed with mine rock underwater.

Segregated Processed Rock Piles

Both coarse processed rock and dewatered fine processed rock generally lend themselves to surface disposal. If dewatering of fine processed rock is selected for other reasons (e.g., water recycling in the process), the lowest effort option may be segregated surface piles. These piles would be placed on surface, likely near the process facility to reduce transportation requirements, and though have favorable geotechnical properties and may be effective in limiting ARD by limiting oxygen advection and seepage to deeper parts of the piles, they are likely to be susceptible to ML/ARD near surface. This alternative also requires drainage management from multiple sources, which increases risk and complexity.

Blended Fine/Coarse Processed Rock Piles

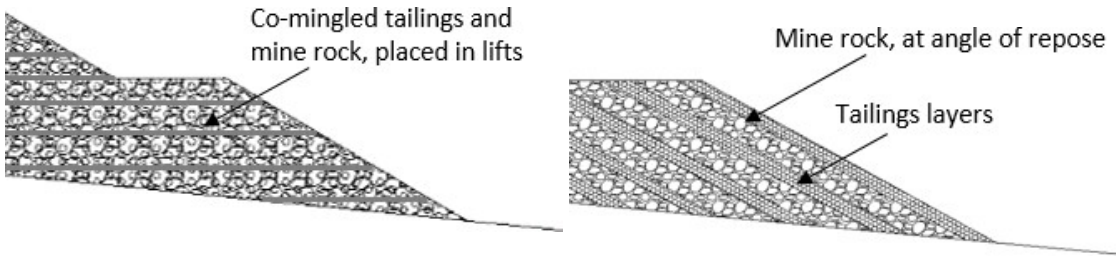
Blending dewatered fine and coarse processed rock can be done at the CPP, prior to transportation, to reduce the footprint and number of drainage management locations. Blending also has the benefit of further reducing oxygen advection and seepage compared to segregated piles.

Blended and Co-Disposal with Mine Rock

In this alternative, processed rock is co-mingled with PAG rock and deposited in the same facility. If the materials are going to be deposited subaqueously, fine processed rock may be dewatered or not, however dewatering simplifies transportation logistics and reduces freshwater demands. If the materials are going to be deposited in a surface pile, fine processed rock should be dewatered for stability and water management purposes, and co-mingled and/or placed in lifts to prevent segregation during placement. If the material will be submerged or disposed with non-PAG mine rock, end-dumping of different materials without specific co-mingling would provide similar results.

The two (2) configurations are shown schematically in **Figure 5-3**, though it is noted that the ratio of processed rock to mine rock is insufficient to allow effective layering for the Project.

Figure 5-3: Co-Disposal of Processed Rock with Mine rock – Schematic Options



(a) Co-mingled and placed in lifts **(b) End-dumped**

Notes: *Schematic. Not to scale.*

5.1.4 Open Pit Walls

Although planned the mine plan involves staging and backfilling of open pits with mine rock, open pit development will result in progressive and sustained exposure of PAG rock walls throughout the life of mine and, without mitigation, post-closure. The following alternatives to mitigate open pit wall ARD were considered:

- Do nothing;
- Partial end-pit lake established based on natural topography and staging;
- Total submergence end-pit lake established via construction of embankments; and
- Open is backfilled with non-PAG rock, overburden, and reclaimed materials.

Do Nothing

In this alternative, open pits are exploited sequentially per the mine plan, but no measures are taken to promote ponding and no material is placed on the exposed open pit walls. Inflows are allowed to drain by gravity and open pit walls remain exposed.

Partial End-Pit Lake

In this alternative, open pits are exploited sequentially per the mine plan and open pit development and sequencing is done to promote ponding within the open pits, resulting in formation of (relatively shallow) end-pit lakes. Inflows are allowed to drain by gravity and pit highwalls remain exposed. No material is placed on the exposed open pit walls.

Total Submergence End-Pit Lake

This alternative promotes total submergence of exposed open pit walls by the construction of embankments to impound water within and outside of the open pits once they are exhausted. No materials is placed on the exposed open pit walls.

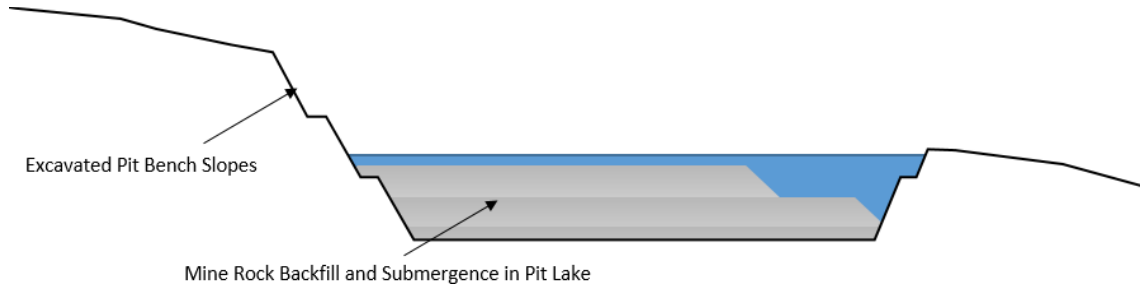
Backfill with Mine Rock and Overburden and Partial End-Pit Lake Submergence

In this alternative, open pit development will be staged in a way that facilitates progressive backfill with mine rock, and partial submergence during the Operation Phase with final end-pit lake elevations reached in the Decommissioning and Reclamation, and Post-closure phases. Upon decommissioning, remaining exposed open pit walls will be covered with excess overburden and non-PAG rock present in the backfill, embankments and buttresses, placed in lifts and reshaped to a final slope of 2.5H:1V. See **Figure 5-4**.

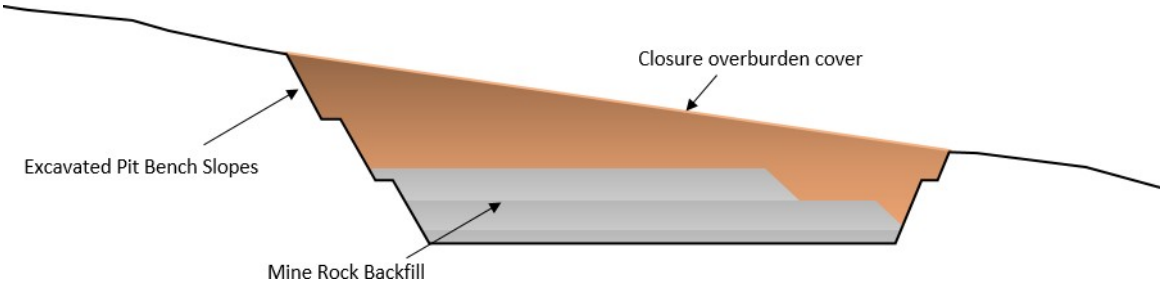
This approach is consistent with the mine development plan, as well as mine rock management objectives and the decommissioning and reclamation plan. The alternative approaches discussed above were not considered in detail in this assessment (see **Table 5-3** for selection rationale).

Figure 5-4: Open Pit Mine Rock Backfill and Submergence – Schematic

(a) Open Pit Backfill During Operation



(b) Open Pit Backfill Decommissioning and Reclamation Cover of Overburden and Reclamation Materials and Partial Submergence of Mine Rock with Water



Notes: *Schematic. Not to scale.*

5.1.5 Mine Rock

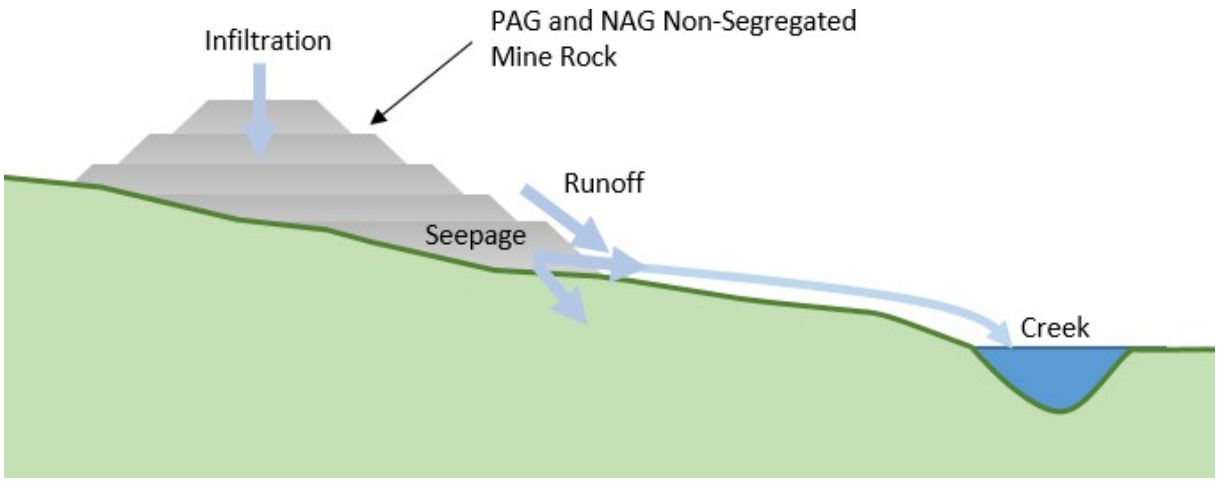
Do Nothing

In the “do nothing” scenario, mine rock generated from the open pit would be placed on surface without management of segregated PAG and non-PAG mine rock. The total mine rock volume is 60 MBMC plus an estimated 30% bulking, of which 52% is expected to be PAG. Depending on the timing and configuration of the mine rock deposition, some natural blending and neutralization may occur, however, pockets of PAG rock should be expected. The onset of acid generation would be expected to occur within 4 to 12 years (see **Section 2**), with some sections (Zone 4 NPR of 0.3) going acid in as little as 0.3 years under laboratory conditions.

Processed rock may be deposited in a separate storage facility (as per the Manalta project [1997]) or dewatered and deposited with the mine rock.

In this alternative, the effects of ML/ARD would be managed by the assimilative capacity of the site and dilution in receiving waterbodies. This alternative is shown schematically in **Figure 5-5**.

Figure 5-5: Do Nothing Option Schematic



Notes: *Schematic. Not to scale.*

Active Water Treatment

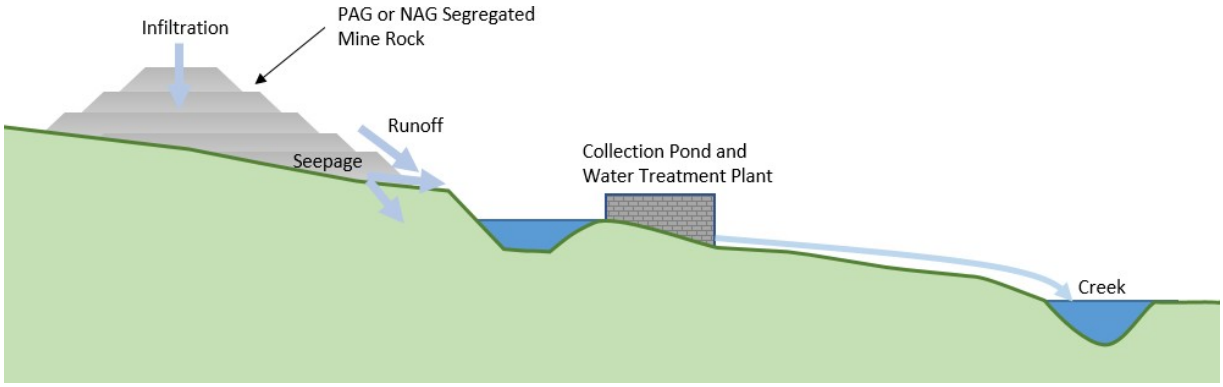
Active water treatment of ARD with lime was considered for the pre-feasibility study (SRK 2017a and 2017b) but was dismissed for the feasibility study (SRK 2019a) due to the risks associated with long-term operation of the water treatment plant, including management of sludges and maintenance of structures (ditches and ponds) to ensure strongly acidic waters are not accidentally discharged.

Active water treatment of neutral metal drainage has not been identified as a requirement based on water quality results.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with filtered processed rock in a dry storage pile, separate from the non-PAG and overburden storage facilities. Surface runoff and infiltration from this facility are collected and directed to a treatment plant consisting of lime-based neutralization, precipitation, solid/liquid separation and including a high-density sludge (HDS) system to optimize lime demand and reduce residual sludge volumes, consistent with the pre-feasibility study (SRK 2017a). The water treatment system would operate on a seasonal basis for 5 months per year from May through September, with excess water stored in winter months in collection ponds and/or depleted open pits and would discharge to Telkwa River. A schematic of the system is shown in **Figure 5-6.**

Lime treatment is expected to be effective at reducing effluent metal loads to acceptable levels. However, localized ML/ARD seeps and acidic pond water may impact local flora and fauna, and long-term operation of the facility and management of sludge presents operational and environmental risks.

Figure 5-6: Active Water Treatment Option Schematic

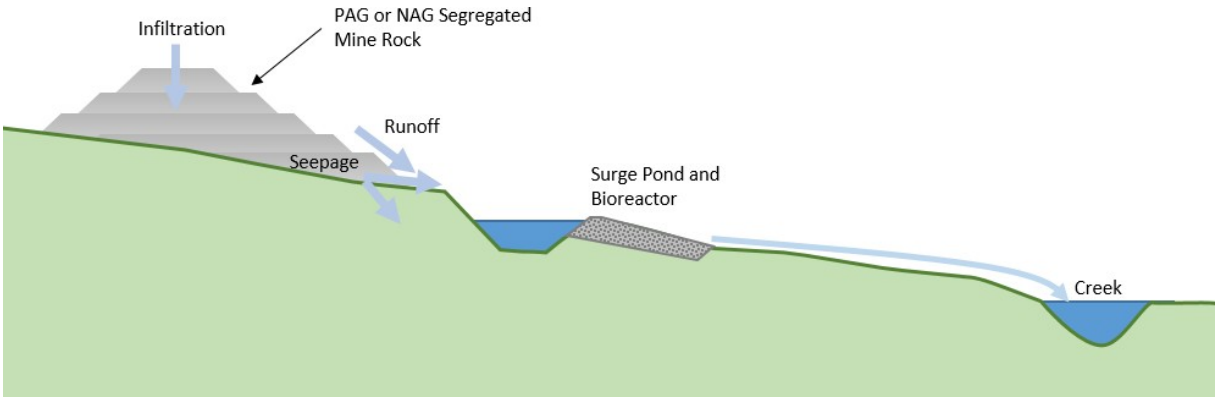


Notes: *Schematic. Not to scale.*

Passive Water Treatment

Passive water treatment has not previously been proposed for the project. Passive treatment systems exist for ARD neutralization and metal and nutrient removal from neutral drainage. This scenario evaluates a gravel bed bioreactor to remove nitrate and selenium, and potentially other parameters of concern, from the overflow from the sub-aqueous (PAG) and/or sub-aerial (non-PAG) mine rock storage areas during the Operation Phase. Design of passive treatment systems are highly dependent onsite conditions, including influent geochemistry, and site climate and hydrology. Detailed design of a passive treatment system has not been completed for the Project due to the significant challenges imposed by the site climate and geochemistry and significant retention times, water flow volumes, metal loading under ARD conditions, and areas expected to be required, and the inherent unpredictability of the systems at achieving water quality outcomes. See **Figure 5-7.**

Figure 5-7: Active Water Treatment Option Schematic



Notes: *Schematic. Not to scale.*

Potentially Acid Generating (PAG)/Non-PAG Blending

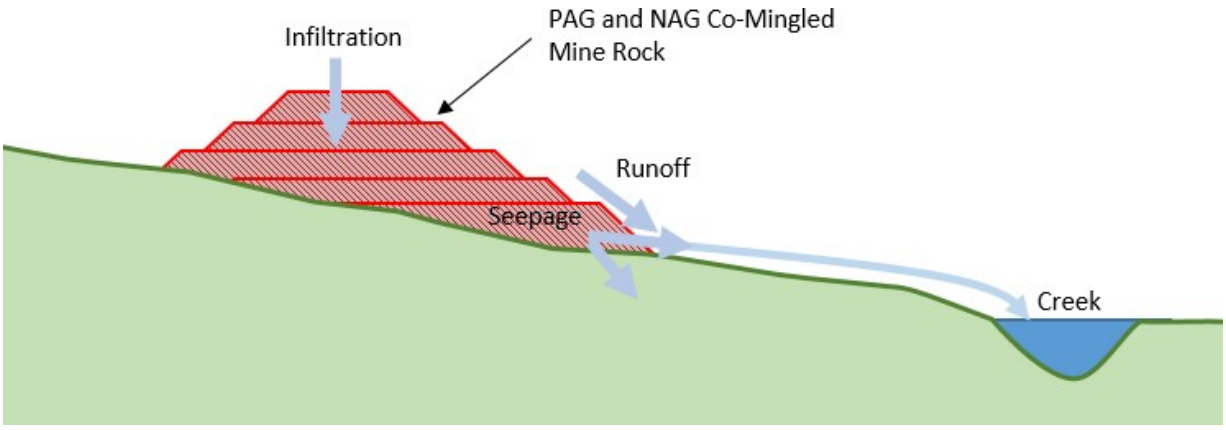
PAG/Non-PAG blending is achieved by co-mingling sufficient neutralizing alkaline materials with PAG materials, such that ML/ARD in the resulting seepage is avoided. An “ideal blend” occurs when, due to the availability and degree of blending of alkaline materials is sufficient that acidification and accelerated oxidation does not occur except at the grain scale. A “non-ideal” blend occurs when acidification and the resulting accelerated oxidation occurs at larger scales but is neutralized by alkaline materials along the flow path. In non-ideal blends, high concentrations of certain elements can persist in solution after neutralization, therefore these blends are less effective than ideal blends. The degree of mixing required to achieve an ideal blend is calculated in the form of a flow path length, based on the infiltration rate, degree of alkalinity and rate of acid generation. This alternative is shown schematically in **Figure 5-8.**

PAG/Non-PAG blending was initially proposed as part of the Manalta project in the 1990s (Manalta 1997, Piteau 1998), and was evaluated for the Project as part of the feasibility study (SRK 2017a, 2017b). The evaluation concluded that conventional blending will be challenging for the Project due to the lack of distinctive PAG and non-PAG layers, elevated sulphide content and high geochemical reactivity. Furthermore, due to the low NPR of PAG materials the lift thicknesses would need to be relatively thin (e.g., in the range of 150 mm) to achieve adequate blending. Lastly to ensure the blend was robust enough a NPR of in the range of 3 to 1 or greater would need to be achieved and there is simply not enough non-PAG rock to blend with PAG materials.

An important consideration for operational mine rock management is that as the stratigraphic average NP/AP_{blend} approaches the target NP/AP_{blend}, the need for rigorous operational control increases to ensure effective blending (SRK 2017b).

In addition, the NP/AP target for a blend mixture needs to be greater than that used to define ARD potential for individual samples ($NP/AP_{blend}>2$, as described in **Section 2**) to provide a factor of safety for inefficiencies of mixing. According to the mine plan, 52% of the mine rock to be produced from the Project is expected to be PAG, though all the PAG zones, except for Zone 1a, contained a component of non-PAG rock (SRK 2019b). Based on these proportions, heterogeneity of the zones, and relatively low NPRs of many of the zones (see **Table 2-2**), it is unlikely that sufficient neutralizing material will be produced over the course of mining activities to offset the PAG materials.

Figure 5-8: Potentially Acid Generating (PAG)/non-PAG Blending Option Schematic



Notes: *Schematic. Not to scale.*

Dry Covers

Dry covers were proposed for post-closure for the pre-feasibility study (SRK 2017a and 2017b) though, as noted above, they conservatively were assumed to not be sufficiently effective to preclude the need for water treatment of ML/ARD in the long term.

The objectives of the dry cover are to:

1. Reduce the supply of oxygen, to slow or prevent the sulphide oxidation reaction (acidification).
2. Reduce the supply of water available for ML/ARD.
3. Provide a surface for post-mining land-use reclamation and revegetation.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with dewatered processed rock in a dry storage pile, separate from the non-PAG and overburden storage facilities. Co-disposal of fine processed rock with mine rock reduces the available pore space within the PAG mine rock, reducing the rate of infiltration and oxygen ingress to the mine rock pile.

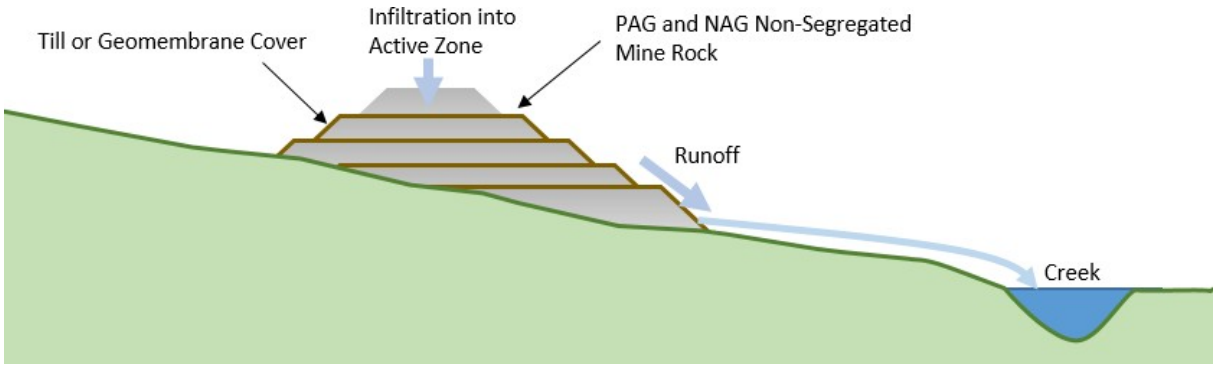
The mine rock piles are constructed in phases, and a dry cover is constructed progressively as shown in **Figure 5-9**. Based on geochemical characterization, the onset of acid generation of the PAG mine rock is expected to occur within 4 to 12 years (see **Section 2**), with some Zone 4 sections going acid in as little as 0.3 years. Onset of acid generation for processed rock is 6 years. Therefore, Zone 4 PAG materials should be segregated and stored separately and covered immediately (likely subaqueously). Progressive reclamation of the remaining PAG materials should be done with sufficient frequency to prevent the onset of acid generation (i.e., covers should be in place within 4 years of extraction). For the non-PAG rock piles, ML is expected to occur immediately but at relatively low concentrations. Progressive covering would be designed primarily to reduce mine rock infiltration and impacted seepage rates.

Areas of uncertainty regarding dry covers are generally related to long-term performance and the degree of effectiveness in reducing oxygen supply and infiltration (MEND 2009) and are related in large part to site climatic conditions and to the availability and properties of high-fines granular materials (glacial tills and clays) at the site. Due to the relatively wet climatic conditions at the

Project, some infiltration should be expected to occur through most covers. Addition of geosynthetic liners can further reduce rates of infiltration and oxygen advection but require additional cost and detailed Quality Assurance/Quality Control (QA/QC) during installation and operation.

For PAG rock piles, water treatment and/or other ML/ARD mitigation may be required during progressive operation of the PAG piles as they are progressively covered due to local variability in mine rock properties, and after closure due to imperfections in the cover system. However, water treatment rates would be expected to be significantly reduced compared to the active water treatment only case. For non-PAG rock piles, progressive cover is considered a conservative measure to further reduce effluent loadings to receiving water bodies.

Figure 5-9: Progressive Dry Cover Option Schematic



Notes: *Schematic. Not to scale.*

Wet Covers and Saturation Covers

Submergence or saturation of PAG materials has been demonstrated as being the most effective means of preventing ARD and reducing ML and has wide-ranging application in BC (MEND 2009). Due to the low solubility of oxygen in water, the rate of sulphide oxidation is controlled by mass transfer.

Key considerations for saturation covers are as follows:

- Submergence of weathered PAG materials can increase dissolution of soluble contaminants (e.g., from secondary oxidation reactions). Therefore, it is important to submerge PAG mine rock before onset of acid generation, or significant oxidation under non-acidic conditions;
- Saturation or water cover must be maintained in perpetuity, and design must account for natural and anthropogenic variations in hydrological regimes to prevent exposure of PAG materials to the atmosphere. However, finer materials can be partially saturated to a level at which the rate of oxygen ingress is the same as if the mine rock were fully saturated with water. The moisture content at which this typically occurs is about 60%. Therefore, if the PAG mine rock materials or (in the case of saturation cover, the cover materials) are sufficiently fine to maintain saturation in the pore spaces, temporary exposure should not result in oxidation reactions and ML/ARD; and
- Geotechnical risks increase with flooded impoundments. The potential consequence of impoundment failure must be considered, as well as the additional construction, maintenance,

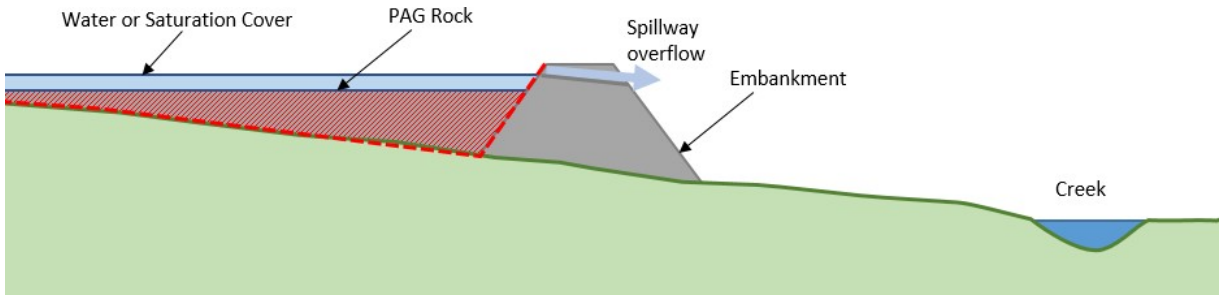
and surveillance requirements, in addition to the risk of ML/ARD.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with dewatered processed rock in a lined and flooded impoundment, separate from the non-PAG and overburden storage facilities. The impoundment embankment is raised progressively over the life of mine to accommodate PAG storage and water cover requirements. Construction of saturation covers are not considered feasible for operations because mine rock is continuously deposited in the PAG cells (management ponds).

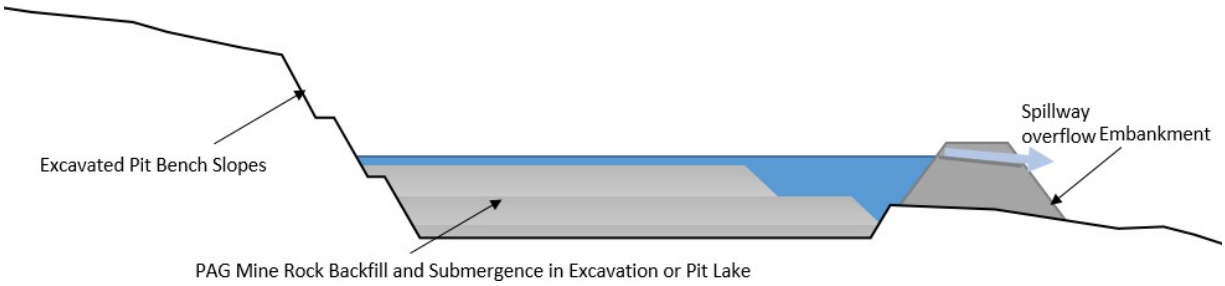
Co-disposal of fine processed rock with mine rock does not offer significant benefits to the PAG storage facility but eliminates the need for a separate PAG processed rock storage facility. An alternative configuration is considered in the feasibility study (2019a), in which PAG rock is deposited in excavated PAG cells (management ponds) with smaller impoundments. While this alternative reduces the overall embankment heights and thus geotechnical risks, it increases capital expenses (the entire facility must be excavated prior to PAG placement, rather than raised sequentially over the life of mine). Both alternatives are shown in **Figure 5-10**.

Figure 5-10: Wet Cover Option Schematic with Impoundment or Excavated Management Ponds (PAG cells)

a) Impoundment Disposal



b) Excavated PAG Cell (Management Pond) Disposal (shown as open pit)



Notes: *Schematic. Not to scale.*

5.1.6 Summary and Screening

Alternatives are summarized in **Table 5-2.** Initial screening of alternatives based on technical applicability and economic feasibility is presented in **Table 5-3.**

Technical applicability and economic feasibility selection criteria are defined as follows:

- **Unacceptable:** Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive). Alternatives that are either technically or economically unacceptable are discarded;
- **Challenging:** Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability. Alternatives that are either technically or economically challenging are discarded *if there is a more favorable alternative available*; and
- **Acceptable:** Is expected to achieve stated objectives without significant challenges or economic risk or liability.

Alternatives that are not discarded are either assessed further based on their effects on the natural environment and communities (**Section 5.2**) or selected if only one alternative is considered technically and economically feasible.

Table 5-2: Management Alternatives for Potentially Acid Generating (PAG) and non-PAG Materials

Component	Management Option	Description	ML/ARD Management Mechanism	Key Considerations
Mine rock	Do nothing	Non-segregated surface piles for PAG and non-PAG materials.	None.	The remineralization of carbon in some coal materials can consume oxygen at a greater rate than metal mine materials. Placement of coarser materials reduces oxidation reaction rates by reduced surface areas. However, mine rock at Telkwa is generally expected to be relatively fine.
	Active water treatment	Segregated surface piles for PAG and non-PAG materials. ARD or neutral metal leachate is collected and treated.	Neutralization of ARD and removal of neutral metals after onset.	Long term operations and maintenance, including sludge management post-closure.
	Passive water treatment	Segregated surface piles for PAG and non-PAG materials. Leachate is passed through a bioreactor to remove selected parameters of concern.	Neutralization of ARD and removal of neutral metals after onset. Biochemical anaerobic-anoxic reactions to consume nutrients and attenuate metals.	Site-specific design of system to address key parameters of concern and nutrient loading. High flow rates and low temperatures are key challenges for bioreactor effectiveness. Reliability of systems at meeting end-of-pipe concentration requirements makes permitting challenging Post-closure operations and maintenance challenges. Long term operations and maintenance, including sludge management post-closure.
	PAG and non-PAG blending	Blended PAG and non-PAG surface piles to achieve NPR>2.	Neutralization of PAG materials at source (ideal blend) or ARD after onset (non-ideal blend) ML/ARD.	Effectiveness of co-mingling of PAG and non-PAG materials, influenced by structural formation and mineralization. Challenging for the Project due to the lack of distinctive PAG and non-PAG layers, elevated sulphide content and high geochemical reactivity.
	Dry cover	Segregated surface piles for PAG and non-PAG materials. Piles are progressively covered with low-permeability materials (high-fines granular materials or geosynthetics).	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates.	Availability and material properties of high-fines granular materials (e.g., clays or glacial tills). Long-term (post-closure) effectiveness of cover, potentially supported by oxygen consumption of coal mine rock.
	Wet cover	Segregated PAG or non-PAG storage facility with water cover.	Limiting oxygen availability (diffusion).	Water cover maintenance. Geotechnical risk of impounded water and saturated processed rock, including post-closure. Placement of finer materials decreases rate of diffusion even under partial saturation conditions.
	Saturation cover	Segregated PAG or non-PAG storage facility with saturated granular fill cover.	Limiting oxygen availability (diffusion).	Maintaining saturation. Geotechnical risk of saturated processed rock (e.g., liquefaction). Presents logistical challenges during operations due to difficulty maintaining cover saturation during active placement. Placement of finer materials decreases rate of diffusion even under partial saturation conditions.
Processed rock (tailings)	Conventional slurry tailings impoundment	Deposition as conventional slurry in a tailings' impoundment with a water cover.	Limiting oxygen availability (diffusion).	Water cover maintenance during operations and post-closure. Geotechnical risk of impounded water and liquifiable tailings.
	Dewatered tailings stack (filter press) and on-surface coarse processed rock pile	Filter press circuit to dewater tailings and allow storage as dry stack or co-disposal with processed rock and/or mine rock.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Likely to require additional measures such as covers or active treatment if deposited on surface.	Placement of finer materials decreases oxygen ingress even under partial saturation conditions. Relatively small volumes to justify a separate disposal facility. Impact of the grain size distribution and water content of dewatered product on limiting oxygen advection and infiltration. Long-term geochemical weathering. Lower geotechnical risks compared to conventional slurry impoundments.
Coarse processed rock	Segregated processed rock piles	On-surface coarse reject pile and separate dewatered fine processed rock pile or impoundment (see Conventional slurry tailings impoundment).	None. Likely to require additional measures such as covers or active treatment.	Multiple PAG management facilities required, increasing cost, complexity, and post-closure risk. Oxidation near surface leading to ARD. Geotechnical stability and surface erosion. Relatively small volumes to justify a separate disposal facility.
	Blended fine/coarse processed rock piles	Processed rock and dewatered fine processed rock are blended and placed in dry surface stack.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Likely to require additional measures such as covers or active treatment.	Multiple PAG management facilities required, increasing cost, complexity, and post-closure risk. Oxidation near surface leading to ARD. Geotechnical stability and surface erosion.
	Blended and co-disposal with mine rock (PAG, non-PAG or unsegregated)	Processed rock and dewatered tailings are blended and co-mingled with mine rock prior to placement. Could be blended with segregated non-PAG rock, or unsegregated (PAG/non-PAG) mine rock.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Neutralization of PAG materials via blending (if option selected). May require additional measures such as covers or active treatment.	Geotechnical stability.

Component	Management Option	Description	ML/ARD Management Mechanism	Key Considerations
Open pit walls	Do nothing	Open pits are exploited sequentially. Inflow drains by gravity.	None.	Spatial constraints and haul distances for mine rock storage.
	Partial end-pit lake	Open pits are exploited sequentially, and open pit design and sequencing promotes formation of a partial end-pit lake in inactive open pits. Some of open pit walls remain exposed.	Limiting oxygen availability (diffusion).	Pit staging and geometry to promote ponding. Spatial constraints and haul distances for mine rock storage. Impact of exposed pit walls on pit lake geochemistry in the long term.
	Total submergence end-pit lake	Open pits are exploited sequentially, and embankments are constructed to promote formation of an end-pit lake in inactive open pits that completely submerges open pit walls.	Limiting oxygen availability (diffusion).	Embankment construction to promote ponding. Spatial constraints and haul distances for mine rock storage. Geotechnical risk of embankments during Operations and Post-closure phases.
	Backfill with mine rock and partial end-pit lake	Open pits are exploited sequentially, and embankments are constructed to promote formation of an end-pit lake in inactive open pits that partially submerges open pit walls.	Limiting oxygen availability (diffusion).	Embankment construction to promote ponding. Spatial constraints and haul distances for mine rock storage. Geotechnical risk of embankments during Operation, and Post-closure phases.

***Sources**: Compiled in report.*

***Notes**: ARD=acid rock drainage; ML=metal leaching; NPR=neutralization potential ratio; PAG=potentially acid generating*

Table 5-3: Initial Screening based on Technical and Economic Feasibility

Component	Management Option	Technical Applicability	Rationale	Economic Feasibility	Rationale	Screening Decision	Rationale
Fine processed rock (tailings)	Conventional slurry tailings impoundment	Acceptable	Conventional method which facilitates submergence of PAG materials, but results in requirement for a separate storage facility requiring long-term maintenance after closure.	Challenging	Lower initial capital and operating costs are offset by long-term costs of managing separate PAG facilities.	Discard	Lower initial cost and extensive precedence for effective management of PAG, however, creates additional technical challenges compared to other alternatives associated with managing multiple facilities, as well as geotechnical risk of impounded fine materials, without corresponding benefits.
	Dewatered fine processed rock (filter press)	Acceptable	Though more expensive, filter pressing is technically feasible and provides environmental benefits (e.g., increases process water recycling)	Challenging	Higher initial capital and operating costs due to process infrastructure requirements and transportation costs are offset by reduced long-term liability.	Select, in combination with other ML/ARD alternatives	Though higher cost initially, provides many benefits including reducing process water makeup demands, reducing geotechnical risk and project footprint, especially if paired with co-disposal with processed rock and mine rock. Does not, on its own, mitigate ML/ARD potential.
Coarse processed rock	Segregated coarse/fine processed rock piles	Challenging	Though surface coarse and dewatered processed rock disposal is well-established technology, it will present ML/ARD challenges in this application.	Challenging	Multiple PAG management facilities required, increasing cost and complexity.	Discard	Does not mitigate ML/ARD generation for PAG coal reject materials, and creates additional technical challenges associated with managing multiple facilities.
	Blended coarse/fine processed rock piles	Acceptable	Well established processed, that may help mitigate ML/ARD challenges.	Challenging	Multiple PAG management facilities required, increasing cost and complexity	Discard	Does not adequately mitigate ML/ARD generation for PAG coal reject materials, and creates additional technical challenges associated with managing multiple facilities. Does not offer benefits compared to co-disposal with mine rock.
	Blended and co-disposal with mine rock (non-PAG or unsegregated)	Acceptable	Well established technology, that may help mitigate ML/ARD challenges and reduces number of PAG management facilities.	Acceptable	Most economically viable method in the long-term, due to reduced number of separate PAG management facilities.	Select	Reduces technical complexity by providing a single PAG management location and provides additional benefits to geotechnical and geochemical performance of the mine rock pile.
Open pit walls	Do nothing	Unacceptable	Significant portions of the exposed pit wall area are expected to be acid generating, resulting in unacceptable water quality effects.	Challenging	Exposed PAG surfaces expected to require active dewatering and ARD water management.	Discard	Does not, on its own, adequately mitigate ML/ARD risk.
	Partial end-pit lake	Acceptable	Establishing end-pit lakes is feasible within the mine development staging plan and would reduce ARD as exposed open pit wall areas are relatively small compared to submerged open pit areas.	Acceptable	Establishing pit lakes is consistent with the mine plan and is expected to occur naturally due to the site hydrology, and therefore should not result in significant extra costs.	Discard	Provides adequate mitigation of ML/ARD risk due to reduction of exposed reactive surface areas, however, does not offer any corresponding benefits compared to the alternative with mine rock backfill.
	Total submergence end-pit lake	Challenging	Constructing embankments to submerge open pit walls is technically feasible, though introduces geotechnical risks without commensurate benefits of ARD risk reduction.	Challenging	Additional embankments introduce additional costs and long-term (post-closure) liabilities.	Discard	ARD-mitigation benefits offered by submerging pit walls during operations are offset by additional technical risk and long-term liability associated with the additional dams.
	Backfill with mine rock and partial end-pit lake	Acceptable	Backfilling open pits with mine rock and partial submerging is feasible within the mine development and has overall benefits of reducing the requirement for external PAG rock management and facilitating closure ARD management.	Acceptable	Backfilling with mine rock is complementary to the mine plan and reduces haul distances. Establishing end-pit lakes is consistent with the mine plan and is expected to occur naturally due to the site hydrology, and therefore should not result in significant extra costs	Select	Backfilling with mine rock is complementary to the mine plan and reduces haul distances, providing environmental, reclamation and economic benefits.
Mine rock	Do nothing	Unacceptable	Significant portions of the mine rock are expected to be acid generating, resulting in unacceptable water quality effects.	Unacceptable	Lack of ML/ARD management is expected to result in unacceptable long-term liability.	Discard	Does not, on its own, adequately mitigate ML/ARD risk.
	Active water treatment of PAG mine rock	Challenging	Lime treatment of ARD is a well-established technology, however, the ability to effectively capture ARD from sources presents potential challenges.	Challenging	Potential high capital costs, and requirement for long-term water treatment presents a significant long-term liability.	Assess further	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure conditions), and presents challenges associated with capturing ARD.
	Active water treatment of non-PAG mine rock	Challenging	Treatment methods of metals in neutral drainage are generally parameter specific, and multiple treatment methods would be required.	Unacceptable	Capital and operating cost of multiple treatment methods presents an unacceptable cost to the project.	Discard	Economic and technical challenges.
	Passive water treatment of non-PAG	Challenging	Passive water treatment systems have demonstrated effectiveness in reducing selected parameters of	Challenging	Significant areas and retention times are required for passive treatment in cold, wet climates, and challenges in	Discard	Economic and technical challenges.

Component	Management Option	Technical Applicability	Rationale	Economic Feasibility	Rationale	Screening Decision	Rationale
	mine rock		concern (notably selenium and nitrate), however, present challenges in cold, wet climates.		reliably predicting end-of-pipe compliance.		
	PAG/non-PAG blending	Unacceptable	PAG/non-PAG blending presents many challenges and has limited examples of successful application. In addition, PAG/non-PAG mass balance does not support this alternative.	Challenging	Significant logistical and construction effort is required to achieve effective blending.	Discard	Not likely to be achievable based on-site conditions.
	Dry cover over PAG (granular or geosynthetic)	Challenging	Dry covers are a well-established technology; however, it is generally agreed that they are effective at slowing, but not eliminating, processes for ARD in cold, wet BC climates.	Challenging	Significant construction effort and perpetual ongoing monitoring and maintenance required to ensure cover performance at limiting ARD reactions.	Discard	Unlikely to adequately mitigate ML/ARD from PAG materials.
	Dry cover over non-PAG (granular or geosynthetic)	Preferred	Dry covers are a well-established technology at limiting infiltration, which should be effective at limiting neutral metal leaching.	Acceptable	Significant construction effort and ongoing monitoring and maintenance required to ensure cover performance; however, lower performance measures are required to limit metal leaching than ARD reactions.	Assess further	Dry cover is an effective long-term risk mitigation method.
	Wet cover over PAG	Acceptable	Wet covers are a well-established technology for ML/ARD management in cold, wet BC climates.	Acceptable	Higher capital costs for impoundment construction are offset by lower long-term operating costs associated with preventing ARD.	Assess further	Most robust alternative and cost-effective alternative for mitigating ML/ARD from PAG materials in a humid environment. However, requires an impoundment which increases geotechnical risk.
	Wet cover over non-PAG	Acceptable	Wet covers are a well-established technology for ML/ARD management in cold, wet BC climates.	Unacceptable	The cost and effort required to maintain submergence of the full volume of both PAG and non-PAG materials is likely to be prohibitive.	Discard	Submerging both PAG and non-PAG material volumes would negatively affect project economics and create additional geotechnical risks without corresponding benefit of improving environmental outcomes.
	Saturation cover over PAG	Acceptable (closure)	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk. Not feasible during operations due to the need for continual material placement.	Acceptable (closure)	Logistically challenging to place progressive saturated covers during active deposition. For closure, higher capital costs for impoundment and cover construction are offset by lower long-term costs associated with preventing ARD post-closure.	Assess further	Most robust alternative and cost-effective alternative for mitigating ML/ARD from PAG materials in a humid environment post-closure. Geotechnical risk of impoundment exists but is reduced compared to water cover.
	Saturation cover over non-PAG	Acceptable	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk.	Unacceptable	The cost and effort required to construct and maintain saturated cover of the full volume of both PAG and non-PAG materials is likely to be prohibitive.	Discard	Submerging both PAG and non-PAG material volumes would negatively affect project economics and create additional geotechnical risks without corresponding benefit of improving environmental outcomes.

Sources: *Compiled in report.*

Notes*: ARD=acid rock drainage; ML=metal leaching; PAG=potentially acid generating*

Technical Applicability and Economic Feasibility selection criteria are defined as follows:

- *Unacceptable: Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive).*
- *Challenging: Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability.*
- *Acceptable: Is expected to achieve stated objectives without significant challenges or economic risk or liability.*

5.2 Environmental and Community Alternatives Assessment

Based on the pre-screening assessment detailed in **Table 5-3**, the alternative of blending dewatered fine rock and coarse processed rock and co-mingling with PAG mine rock is selected due to lack of technically and economically feasible alternatives. Similarly, ML/ARD from open pit walls will be managed by progressively backfilling with non-PAG rock and overburden and partially submerging as open pits become exhausted, and ML/ARD from non-PAG mine rock will be mitigated by progressive placement of overburden and reclamation material (surface soil) covers over the mine life.

Alternatives for PAG mine rock management (blended with processed rock) are evaluated against environmental and community effects criteria, as summarized in **Table 5-4.**

Table 5-4: Alternatives Assessment based on Effects on the Natural Environmental and Community Effects and Inputs including Human Health (Mine Rock)

Management Option	Environmental Effects	Rationale	Community Input	Rationale	Screening Decision	Rationale
Active water treatment of PAG mine rock	Challenging	Treating water will result in improved water quality outcomes in receiving environments but involves long-term management of water treatment sludge. Risk of not capturing ML/ARD seeps from the open pit and/or impoundments may result in environmental impacts.	Challenging	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure). Possibility of parameters of concern entering the downstream environment having a negative effect on human health.	Implement as contingency, in case of failure of other methods	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure conditions), and presents challenges associated with capturing ARD. However, water treatment is an effective mitigation technology in the case of failure of preferred ML/ARD prevention methods.
Wet cover over PAG	Acceptable	Wet covers are an effective method of effectively eliminating ML/ARD. Local climate lends itself to maintaining water cover, even under drought and climate change conditions. However, there is a risk of losing the wet cover due to evaporation and resultant ARD potential.	Challenging	Passive ML/ARD management option. However, presents long-term geotechnical risk associated with embankment failure	Select for operation phase	Effective at providing ML/ARD source control from PAG materials in a humid environment. However, requires an impoundment which increases geotechnical risk.
Saturation cover over PAG	Acceptable (closure)	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk.	Acceptable (closure)	Passive ML/ARD option that allows re-establishment of vegetation. Geotechnical risk of impoundment exists but is reduced compared to wet cover.	Select for Decommissioning and Reclamation and Post-closure phases	Effective at providing ML/ARD source control from PAG materials in a humid environment, but not practical to implement during active material placement. Geotechnical risk of impoundment exists but is reduced compared to water cover.

Sources: *Compiled in report.*

Notes*: ARD=acid rock drainage; ML=metal leaching; PAG=potentially acid generating*

Technical Applicability and Economic Feasibility selection criteria are defined as follows:

- *Unacceptable: Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive).*
- *Challenging: Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability.*
- *Acceptable: Is expected to achieve stated objectives without significant challenges or economic risk or liability.*

6 Conclusions and Recommendations

ML/ARD mitigations for PAG and non-PAG mine rock, including fine processed rock and open pit walls, recommended based on this assessment, and their rationale, are as follows:

Fine processed rock (tailings) treated as PAG: Dewatered fine processed rock (tailings) blended with coarse processed rock (also treated as PAG), for co-disposal with PAG mine rock and placed underwater for permanent storage:

- Increased process water recycling leading to lower freshwater makeup requirements; and
- Reduced operational complexity and risk of managing a single PAG facility.

Open pit walls: covered with non-PAG rock and overburden and partially submerged to form an end-pit lake during operations. Any remaining exposed open pit walls will be covered with an overburden and reclamation materials (surface soils) cover during the Decommissioning and Reclamation Phase to meet Post-closure land use objectives:

- Reduction of infiltration of water and oxygen to the open pit walls;
- Prevention of ML/ARD during Operation, Decommissioning and Reclamation, and Post-closure phases by providing constant availability of NP materials and seepage to the open pit wall; and
- Amenable to Post-closure restoration of pre-mining landforms.

Non-PAG mine rock: progressively covered with overburden and finally reclamation materials (surface soils):

- Reduced infiltration and seepage to the receiving environment; and
- Promote vegetation and meet Post-closure land use objectives.

PAG mine rock: impounded, with a water cover:

- Demonstrated effectiveness of the method in managing ML/ARD in the long-term;
- Ability to incorporate design contingencies to mitigate risks of system failure; and
- Relatively low operational and maintenance requirements, post-closure.

It is recommended that the Project design incorporate the following considerations:

1. Design the saturation cover depth with consideration to be resilient to drought conditions, considering the potential long-term effects of climate change.
2. Incorporate design measures to reduce the likelihood and potential consequence of an embankment failure on the downstream environment (e.g., closure spillways designed for the probable maximum flood (PMF), saturated rockfill cover Post-closure).

Other materials such as **overburden**, **reclamation materials (surface soils, woody debris)** and surficial construction materials (gravel and rock quarry) are not expected to require any specific material management procedures beyond best practices for excavation and placement of these materials.

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Regards,

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APPENDIX 21: TENAS PROJECT POTENTIAL ACID GENERATING MATERIAL STORAGE ALTERNATIVES ASSESSMENT, SRK

FINAL

Tenas Project Potential Acid Generating Material Storage Alternatives Assessment

Tenas Project, British Columbia, Canada

Telkwa Mining Limited



SRK Consulting (Canada) Inc. ▪ CAPR002055 ▪ June 2024

srk consulting

FINAL

Tenas Project Potential Acid Generating Material Storage Alternatives Assessment

Tenas Project, British Columbia, Canada

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File Name:
03-B Tenas Project_PAG Material Storage Alternatives Assessment_Report_CAPR002055_20240614_FNL

Suggested Citation:
SRK Consulting (Canada) Inc. 2024. Tenas Project Potential Acid Generating Material Storage Alternatives Assessment. Final report. Prepared for Telkwa Mining Ltd.: Telkwa, British Columbia. Project number: CAPR002055. Issued June 2024.

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Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

ABA	Acid Base Accounting
ALR	Agriculture Land Reserve
AP	Acid Potential
ARD	Acid Rock Drainage
BAP	Best Available Practices
BAT	Best Available Technologies
CPP	Coal Processing Plant
DMC	Dense Medium Cyclone
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
ECCC	Environment and Climate Change Canada
EMP	East Management Pond
GHG	Greenhouse Gases
MAA	Multiple Account Analysis
MBCM	Million Banked Cubic Metres
ML	Metal Leaching
MP	Management Ponds
NMP	North Management Pond
Non-PAG	Non Potentially-Acid Generating
NP	Neutralization Potential
NPR	Neutralization Potential Ratio
PAG	Potentially-Acid Generating
PGA	Peak Ground Acceleration
SHA	Seismic Hazard Assessment
SRK	SRK Consulting (Canada) Inc.
TCP	Tenas Control Pond
Telkwa	Telkwa Mining Ltd.
WMP	West Management Pond
XRD	X-Ray Diffraction

Executive Summary

The Tenas Project is a Telkwa Mining Limited (Telkwa) owned steelmaking surface coal project located in central British Columbia, approximately 25 km south of Smithers and 7 km southwest of Telkwa. The Project site is located south of the Tenas River and the boundaries of the Project encompass the lower reaches of the Telkwa River, Goathorn Creek, and Tenas Creek. The Tenas Project's total mine life is anticipated to be 22.5 years, including one and half years of mine development and construction followed by 21 years of production.

The mine plan was designed and scheduled in a manner that allows potentially-acid generating (PAG) rock including processed rock (tailings) to be deposited into Management Ponds (MP), including the East Management Pond (EMP), West Management Pond (WMP), and North Management Pond (NMP).

In 2022, Telkwa prepared the Environmental Assessment Certificate Application (EACA) and submitted this to the Environmental Assessment Office (EAO). In response, the EAO submitted a letter to Telkwa with a list of information requests (IRs) related to first nation aspects, water quality, pond liner design, water and load balance, ARD/ML, and MP management and design. Among others, the EAO requested Telkwa to provide a detailed review of the PAG material storage alternatives assessed to support the mine plan and management ponds provided in the EACA.

This document presents the PAG material storage alternatives assessment conducted for the Tenas Project in response to the list of information requests (IRs) requested by the EAO in response to the Project provided by Telkwa Mining in the EACA. The PAG material storage alternatives assessment was conducted in terms of a Multiple Account Analysis (MAA), following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC) (ECCC, 2013). The seven steps of the MAA presented in (ECCC, 2013) were conducted.

A set of threshold criteria was set to establish the regional boundaries for selecting candidate alternatives for storing the mine materials and pre-screening criteria were set to establish the 'fatal flaws' for eliminating the candidate alternatives that do not meet minimum specifications developed for the Project. Based on this, the candidate alternatives of the 'EAC Submitted Option' and two alternative configurations were selected for the next steps of the Alternatives Assessment.

To ensure a robust process a multi-disciplinary workshop was organized by Telkwa Mining and held on February 28th, 2024, which had representatives from SRK, Telkwa Mining, Fisheries, Wildlife, and Public groups. The multi-disciplinary workshop was held on February 28th, 2024. A summary presentation of this report will be presented and reviewed with Participating Indigenous Nations such as the Office of the Wet'suwet'en and Witset First Nation for questions, input, and understanding and will be incorporated as an amendment to this document if required. Furthermore, as part of the EAO process a presentation will also be made to the EAO Technical Advisory Committee/Working Group for input and clarifications which will be incorporated as an amendment to this document inf required.

During the multi-disciplinary workshop, a summary of the candidate alternatives and pre-screening assessment was presented to participants. It was agreed to include 'an additional alternative

configuration in the next steps of the Alternatives Assessment to account for a completely different alternative (i.e., dams vs no dams). Scoring for each Indicator, and Weighting for each Account and Sub-Account were revised and agreed with participants during the multi-disciplinary workshop.

Final Scoring and Weighting were provided to the participants for a final review after the workshop with any further edits incorporated into this document's results. The results of the MAA showed that the 'EAC Submitted Option' is the preferred alternative for storing PAG materials, as presented in Figure E-1. Sensitivity analyses were conducted to better assess if bias and subjectivity during the process could impact in the decision making. Results showed that independently of the weightings, the 'EAC Submitted Option' was the highest rated alternative (see Figure E-2).

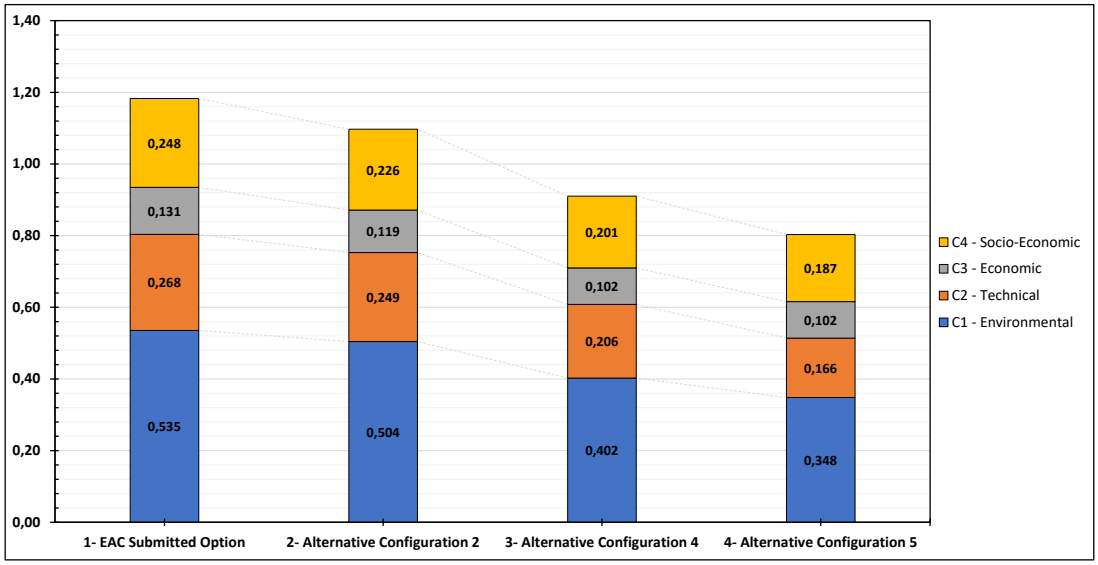


Figure E-1: Results of the Value-Based Decision Process.

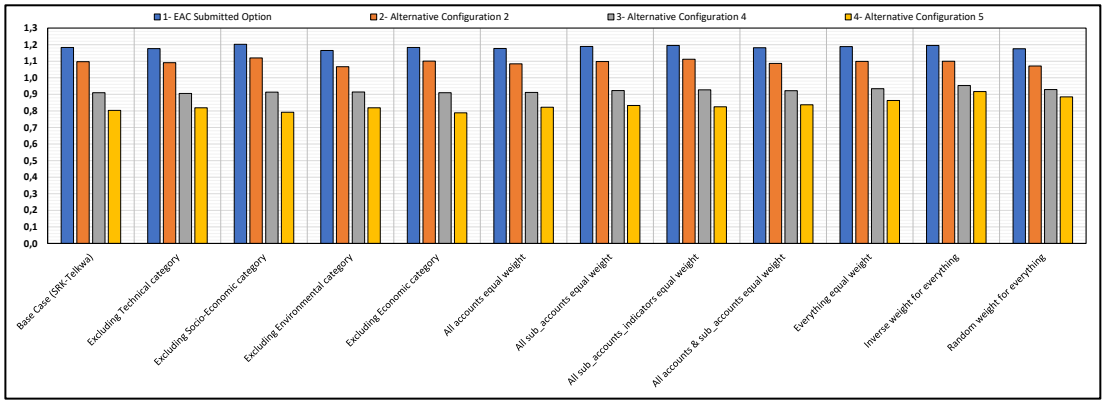


Figure E-2: Results of the Sensitivity Analyses.

Based on the outcomes of the Value-Based Decision Process and the Sensitivity Analyses, SRK and Telkwa Mining considers that the ‘EAC Submitted Option’ as the preferred alternative for storing PAG materials for this Project. It is recommended to advance with the field work and detailed design process for this configuration.

1 Introduction

1.1 Project description

The Tenas Project (Project) is a Telkwa Mining Ltd. (Telkwa) owned coal project located in central British Columbia, approximately 25 km south of Smithers and 7 km southwest of Telkwa. The Project site is located south of the Tenas River and the boundaries of the Project encompass the lower reaches of the Telkwa River, Goathorn Creek, and Tenas Creek. The Tenas Project's total mine life is anticipated to be 22.5 years, including one and half years of mine development and construction followed by 21 years of production.

The mine plan was designed and scheduled in a manner that allows potentially-acid generating (PAG) rock including processed rock (tailings)to be deposited into Management Ponds (MP), including the East Management Pond (EMP), West Management Pond (WMP), and North Management Pond (NMP).

These MPs will be constructed ahead of time, in sequence as per the mine plan developed by Telkwa, and allowed to flood with water to a level that maintains a minimum 1 m water cover above the PAG material placed in the MP at the end of a 12-month period. This PAG management plan is intended to reduce oxygen levels so that the oxidization of rock will be minimized with the goal of preventing Acid Rock Drainage and the associated implications to water quality from occurring. Once a particular management pond is completed the water cover will be increased to 2 m for permanent storage of PAG material below this level.

The mine plan also includes the construction of the Tenas Control Pond (TCP) to aid with onsite water management, provide a central sedimentation pond for the Project, and provide additional water for submerging PAG materials. The TCP will be constructed north of the NMP, and adjacent to the Coal Processing Plant and Mine Infrastructure Complex Pad.

1.2 Project background

During 2018 and 2019, SRK Consulting (Canada) Inc. (SRK) conducted field programs to investigate the foundation characteristics for previous versions of the MP design, and rock geotechnical investigations for the open pit slopes.

During 2021, a geotechnical assessment of the Management Ponds (MP) and the Tenas Control Pond (TCP) was completed by SRK (SRK, 2024b), at a feasibility study level, based on the proposed ponds design provided by Telkwa (v.7 20210304) and the field investigation results from 2018 and 2019.

To support the Environmental Assessment (EA) level design for the geotechnical components of the TCP, and the proposed management pond MP structures to store PAG material, a field investigation was performed in 2021, involving the completion sonic drillholes, test pits, and installation of standpipe and vibrating wire piezometers. Field and laboratory testing was undertaken as part of this field program to reduce uncertainties related to the foundation conditions below the proposed MP and TCP and inform material strength and hydraulic parameters, with focus on determining the presence,

extension, depth, and thickness of weak layers. An interpretation of the obtained results was then completed by SRK issued in 2022 (SRK, 2022). The results were mostly consistent with the previous campaign findings and with the regional interpretation by Levson (Levson et al, 1997).

Based on this, among others, Telkwa prepared the Environmental Assessment Certificate Application (EACA) and submitted this to the Environmental Assessment Office (EAO) in February 2022.

In response to this application, the EAO submitted a letter to Telkwa with a list of information requests (IRs) related to first nation aspects, water quality, water and load balance, ARD/ML and MP management and design. Among others, the EAO requested Telkwa to provide a detailed review of the PAG material storage alternatives assessed to support the mine plan and management ponds provided in the EACA.

1.3 Objective and scope

The objective of this document is to provide a comprehensive review of the different PAG material storage alternatives and definition of the preferred alternative to support the mine plan provided in the EACA. The scope of work includes:

- review of background information;
- methodology description;
- alternatives assessment;
- conclusions and recommendations.

1.4 Exclusions

The results presented herein are intended for the EACA for the Tenas Project and should not be extended beyond this specific scope. The following items are excluded from the alternatives assessment scope of work:

- stability assessment of the PAG material storage alternatives;
- detailed cost model for PAG material storage alternatives,
- reclamation plan for PAG material storage alternatives,
- dam breach assessment of PAG material storage alternatives, and
- water and load balance assessments of PAG material storage alternatives.

2 Background Information

This section presents the background information used as a basis for the PAG Material Storage Alternatives Assessment (refer to Section 4). The objective of this section is to provide a summary of the 'Project-specific framework', including site-specific conditions, mine plan, mine material streams, characterization of each mine material streams as potential acid generating (PAG) versus non-potential acid generating(non-PAG), potential borrow/construction source materials and the foundation terrain. Additional detail on these aspects is included in the '*PAG Management Alternatives Assessment*' memorandum Appendix A, the '*Tenas Project – Management and Control Ponds Stability Assessment Review*' report (SRK, 2024b) and the '*Tenas Project - Site-Specific Probabilistic Seismic Hazard Assessment*' report (SRK, 2024a).

2.1 Site Conditions

2.1.1 Location

The Tenas Project is in central British Columbia approximately 15 km south of Smithers and 7 km southwest of Telkwa as illustrated by Figure 2-1. The project site is located south of the Telkwa River.

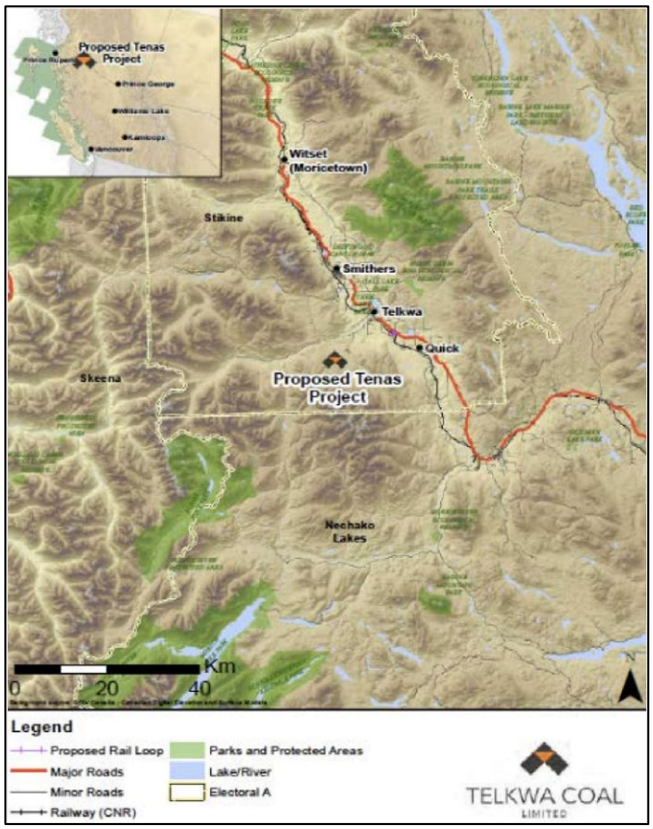


Figure 2-1: Tenas Project Location Plan (SRK, 2024b).

2.1.2 Geomorphology and Surficial Soils

The site is located within the foothills of British Columbia, between the Bulkley Mountain Range to the north and west, and the low-lying gently sloping relief of the Nechako Plateau.

Bedrock is typically covered by Quaternary soils, except for rocky outcrops along deeply eroded sections in adjacent river and creek valleys. Elevation across the site ranges generally from 600 to 900 m, with maximum elevations along the east side of the property (Levson et al, 1997).

The regional surficial soils have been studied by Levson (Levson et al, 1997). Two soil units are characterized regionally, and include:

- A widespread, massive unit, interpreted as a till, is located at or near the ground surface elevation. The till is described as diamicton, with particle sizes ranging from clay to boulders within a fine grained or sandy matrix. No thickness information was provided by (Levson et al, 1997).
- In some areas, the till is underlain by both glaciofluvial stratified sands and gravels, and horizontally bedded sand, silt and clay sequences interpreted to be advanced-phase glacio-lacustrine sediments.

In the 2018 investigations, the surficial soils intercepted were mostly sandy lean clay. The 2019 investigations intercepted finer grained till, more commonly described as a sandy lean clay, as well as coarser-grained soils within the paleo-channel described as a clayey silty sands or gravels. At greater depths within the paleo-channel (i.e., below 30 m) these two broader material types are interfingered. Both materials are comparable to the till units described by Levson (Levson et al, 1997). Results indicate that the silts and clays are commonly stiff to hard in consistency, and the sands and gravels are dense to very dense.

The surficial soil materials encountered in the sonic drillholes during the 2021 campaign (SRK, 2022) indicated the presence of a wide-spread diamicton till material. This was mostly consistent with the previous campaign findings and with the regional interpretation by Levson (Levson et al, 1997). Particle size analyses led to the interpretation of lithology zones, including Upper Till, Lower Till, High Fines, Sand (Silty Sand), and Mixed Sand & Gravel. The results of the index testing show that the majority of the clays are of low to medium plasticity, with only two samples being categorized as high plasticity.

2.1.3 Bedrock Geology

The coal that is to be mined from the Tenas EA Open Pit is located within the sedimentary sequences of the early Cretaceous-aged Skeena Group. The Skeena Group consists of mudstones, siltstones, sandstones, and conglomerates with inter-bedded, bituminous coal seams. The Skeena Group has been historically divided into four units (Palsgrove, 1991), of which two units are economically coal-bearing (Figure 2-2).

Of relevance to this study at Tenas is Unit 1 described by (Palsgrove, 1991). A geological map of the Tenas EA Open Pit with the Unit 1 outcrops is shown by Figure 2-2. Unit 1 comprises a 50 to 120 m thick sedimentary sequence interbedded with Coal Seam 1 (Seams 1A to 1F). The individual coal

seams vary from less than 1 m to 3 m in thickness and can be laterally discontinuous (Palsgrove, 1991).

The Skeena Group unconformably overlies the Hazelton Volcanic Group rocks. Additionally, the project geology map indicates the intrusive unit is in contact with the Skeena Group in directions outside of the Tenas Deposit footprint in white as shown by Figure 2-3. However, the Hazelton Volcanic Group was not intercepted in vertical diamond drillholes that extended below the lower-most coal plys at Tenas or the inclined diamond drillholes that were drilled though the east-limb of the Tenas syncline (i.e., proposed east wall) along the east side of the deposit.

As discussed, the Skeena Group rocks have been folded into a syncline at Tenas. On the west side the rocks are shallow, west dipping and gently folded along a west-limb. Toward the east, the bedding dips increase at the axis of the fold, and the rocks are moderately dipping to the east along the east-limb.

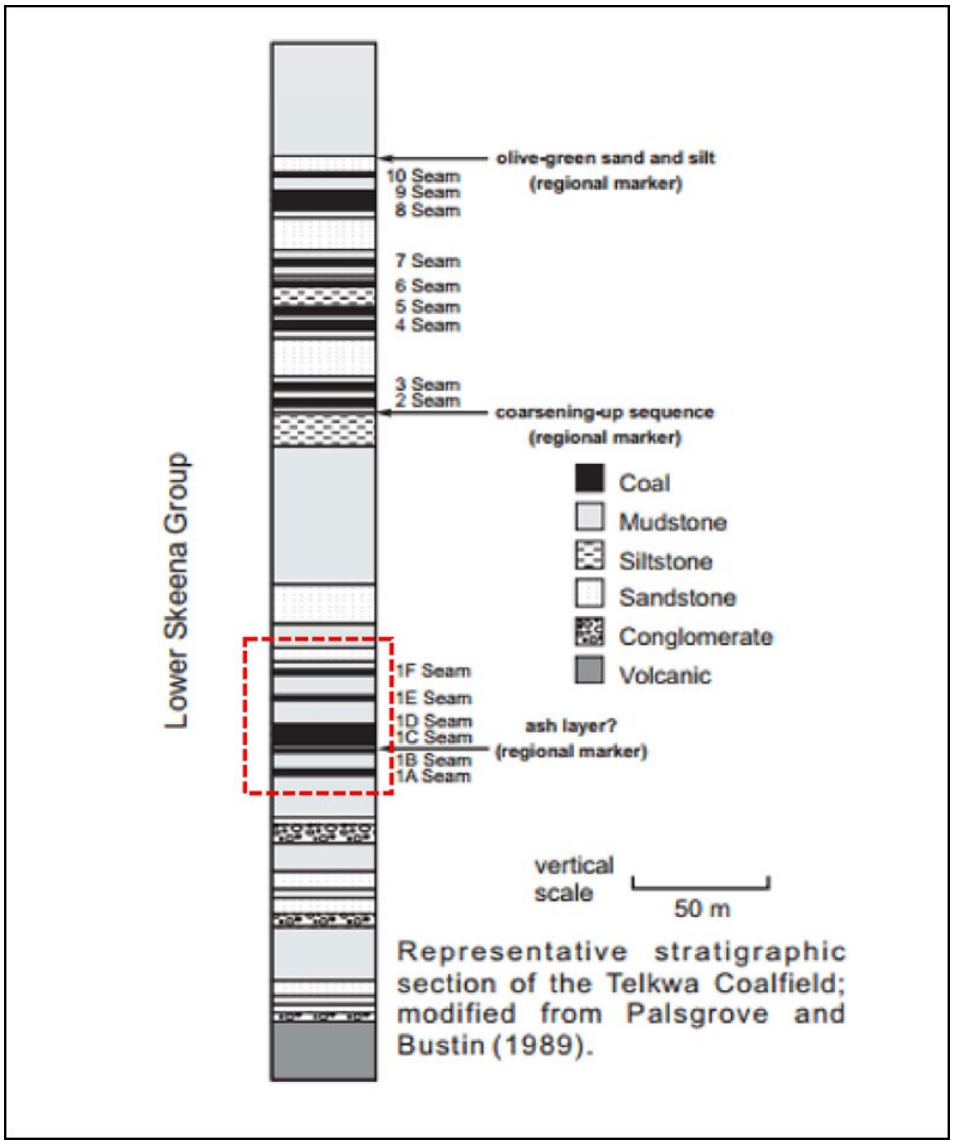


Figure 2-2: Representative Stratigraphy of the Skeena Group (Palsgrove, 1991). Unit 1 shown in Red Dashed Box (SRK, 2024b).

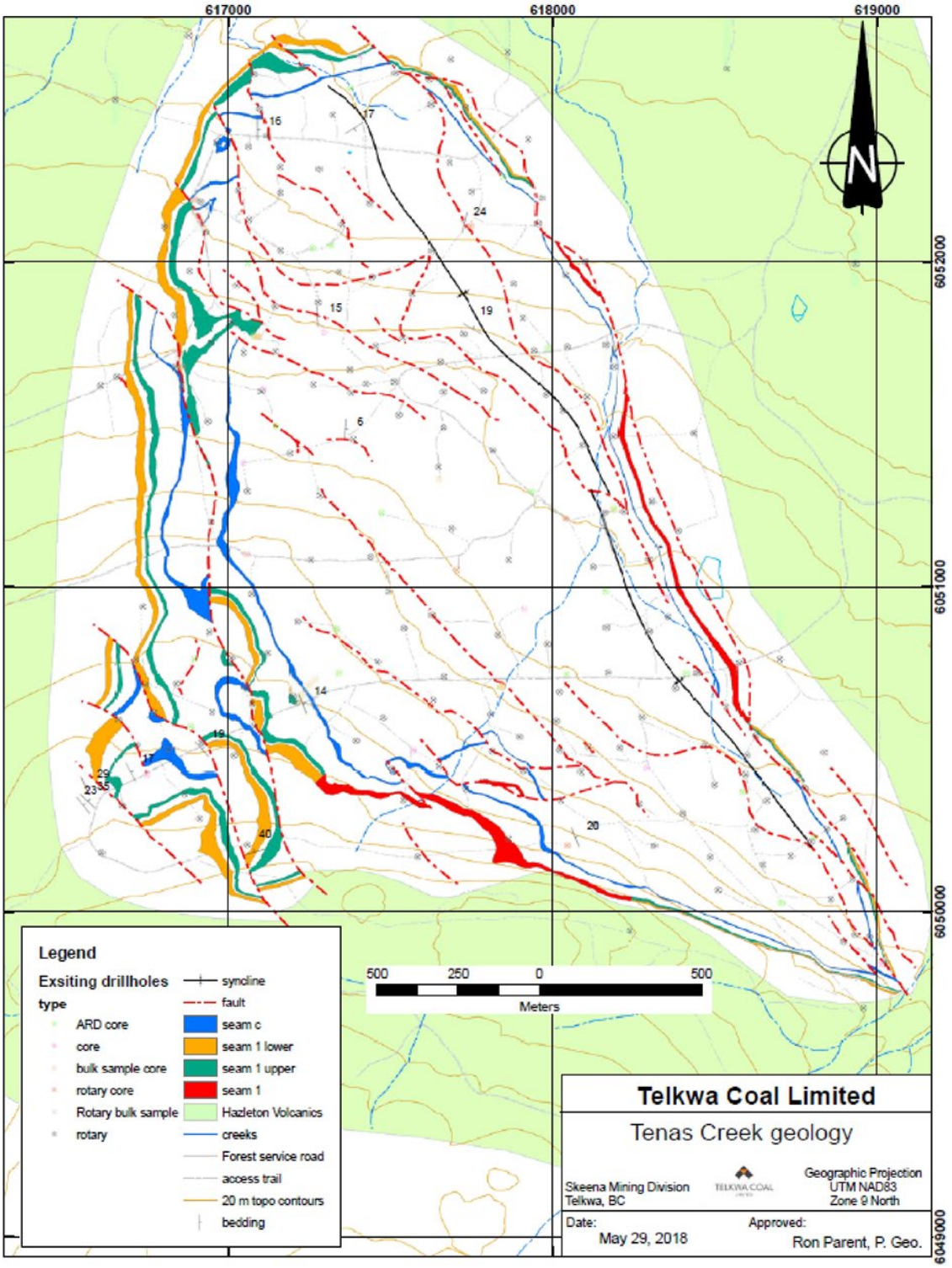


Figure 2-3: Tenas Geology Map (SRK, 2024b).

2.1.4 Seismicity

The 2015 National Building Code Seismic Hazard Map (NCR, 2015) indicates that the Tenas Project is in a relatively stable seismic area. The peak ground acceleration (PGA) for a two percent probability of exceedance in a 50-year period, i.e., 1 in 2,475 years, is 0.049 times the force of gravity of 9.81 m/s^2 (g).

A site-specific seismic hazard assessment (SHA) was conducted in 2023 (SRK, 2024a). The study provides an estimation of the seismic hazard for the Project site for a representative site condition and presents seismic design criteria and design guidance in terms of ground acceleration, spectral accelerations, and horizontal seismic coefficients for use in stability analysis.

The SHA showed that for Project's rock site conditions, the maximum design earthquake (MDE) will have a PGA of 0.10 g (mean) and 0.129 g (84% percentile) with a target AEP of 1:10,000 years. For C site class (site class for Tenas Project) and Extreme Dam Consequence Category, the maximum design earthquake MDE for passive-care stages will have a PGA of 0.11 g (mean) and 0.142 g (84%), according to GISTM and the CDA.

Finally, a range of seismic coefficients (pseudo-static) had been calibrated for different dam heights for the Extreme Dam Consequence Category. The obtained values are approximately between 0.032g and 0.044g. For the purposes of this analysis, a maximum horizontal seismic acceleration (0.045g) was conservatively adopted for the pseudo-static stability assessment.

2.2 Mine Plan and Mine Material Streams

The proposed project will produce metallurgical coal at a planned annual production rate of between 775,000 and 825,000 processed coal tonnes over a life of mine of about 21 years at a maximum production rate of 2,500 tonnes of processed coal per day. The mining of the Run-of-Mine (ROM) coal will require the excavation of surface soils (topsoil), overburden, non-PAG rock, PAG rock, and non-recoverable coal seams. Run-of-Mine coal is processed by a dense medium cyclone (DMC)/flotation coal processing plant with a 145 rom-of-mine tonnes per hour (tph) capacity, with fine processed rock (fine processed rock, defined as materials smaller than 0.5 mm) dewatered to 40% solids content by a belt filter press, before being combined with the coarse processed rock at a 20 to 25% moisture content and stockpiled for disposal by placing it underwater in the management ponds. A schematic of the Coal Processing Plant (CPP) is shown in Figure 2-4. In summary the following are the Porject's material streams that need to be stored on a permanent basis:

- Overburden: this material is either backfilled into the EA Open Pit or used for the construction of the management and control ponds;
- Non-Pag Rock: this material is either backfilled into the EA Open Pit or used for the construction of the management and control ponds;
- PAG Rock: this material is placed underwater in the management ponds;
- Surface Soils (topsoil): this material is temporarily stockpiled or direct placed for reclamation requirements;

- Processed Rock: this material is placed underwater in the management ponds;
- Run-of-Mine Coal: this material is temporarily placed in stockpiles for processing; and
- Processed Coal: this material is temporarily placed in stockpiles for shipment to the overseas markets.

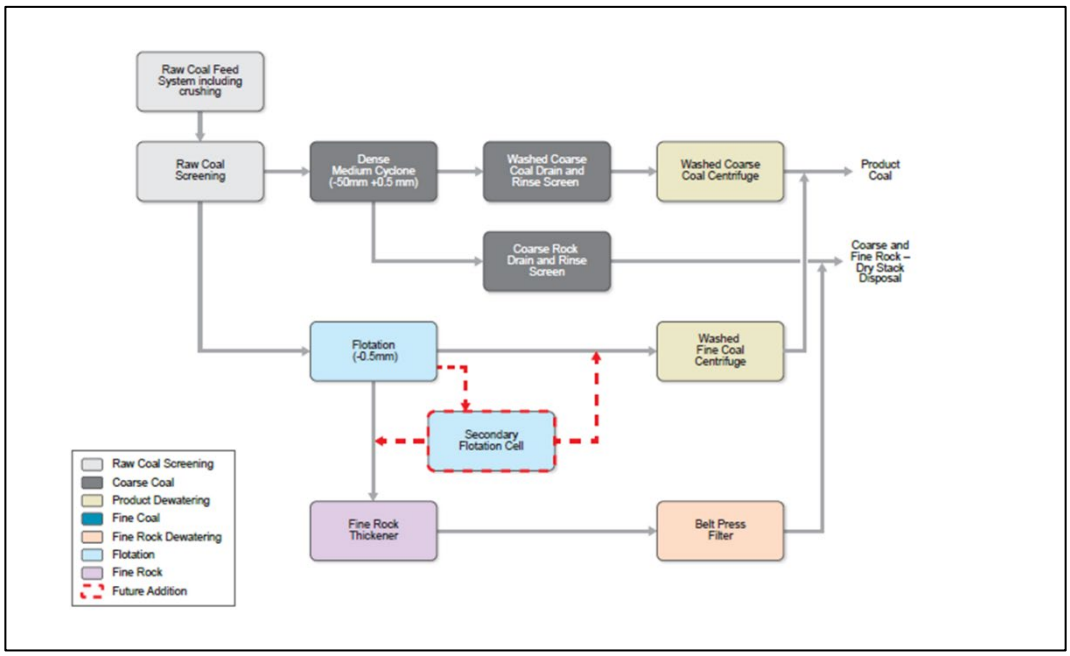


Figure 2-4: DMC/ Flotation CPP schematic flow diagram (SRK, 2021b).

The Tenas EA Open Pit contains both PAG and non-potentially acid generating (non-PAG) materials (see Section 2.4). The mine plan involves separating mine rock based on its potential to generate acid, as it is extracted. A zone model has been developed for the rock units within the EA Open Pit, and supplemental geochemical testing will be conducted during the Operation Phase to confirm mine rock properties as per the ML/ARD Management Plan. Non-economic materials from the Project are expected to include:

- Non-PAG Reclamation materials (surface soils/topsoil) and overburden from EA Open Pit mining (24.22 million banked cubic meters (MBCM)).
- PAG[1] mine rock from EA Open Pit mining (31.83 MBCM).
- Non-PAG mine rock from EA Open Pit mining (29.52 MBCM).

[1] PAG defined as materials with an NPR less than 2.0 (SRK, 2021b) for the EACA and planning purposes, however materials will be subject to the verification testing during the Construction and Operation phases provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials using an NPR cutoff of 1.20 which still requires approval from regulatory agencies.

- Coarse and fine processed rock (tailings) from the Coal Processing Plant. These materials are also expected to be PAG (total 3.28 MBCM):
  - Coarse processed rock which is comprised of material >0.5 millimeters (mm), and is roughly 75% of the processed rock materials produced;
  - Fine processed rock which is comprised of material <0.5 mm and is the remaining 25% of the processed rock materials produced.

2.3 Processed Rock Dewatering

Processed rock produced by the Project can be produced at several different moistures as follows:

- Wet processed rock (conventional slurry): Coarse and Fine Processed Rock are combined together to produce a material with a moisture level of roughly 75% to 85% which can then be pumped to a final disposal area;
- Paste processed rock: Some dewatering occurs for the Fine Processed Rock and then combined with Coarse Processed rock to produce a material with a moisture level of 50% which can then be pumped to a final disposal area; and
- Dry processed rock: Dewatering processes are completed for both Coarse and Fine Processed Rock to produce a final product with a moisture level of roughly 25% which can then be hauled to a final disposal area.

As part of the EACA, Telkwa Mining conducted an alternative means analysis for carrying out the Project with processed rock dewatering being one of the topics reviewed. Based on the analysis and information available when this analysis was conducted a dry processed rock product was selected mainly due to this option's low use of water from the surrounding environment.

2.4 Mine Materials

2.4.1 Mine Material Characterization

A comprehensive historical geochemical characterization program was completed for the Telkwa Project (Norecole, Dames & Moore, 1999) which included geochemical testing of over 700 samples. Supplemental geochemical characterization programs were conducted in 2018 and 2019 (SRK, 2019) which included additional testing of 173 selected samples from these programs, as well as collection and testing of 19 additional samples of processed rock, overburden, and construction rockfill.

Based on these characterizations, mine rock for the Project is characterized as non-PAG or PAG by acid base accounting (ABA), which measures the ratio of the Neutralization Potential (NP) to the Acid Potential (AP) of the material (i.e., the Neutralization Potential Ratio (NPR)). When the mineralogical contributors to NP and AP are well understood (i.e., NP is like that provided by calcite, AP is from oxidation of pyrite and these minerals have the same availability), regulatory guidance allows that NPR of 2.0 can be used to define PAG versus non-PAG (Price, 2009). The results of the supplemental mine rock geochemical characterization for the Project showed a strong positive relationship between

modified-NP and presence of calcium plus magnesium, which provides confidence in the ABA calculations (SRK, 2019).

In addition, there was a strong correlation based on modified-NP and NP calculated based on minerology NP-XRD (SRK, 2021a). Based on this relationship, an NPR of 2.0 was selected to identify rock as PAG or non-PAG for planning and the EAC application, consistent with the guidelines. However, materials will be subject to verification testing as provided for in the ML/ARD management plan during the Construction and Operation phases for final determination of PAG and non-PAG materials where a lower NPR might be approved by regulatory agencies.

In Table 2-1, the results of the geochemical characterization are summarized for the different mine rock types and described in the following sections.

Table 2-1: Non-Economic Material Geochemical Characterization (SRK, 2021b).

Material Type	Geochemical Characterization
Mine Rock	**Eleven (11) zones: 3 non-PAG(portions of Zones 1, 4, and 8) 1 of which is not mined by the EA Open Pit (zone 7), 8 PAG (Portions of Zones 1, Zone 1a, Portions of Zones 2, 3, 4, 5, 55, 6, and 7), 2 of which are not mined by the EA Open Pit (zones 7 and 8)**
Processed rock/tailings (coarse and fine)	**PAG**
Reclamation materials (surface soils/topsoils) and Overburden	**Non-PAG**
Construction Materials	**Non-PAG**
Open Pit EA Walls	**9 zones: 2 non-PAG, 7 PAG**

Sources: Compiled in text.

Notes: PAG distinction based on NPR ≤2 for the EACA and planning purposes, please note these materials will be subject to verification testing during the Operation Phase for the final determination of PAG and non-PAG materials using an NPR cut-off of 1.20 if approved by regulatory agencies.

2.4.2 Mine Material Management

A PAG Management Alternatives Assessment was conducted by SRK in 2021 (SRK, 2021b). The assessment presented and compared best available practices (BAP) and best available technologies (BAT) for processed rock (tailings) and PAG rock management for the specific conditions of the Project. It took into consideration safety (including dam safety), technical and financial aspects, and implications for environmental, health, social, heritage and economic values.

Based on the outcomes of the analysis, ARD/ML mitigation strategies for PAG and non-PAG mine rock, including processed rock and open pit walls, and their rationale are as follows. The detailed methodology and assessment are included in the "*PAG Management Alternatives Assessment*" memorandum (SRK, 2021b) presented in Appendix A.

- Processed rock (tailings): Dewatered fine processed rock (tailings) blended with coarse processed rock, for co-disposal with PAG mine rock:
  - Increased process water recycling leading to lower freshwater makeup requirements.
  - Reduced operational complexity and risk of managing a single PAG facility.
- Open Pit walls: progressively backfilled with non-PAG mine rock/overburden, then covered with overburden, shaped to desired landform, and portions are submerged to form an end pit lake during the Post-closure phase with any remaining areas above water covered with surface soils (topsoil) and revegetated. Any remaining exposed open pit wall areas will be covered with overburden and surface soils during the Decommissioning and Reclamation Phase to meet post-closure land use objectives:
  - Prevention of ARD during Operation and Post-closure phases by reducing oxygen ingress and providing excess neutralizing potential material for the EA Open Pit wall PAG zones.
  - Reduction of ML during Operation and Post-closure phases by reducing oxygen and water ingress into the EA Open Pit wall zones.
  - Amenable to Post-closure restoration of pre-mining landforms.
- Non-PAG mine rock: progressively covered with glacial till and overburden and surface soils(topsoil):
  - Reduced infiltration and seepage to the receiving environment.
  - Promote vegetation and meet post-closure land use objectives.
- PAG mine and processed rocks: impounded, with a water cover:
  - Demonstrated effectiveness of the method in managing ML/ARD in the long-term.
  - Ability to incorporate design contingencies to mitigate risks of system failure.
  - Relatively low operational and maintenance requirements, post-closure.

2.5 Construction Materials

In the event that the selected alternative requires the construction of containment embankments to store PAG material, it is expected that the containment embankments will be constructed with site materials found within the EA Open Pit with the appropriate compaction requirements (e.g., potential for softening under seismic loading, or strength reduction under undrained loads is not expected) (SRK, 2024b).

Independently of the selected alternative, an impermeabilization of the impoundment areas will be required to ensure a positive water balance is maintained to have a water cap on PAG materials for a variety of situations including drought conditions. A liner seepage assessment was conducted to determine the liner composition along the bottom of the management ponds (SRK, 2021c). The liner will be composed of a 0.30 m thick low permeability soil-bentonite material, constructed in two 0.15 m lifts. The soil-bentonite liner system will require a hydraulic conductivity of 1E-10 m/s to reduce total

seepage below 2,800 m3/day which is the maximum seepage below which a positive water balance is maintained even in drought conditions. A laboratory study was performed to determine the optimal proportion of bentonite-soil blend to achieve a hydraulic conductivity $\leq$ 1E-10 m/s. For this EACA study, the geotechnical strength parameters were conservatively adopted equal to those of the High Plasticity Clay (CH) layer.

3 Alternatives Assessment Methodology

The PAG material storage alternatives assessment was conducted following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC) (ECCC, 2013).

The (ECCC, 2013) guidelines present the Multiple Account Analysis (MAA) as the preferred tool to facilitate the decision-making process for allowing '*technical specialists to communicate essential technical considerations while allowing stakeholders to establish valued judgements for the decision*'.

The MAA process is composed of seven steps. A summary of each step is presented below. The flow diagram of the MAA process is shown in Figure 3-1:

- Step 1 – Identify Candidate Alternatives:
  - Define a basic threshold criteria to establish the regional boundaries for selecting candidate alternatives.
  - Develop a list of possible candidate alternatives for mine material disposal. Mine material deposition technologies and storage options should be considered.
  - As an outcome, provide a summary table of candidate alternatives complemented by maps and/or figures and a well-documented threshold criteria to demonstrate to an external reviewer that reasonable mine material disposal alternatives have been considered.
- Step 2 – Pre-Screening Assessment:
  - Define a pre-screening criteria such that 'Yes/No' responses to whether the alternative complies with the set criteria can be provided.
  - As an outcome, provide a summary table presenting each alternative against the pre-screening criteria and associated rationale for the project.
- Step 3 – Alternative Characterization:
  - Develop site specific characterization criteria for the project. These criteria should be categorized in the following four 'accounts' for the purpose of the MAA: 'Environmental characterization', 'Technical characterization', 'Project economic characterization' and 'Socio-economic characterization'. Selection and documentation of the characterization criteria should be done by a multidisciplinary team with representatives from four accounts.
  - As an outcome, provide a series of summary tables that list the selected characterization criteria and rationale for each four accounts.
- Step 4 – Multiple Accounts Ledger:
  - Develop a multiple accounts ledger to identify the elements that differentiate each alternative and provide the basis for the scoring and weighting (refer to Step 5).
  - Define sub-accounts (also known as 'evaluation criteria') that truly differentiate mine material disposal alternatives. As an outcome, provide a summary table presenting the list of sub-accounts and associated rationale, referencing the supporting documentation.

  - Define indicator (also known as ‘measurement criteria’) that allow measurability of each sub-account. These indicators may be different for the different life-cycle stages of the project. As an outcome, provide an expansion of the sub-accounts summary table including the set of indicators, indicator parameter, unit, and quantity.

- Step 5 – Value-Based Decision Process:
  - Assess the combined impacts for each alternative by scoring and weighting the list of accounts, sub-accounts and indicators and quantitatively determine the merit ratings for each alternative.
  - Scoring is done by developing qualitative value scales for every indicator.
  - Weighting should be defined with the input from stakeholders to prevent value bias. The guidelines present a ‘Base Case’ weighting for accounts, prioritizing the Environmental’ aspects.
  - Conduct the quantitative analysis by assessing the combined impacts of scoring and weighting for each indicator and obtain a sub-account merit score.
  - To allow comparison of these values against values for other sub-accounts, normalize to the same scale used to score each indicator value. By this process, a sub-account merit rating is obtained.
  - Repeat the same procedure of weighting and normalization to determine the account merit scores and account merit ratings.
  - Repeat the same procedure one final time to determine the alternative merit score and alternative merit rating.
  - As an outcome, provide justification for scoring and weighting factors and summary tables presenting of each indicator, sub-accounts, accounts and alternative merit scores and merit ratings.
- Step 6 – Sensitivity analyses:
  - Conduct sensitivity analyses to better assess if bias and subjectivity during the process could impact in the decision making. Test the sensitivity of the value-based decision-making process by assigning different weightings to each indicators, sub-accounts, and account according to a range of value systems that represent the perceived disparity between the stakeholders.
  - As an outcome, provide a well-documented summary of the sensitivity analyses. A summary table showing the different sensitivity scenarios and merit ratings for each alternative should be provided.
- Step 7 – Document Results:
  - Complete a comprehensive technical report including the process and outcomes of each step, results and supporting documentation including a recommended option to carry forward into subsequent design and construction.

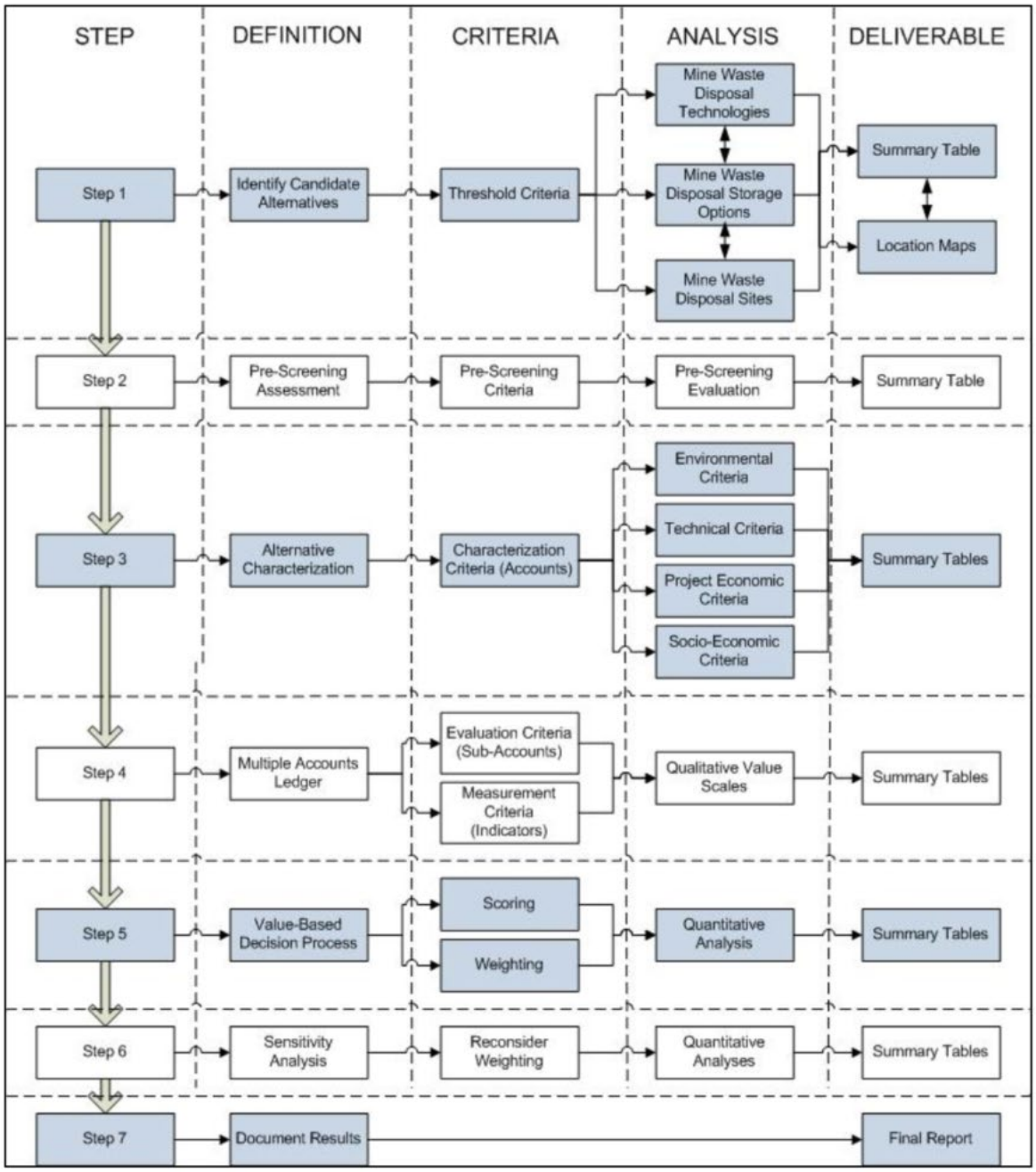


Figure 3-1: Flow diagram of the process of assessing alternatives for mine material disposal (ECCC, 2013).

4 Alternatives Assessment

4.1 Step 1: Candidate Alternatives

Figure 4-1 presents a plan view of the mine property limits and regional boundaries and 'unsuitable areas including riparian areas, waterbodies, watercourses, powerlines, rail lines, provincial roads, municipal boundaries, federal lands, private lands, mineral lease, and forest service roads.

The following threshold criteria was set to establish the regional boundaries for selecting candidate alternatives for storing the mine materials; areas that do not meet these threshold criteria are excluded from the identification of candidate alternatives or the PAG material storage alternatives assessment:

1. Protected areas: Protected areas include First Nation Reserves, Agriculture Land Reserve (ALR) areas, provincial and federal parks and protected areas, recreation areas, known archaeology and heritage sites, high elevation caribou habitat, and fish and fish habitat. In addition, the following watercourses are also considered protected areas from material placement:
    a. Goathorn Creek.
    b. Tenas Creek.
    c. Telkwa River.
    d. Four Creek.
    e. Bulkley River.
2. Topographic constraints: Areas with overall slope angles equal or higher than 4H:1V (14% grade) to avoid construction issues (especially for the installation of the impermeabilization system/liner) and reduce overall stability issues through the foundation for the embankment and/or pile.
3. Existing infrastructure: This includes provincial/municipal/federal infrastructure, hydrological infrastructure, PNG infrastructure, powerlines, rail lines, bridges, and provincial transportation roads.
4. Telkwa Mining owned property or coal license boundaries: Areas outside of TCL property and/or coal license limits are excluded due to uncertainties related to property acquisition and permitting.
5. Infrastructure constraints: Avoid crossings of named watercourses of Goathorn, Four, and Tenas Creeks and the Telkwa and Bulkley Rivers by mining equipment.
6. Distance to the CPP: A maximum distance of 10 km between the CPP and the PAG material storage facilities was set to avoid excessive coarse and fine processed rock transport costs and minimize dust, noise, and greenhouse gases (GHG) emissions.
7. Distance to EA Open Pit: A maximum distance of 10 km between open pit and permanent storage areas was set to avoid excessive material transport costs, and minimize dust, noise and GHG emissions.

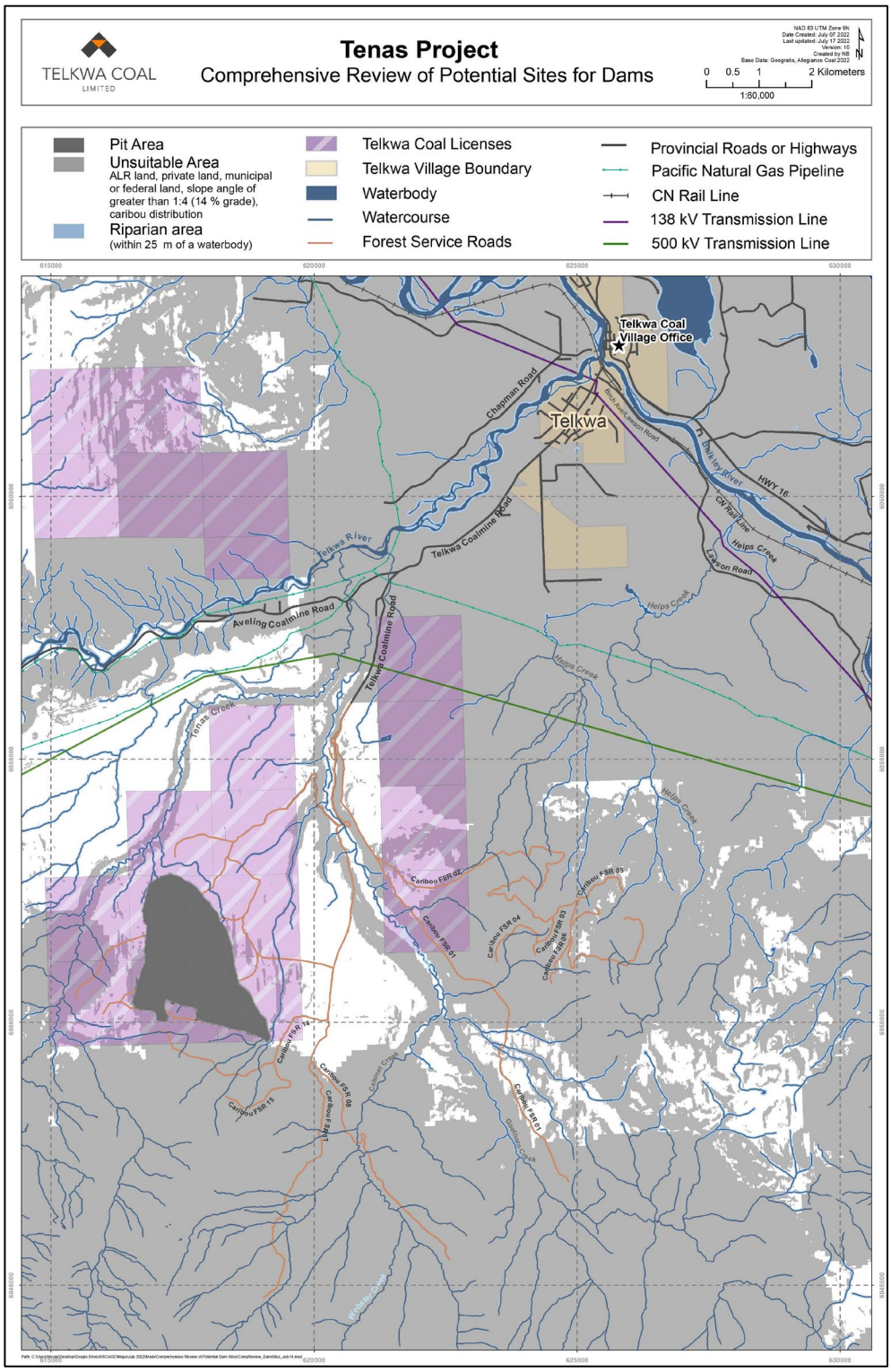
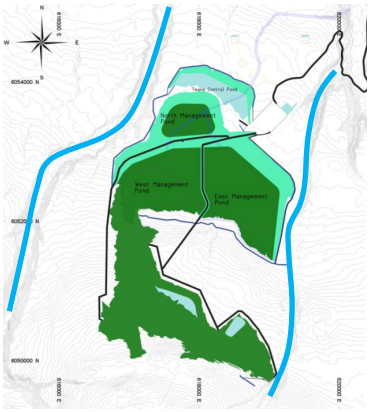
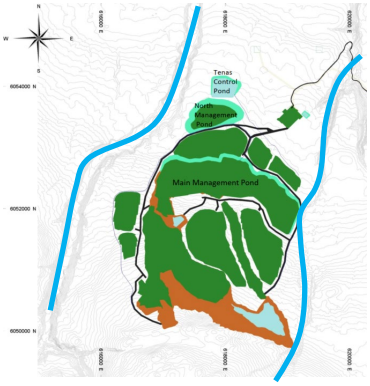


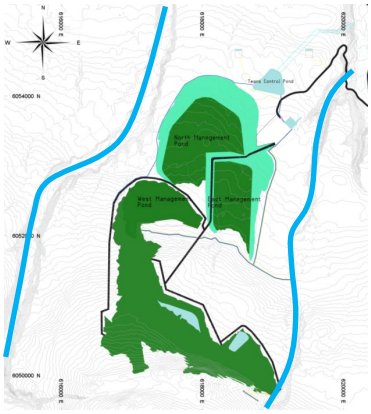
Figure 4-1: Tenas Project – Regional boundaries and property limits.

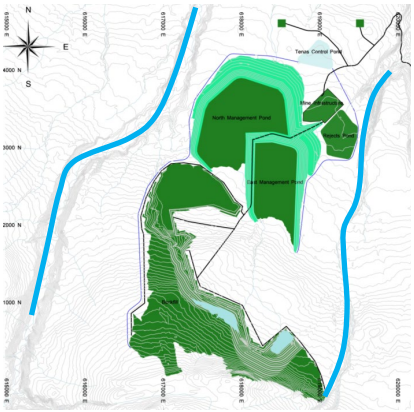
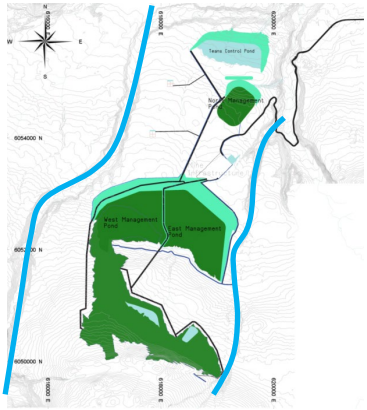
Based on the threshold criteria stated above, the resource open pit area and 'white areas' shown on Figure 4-1 that are within the TML coal licenses in pink and comply with the maximum distance constraints could be used to store materials including PAG. Due to the area required to store materials, the TML coal licenses located north of the EA Open Pit are the only areas that complies with threshold criteria and storage requirements.

Within this area several different alternative configurations were identified. Table 4-1 presents a summary description of each candidate alternative.

Table 4-1: Candidate Alternatives Summary Table.

Candidate Alternative	Description	General Arrangement
EAC Submitted Option	This configuration only uses dams for the MP and to develop the TCP for the Project which is also the main sedimentation and water storage facility. As part of the material placement strategy, no processed rock materials (tailings) will be placed within exclusion zones that are designated as the immediate 75 m in front of the face of any downstream embankment. The reason for this is to ensure that if a potential failure was to occur that there is sufficient coarse PAG rock between the area of a potential failure and processed rock to prevent this material from potentially flowing out into the environment. The TCP is to be constructed at the north of the NMP, and adjacent to the Coal Processing Plant and Run-of-Mine coal stockpile areas. This configuration has the potential for a cascading failure with the WMP failing into the NMP and then the TCP. The MP and TCP have an 'Extreme' dam consequence classification given the potential for a failure affecting the Village of Telkwa and disturbing identified fish habitat in Tenas and Goathorn creeks. This configuration preserves resources in the centre of the deposit for future generations.	
Alternative Configuration 1	This configuration uses a combination of dams and excavated impoundments to contain the PAG material in two MP (the NMP and Main MP) and to develop the TCP for the Project which is the main sedimentation and water storage facility. This configuration would have a potential for the NMP to fail into the TCP as a cascading failure. However, the main MP likely cannot fail into either of these facilities as they are both protected by overburden storage piles. This configuration has approximately 150 ha more disturbance than the current EAC submitted option. The Main MP would have an 'Extreme' dam consequence classification given that a failure would affect the village of Telkwa and identified fish habitat within Tenas and Goathorn Creeks while the NMP and TCP together or	

Candidate Alternative	Description	General Arrangement
	separately would also have a similar dam consequence classification due to the reasons above. This configuration has both coarse and fine processed rock stored in separate above ground unsaturated facilities which was requested during further discussions to be placed underwater by regulatory personnel and the public during open house discussions due to these materials being classified as PAG. This configuration would capture more water from both the Four and Tenas Creek watersheds due to having a larger surface disturbance footprint and required contact water collection systems. This configuration places a permanent material storage pile over potential resources which sterilizes these for future generations.	
Alternative Configuration 2	This configuration is based on the option of removing the WMP dam completely. This configuration also has the TCP as a 100% excavated impoundment that requires no dam. This option has approximately 100 ha more disturbance than the current EAC submitted option. Both the revised EMP and NMP would have at least an 'Extreme' dam consequence rating and there is still the possibility of the EMP failing into the NMP as a cascading failure which would affect the village of Telkwa and identified fish habitat within Tenas Creek This configuration has both coarse and fine processed rock comingled with other PAG rock within the three MP. As part of the material placement strategy, no processed rock materials (tailings) will be placed within exclusion zones that are designated as the immediate 75 m in front of the face of any downstream embankment. The reason for this is to ensure that if a potential failure was to occur that there is sufficient coarse PAG rock between the area of a potential failure and processed rock to prevent this material from potentially flowing out into the environment. This configuration will likely need the explosive facility and magazines to be moved to meet minimum legislated quantity distance requirements. This configuration would require more water than the EAC case from the Tenas Creek watershed due to the increased size of the NMP and location of the TCP. This configuration preserves resources in the center of the deposit for future generations.	

Candidate Alternative	Description	General Arrangement
Alternative Configuration 3	This configuration is based on the option of removing the WMP dam structure completely while keeping the NMP and EMP as fully above ground structures. This configuration also has the TCP as a 100% excavated impoundment that requires no dam. This configuration has both coarse and fine processed rock stored within an independent separate facility that is 100% excavated into the ground to avoid comingling with other PAG materials. This configuration has approximately 150 ha more disturbance than the current EAC submitted option. Both the revised EMP and NMP would have at least an 'Extreme' dam consequence rating and there is still the possibility of the EMP failing into the NMP as a cascading failure which would affect the village of Telkwa and identified fish habitat within Tenas and Goathorn Creeks. This configuration will likely also need the explosive facility and magazines to be moved to an alternate location on the east side of Goathorn Creek to meet minimum legislated quantity distance requirements. This change will require explosive agents to be transported daily over Goathorn Creek which is an additional risk versus the current EAC Project Case. This configuration would require more water than the EAC case from the Tenas and Four Creek watersheds due to the increased size of the NMP, location of the TCP, and the introduction of processed rock storage ponds respectively. This configuration preserves resources in the center of the deposit for future generations.	
Alternative Configuration 4	This configuration is based on the option of avoiding any potential cascading failures between ponds by placing them in locations where they do not have direct flow paths into one other. This involves moving the TCP to the very northeast end of the plateau which would potentially fail into Tenas Creek. The revised NMP is also moved to the east side of the plateau but above a height of land that would have this structure potentially fail into a tributary that leads into the Goathorn Creek versus going north towards the TCP. The EMP is revised so that any potential failure path leads into Four Creek like the EAC application. The WMP would fail to the west into Tenas Creek like the current EAC application. This option has approximately 200 ha more disturbance than the current EAC submitted option. As part of the material placement strategy, no processed rock materials (tailings) will be placed within exclusion zones that are designated as the immediate 75 m in front of	

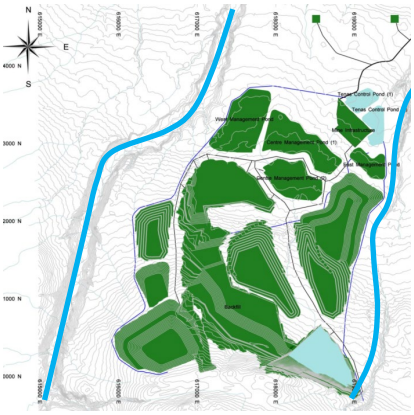
Candidate Alternative	Description	General Arrangement
	the face of any downstream embankment. The reason for this is to ensure that if a potential failure was to occur that there is sufficient coarse PAG rock between the area of a potential failure and processed rock to prevent this material from potentially flowing out into the environment. Water capture increases significantly above the EAC submission due to the revised EMP and NMP locations which would create additional contact water within the Tenas Creek Watershed. These dams would still have an 'Extreme' dam consequence rating due to potential impacts to the village of Telkwa and identified fish habitat within Tenas Creek even without potential cascading failure paths which was demonstrated by the Dam Breach Report for the EMP. This configuration has both coarse and fine processed rock comingled within the other PAG materials within the Management Pond impoundments. This configuration preserves resources in the center of the deposit for future generations.	
Alternative Configuration 5	This configuration is based on the option of avoiding any potential cascading failures between the MP and TCP by removing dams by having no water being held above the existing topography surface. This is addressed by having water held below existing ground elevations which eliminates the possibility of a dam failure. This configuration involves excavating several management pits into the overburden layer for the deposit to hold PAG material and a control pond to act as the main sedimentation pond for the site and water storage. This configuration has approximately 400 ha more disturbance than the current EAC submitted option due to the additional overburden material being placed into permanent piles. Water capture increases significantly above the EAC submission due to the extra material required to develop ponds without dams as pits and creates the most contact water within the Tenas Creek watershed. This configuration has both coarse and fine processed rock comingled within the other PAG materials within the MP excavations. This configuration places a permanent storage pile over potential resources which sterilizes these for future generations.	

Table 4-2 presents a summary of the main aspects for each candidate alternative. This includes the containment strategy (dams vs excavated), potential for cascading failure, Consequence Dam

Category of the facility, deposition strategy, additional infrastructure requirements, water capture area and water management requirements vs the EAC Submitted Option and potential impact to resources.

Table 4-2: Summary of main aspects for each candidate alternative

Item	EAC	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Containment	Dams	Dams + Excavated	Dams + Excavated	Dams + Excavated	Dams	Excavated
Potential for cascading failure	YES	YES	YES	YES	NO	NO
Consequence Dam Category	Extreme	Extreme	Extreme	Extreme	TBD but lower than Extreme	TBD but much lower than Extreme
Mine materials management	Comingling. Exclusion zones ~75 m from the dam face	Coarse and fine processed rock stored in separate above ground facilities.	Coarse and fine processed rock comingled with other PAG rock. Comingling. Exclusion zones ~75 m from the dam face	Coarse and fine processed rock stored in separate excavated facilities.	Coarse and fine processed rock comingled with other PAG rock. Comingling. Exclusion zones ~75 m from the dam face	Coarse and fine processed rock comingled with other PAG rock.
Infrastructure requirements	NO	NO	Movement of the proposed explosive facility and magazines.	Movement of the proposed explosive facility and magazines.	NO	NO
Water capture area vs EAC	N/A	+150 ha	+100 ha	+150 ha	+200 ha	+400 ha
Water Management requirements vs EAC	N/A	Captures more water from both the Four and Tenas Creek watersheds.	Require more water from the Tenas Creek watershed.	Require more water from the Tenas and Four Creek watersheds.	Captures more water due to additional contact water within the Tenas Creek Watershed.	Captures more water due to additional contact water within the Tenas Creek Watershed.
Potential impact to coal resources	NO	YES	NO	NO	NO	YES

4.2 Step 2: Pre-Screening Assessment

The following pre-screening criteria and rationale was set to establish the 'fatal flaws' for eliminating the candidate alternatives that do not meet minimum specifications developed for the Project.

The pre-screening criteria is formulated such that 'Yes/No' responses can be provided; candidate alternatives that get a 'Yes' response to at least one of the pre-screening criteria are excluded from the next stages of the Alternatives Assessment:

1. *Is the infrastructure out of the boundaries of Tenas and Four Creek?* A candidate alternative that places its ancillary infrastructure outside the boundaries of Tenas and Four Creek increases the costs and risks associated with materials deposition and materials and water monitoring and surveillance.
2. *Would the candidate alternative preclude future exploitation or mining of a potential resource?* A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.
3. *Does the candidate alternative store coarse and fine processed rock in separate facilities than the PAG rock?* A candidate alternative that stores coarse and fine processed rock in separate facilities than the PAG rock pose a higher impacted area due to the need of different facilities. Comingling allows better prevention and control of ARD/ML.

Table 4-3 presents a summary description of how each candidate alternative compares with the pre-screening criteria and whether each should be excluded from further assessment or not.

Table 4-3: Pre-Screening Assessment Summary Table.

Pre-screening criterion	EAC Submitted Option	Alternative Configuration 1	Alternative Configuration 2	Alternative Configuration 3	Alternative Configuration 4	Alternative Configuration 5
Is the infrastructure out of the boundaries of Tenas and Four Creek?	NO	NO	NO	YES	NO	NO
Would the candidate alternative preclude future exploitation or mining of a potential resource?	NO	YES	NO	NO	NO	YES
Does the candidate alternative store coarse and fine	NO	YES	NO	YES	NO	NO

Pre-screening criterion	EAC Submitted Option	Alternative Configuration 1	Alternative Configuration 2	Alternative Configuration 3	Alternative Configuration 4	Alternative Configuration 5
processed rock in separate facilities than the PAG rock?						
Should candidate alternative be excluded from further assessment?	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**

Based on this, the candidate alternatives selected for the next stages of the Alternatives Assessment were the 'EAC Submitted Option', 'Alternative Configuration 2' and 'Alternative Configuration 4'. However, during the multi-disciplinary workshop held on February 28th, 2024, it was agreed to include 'Alternative Configuration 5' in the next stages of the Alternatives Assessment to account for a completely different alternative (i.e., dams vs no dams). Figure 4-2 presents the four alternatives considered for the next steps of the Alternatives Assessment.

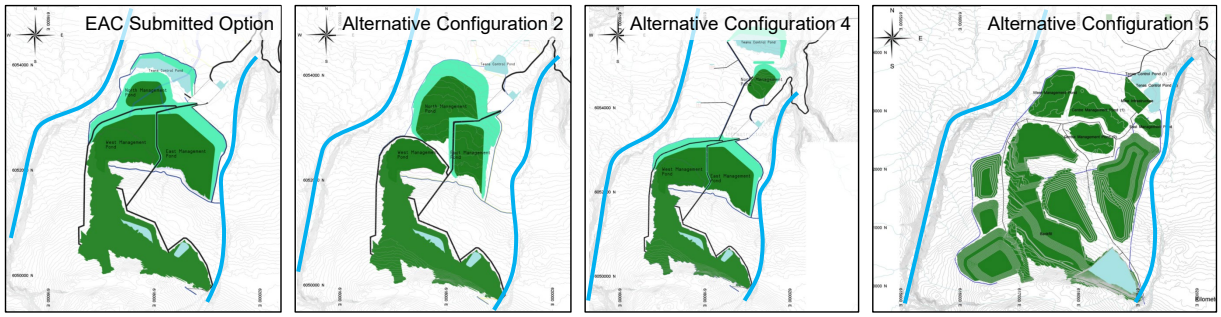


Figure 4-2: Candidate Alternatives selected for the next steps of the Alternatives Assessment.

4.3 Step 3: Alternatives Characterization

This section presents the site-specific characterization criteria for the Project and their rationale, categorized in the following four 'accounts' for the purpose of the MAA:

1. Environmental characterization: Local and regional environment surrounding the different configurations, including climate, geology, hydrology, hydrogeology, water quality, flora, fauna, etc.
2. Technical characterization: Technical aspects of each configuration, including storage capacity, dam size and volume, diversion structures, ancillary infrastructure, haul distances, materials hauling and deposition methods, closure aspects, water management, access roads, etc.
3. Project economic characterization: Aspects that impact the project economics during the LOM, including investigation, design, construction, operation, closure, post-closure, land acquisition, borrow sources development, etc.

4. Socio-economic characterization: Aspects from the different configurations that influence the local and regional land users and community perception, including land use, cultural significance, presence of archaeological sites, employment, training opportunities, etc.

As part of this characterization the criteria were reviewed by SRK and the Project Team to determine if any of the indicators could be removed and new ones added based on the Project Specific characteristics.

Appendix C presents the characterization criteria summary tables; as seen, some elements are 'double-counted' since different goals are followed in each account. This apparent double-counting will be addressed during Step 4. Tables from Appendix C includes indicators defined prior to the multi-disciplinary workshop, clarifying which of them were considered and which of them were ruled out during the multi-disciplinary workshop.

4.4 Step 4: Multiple Accounts Ledger

This section presents the Multiple Accounts Ledger developed to differentiate each alternative and to provide the basis for the scoring and weighting. This includes the sub-accounts (also known as 'evaluation criteria') and indicators (also known as 'measurement criteria').

4.4.1 Sub-Accounts

Sub-Accounts were defined by SRK and reviewed by Telkwa prior to the multi-disciplinary workshop and at the multi-disciplinary workshop. Appendix D.1 presents the list sub-accounts and associated rationale, referring to each Account.

4.4.2 Indicators

Indicators were previously presented in Step 3 (Section 4.3). Appendix D.2 presents an expansion of the sub-accounts summary table including the set of indicators and associated rationale defined during the multi-disciplinary workshop.

4.5 Step 5: Value-Based Decision Process

To ensure a robust process a multi-disciplinary workshop was organized by Telkwa Mining and held on February 28th, 2024, which had representatives from SRK, Telkwa Mining, Fisheries, Wildlife and Public groups. Appendix G holds the multi-disciplinary workshop minutes from February 28th, 2024. A summary presentation of this report will be presented and reviewed with Participating Indigenous Nations such as the Office of the Wet'suwet'en and Witset First Nation for questions, input, and understanding and will be incorporated as an amendment to this document if required. Furthermore, as part of the EAO process a presentation will also be made to the EAO Technical Advisory Committee/Working Group for input and clarifications which will be incorporated as an amendment to this document inf required.

This section presents the Value-Based Decision Process followed to define the preferred alternative for PAG materials storage. Scoring for each Indicator and Weighting for each Indicator, Sub-Account and Account and justification are presented. The final results of the analysis are presented, defining the preferred alternative for PAG materials storage.

4.5.1 Scoring

Scoring for each Indicator were defined by representatives from SRK, Telkwa Mining, Fisheries, Wildlife and Public groups during the multi-disciplinary workshop. Indicators were scored using a qualitative value scale of 1 (Worst) to 6 (Best), following the proposed scale from (ECCC, 2013).

Scorings for each Indicator were provided after the multi-disciplinary workshop to the participants to do a final review and approval. Appendix G.1 presents the final scoring adopted for each Indicator with its justification.

4.5.2 Weighting

Weighting for each Indicator were defined by SRK before the multi-disciplinary workshop. Indicators were weighted using a qualitative value scale of 1 (Worst) to 6 (Best), following the proposed scale from (ECCC, 2013). Appendix E.2 presents the final weighting adopted for each Indicator.

Weighting for Accounts were defined by SRK before the multi-disciplinary workshop using the proposed weighting from (ECCC, 2013):

- Environment – 6.
- Technical – 3.
- Economic – 1.5.
- Socio-Economic – 3.

Weighting for Sub-Accounts were defined by SRK before the multi-disciplinary workshop. Sub-Accounts were weighted using a qualitative value scale of 1 (Worst) to 6 (Best), following the proposed scale from (ECCC, 2013).

Weighting for Accounts and Sub-Accounts were reviewed, revised where required, and agreed during the multi-disciplinary workshop. Weighting for Accounts and Sub-Accounts were provided after the multi-disciplinary workshop to the participants to do a final review and approval. Appendix E.3 presents the final scoring adopted for each Accounts and Sub-Accounts.

4.5.3 Quantitative Analysis

The results of the Value-Based Decision Process are shown in Figure 4-3. Comprehensive tables with the results are included in Appendix E.4. The results show that the ‘EAC Submitted Option’ is the preferred alternative for PAG materials storage.

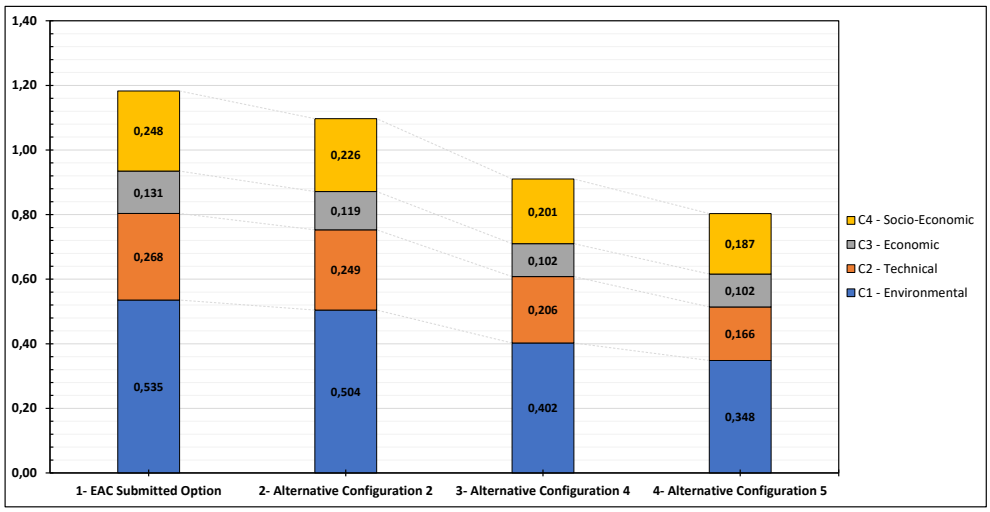


Figure 4-3: Results of the Value-Based Decision Process.

4.6 Step 6: Sensitivity Analysis

Sensitivity analyses were conducted to better assess if bias and subjectivity during the process could impact in the decision making. Different weightings to each Indicator, Sub-account and Account were assessed, as well as excluding the different Accounts.

Table 4-4 presents the modelled scenarios. Figure 4-4 presents the outcomes of the sensitivity analyses. Results show that independently of the weightings, the ‘EAC Submitted Option’ was the highest rated alternative. Comprehensive details of each Sensitivity Analysis are included in Appendix F.

Table 4-4: Sensitivity Analyses.

Sensitivity Analysis	Comments
Equal Weighting for Accounts	A Weighting equal to 1.0 was defined for Accounts.
Equal Weighting for Sub-Accounts	A Weighting equal to 1.0 was defined for Sub-Accounts.
Equal Weighting for Indicators	A Weighting equal to 1.0 was defined for Indicators.
Equal Weighting for Accounts and Sub-Accounts	A Weighting equal to 1.0 was defined for Accounts and Sub-Accounts.
Equal Weighting for Accounts, Sub-Accounts and Indicators	A Weighting equal to 1.0 was defined for Accounts, Sub-Accounts and Indicators.
Inverse Weighting for Accounts, Sub-Accounts and Indicators	Inverse Weighting was defined for Accounts, Sub-Accounts and Indicators. This means that a Weighting of 1.0 was turned to 6.0, a Weighting of 2.0 was turned to a 5.0, a Weighting of 3.0 was turned to a 4.0 and vice versa.
Random Weighting for Accounts, Sub-Accounts and Indicators	Random Weightings were defined for Accounts, Sub-Accounts and Indicators.
Excluding Environmental Account	Environmental Account was excluded form the analysis.
Excluding Technical Account	Technical Account was excluded form the analysis.
Excluding Economic Account	Economic Account was excluded form the analysis.
Excluding Socio-Economic Account	Socio-Economic Account was excluded form the analysis.

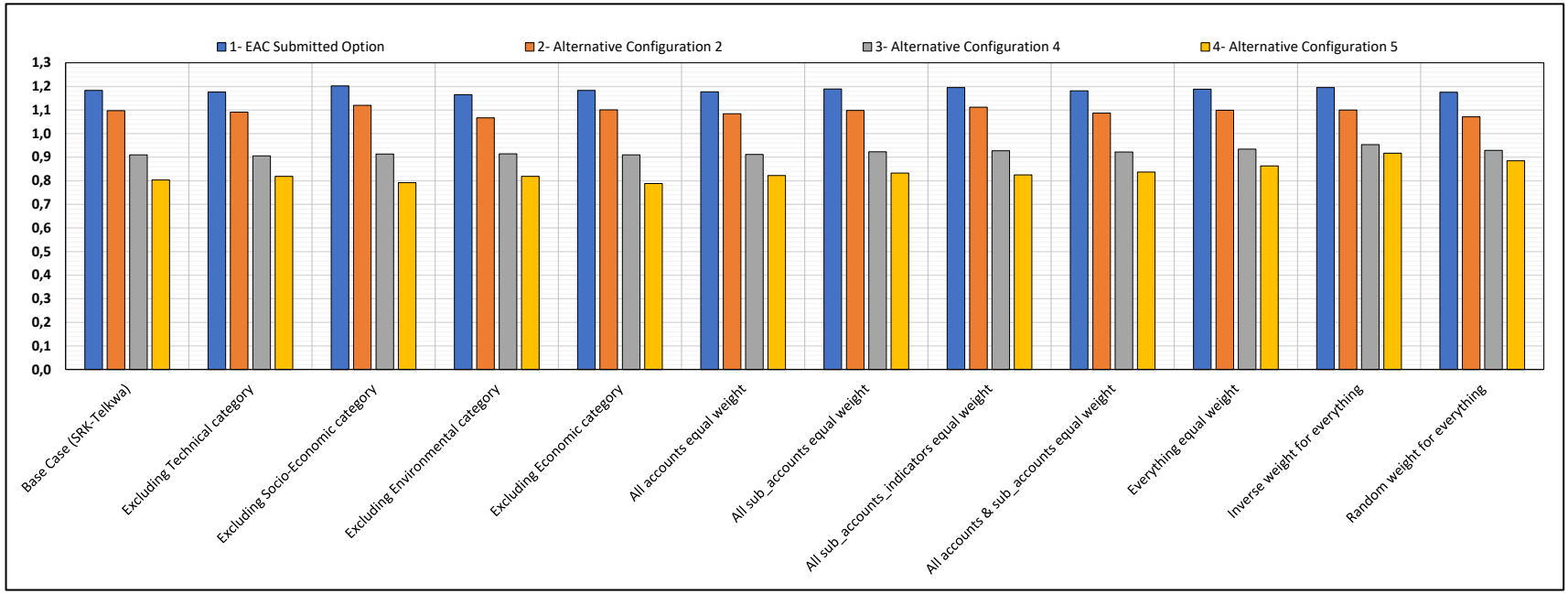


Figure 4-4: Results of the Sensitivity Analyses.

5 Conclusions and Recommendations

This document presented the PAG material storage alternatives assessment conducted for the Tenas Project in response to the list of information requests (IRs) requested by the EAO in relation to the Project provided by Telkwa Mining in the EACA.

The PAG material storage alternatives assessment was conducted in terms of a Multiple Account Analysis (MAA), following the '*Guidelines for the Assessment of Alternatives for Mine Waste Disposal*' document, prepared by the Environment and Climate Change Canada (ECCC) (ECCC, 2013).

The seven steps of the MAA presented in (ECCC, 2013) were conducted:

1. A set of threshold criteria was set to establish the regional boundaries for selecting candidate alternatives for storing the mine materials. Based on the threshold criteria and the area required to store materials, the TML coal licenses located north of the open pit were identified as the only areas for PAG materials storage. Within this area, the 'EAC Submitted Option' and five different alternative configurations were identified as candidate alternatives for PAG materials storage.
2. Pre-screening criteria and rationale were set to establish the 'fatal flaws' for eliminating the candidate alternatives that do not meet minimum specifications developed for the project. Location of infrastructure outside the boundaries of Tenas and Four Creek, placement of permanent storage pile over an area with proven indicators of mineralization and storage of the different mine materials in separate facilities were identified as the pre-screening criteria. Based on this, the candidate alternatives selected for the next stages of the Alternatives Assessment were the 'EAC Submitted Option', 'Alternative Configuration 2' and 'Alternative Configuration 4'.
3. Site-specific characterization criteria were developed by SRK, categorized in four 'accounts' (environmental, technical, economic and socio-economic) for the purpose of the MAA. The characterization criteria were reviewed by Telkwa Mining.
4. A Multiple Accounts Ledger was developed by SRK to differentiate each alternative and to provide the basis for the scoring and weighting. A set of Sub-Accounts were defined, associated to each Account. The characterization criteria (Indicators) were assigned to each Sub-Account. Weighting for Sub-Accounts were defined by SRK. The Multiple Accounts Ledger was reviewed by Telkwa Mining.
5. To ensure a robust process a multi-disciplinary workshop was organized by Telkwa Mining and held on February 28th, 2024, which had representatives from SRK, Telkwa Mining, Fisheries, Wildlife and Public groups. The multi-disciplinary workshop was held on February 28th, 2024. A summary presentation of this report will be presented and reviewed with Participating Indigenous Nations such as the Office of the Wet'suwet'en and Witset First Nation for questions, input, and understanding and will be incorporated as an amendment to this document if required. Furthermore, as part of the EAO process a presentation will also be made to the EAO Technical Advisory Committee/Working Group for input and clarifications which will be incorporated as an amendment to this document inf required.

   During the multi-disciplinary workshop, a summary of the candidate alternatives and pre-screening assessment was presented to participants. It was agreed to include 'Alternative Configuration 5' in

the next stages of the Alternatives Assessment to account for a completely different alternative (i.e., dams vs no dams). Hence, the ‘EAC Submitted Option’, ‘Alternative Configuration 2’, ‘Alternative Configuration 4’ and ‘Alternative Configuration 5’ were considered for MAA.

During the multi-disciplinary workshop, Scoring for each Indicator, and Weighting for each Account and Sub-Account were revised and agreed with participants. Final Scoring and Weighting were provided to the participants for a final review after the workshop.

The results of the MAA showed that the ‘EAC Submitted Option’ is the preferred alternative for storing PAG materials.

Sensitivity analyses were conducted to better assess if bias and subjectivity during the process could impact in the decision making. Different weightings to each Indicator, Sub-account and Account were assessed, as well as excluding the different Accounts. Results showed that independently of the weightings, the ‘EAC Submitted Option’ was the best rated alternative.

Based on the outcomes of the Value-Based Decision Process and the Sensitivity Analyses, SRK and Telkwa Mining consider the ‘EAC Submitted Option’ as the preferred alternative for storing PAG materials. It is recommended to advance with the field work and detailed design process for this configuration.

Closure

This report, Tenas Project Potential Acid Generating Material Storage Alternatives Assessment, was prepared by



Nicolás Alscher
Consultant



Santiago Pastine
Senior Consultant

and reviewed by



Calvin Boese, MSC, PEng
Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A PAG Management Alternatives Assessment

Appendix 1.0-Q SRK, Tenas Project PAG Management Alternatives Assessment Memo

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Technical Memo

20 April 2022

To	Dan Farmer
From	Michael Dabiri
Cc	Samantha Barnes, Tom Sharp
Subject	PAG Management Alternatives Assessment
Client	Telkwa Coal Ltd
Project	1CT027.003

1 Introduction

This technical memorandum presents the processes and criteria used to select preferred alternatives, and “Alternative Means", for management of Potentially Acid Generating (PAG) materials, as well as potential Metal Leaching (ML) from non-PAG materials, at the Tenas Project (Project).

This alternatives assessment for the Project meets the information requirements as outlined in the British Columbia (BC) Environmental Assessment Office (EAO) Application Information Requirements (AIR) for the Project (EAO 2022). The assessment complies with the BC *Environmental Assessment Act* (GovBC 2002) and the EAO guidance for information requirements for tailings management (EAO 2015), and with the Operational Policy Statement Addressing “Purpose of” and “Alternative Means” under the *Canadian Environmental Assessment Act* (Canadian Environmental Assessment Agency [CEAA] 2012).

“Alternative means” are the various technically and economically feasible ways under consideration by the proponent that would allow the Project to be carried out. The proposed Project reflects the analysis of alternatives throughout the history of the mine site as information on coal resources was supplemented over time. This analysis of the alternative means considers the major decisions for the management of PAG materials.

The assessment presents and compares best practices and best available technologies for processed rock (tailings) and PAG rock management for the specific conditions of the Project. It takes into consideration safety (including dam safety), technical and financial aspects, and implications for environmental, health, social, heritage and economic values.

This memo presents background material on the history of the mine, geochemical material characterizations, the method for the review of alternative means, and an assessment of alternative means to manage mined and processed rock.

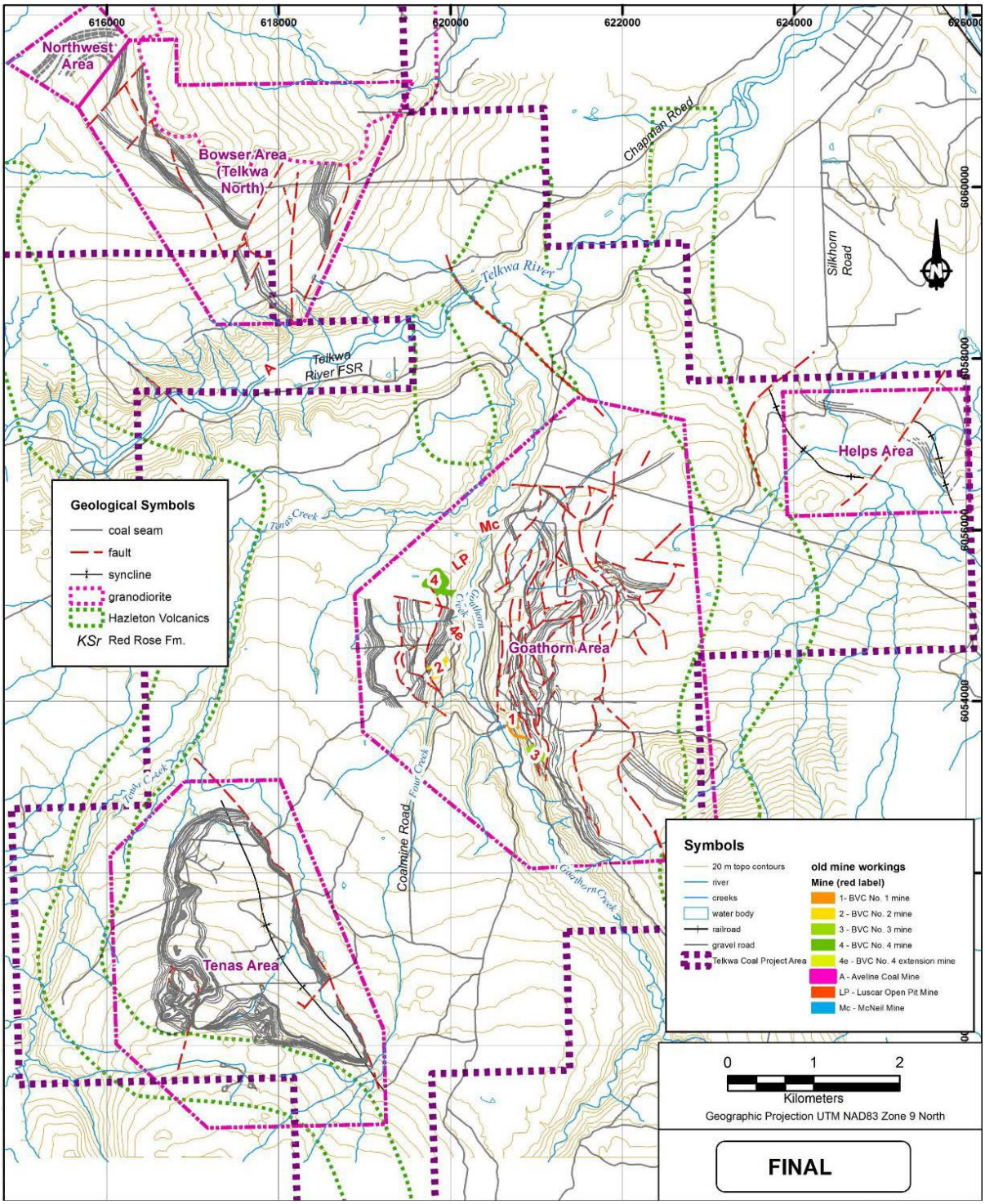
1.1 Background

Coal was discovered in the Telkwa area around the year 1900. Mining is reported to have begun as early as 1918, with small-scale operations supplying thermal coal locally for heating. Approximately 400,000 tonnes of coal were reportedly produced from 1918 to 1985. Through the 1980s and 1990s, the Telkwa property, which includes the Telkwa North, Tenas, and Goathorn Creek deposits (see **Figure 1-1**), changed hands several times with no coal production, before the coal licenses and property were acquired by Telkwa Coal Limited (TCL) in 2017 and 2018.

Geochemical characterization studies performed by previous owners of the project to support economic and environmental assessments in the 1990s showed that Metal Leaching/Acid Rock Drainage (ML/ARD) potential management needed to be considered for the project. The resulting management plans prescribed segregation of highly reactive rock components for subaqueous disposal in backfilled pits and blending of PAG and non-PAG components to create non-PAG mine rock dumps and backfilling of the open pit.

More recently, pre-feasibility studies were completed for large mine designs (encompassing the three (3) deposits, SRK 2017b) and small mine designs (encompassing only the Tenas deposit, SRK 2017a), which included initial expit non-PAG rock piles and in-pit disposal of PAG rock. Due to the requirement for long-term treatment of ARD, this configuration was abandoned for the subsequent Project feasibility study (SRK 2019a) in favour of subaqueous disposal of all PAG materials in purpose-built “PAG cells also known as management ponds”.

Figure 1-1: Telkwa Project Geology and Deposits



***Source**: SRK 2019a*

1.2 Environmental Assessment (EA) Mine Plan

The proposed Project will produce metallurgical coal at a planned annual production rate of between 775,000 and 825,000 tonnes over a life of mine of about 25 years at a maximum production rate of 2,500 tonnes of processed coal per day. Coal is processed by a dense medium cyclone (DMC)/flotation Coal Processing Plant (CPP) with a 145 tonnes per hour (tph) capacity, with fine processed rock (fine processed rock, defined as materials smaller than 0.5 millimetres [mm]) dewatered to 40 percent (%) solids content by a belt filter press, before being combined with the coarse reject and stockpiled for disposal. A schematic of the CPP is shown in **Figure 1-2.**

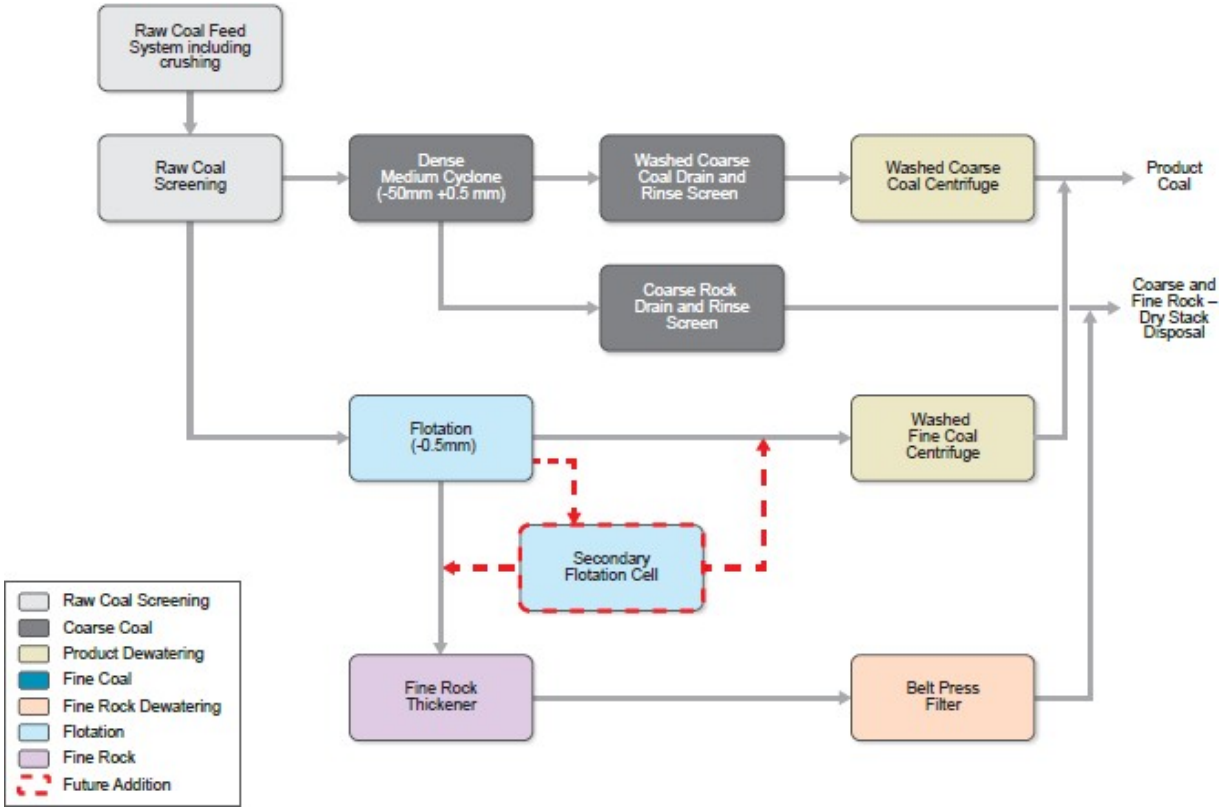
The Tenas Environmental Assessment (EA) Open Pit contains both PAG and non-PAG materials (see **Section 2**). The current mine plan involves separating mine rock based on its potential to generate acid, as it is extracted. A zone model has been developed for rock units within the open pit, and supplemental geochemical testing will be conducted during the Operation Phase to confirm mine rock properties. Non-economic materials from the project are expected to include:

- Non-PAG reclamation materials (surface soils) and overburden from open pit mining and haul road development (24.22 million banked cubic metres [MBCM]);
- PAG[1] mine rock from open pit mining (31.83 MBCM);
- Non-PAG rock from open pit mining including rehandle (29.52 MBCM); and
- Coarse and fine processed rock. These materials are also expected to be PAG (total 3.28 MBCM).

In addition, portions of the open pit walls are expected to be PAG. The mine production schedule is summarized in **Figure 1-3**. The risk of neutral ML from non-PAG rock is also considered in this assessment.

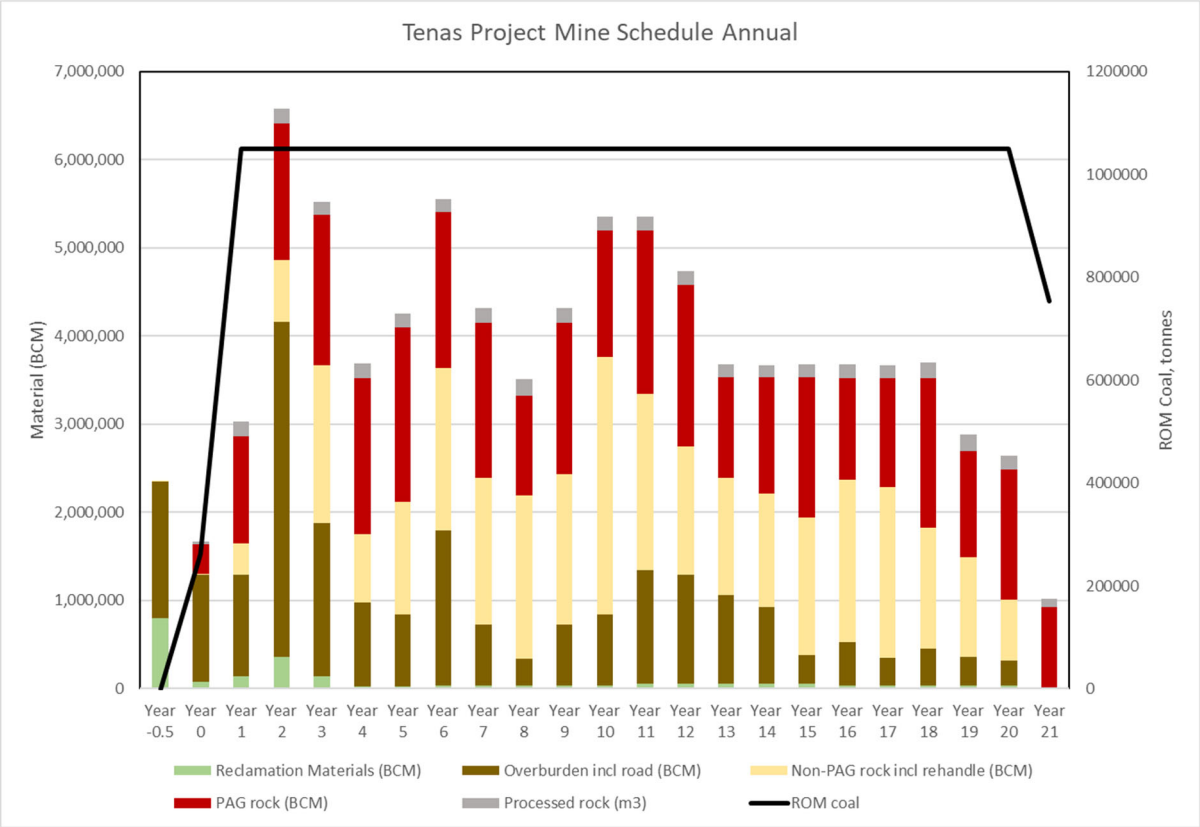
[1] PAG defined as rock with a neutralization potential ratio (NPR) less than 2, see **Section 2.**

Figure 1-2: DMC/Flotation CPP Schematic



***Sources**: SRK 2019a*

Figure 1-3: Tenas Project Annual Production Schedule



2 Geochemical Material Characterization

2.1 Background

A comprehensive historical geochemical characterization program was completed for the Telkwa Project (Norecol Dames and Moore 1999) which included geochemical testing of over 700 samples. A supplemental geochemical characterization program was conducted in 2019 (SRK 2019b) which included additional testing of 173 selected samples from the 1999 program, as well as collection and testing of 19 additional samples of processed rock, overburden, and construction rockfill.

Based on these characterizations, mine rock for the Project is characterized as non-PAG or PAG by acid base accounting (ABA), which measures the ratio of the Neutralization Potential (NP) to the Acid Potential (AP) of the material (i.e., the Neutralization Potential Ratio [NPR]). When the mineralogical contributors to NP and AP are well understood (i.e., NP is like that provided by calcite, AP is from oxidation of pyrite and these minerals have the same availability), regulatory guidance allows that NPR of 2 can be used to define PAG versus non-PAG (MEND 2009). The results of the supplemental mine rock geochemical characterization for the Project showed a strong positive relationship between modified-NP and presence of calcium plus magnesium, which provides confidence in the ABA calculations (SRK 2019b). In addition, there was a strong correlation based on modified-NP and NP calculated based on minerology NP-XRD (SRK 2022). Based on this relationship, an NPR of 2 is selected to identify rock as PAG or non-PAG, consistent with the guidelines.

The results of geochemical characterization are summarized for the different mine rock types in **Table 2-1**, and described in the following sections.

Table 2-1: Non-Economic Material Geochemical Characterization

Material Type	Geochemical Characterization
Mine Rock	Ten (10) zones: 3 non-PAG, 7 PAG, 2 of which are not mined by the EA open pit (zones 7 and 8)
Processed rock (coarse and fine)	PAG
Reclamation materials (surface soils) and Overburden	non-PAG
Open Pit Walls	8 zones: 3 non-PAG, 6 PAG

Sources: *Compiled in text.*

Notes: *EA=environmental assessment; PAG=potentially acid generating; PAG distinction based on NPR ≤2*

2.2 Mine Rock

Seven (7) non-economic rock zones were defined in the 1990s by reference to the coal seams, with four (4) added (0, 1a, 7, and 8) to represent the entire Tenas Deposit and reflecting EA zone geochemical model, as summarized by **Table 2-2** and shown in **Figure 2-1**.

Table 2-2: Acid Rock Drainage (ARD) Management Zone Definitions (Potentially Acid Generating (PAG) Material Highlighted in Yellow)

Zone	Stratigraphic Location	Average Weighted NPR
0	Till and overburden – topography to bedrock surface	17.5
1	Bedrock surface to top of Seam e (minus Zone 1a)	3.5
1a	Select area above Seam e to bottom of Seam e	0.8
2 & 3	Bottom of Seam e to bottom of Seam c	0.9
4	Bottom of Seam c to top of Seam b	2.7
5	Top of Seam b to top of Seam 1U	1.4
55	Top of Seam 1U to bottom of Seam 1L	2.3
6	Bottom of Seam 1L to bottom of Seam 1Lc	1.4
7**	Below Seam 1Lc to the bottom of Seam 1Ld	1.7
8**	Below Seam 1Ld	5.5

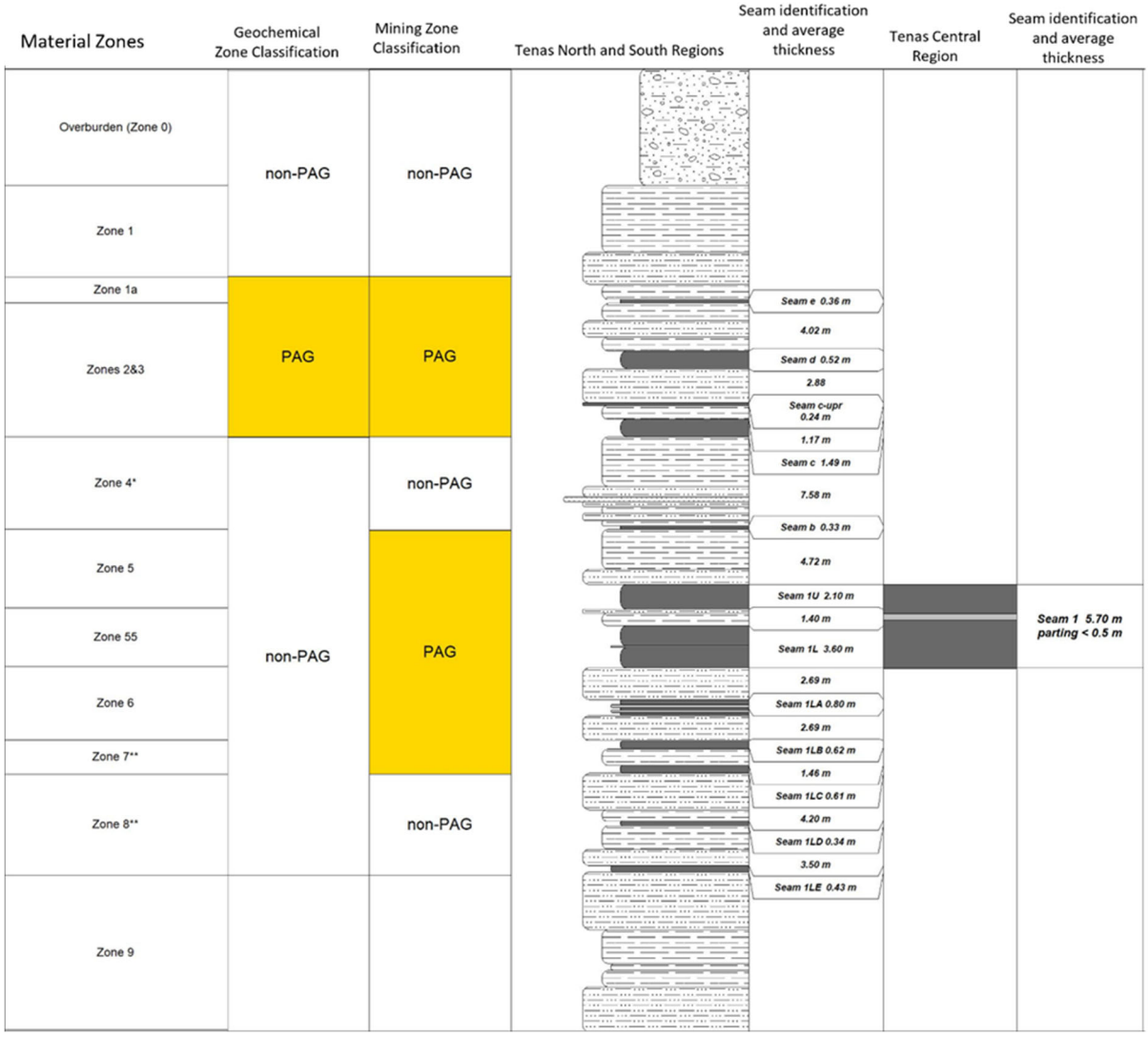
Sources: SRK 2019b)

Notes: *EA=environmental assessment; NPR=neutralization potential ratio; PAG=potentially acid generating*

(1) Zone 4 is spatially segregated as non-PAG and PAG, with the larger portion of the zone (75%) being non-PAG,

***these two zones are currently not being excavated by the EA Open Pit*

Figure 2-1: Tenas Project Lithology



According to SRK (2019b), seven (7) (Zones 1a, 2/3, 5, 55, 6 and 7) out of the 11 zones have average NPRs less than 2 and are classified as PAG, even though all zones, except for Zone 1a, have a component of non-PAG rock (i.e., the non-PAG rock is included in the PAG estimates as part of the mine plan). Zones 1 and 8 are classified as non-PAG. Zone 4 contains quantities of both PAG and non-PAG mine rock but is classified as non-PAG based on the overall weighted average of the Zone, however in mine planning the portions of this zone identified as PAG were managed as other PAG rock zones.

In summary, the following zones were identified to be PAG and non-PAG:

- **Non-PAG** – Zones 0 (includes overburden and reclamation materials/surface soils), 1, 4 and 8 (not excavated in EA mine plan); and
- **PAG** – Zones 1a, 2/3, 5, 55, 6 and 7 (not excavate in the EA mine plan).

The sulfide oxidation rates in the humidity cell samples were used to estimate the lag time for acid generation (SRK 2019b). The evaluation indicated that for the bulk properties of PAG rock, the lag

time varies from 2 to 12 years for the different zones. A minimum lag time of 0.6 years was estimated for PAG rock units with minimum NPRs in Zone 4 under laboratory conditions. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

Geochemical testing has indicated elevated concentrations of aluminum, cadmium, nitrite, cobalt, and selenium may be present in leachate at both acidic and neutral/alkaline pH. Aluminum is projected to have high concentrations in suspended form. Note that sediment control for the project is outside of the scope of this assessment.

2.3 Processed Rock

Processed rock samples tested were generally found to be PAG and contained more sulphur than interburden mine rock. Depletion calculations on the humidity cell tests (SRK 2019b) indicate that NP will be consumed prior to sulfide in all samples, with the NP predicted to be depleted after 1.3 years based on laboratory conditions. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

2.4 Reclamation Materials (Surface Soils) and Overburden

All the overburden and reclamation material (surface soil) samples tested had NPRs greater than 2 and were classified as non-PAG (SRK 2019b).

2.5 Open Pit Walls

At Post-closure, an end-pit lake will form in portions of the backfilled open pit. However, unsubmerged open pit walls (highwall and footwall) will remain above the end-pit lake composed mainly of PAG Zone 6 rock. While loading rates are expected to be lower than those of PAG mine rock or processed rock due to the lower reaction surface areas, these exposed surfaces should be expected to become acid-generating within 2 to 12 years based on laboratory conditions and contribute ML/ARD to the end-pit lakes if not management plan is provided. Note that field conditions are expected to result in longer lag times due to temperature, and material size corrections.

3 Methods

As defined in the AIR (EAO 2022), this framework constitutes an assessment of alternative means for material management, that are technically and economically feasible, of both PAG and non-PAG materials. PAG materials include processed rock (coarse coal rejects, fine coal rejects, and tailings) and mine generated PAG material (EAO 2015).

The following four (4) steps, consistent with CEAA (2012), were adopted to determine the preferred PAG management alternative for the Project:

1. Identify technically and economically feasible alternatives.
2. Characterize the options, including their potential effectiveness at reducing ML/ARD and expected effects on the environment and communities.
3. Select the approach for the analysis of alternatives means.
4. Assess the environmental effects of the preferred alternative, or alternatives if multiple are being carried forward.

Potential alternatives were first screened for cost effectiveness and technical applicability. Alternatives that met the screening criteria are further assessed based on their environmental and community effects. This assessment is carried out qualitatively, at a level sufficient to distinguish the relative merits of the different alternatives based on consideration for the advantages and disadvantages of each.

4 Performance Objectives and Criteria

PAG management alternatives are evaluated with respect to their effectiveness in mitigating long-term project risks and their potential effects on VCs. Feedback obtained from community outreach and consultations were considered in defining the VCs and establishing these objectives. The following criteria are considered for this assessment:

- Cost effectiveness;
- Technically applicability, including system integrity and reliability;
- Effects on the natural environment;
- Community effects and input including human health; and

These criteria are discussed further in the following subsections.

4.1 Cost Effectiveness

The cost effectiveness performance objective compares the relative capital and life cycle (including Post-closure) costs of each alternative, relative to the corresponding long-term benefits. Cost considerations include pre-mining (capital) construction, operating and sustaining costs, closure, and Post-closure operations, maintenance, and surveillance costs, as well as amenability for financing and financial risk.

Preference is given to lower-maintenance alternatives and alternatives that enable deferral of construction costs into cash-flow positive periods of the mine life.

4.2 Technical Applicability, System Integrity, and Reliability

The technical performance objective addresses the following technical risks associated with the alternative:

- Suitability for the proposed mine plan, climate, terrain, and design;
- Precedence of successful implementation in similar conditions;
- Risk of long-term degradation or failure of the system;
- Feasibility and ease of implementing contingency measures should the system degrade or fail; and
- Reliance on long-term operations, surveillance, and maintenance.

4.3 Effects on the Natural Environment

This performance objective describes the expected effectiveness of the alternative in reducing impacts to the natural environment, and primarily refers to water quality in effluent and the receiving environment, and the resulting effects on aquatic life.

However, additional considerations include effects on natural hydrological regimes, footprint area, post-reclamation land use, air quality, and terrestrial fauna and flora.

4.4 Community Effects and Input Including Human Health

This performance objective evaluates the effects of the alternative on the local communities and considers feedback from ongoing engagement activities with the community of Telkwa and the Wet'suwet'en First Nation.

Community effects include aspects of cultural heritage as well as Aboriginal and treaty rights, and includes traditional land use, access to quality resources, community well-being (including access to education, infrastructure, and services), archaeological resources, outdoor recreation, noise and vibration, and human health.

5 Metal Leaching/Acid Rock Drainage (ML/ARD) Alternatives Assessment

This section describes the alternatives assessment for ML/ARD management for the following materials:

- Processed rock (coarse and fine);
- Open pit walls; and
- Mine rock (non-PAG and PAG).

Sulphide oxidation occurs when minerals containing sulphide and elemental sulphur are exposed to the weathering effects of oxygen and water. ARD results from premature depletion of acid neutralizing minerals and results in elevated metal solubility and faster sulphide weathering rates under acidic conditions, however, ML can also occur at circum-neutral pH. “Metal” in this context includes any constituents of potential concern (COPC) and is not limited to elements or parameters classified as metals. Measures to reduce ML/ARD generally require one or more of the following mechanisms shown in **Table 5-1**.

Table 5-1: Metal Leaching/Acid Rock Drainage (ML/ARD) Mitigation Mechanisms

Mechanism	Examples
Limiting oxygen availability	Subaqueous deposition, saturation covers, oxygen diffusion barriers
Limiting water availability[1]	Dry (shedding) covers
Neutralization of PAG materials[2]	PAG/non-PAG blending (“ideal blend”), tailings de-sulphurization
Neutralization of ARD after onset	Active treatment, passive treatment (bioreactors), “non-ideal” PAG/non-PAG blending
Removal of neutral metals after onset	Active treatment, passive treatment (bioreactors, wetlands)

Sources: *Modified from the GARD guide (2010)*

Notes: *ARD=acid rock drainage; PAG=potentially acid generating*

[1] Water is both a reactant and a transport mechanism for ML/ARD

[2] Neutralization of PAG materials may be achieved by removing or isolating sulphide materials, maximizing the availability of alkaline materials or porewater, or controlling bacteria and/or biogeochemical processes.

5.1 Alternative Characterization and Screening

Proposed alternative means for mitigating ML/ARD from PAG materials (processed rock, mine rock, and open pits), as well as non-PAG mine rock, evaluated for the Project are described in the following subsections and summarized in **Table 5-2**. These alternatives were screened for technical applicability and economic feasibility, as summarized in **Table 5-3**. Where more than one (1) alternative was technically feasible, the alternatives were evaluated with the environmental and social criteria to determine a final preferred alternative, as summarized in **Table 5-4**.

5.1.1 Fine Processed Rock (Tailings)

Processed rock storage (both fine and coarse) was discussed in each of the PAG management alternatives above and is discussed in further detail below. Note that total processed rock (coarse and fine) represents 8% of the total PAG materials, and 4% of the total mine rock (excluding overburden and reclamation materials (surface soils)), with fine processed rock making up a small percentage of project materials (2% of total PAG materials and 1% of total mine rock). The following

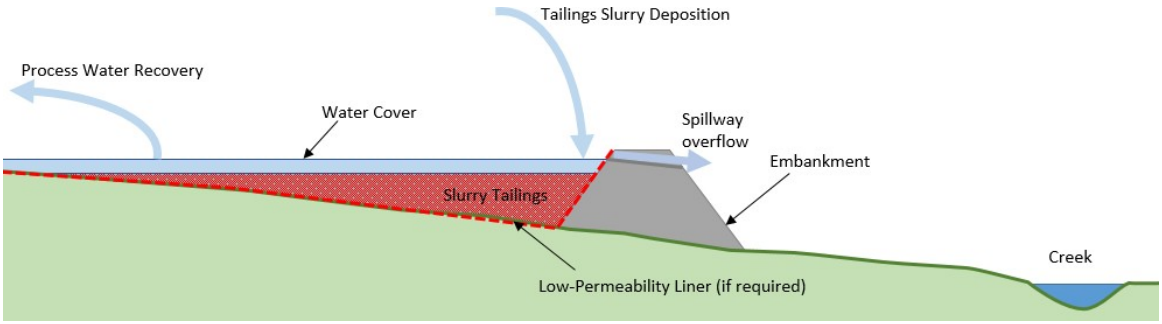
alternatives for fine processed rock are considered:

- Slurry, deposited in a conventional tailings impoundment, or
- Dewatered, and either stacked on-surface or co-disposed with coarse processed rock and/or mine rock (disposal options are discussed further in **Section 5.1.2**)

5.1.2 Conventional Tailings Impoundment

The mine plan described in the Manalta Telkwa Project Environmental Assessment (Manalta 1998) included a separate impoundment to store tailings. In this alternative, tailings are deposited subaqueously in a lined impoundment to prevent the onset of ARD. Water reclaimed from this facility supplies the coal processing plant process. This is shown schematically in **Figure 5-1**.

Figure 5-1: Processed Rock (Tailings) Impoundment Schematic



Notes: *Schematic. Not to scale.*

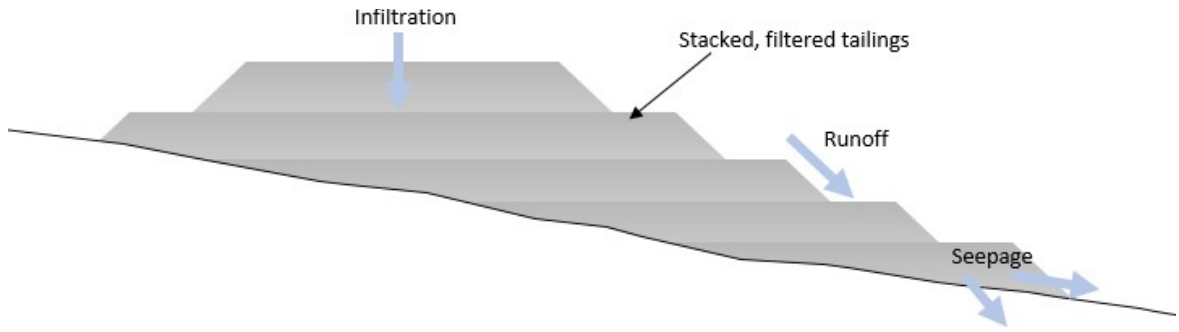
Dewatered Tailings Stack (Filter Press)

A dewatered processed rock (tailings) stack, separate from the PAG rock storage facility, was proposed as part of the Project feasibility study (SRK 2019a). Fine processed rock is dewatered to 40% solids by weight as part of the process, combined with the coarse processed rock, and trucked and placed in compacted lifts in a dedicated storage facility. Dewatering the fine processed rock allows the fine processed rock to be placed and stacked in a compacted pile without the need for an impoundment. It also increases the volume of water recovered, reducing freshwater makeup demands from either onsite or offsite sources.

Oxygen flux in fine materials is more likely to occur by diffusion rather than advection thereby significantly reducing oxygen availability for oxidation of sulphide minerals compared to coarser mine rock. In addition, fine materials can be partially saturated to a level at which the rate of air entry is the same as if the material were fully saturated with water. The moisture content at which this typically occurs is about 60%. Therefore, if the materials are sufficiently fine and well-compacted, the moisture content of the pile may be sufficient to prevent ML/ARD from occurring. Moisture content in the near surface would not be expected to be this high, and as such some ML/ARD should be expected to occur unless additional measures are implemented (e.g., soil cover, blending with neutralizing material).

For filtered tailings, a separate water management facility is typically required for site water management and to provide a source of process water supply.

Figure 5-2: Dry Stack Fine Processed Rock – Schematic



Notes: *Schematic. Not to scale.*

5.1.3 Coarse Processed Rock

The following alternatives were considered for coarse processed rock:

- Surface disposal (stack), in segregated coarse and fine processed rock piles;
- Surface disposal (stack), in blended coarse and fine processed rock piles; and
- Blended coarse and fine processed rock, co-disposed with mine rock underwater.

Segregated Processed Rock Piles

Both coarse processed rock and dewatered fine processed rock generally lend themselves to surface disposal. If dewatering of fine processed rock is selected for other reasons (e.g., water recycling in the process), the lowest effort option may be segregated surface piles. These piles would be placed on surface, likely near the process facility to reduce transportation requirements, and though have favorable geotechnical properties and may be effective in limiting ARD by limiting oxygen advection and seepage to deeper parts of the piles, they are likely to be susceptible to ML/ARD near surface. This alternative also requires drainage management from multiple sources, which increases risk and complexity.

Blended Fine/Coarse Processed Rock Piles

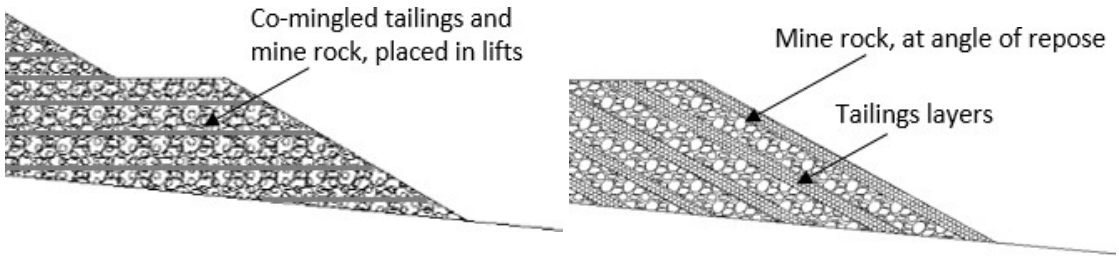
Blending dewatered fine and coarse processed rock can be done at the CPP, prior to transportation, to reduce the footprint and number of drainage management locations. Blending also has the benefit of further reducing oxygen advection and seepage compared to segregated piles.

Blended and Co-Disposal with Mine Rock

In this alternative, processed rock is co-mingled with PAG rock and deposited in the same facility. If the materials are going to be deposited subaqueously, fine processed rock may be dewatered or not, however dewatering simplifies transportation logistics and reduces freshwater demands. If the materials are going to be deposited in a surface pile, fine processed rock should be dewatered for stability and water management purposes, and co-mingled and/or placed in lifts to prevent segregation during placement. If the material will be submerged or disposed with non-PAG mine rock, end-dumping of different materials without specific co-mingling would provide similar results.

The two (2) configurations are shown schematically in **Figure 5-3**, though it is noted that the ratio of processed rock to mine rock is insufficient to allow effective layering for the Project.

Figure 5-3: Co-Disposal of Processed Rock with Mine rock – Schematic Options



(a) Co-mingled and placed in lifts **(b) End-dumped**

Notes: *Schematic. Not to scale.*

5.1.4 Open Pit Walls

Although planned the mine plan involves staging and backfilling of open pits with mine rock, open pit development will result in progressive and sustained exposure of PAG rock walls throughout the life of mine and, without mitigation, post-closure. The following alternatives to mitigate open pit wall ARD were considered:

- Do nothing;
- Partial end-pit lake established based on natural topography and staging;
- Total submergence end-pit lake established via construction of embankments; and
- Open is backfilled with non-PAG rock, overburden, and reclaimed materials.

Do Nothing

In this alternative, open pits are exploited sequentially per the mine plan, but no measures are taken to promote ponding and no material is placed on the exposed open pit walls. Inflows are allowed to drain by gravity and open pit walls remain exposed.

Partial End-Pit Lake

In this alternative, open pits are exploited sequentially per the mine plan and open pit development and sequencing is done to promote ponding within the open pits, resulting in formation of (relatively shallow) end-pit lakes. Inflows are allowed to drain by gravity and pit highwalls remain exposed. No material is placed on the exposed open pit walls.

Total Submergence End-Pit Lake

This alternative promotes total submergence of exposed open pit walls by the construction of embankments to impound water within and outside of the open pits once they are exhausted. No materials is placed on the exposed open pit walls.

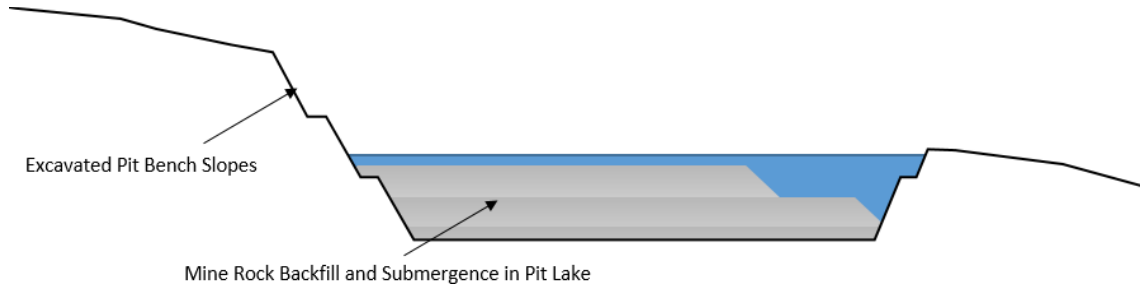
Backfill with Mine Rock and Overburden and Partial End-Pit Lake Submergence

In this alternative, open pit development will be staged in a way that facilitates progressive backfill with mine rock, and partial submergence during the Operation Phase with final end-pit lake elevations reached in the Decommissioning and Reclamation, and Post-closure phases. Upon decommissioning, remaining exposed open pit walls will be covered with excess overburden and non-PAG rock present in the backfill, embankments and buttresses, placed in lifts and reshaped to a final slope of 2.5H:1V. See **Figure 5-4**.

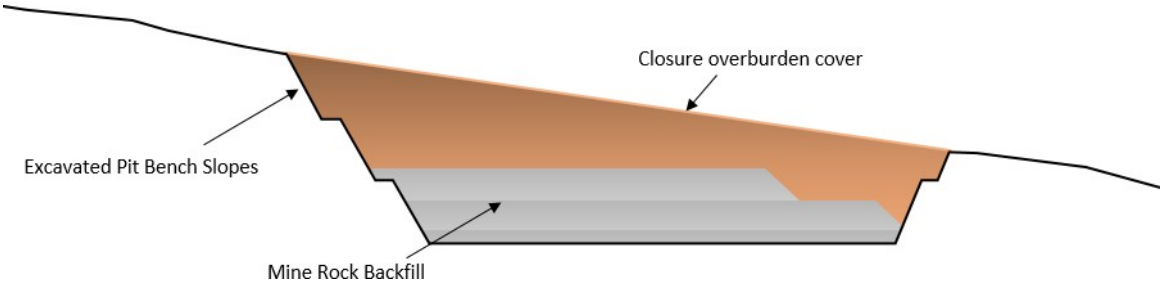
This approach is consistent with the mine development plan, as well as mine rock management objectives and the decommissioning and reclamation plan. The alternative approaches discussed above were not considered in detail in this assessment (see **Table 5-3** for selection rationale).

Figure 5-4: Open Pit Mine Rock Backfill and Submergence – Schematic

(a) Open Pit Backfill During Operation



(b) Open Pit Backfill Decommissioning and Reclamation Cover of Overburden and Reclamation Materials and Partial Submergence of Mine Rock with Water



Notes: *Schematic. Not to scale.*

5.1.5 Mine Rock

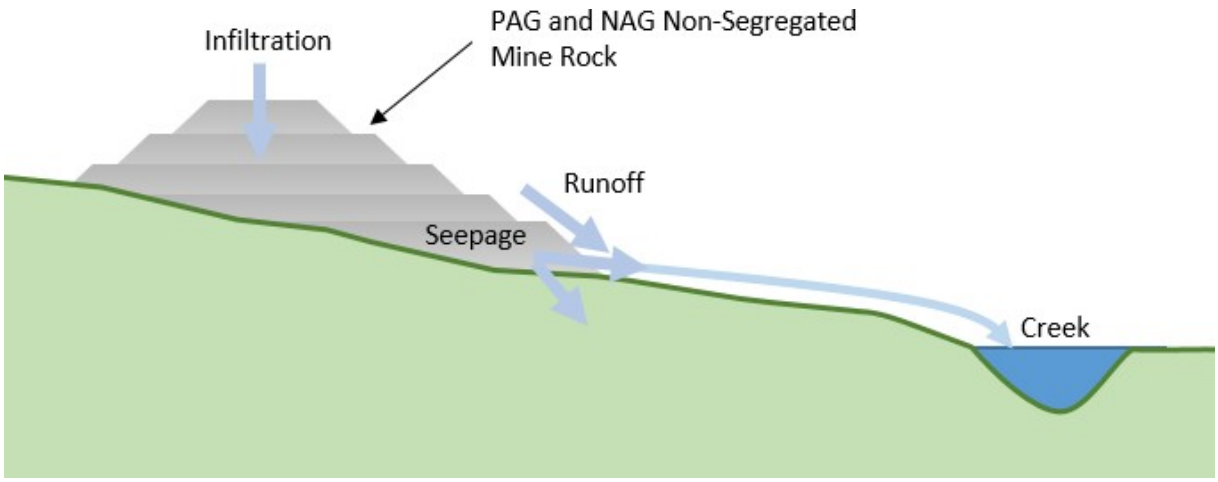
Do Nothing

In the “do nothing” scenario, mine rock generated from the open pit would be placed on surface without management of segregated PAG and non-PAG mine rock. The total mine rock volume is 60 MBMC plus an estimated 30% bulking, of which 52% is expected to be PAG. Depending on the timing and configuration of the mine rock deposition, some natural blending and neutralization may occur, however, pockets of PAG rock should be expected. The onset of acid generation would be expected to occur within 4 to 12 years (see **Section 2**), with some sections (Zone 4 NPR of 0.3) going acid in as little as 0.3 years under laboratory conditions.

Processed rock may be deposited in a separate storage facility (as per the Manalta project [1997]) or dewatered and deposited with the mine rock.

In this alternative, the effects of ML/ARD would be managed by the assimilative capacity of the site and dilution in receiving waterbodies. This alternative is shown schematically in **Figure 5-5**.

Figure 5-5: Do Nothing Option Schematic



Notes: *Schematic. Not to scale.*

Active Water Treatment

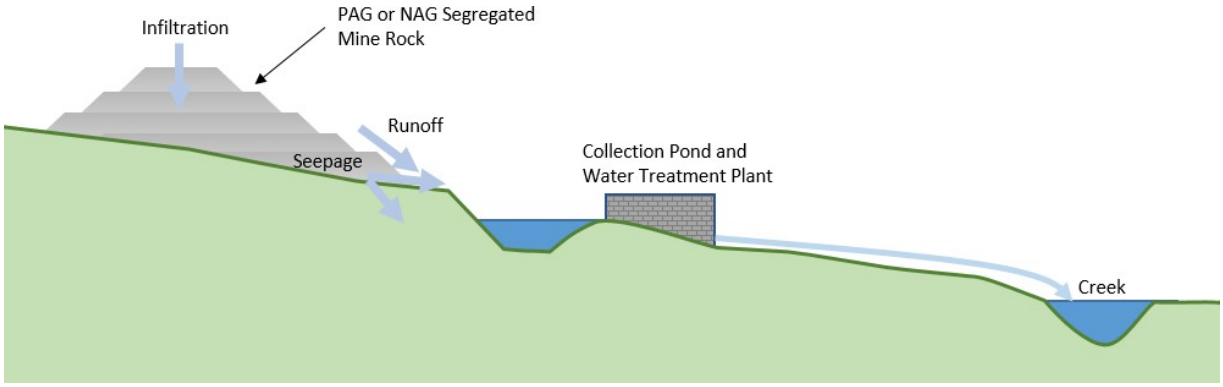
Active water treatment of ARD with lime was considered for the pre-feasibility study (SRK 2017a and 2017b) but was dismissed for the feasibility study (SRK 2019a) due to the risks associated with long-term operation of the water treatment plant, including management of sludges and maintenance of structures (ditches and ponds) to ensure strongly acidic waters are not accidentally discharged.

Active water treatment of neutral metal drainage has not been identified as a requirement based on water quality results.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with filtered processed rock in a dry storage pile, separate from the non-PAG and overburden storage facilities. Surface runoff and infiltration from this facility are collected and directed to a treatment plant consisting of lime-based neutralization, precipitation, solid/liquid separation and including a high-density sludge (HDS) system to optimize lime demand and reduce residual sludge volumes, consistent with the pre-feasibility study (SRK 2017a). The water treatment system would operate on a seasonal basis for 5 months per year from May through September, with excess water stored in winter months in collection ponds and/or depleted open pits and would discharge to Telkwa River. A schematic of the system is shown in **Figure 5-6.**

Lime treatment is expected to be effective at reducing effluent metal loads to acceptable levels. However, localized ML/ARD seeps and acidic pond water may impact local flora and fauna, and long-term operation of the facility and management of sludge presents operational and environmental risks.

Figure 5-6: Active Water Treatment Option Schematic

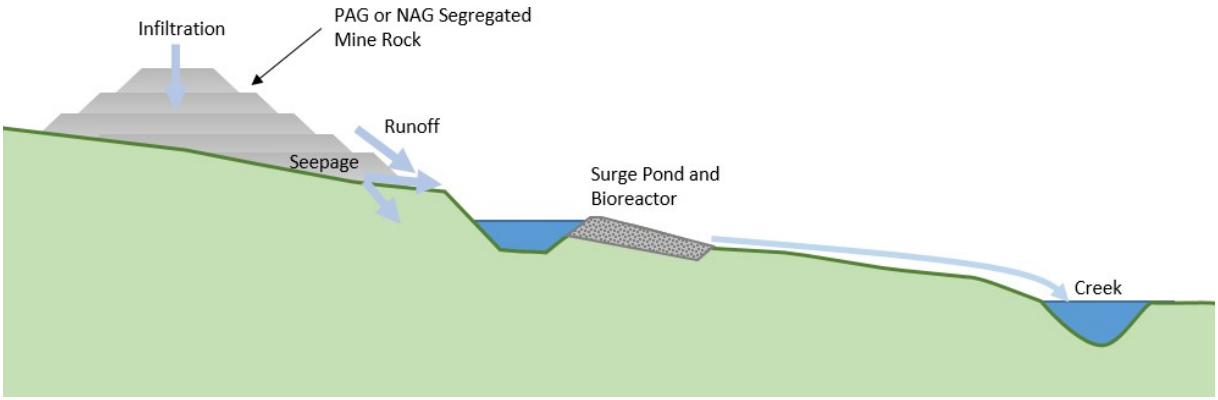


Notes: *Schematic. Not to scale.*

Passive Water Treatment

Passive water treatment has not previously been proposed for the project. Passive treatment systems exist for ARD neutralization and metal and nutrient removal from neutral drainage. This scenario evaluates a gravel bed bioreactor to remove nitrate and selenium, and potentially other parameters of concern, from the overflow from the sub-aqueous (PAG) and/or sub-aerial (non-PAG) mine rock storage areas during the Operation Phase. Design of passive treatment systems are highly dependent onsite conditions, including influent geochemistry, and site climate and hydrology. Detailed design of a passive treatment system has not been completed for the Project due to the significant challenges imposed by the site climate and geochemistry and significant retention times, water flow volumes, metal loading under ARD conditions, and areas expected to be required, and the inherent unpredictability of the systems at achieving water quality outcomes. See **Figure 5-7.**

Figure 5-7: Active Water Treatment Option Schematic



Notes: *Schematic. Not to scale.*

Potentially Acid Generating (PAG)/Non-PAG Blending

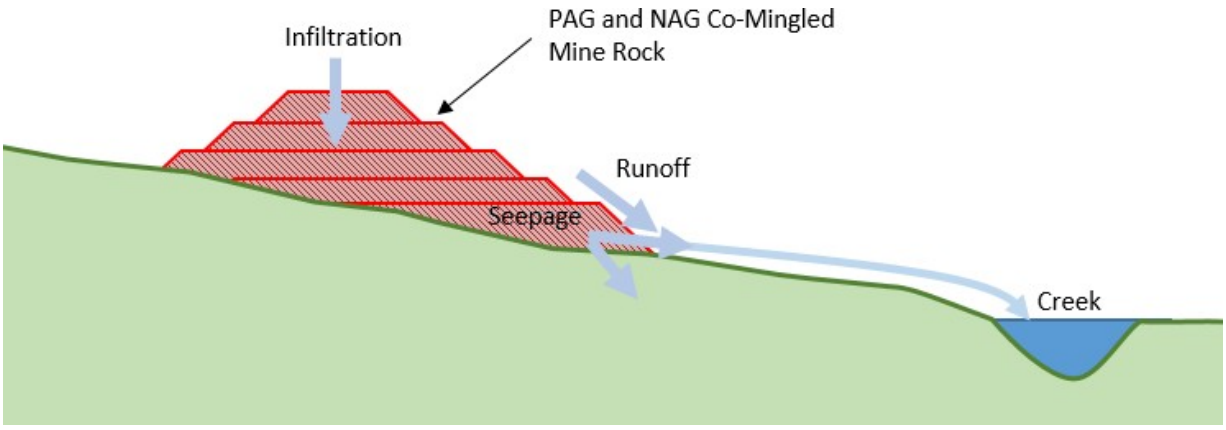
PAG/Non-PAG blending is achieved by co-mingling sufficient neutralizing alkaline materials with PAG materials, such that ML/ARD in the resulting seepage is avoided. An “ideal blend” occurs when, due to the availability and degree of blending of alkaline materials is sufficient that acidification and accelerated oxidation does not occur except at the grain scale. A “non-ideal” blend occurs when acidification and the resulting accelerated oxidation occurs at larger scales but is neutralized by alkaline materials along the flow path. In non-ideal blends, high concentrations of certain elements can persist in solution after neutralization, therefore these blends are less effective than ideal blends. The degree of mixing required to achieve an ideal blend is calculated in the form of a flow path length, based on the infiltration rate, degree of alkalinity and rate of acid generation. This alternative is shown schematically in **Figure 5-8.**

PAG/Non-PAG blending was initially proposed as part of the Manalta project in the 1990s (Manalta 1997, Piteau 1998), and was evaluated for the Project as part of the feasibility study (SRK 2017a, 2017b). The evaluation concluded that conventional blending will be challenging for the Project due to the lack of distinctive PAG and non-PAG layers, elevated sulphide content and high geochemical reactivity. Furthermore, due to the low NPR of PAG materials the lift thicknesses would need to be relatively thin (e.g., in the range of 150 mm) to achieve adequate blending. Lastly to ensure the blend was robust enough a NPR of in the range of 3 to 1 or greater would need to be achieved and there is simply not enough non-PAG rock to blend with PAG materials.

An important consideration for operational mine rock management is that as the stratigraphic average NP/AP_{blend} approaches the target NP/AP_{blend}, the need for rigorous operational control increases to ensure effective blending (SRK 2017b).

In addition, the NP/AP target for a blend mixture needs to be greater than that used to define ARD potential for individual samples ($NP/AP_{blend}>2$, as described in **Section 2**) to provide a factor of safety for inefficiencies of mixing. According to the mine plan, 52% of the mine rock to be produced from the Project is expected to be PAG, though all the PAG zones, except for Zone 1a, contained a component of non-PAG rock (SRK 2019b). Based on these proportions, heterogeneity of the zones, and relatively low NPRs of many of the zones (see **Table 2-2**), it is unlikely that sufficient neutralizing material will be produced over the course of mining activities to offset the PAG materials.

Figure 5-8: Potentially Acid Generating (PAG)/non-PAG Blending Option Schematic



Notes: *Schematic. Not to scale.*

Dry Covers

Dry covers were proposed for post-closure for the pre-feasibility study (SRK 2017a and 2017b) though, as noted above, they conservatively were assumed to not be sufficiently effective to preclude the need for water treatment of ML/ARD in the long term.

The objectives of the dry cover are to:

1. Reduce the supply of oxygen, to slow or prevent the sulphide oxidation reaction (acidification).
2. Reduce the supply of water available for ML/ARD.
3. Provide a surface for post-mining land-use reclamation and revegetation.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with dewatered processed rock in a dry storage pile, separate from the non-PAG and overburden storage facilities. Co-disposal of fine processed rock with mine rock reduces the available pore space within the PAG mine rock, reducing the rate of infiltration and oxygen ingress to the mine rock pile.

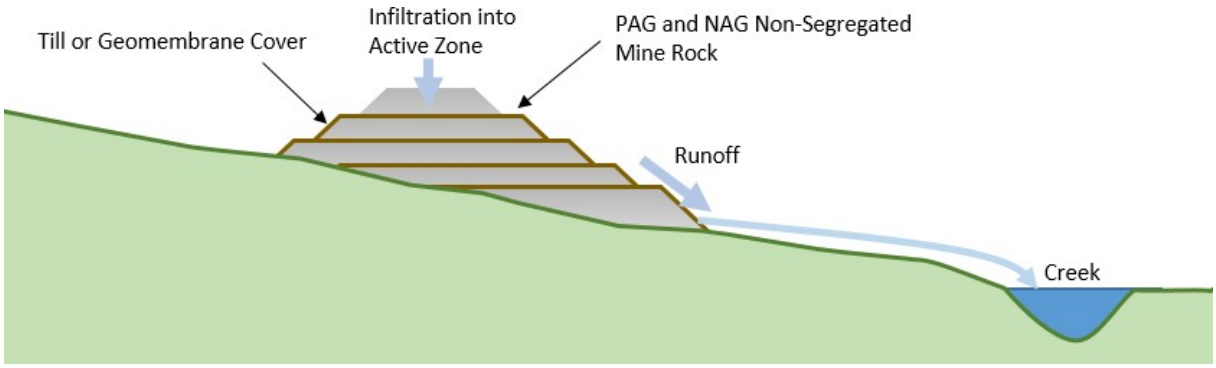
The mine rock piles are constructed in phases, and a dry cover is constructed progressively as shown in **Figure 5-9**. Based on geochemical characterization, the onset of acid generation of the PAG mine rock is expected to occur within 4 to 12 years (see **Section 2**), with some Zone 4 sections going acid in as little as 0.3 years. Onset of acid generation for processed rock is 6 years. Therefore, Zone 4 PAG materials should be segregated and stored separately and covered immediately (likely subaqueously). Progressive reclamation of the remaining PAG materials should be done with sufficient frequency to prevent the onset of acid generation (i.e., covers should be in place within 4 years of extraction). For the non-PAG rock piles, ML is expected to occur immediately but at relatively low concentrations. Progressive covering would be designed primarily to reduce mine rock infiltration and impacted seepage rates.

Areas of uncertainty regarding dry covers are generally related to long-term performance and the degree of effectiveness in reducing oxygen supply and infiltration (MEND 2009) and are related in large part to site climatic conditions and to the availability and properties of high-fines granular materials (glacial tills and clays) at the site. Due to the relatively wet climatic conditions at the

Project, some infiltration should be expected to occur through most covers. Addition of geosynthetic liners can further reduce rates of infiltration and oxygen advection but require additional cost and detailed Quality Assurance/Quality Control (QA/QC) during installation and operation.

For PAG rock piles, water treatment and/or other ML/ARD mitigation may be required during progressive operation of the PAG piles as they are progressively covered due to local variability in mine rock properties, and after closure due to imperfections in the cover system. However, water treatment rates would be expected to be significantly reduced compared to the active water treatment only case. For non-PAG rock piles, progressive cover is considered a conservative measure to further reduce effluent loadings to receiving water bodies.

Figure 5-9: Progressive Dry Cover Option Schematic



Notes: *Schematic. Not to scale.*

Wet Covers and Saturation Covers

Submergence or saturation of PAG materials has been demonstrated as being the most effective means of preventing ARD and reducing ML and has wide-ranging application in BC (MEND 2009). Due to the low solubility of oxygen in water, the rate of sulphide oxidation is controlled by mass transfer.

Key considerations for saturation covers are as follows:

- Submergence of weathered PAG materials can increase dissolution of soluble contaminants (e.g., from secondary oxidation reactions). Therefore, it is important to submerge PAG mine rock before onset of acid generation, or significant oxidation under non-acidic conditions;
- Saturation or water cover must be maintained in perpetuity, and design must account for natural and anthropogenic variations in hydrological regimes to prevent exposure of PAG materials to the atmosphere. However, finer materials can be partially saturated to a level at which the rate of oxygen ingress is the same as if the mine rock were fully saturated with water. The moisture content at which this typically occurs is about 60%. Therefore, if the PAG mine rock materials or (in the case of saturation cover, the cover materials) are sufficiently fine to maintain saturation in the pore spaces, temporary exposure should not result in oxidation reactions and ML/ARD; and
- Geotechnical risks increase with flooded impoundments. The potential consequence of impoundment failure must be considered, as well as the additional construction, maintenance,

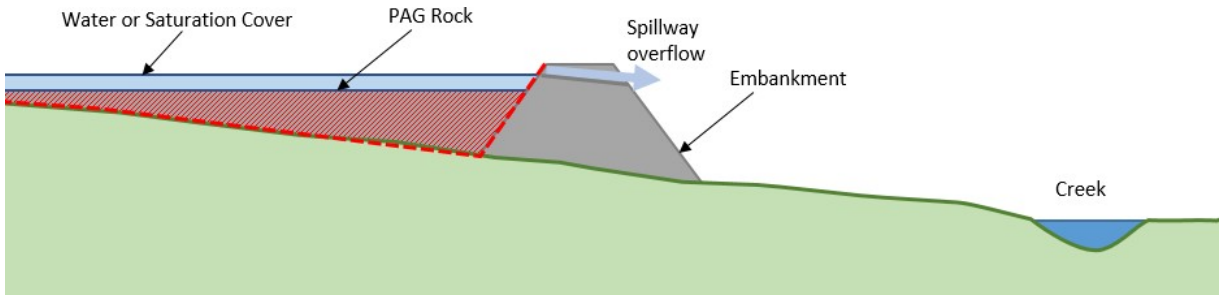
and surveillance requirements, in addition to the risk of ML/ARD.

In this alternative, PAG and non-PAG mine rock are separated at source, and PAG mine rock is co-disposed with dewatered processed rock in a lined and flooded impoundment, separate from the non-PAG and overburden storage facilities. The impoundment embankment is raised progressively over the life of mine to accommodate PAG storage and water cover requirements. Construction of saturation covers are not considered feasible for operations because mine rock is continuously deposited in the PAG cells (management ponds).

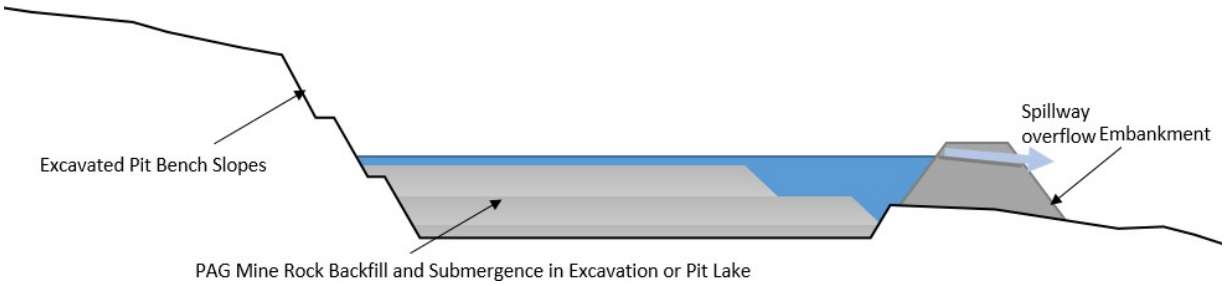
Co-disposal of fine processed rock with mine rock does not offer significant benefits to the PAG storage facility but eliminates the need for a separate PAG processed rock storage facility. An alternative configuration is considered in the feasibility study (2019a), in which PAG rock is deposited in excavated PAG cells (management ponds) with smaller impoundments. While this alternative reduces the overall embankment heights and thus geotechnical risks, it increases capital expenses (the entire facility must be excavated prior to PAG placement, rather than raised sequentially over the life of mine). Both alternatives are shown in **Figure 5-10**.

Figure 5-10: Wet Cover Option Schematic with Impoundment or Excavated Management Ponds (PAG cells)

a) Impoundment Disposal



b) Excavated PAG Cell (Management Pond) Disposal (shown as open pit)



Notes: *Schematic. Not to scale.*

5.1.6 Summary and Screening

Alternatives are summarized in **Table 5-2.** Initial screening of alternatives based on technical applicability and economic feasibility is presented in **Table 5-3.**

Technical applicability and economic feasibility selection criteria are defined as follows:

- **Unacceptable:** Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive). Alternatives that are either technically or economically unacceptable are discarded;
- **Challenging:** Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability. Alternatives that are either technically or economically challenging are discarded *if there is a more favorable alternative available*; and
- **Acceptable:** Is expected to achieve stated objectives without significant challenges or economic risk or liability.

Alternatives that are not discarded are either assessed further based on their effects on the natural environment and communities (**Section 5.2**) or selected if only one alternative is considered technically and economically feasible.

Table 5-2: Management Alternatives for Potentially Acid Generating (PAG) and non-PAG Materials

Component	Management Option	Description	ML/ARD Management Mechanism	Key Considerations
Mine rock	Do nothing	Non-segregated surface piles for PAG and non-PAG materials.	None.	The remineralization of carbon in some coal materials can consume oxygen at a greater rate than metal mine materials. Placement of coarser materials reduces oxidation reaction rates by reduced surface areas. However, mine rock at Telkwa is generally expected to be relatively fine.
	Active water treatment	Segregated surface piles for PAG and non-PAG materials. ARD or neutral metal leachate is collected and treated.	Neutralization of ARD and removal of neutral metals after onset.	Long term operations and maintenance, including sludge management post-closure.
	Passive water treatment	Segregated surface piles for PAG and non-PAG materials. Leachate is passed through a bioreactor to remove selected parameters of concern.	Neutralization of ARD and removal of neutral metals after onset. Biochemical anaerobic-anoxic reactions to consume nutrients and attenuate metals.	Site-specific design of system to address key parameters of concern and nutrient loading. High flow rates and low temperatures are key challenges for bioreactor effectiveness. Reliability of systems at meeting end-of-pipe concentration requirements makes permitting challenging Post-closure operations and maintenance challenges. Long term operations and maintenance, including sludge management post-closure.
	PAG and non-PAG blending	Blended PAG and non-PAG surface piles to achieve NPR>2.	Neutralization of PAG materials at source (ideal blend) or ARD after onset (non-ideal blend) ML/ARD.	Effectiveness of co-mingling of PAG and non-PAG materials, influenced by structural formation and mineralization. Challenging for the Project due to the lack of distinctive PAG and non-PAG layers, elevated sulphide content and high geochemical reactivity.
	Dry cover	Segregated surface piles for PAG and non-PAG materials. Piles are progressively covered with low-permeability materials (high-fines granular materials or geosynthetics).	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates.	Availability and material properties of high-fines granular materials (e.g., clays or glacial tills). Long-term (post-closure) effectiveness of cover, potentially supported by oxygen consumption of coal mine rock.
	Wet cover	Segregated PAG or non-PAG storage facility with water cover.	Limiting oxygen availability (diffusion).	Water cover maintenance. Geotechnical risk of impounded water and saturated processed rock, including post-closure. Placement of finer materials decreases rate of diffusion even under partial saturation conditions.
	Saturation cover	Segregated PAG or non-PAG storage facility with saturated granular fill cover.	Limiting oxygen availability (diffusion).	Maintaining saturation. Geotechnical risk of saturated processed rock (e.g., liquefaction). Presents logistical challenges during operations due to difficulty maintaining cover saturation during active placement. Placement of finer materials decreases rate of diffusion even under partial saturation conditions.
Processed rock (tailings)	Conventional slurry tailings impoundment	Deposition as conventional slurry in a tailings' impoundment with a water cover.	Limiting oxygen availability (diffusion).	Water cover maintenance during operations and post-closure. Geotechnical risk of impounded water and liquifiable tailings.
	Dewatered tailings stack (filter press) and on-surface coarse processed rock pile	Filter press circuit to dewater tailings and allow storage as dry stack or co-disposal with processed rock and/or mine rock.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Likely to require additional measures such as covers or active treatment if deposited on surface.	Placement of finer materials decreases oxygen ingress even under partial saturation conditions. Relatively small volumes to justify a separate disposal facility. Impact of the grain size distribution and water content of dewatered product on limiting oxygen advection and infiltration. Long-term geochemical weathering. Lower geotechnical risks compared to conventional slurry impoundments.
Coarse processed rock	Segregated processed rock piles	On-surface coarse reject pile and separate dewatered fine processed rock pile or impoundment (see Conventional slurry tailings impoundment).	None. Likely to require additional measures such as covers or active treatment.	Multiple PAG management facilities required, increasing cost, complexity, and post-closure risk. Oxidation near surface leading to ARD. Geotechnical stability and surface erosion. Relatively small volumes to justify a separate disposal facility.
	Blended fine/coarse processed rock piles	Processed rock and dewatered fine processed rock are blended and placed in dry surface stack.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Likely to require additional measures such as covers or active treatment.	Multiple PAG management facilities required, increasing cost, complexity, and post-closure risk. Oxidation near surface leading to ARD. Geotechnical stability and surface erosion.
	Blended and co-disposal with mine rock (PAG, non-PAG or unsegregated)	Processed rock and dewatered tailings are blended and co-mingled with mine rock prior to placement. Could be blended with segregated non-PAG rock, or unsegregated (PAG/non-PAG) mine rock.	Limiting oxygen availability (by advection). Limiting water availability, by limiting seepage rates. Neutralization of PAG materials via blending (if option selected). May require additional measures such as covers or active treatment.	Geotechnical stability.

Component	Management Option	Description	ML/ARD Management Mechanism	Key Considerations
Open pit walls	Do nothing	Open pits are exploited sequentially. Inflow drains by gravity.	None.	Spatial constraints and haul distances for mine rock storage.
	Partial end-pit lake	Open pits are exploited sequentially, and open pit design and sequencing promotes formation of a partial end-pit lake in inactive open pits. Some of open pit walls remain exposed.	Limiting oxygen availability (diffusion).	Pit staging and geometry to promote ponding. Spatial constraints and haul distances for mine rock storage. Impact of exposed pit walls on pit lake geochemistry in the long term.
	Total submergence end-pit lake	Open pits are exploited sequentially, and embankments are constructed to promote formation of an end-pit lake in inactive open pits that completely submerges open pit walls.	Limiting oxygen availability (diffusion).	Embankment construction to promote ponding. Spatial constraints and haul distances for mine rock storage. Geotechnical risk of embankments during Operations and Post-closure phases.
	Backfill with mine rock and partial end-pit lake	Open pits are exploited sequentially, and embankments are constructed to promote formation of an end-pit lake in inactive open pits that partially submerges open pit walls.	Limiting oxygen availability (diffusion).	Embankment construction to promote ponding. Spatial constraints and haul distances for mine rock storage. Geotechnical risk of embankments during Operation, and Post-closure phases.

***Sources**: Compiled in report.*

***Notes**: ARD=acid rock drainage; ML=metal leaching; NPR=neutralization potential ratio; PAG=potentially acid generating*

Table 5-3: Initial Screening based on Technical and Economic Feasibility

Component	Management Option	Technical Applicability	Rationale	Economic Feasibility	Rationale	Screening Decision	Rationale
Fine processed rock (tailings)	Conventional slurry tailings impoundment	Acceptable	Conventional method which facilitates submergence of PAG materials, but results in requirement for a separate storage facility requiring long-term maintenance after closure.	Challenging	Lower initial capital and operating costs are offset by long-term costs of managing separate PAG facilities.	Discard	Lower initial cost and extensive precedence for effective management of PAG, however, creates additional technical challenges compared to other alternatives associated with managing multiple facilities, as well as geotechnical risk of impounded fine materials, without corresponding benefits.
	Dewatered fine processed rock (filter press)	Acceptable	Though more expensive, filter pressing is technically feasible and provides environmental benefits (e.g., increases process water recycling)	Challenging	Higher initial capital and operating costs due to process infrastructure requirements and transportation costs are offset by reduced long-term liability.	Select, in combination with other ML/ARD alternatives	Though higher cost initially, provides many benefits including reducing process water makeup demands, reducing geotechnical risk and project footprint, especially if paired with co-disposal with processed rock and mine rock. Does not, on its own, mitigate ML/ARD potential.
Coarse processed rock	Segregated coarse/fine processed rock piles	Challenging	Though surface coarse and dewatered processed rock disposal is well-established technology, it will present ML/ARD challenges in this application.	Challenging	Multiple PAG management facilities required, increasing cost and complexity.	Discard	Does not mitigate ML/ARD generation for PAG coal reject materials, and creates additional technical challenges associated with managing multiple facilities.
	Blended coarse/fine processed rock piles	Acceptable	Well established processed, that may help mitigate ML/ARD challenges.	Challenging	Multiple PAG management facilities required, increasing cost and complexity	Discard	Does not adequately mitigate ML/ARD generation for PAG coal reject materials, and creates additional technical challenges associated with managing multiple facilities. Does not offer benefits compared to co-disposal with mine rock.
	Blended and co-disposal with mine rock (non-PAG or unsegregated)	Acceptable	Well established technology, that may help mitigate ML/ARD challenges and reduces number of PAG management facilities.	Acceptable	Most economically viable method in the long-term, due to reduced number of separate PAG management facilities.	Select	Reduces technical complexity by providing a single PAG management location and provides additional benefits to geotechnical and geochemical performance of the mine rock pile.
Open pit walls	Do nothing	Unacceptable	Significant portions of the exposed pit wall area are expected to be acid generating, resulting in unacceptable water quality effects.	Challenging	Exposed PAG surfaces expected to require active dewatering and ARD water management.	Discard	Does not, on its own, adequately mitigate ML/ARD risk.
	Partial end-pit lake	Acceptable	Establishing end-pit lakes is feasible within the mine development staging plan and would reduce ARD as exposed open pit wall areas are relatively small compared to submerged open pit areas.	Acceptable	Establishing pit lakes is consistent with the mine plan and is expected to occur naturally due to the site hydrology, and therefore should not result in significant extra costs.	Discard	Provides adequate mitigation of ML/ARD risk due to reduction of exposed reactive surface areas, however, does not offer any corresponding benefits compared to the alternative with mine rock backfill.
	Total submergence end-pit lake	Challenging	Constructing embankments to submerge open pit walls is technically feasible, though introduces geotechnical risks without commensurate benefits of ARD risk reduction.	Challenging	Additional embankments introduce additional costs and long-term (post-closure) liabilities.	Discard	ARD-mitigation benefits offered by submerging pit walls during operations are offset by additional technical risk and long-term liability associated with the additional dams.
	Backfill with mine rock and partial end-pit lake	Acceptable	Backfilling open pits with mine rock and partial submerging is feasible within the mine development and has overall benefits of reducing the requirement for external PAG rock management and facilitating closure ARD management.	Acceptable	Backfilling with mine rock is complementary to the mine plan and reduces haul distances. Establishing end-pit lakes is consistent with the mine plan and is expected to occur naturally due to the site hydrology, and therefore should not result in significant extra costs	Select	Backfilling with mine rock is complementary to the mine plan and reduces haul distances, providing environmental, reclamation and economic benefits.
Mine rock	Do nothing	Unacceptable	Significant portions of the mine rock are expected to be acid generating, resulting in unacceptable water quality effects.	Unacceptable	Lack of ML/ARD management is expected to result in unacceptable long-term liability.	Discard	Does not, on its own, adequately mitigate ML/ARD risk.
	Active water treatment of PAG mine rock	Challenging	Lime treatment of ARD is a well-established technology, however, the ability to effectively capture ARD from sources presents potential challenges.	Challenging	Potential high capital costs, and requirement for long-term water treatment presents a significant long-term liability.	Assess further	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure conditions), and presents challenges associated with capturing ARD.
	Active water treatment of non-PAG mine rock	Challenging	Treatment methods of metals in neutral drainage are generally parameter specific, and multiple treatment methods would be required.	Unacceptable	Capital and operating cost of multiple treatment methods presents an unacceptable cost to the project.	Discard	Economic and technical challenges.
	Passive water treatment of non-PAG	Challenging	Passive water treatment systems have demonstrated effectiveness in reducing selected parameters of	Challenging	Significant areas and retention times are required for passive treatment in cold, wet climates, and challenges in	Discard	Economic and technical challenges.

Component	Management Option	Technical Applicability	Rationale	Economic Feasibility	Rationale	Screening Decision	Rationale
	mine rock		concern (notably selenium and nitrate), however, present challenges in cold, wet climates.		reliably predicting end-of-pipe compliance.		
	PAG/non-PAG blending	Unacceptable	PAG/non-PAG blending presents many challenges and has limited examples of successful application. In addition, PAG/non-PAG mass balance does not support this alternative.	Challenging	Significant logistical and construction effort is required to achieve effective blending.	Discard	Not likely to be achievable based on-site conditions.
	Dry cover over PAG (granular or geosynthetic)	Challenging	Dry covers are a well-established technology; however, it is generally agreed that they are effective at slowing, but not eliminating, processes for ARD in cold, wet BC climates.	Challenging	Significant construction effort and perpetual ongoing monitoring and maintenance required to ensure cover performance at limiting ARD reactions.	Discard	Unlikely to adequately mitigate ML/ARD from PAG materials.
	Dry cover over non-PAG (granular or geosynthetic)	Preferred	Dry covers are a well-established technology at limiting infiltration, which should be effective at limiting neutral metal leaching.	Acceptable	Significant construction effort and ongoing monitoring and maintenance required to ensure cover performance; however, lower performance measures are required to limit metal leaching than ARD reactions.	Assess further	Dry cover is an effective long-term risk mitigation method.
	Wet cover over PAG	Acceptable	Wet covers are a well-established technology for ML/ARD management in cold, wet BC climates.	Acceptable	Higher capital costs for impoundment construction are offset by lower long-term operating costs associated with preventing ARD.	Assess further	Most robust alternative and cost-effective alternative for mitigating ML/ARD from PAG materials in a humid environment. However, requires an impoundment which increases geotechnical risk.
	Wet cover over non-PAG	Acceptable	Wet covers are a well-established technology for ML/ARD management in cold, wet BC climates.	Unacceptable	The cost and effort required to maintain submergence of the full volume of both PAG and non-PAG materials is likely to be prohibitive.	Discard	Submerging both PAG and non-PAG material volumes would negatively affect project economics and create additional geotechnical risks without corresponding benefit of improving environmental outcomes.
	Saturation cover over PAG	Acceptable (closure)	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk. Not feasible during operations due to the need for continual material placement.	Acceptable (closure)	Logistically challenging to place progressive saturated covers during active deposition. For closure, higher capital costs for impoundment and cover construction are offset by lower long-term costs associated with preventing ARD post-closure.	Assess further	Most robust alternative and cost-effective alternative for mitigating ML/ARD from PAG materials in a humid environment post-closure. Geotechnical risk of impoundment exists but is reduced compared to water cover.
	Saturation cover over non-PAG	Acceptable	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk.	Unacceptable	The cost and effort required to construct and maintain saturated cover of the full volume of both PAG and non-PAG materials is likely to be prohibitive.	Discard	Submerging both PAG and non-PAG material volumes would negatively affect project economics and create additional geotechnical risks without corresponding benefit of improving environmental outcomes.

Sources: *Compiled in report.*

Notes*: ARD=acid rock drainage; ML=metal leaching; PAG=potentially acid generating*

Technical Applicability and Economic Feasibility selection criteria are defined as follows:

- *Unacceptable: Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive).*
- *Challenging: Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability.*
- *Acceptable: Is expected to achieve stated objectives without significant challenges or economic risk or liability.*

5.2 Environmental and Community Alternatives Assessment

Based on the pre-screening assessment detailed in **Table 5-3**, the alternative of blending dewatered fine rock and coarse processed rock and co-mingling with PAG mine rock is selected due to lack of technically and economically feasible alternatives. Similarly, ML/ARD from open pit walls will be managed by progressively backfilling with non-PAG rock and overburden and partially submerging as open pits become exhausted, and ML/ARD from non-PAG mine rock will be mitigated by progressive placement of overburden and reclamation material (surface soil) covers over the mine life.

Alternatives for PAG mine rock management (blended with processed rock) are evaluated against environmental and community effects criteria, as summarized in **Table 5-4.**

Table 5-4: Alternatives Assessment based on Effects on the Natural Environmental and Community Effects and Inputs including Human Health (Mine Rock)

Management Option	Environmental Effects	Rationale	Community Input	Rationale	Screening Decision	Rationale
Active water treatment of PAG mine rock	Challenging	Treating water will result in improved water quality outcomes in receiving environments but involves long-term management of water treatment sludge. Risk of not capturing ML/ARD seeps from the open pit and/or impoundments may result in environmental impacts.	Challenging	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure). Possibility of parameters of concern entering the downstream environment having a negative effect on human health.	Implement as contingency, in case of failure of other methods	Long-term active water treatment would prevent the mine from achieving reclamation objectives (i.e., passive closure conditions), and presents challenges associated with capturing ARD. However, water treatment is an effective mitigation technology in the case of failure of preferred ML/ARD prevention methods.
Wet cover over PAG	Acceptable	Wet covers are an effective method of effectively eliminating ML/ARD. Local climate lends itself to maintaining water cover, even under drought and climate change conditions. However, there is a risk of losing the wet cover due to evaporation and resultant ARD potential.	Challenging	Passive ML/ARD management option. However, presents long-term geotechnical risk associated with embankment failure	Select for operation phase	Effective at providing ML/ARD source control from PAG materials in a humid environment. However, requires an impoundment which increases geotechnical risk.
Saturation cover over PAG	Acceptable (closure)	Saturation covers offer similar benefits to wet covers but reduce risk of desaturation (reduced evaporation rates) and reduced geotechnical risk.	Acceptable (closure)	Passive ML/ARD option that allows re-establishment of vegetation. Geotechnical risk of impoundment exists but is reduced compared to wet cover.	Select for Decommissioning and Reclamation and Post-closure phases	Effective at providing ML/ARD source control from PAG materials in a humid environment, but not practical to implement during active material placement. Geotechnical risk of impoundment exists but is reduced compared to water cover.

Sources: *Compiled in report.*

Notes*: ARD=acid rock drainage; ML=metal leaching; PAG=potentially acid generating*

Technical Applicability and Economic Feasibility selection criteria are defined as follows:

- *Unacceptable: Contains an obvious critical flaw or does not meet required threshold criteria for further consideration (e.g., does not achieve objective of mitigating ML/ARD risks, or is obviously economically prohibitive).*
- *Challenging: Does not contain an obvious critical flaw, but presents significant challenges for achieving stated objectives, or presents significant (though not obviously prohibitive) economic risk or liability.*
- *Acceptable: Is expected to achieve stated objectives without significant challenges or economic risk or liability.*

6 Conclusions and Recommendations

ML/ARD mitigations for PAG and non-PAG mine rock, including fine processed rock and open pit walls, recommended based on this assessment, and their rationale, are as follows:

Fine processed rock (tailings) treated as PAG: Dewatered fine processed rock (tailings) blended with coarse processed rock (also treated as PAG), for co-disposal with PAG mine rock and placed underwater for permanent storage:

- Increased process water recycling leading to lower freshwater makeup requirements; and
- Reduced operational complexity and risk of managing a single PAG facility.

Open pit walls: covered with non-PAG rock and overburden and partially submerged to form an end-pit lake during operations. Any remaining exposed open pit walls will be covered with an overburden and reclamation materials (surface soils) cover during the Decommissioning and Reclamation Phase to meet Post-closure land use objectives:

- Reduction of infiltration of water and oxygen to the open pit walls;
- Prevention of ML/ARD during Operation, Decommissioning and Reclamation, and Post-closure phases by providing constant availability of NP materials and seepage to the open pit wall; and
- Amenable to Post-closure restoration of pre-mining landforms.

Non-PAG mine rock: progressively covered with overburden and finally reclamation materials (surface soils):

- Reduced infiltration and seepage to the receiving environment; and
- Promote vegetation and meet Post-closure land use objectives.

PAG mine rock: impounded, with a water cover:

- Demonstrated effectiveness of the method in managing ML/ARD in the long-term;
- Ability to incorporate design contingencies to mitigate risks of system failure; and
- Relatively low operational and maintenance requirements, post-closure.

It is recommended that the Project design incorporate the following considerations:

1. Design the saturation cover depth with consideration to be resilient to drought conditions, considering the potential long-term effects of climate change.
2. Incorporate design measures to reduce the likelihood and potential consequence of an embankment failure on the downstream environment (e.g., closure spillways designed for the probable maximum flood (PMF), saturated rockfill cover Post-closure).

Other materials such as **overburden**, **reclamation materials (surface soils, woody debris)** and surficial construction materials (gravel and rock quarry) are not expected to require any specific material management procedures beyond best practices for excavation and placement of these materials.

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Regards,

SRK Consulting (Canada) Inc.



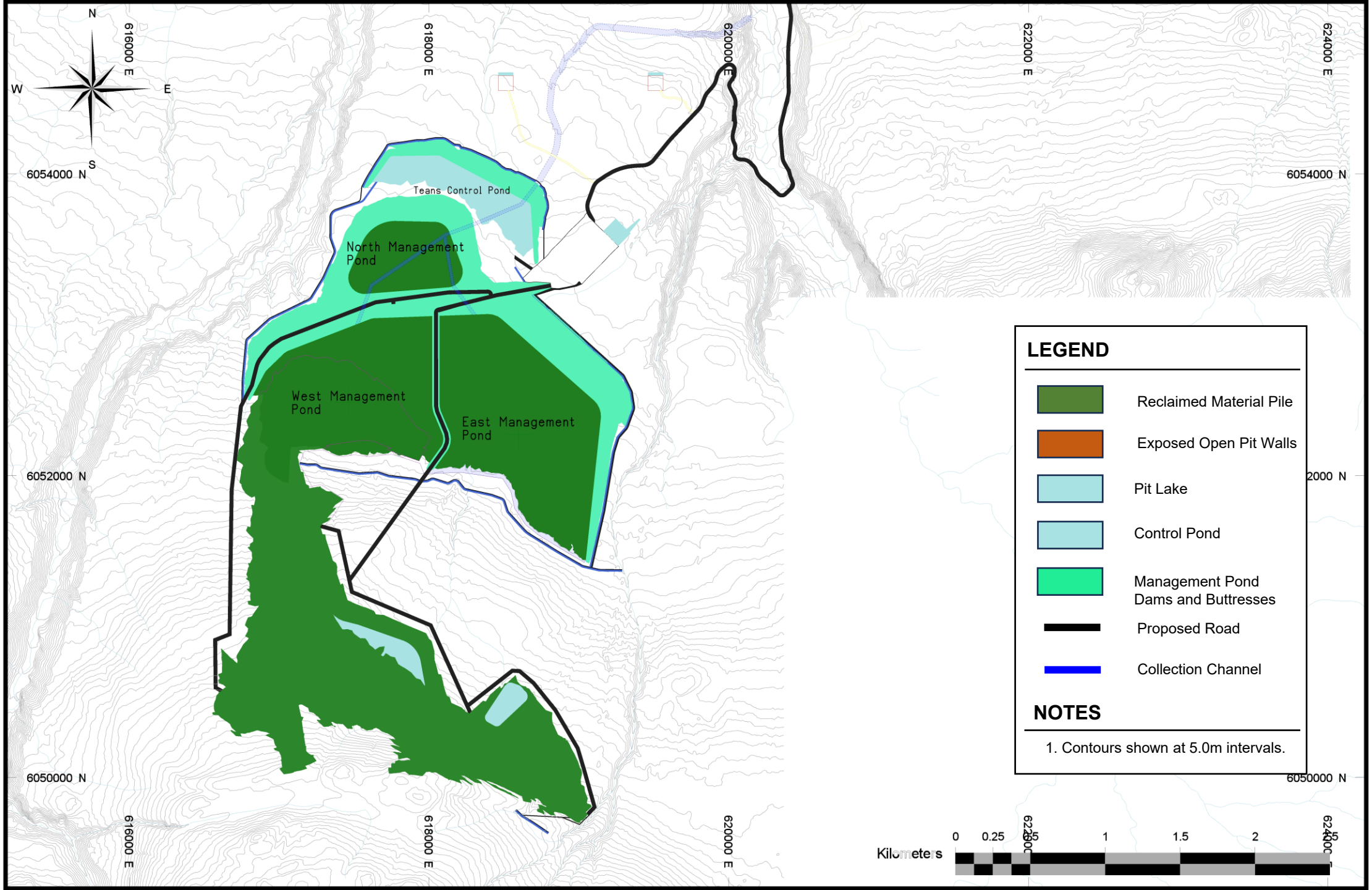
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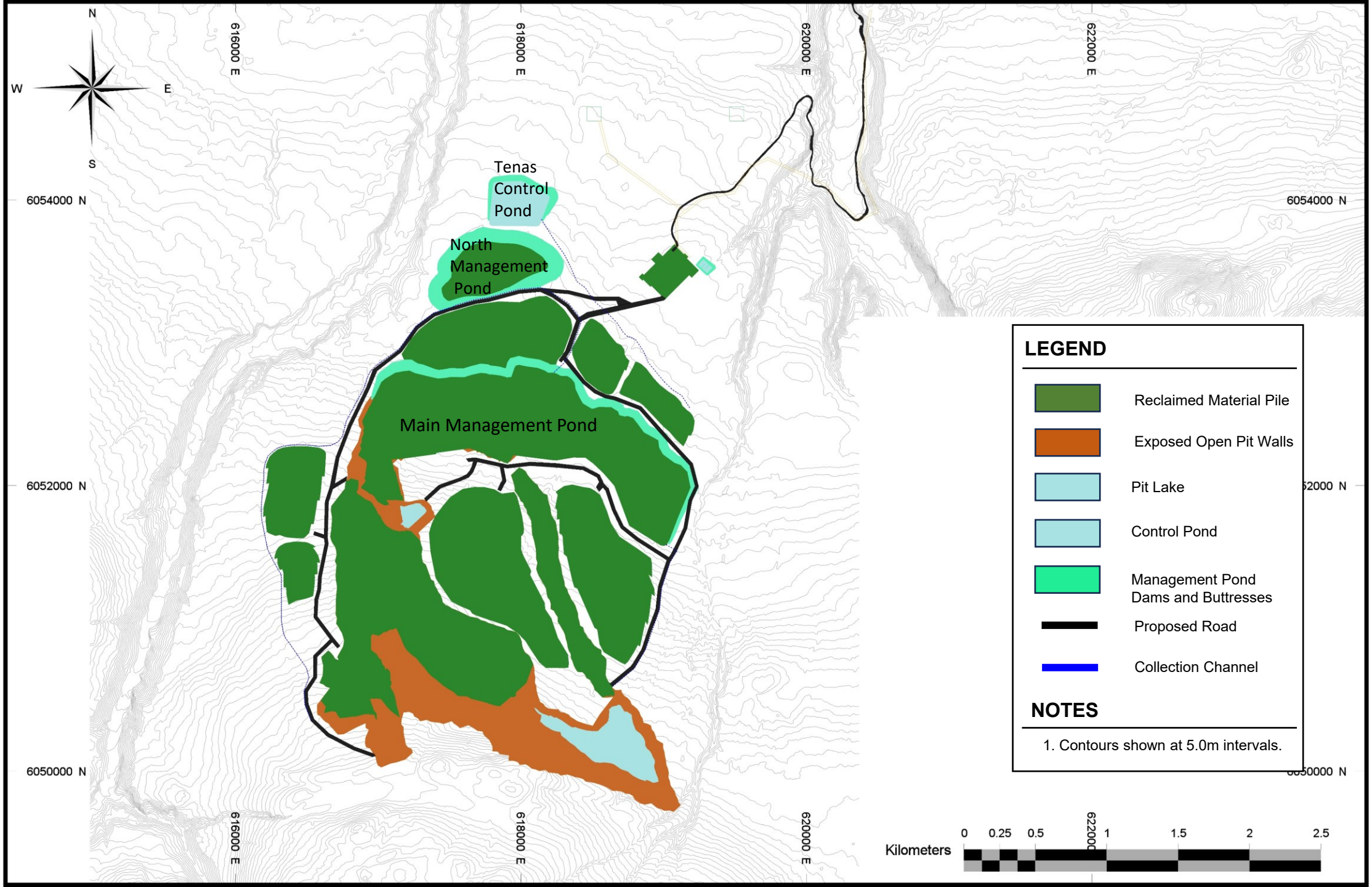
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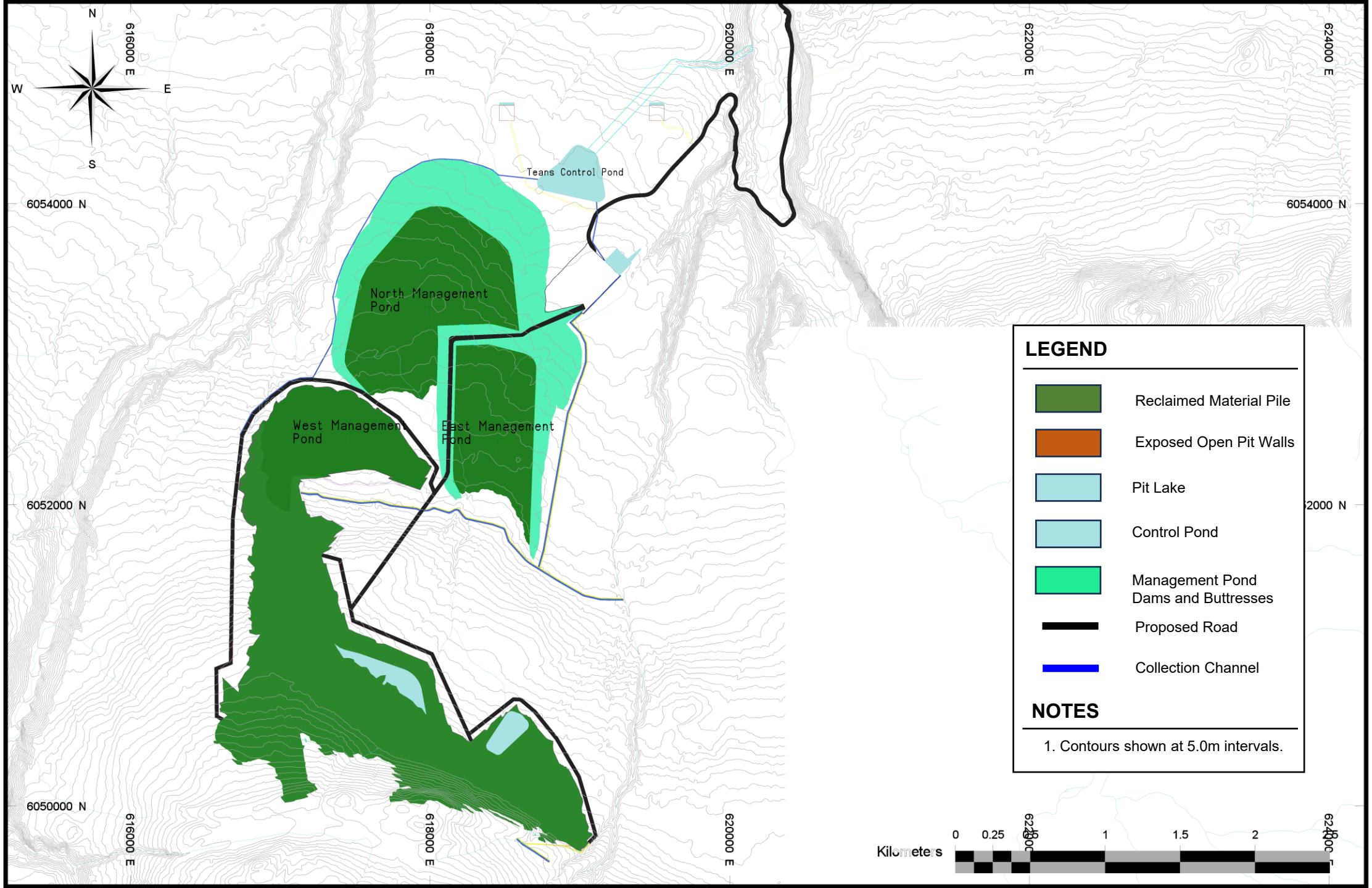
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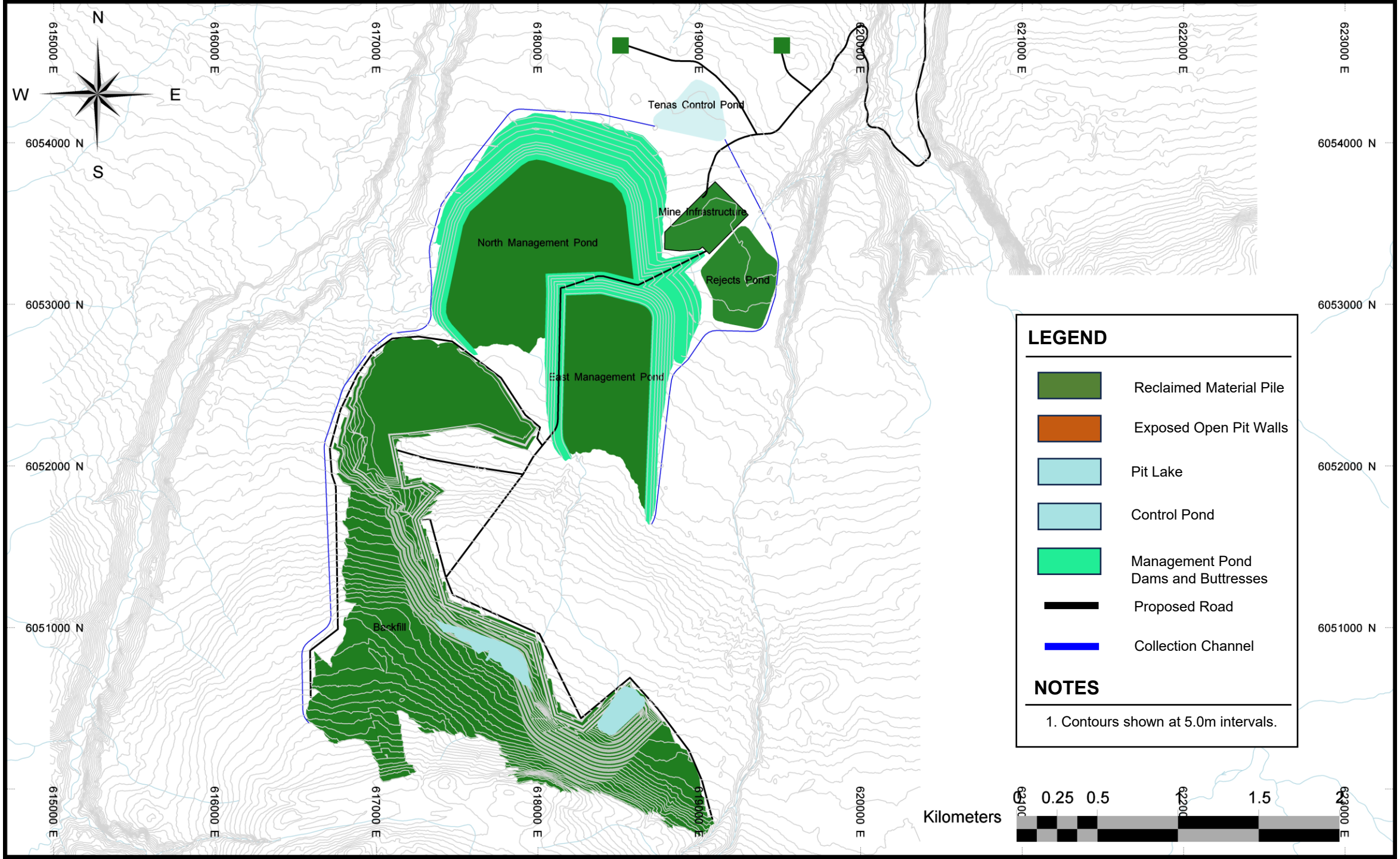
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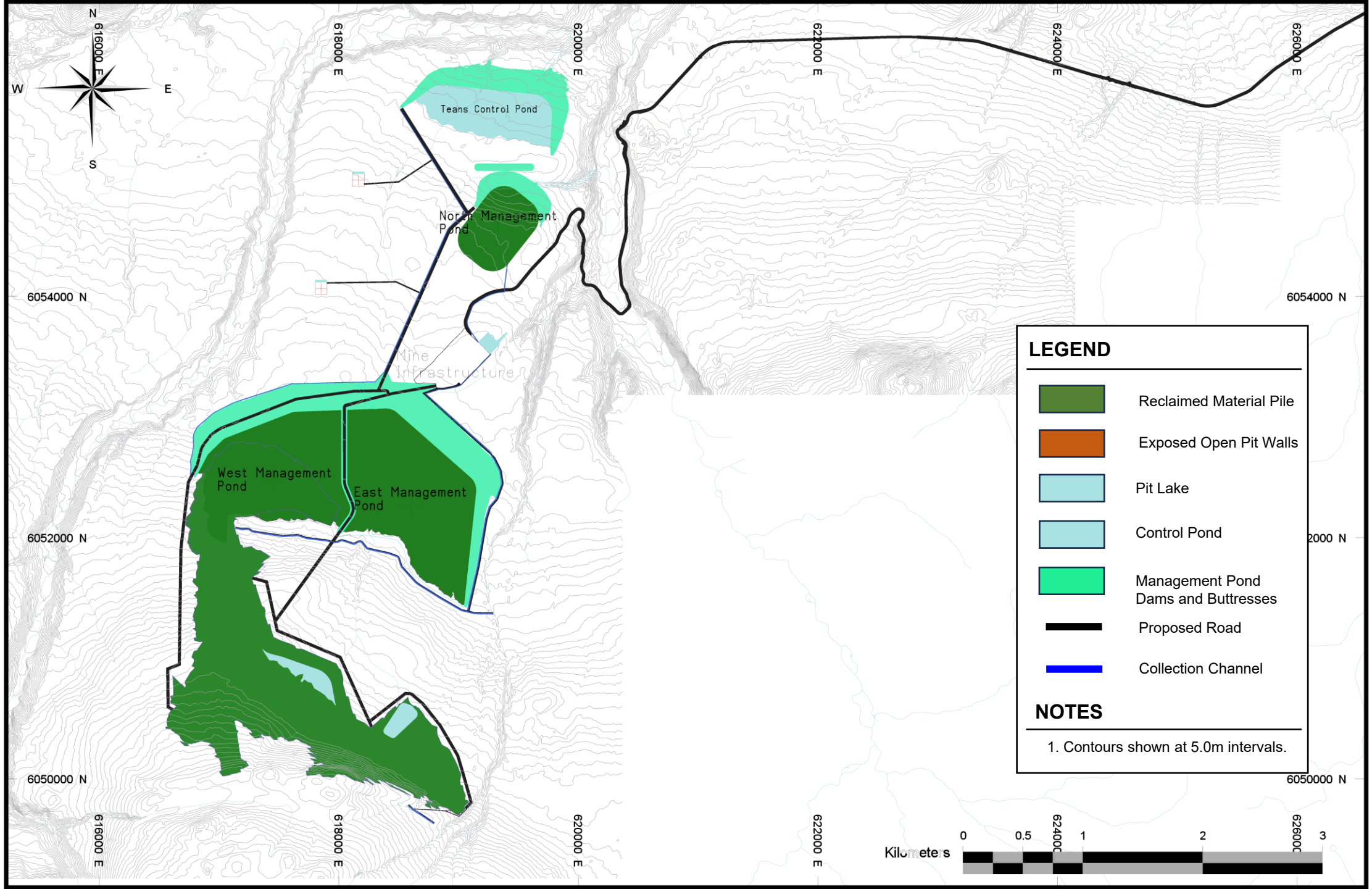
Appendix B Candidate Alternatives General Arrangements

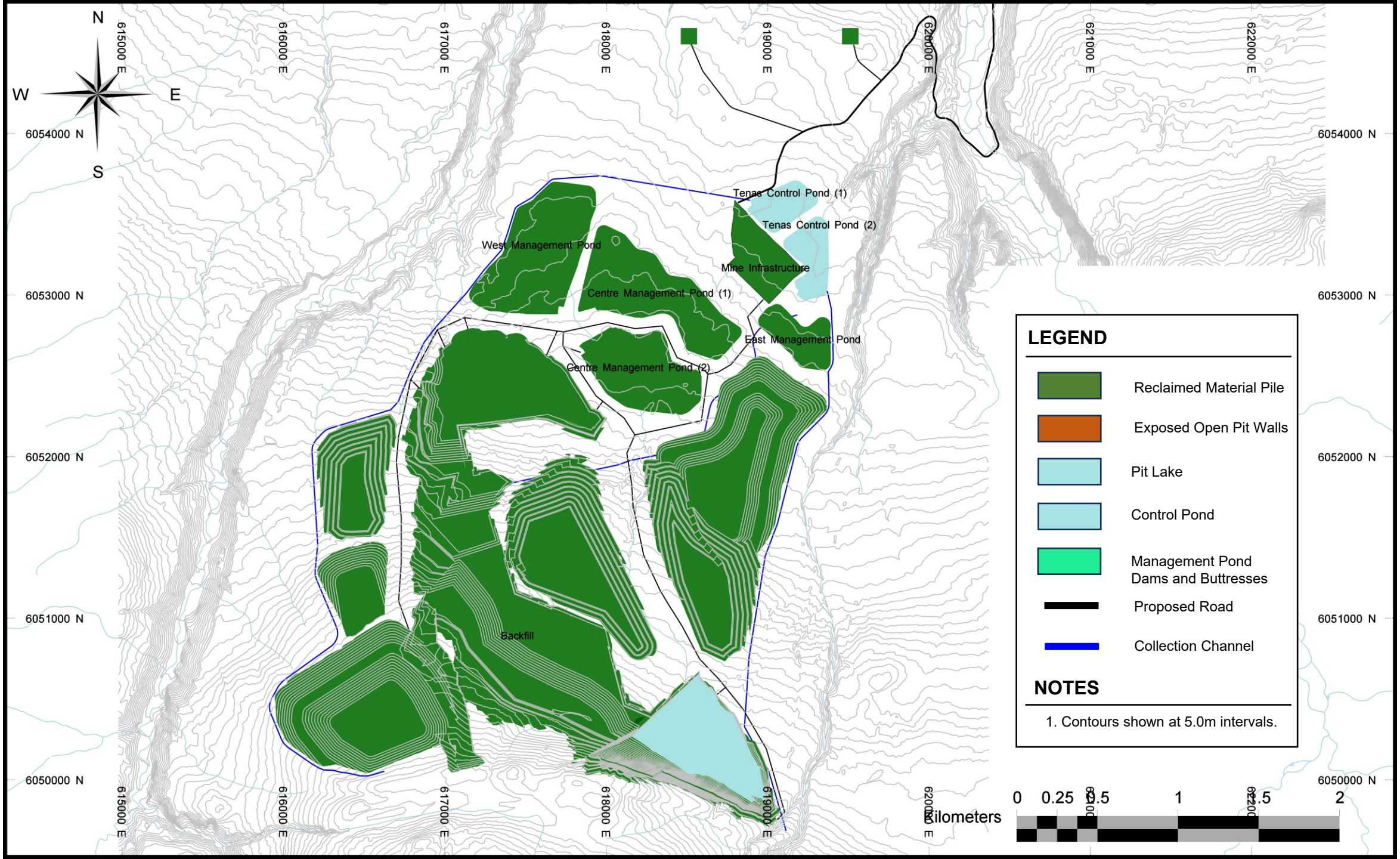

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Appendix C Alternatives Characterization

Appendix C.1 Environmental Characterization

Indicator	Rationale	Rank order	Unit	Comment
Aesthetics - Re-vegetation	Facilities with slope covers that differ from the natural environment pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest distrubance and variety of slopes and landforms in closure.
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.
Aquatic life and habitat	Facilities that affect aquatic fauna and their natural habitat pose greater environmental impacts.	High best		Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Aquatic life and habitat (endangered/protected fauna)	Facilities near to the presence of endangered/protected aquatic fauna and their habitat pose greater environmental impacts and more complex water quality monitoring and water treatment.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected aquatic fauna and their habitat as there is no endangered aquatic fauna witin the Project Area.
Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	COPC are important to the effects assessment	High best		Added after the workshop. Larger material movement, closenes to waterbodies and size/height of impoundments effect this indicator.
Atmospheric issues due to dam construction	Related to the amount of equipment mobilized for construction (trucks, compactors, blasting equipment, etc.) and its impact to air quality, noise and direct receptors (mine and construction personnel, wildlife, and nearby towns).	High best	-	Related to the materials needed and the dams/embankments volume for each alternative.
Bat and Bat Habitat	Bats have been identified by the regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options.
Bird life and habitat	Facilities that affect birds and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Bird life and habitat (endangered/protected species)	Facilities near the presence of endangered/protected birds and their habitat pose greater environmental impacts and more complex air quality monitoring and materials deposition and dust control.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected birds and their habitat as there is no endangered birds and habitat witin the Project Area.
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.
Caribou and Caribou Habitat	Caribou have been identified by First Nations, public and regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.

Indicator	Rationale	Rank order	Unit	Comment
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.

Indicator	Rationale	Rank order	Unit	Comment
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Prevalent wind speed and direction	Facilities whose relative location to the mine camp and mine installations is aligned with the prevailing wind speed and direction present greater risks of affecting air quality and mine personnel.	High best	-	Similar for all alternatives. Alternative 5 scores worse due to the waste rock dumps and the overall footprint.
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.
Quantity of non-PAG materials produced that remain above the closure water table	Non-PAG materials are the main source of contaiminants of concern for the Project. The more of this material above water the more metail leaching is expected to occur.	High best		Added after the workshop. Based on the quantity of Non-Pag materials above final closure water levels
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.

Indicator	Rationale	Rank order	Unit	Comment
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.
Tailings delivery and deposition system - Design	Related to the type, capacity, location and containment required.	High best		Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Terrestrial life and habitat	Facilities that affect terrestrial fauna and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Third-party reviews	The frequency for third-party reviews will depend on the complexities of the facility in terms of the design, construction, operation and closure.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix C.2 Technical Characterization

Indicator	Rationale	Rank order	Unit	Comment
Additional site investigation	Additional studies to determine foundation conditions. Related to the number of studies (e.g. CPT and lab studies) required to better characterize the foundation and deposited materials.	High best	-	Assumed to be related to the overall footprint of the facility.
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.
Capacity vs Dam construction ratio	Higher ratios indicate a better use of the natural topography for tailings/ materials deposition.	High best		Ruled out prior to the workshop. Since required capacity is considered to be the same for all alternatives, it is assumed the indicator is included within indicator 39 ("Embankment Volume").
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Compliance with industry good practice	Compliance with industry good practice includes tailings design guidelines, corporate guidelines and local/ national regulations.	High best	-	Ruled out prior to the workshop. All alternatives are to be designed to comply with good industry practices, guidelines and recommendations.
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.
Construction constraints	Related to the potential constraints and complexities related to the different construction tasks.	High best	-	Dam construction might pose higher risks of construction constrains, while alternative 5 do not require retaining structures.
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.
Construction time	Related with earthworks, lining placement, ancillary infrastructure, pipeline and pumping	High best	-	Assumed to be related to the embankment volume and the overall footprint (higher liner area requirements, infrastructure construction, etc.).
Containment structure design	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Higher structures require more complex designs.
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.

Indicator	Rationale	Rank order	Unit	Comment
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.
Distance between existing roads and the facility	Related to the need to build new roads or the possibility to use existing ones, depending on the facility location from existing access roads.	High best		Ruled-out during the workshop (all alternatives score equal).
Distance between the Coal Process Plant and the facility	Higher distances represent more complex delivery system designs, higher transportation costs and maintenance.	High best	-	Due to the process plant location, all alternatives pose similar distances. Alternative 5 requires less complex delivery systems and lower transportation costs due to digs backfilling.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Distance to streams/water reservoir/waterbodies	Facilities near streams/ water reservoir/ waterbodies require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. Assumed to be included within "Distance between the nearest waterway and the facility" Indicator.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).
Economic benefits	Partnerships, royalties, lease payments, compensation and benefit agreements	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.
Embankment height	Higher embankments are more complex, pose greater risks, require more construction material, and require more operation, maintenance and surveillance.	High best	-	Alternative 5 do not require retaining structures. Alternatives 4 and EAC Submitted Option have similar EMP maximum height centerline (about 36m), while the highest Alternative 2 structure is the NMP (about 44m).
Embankment volume	Volume of material required for the dam raise to provide containment for the target storage capacity.	High best	-	Alternatives 4 and EAC Submitted Option require similar dam and buttress volumes (about 20Mm3), and are both lower than the Alternative 2 requirement (about 27Mm3). The volume for the alternative 5 is the excavation amount required to make the PAG fit in the external holes (which is
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Flexibility to expand the storage capacity	Related to the possibility of increasing the storage capacity of the facility considering technical and topographic constraints.	High best	-	Small changes are required in every option for expansion. Alternative 5 will require additional digging for placing material, so it's considered to has the worst scoring. Alternative 4 is the best since construction at north of WMP and EMP is easier due to the relative location of the NMP and TCP. In the EAC Submitted Option, storage capacity might be expanded by placing material over the TCP and constructing a new one northern (downstream).

Indicator	Rationale	Rank order	Unit	Comment
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.
Geographical boundaries	Facilities that affect or are nearby country, provincial, territorial and municipal boundaries, land claim, land use, cadastral or other re-defined boundaries pose more complexities in the design, construction, operation and reclamation stages.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks)
Geotechnical conditions - Cavity formation		High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Impermeabilization Requirements	Related to the design of the liner. More complex liners require greater construction complexities and costs.	High best		Ruled-out during the workshop (covered in the other impermeabilization indicators).
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.
Interference with existing roads	Related to the usage of existing roads affecting local communities circulation.	High best		Ruled-out during the workshop (all alternatives will equally affect the usage of existing roads).
Interference with exploration/exploitation areas	A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.	High best	-	Ruled out prior to the workshop. Considered as a fatal-flaw.
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.

Indicator	Rationale	Rank order	Unit	Comment
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Physical interference with existing infrastructure (constraints)	Interferences with roads, monitoring systems, fences, surrounding features, pumping systems etc.	High best		Ruled-out during the workshop (none of the alternatives interfere with existing infrastructure).
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.
Project-specific technologies - Precedents of usage	Related to emerging/ not proven technologies for the project-specific conditions.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.
QA/QC requirements for segregating non-PAG from PAG	Testing requirements for PAG and non-PAG is a critical element for understanding of the alternatives	High best		Added after the workshop. Alt 5 would score the lowest due to the amount of overburden non-Pag material that needs to be tested.
Quantity of non-PAG materials produced that remain above the closure water table	Non-PAG materials are the main source of contaiminants of concern for the Project. The more of this material above water the more metail leaching is expected to occur.	High best		Added after the workshop. Based on the quantity of Non-Pag materials above final closure water levels
Rip-rap material requirement	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best	-	Added after the workshop. Material for spillway and other ancillary structures.

Indicator	Rationale	Rank order	Unit	Comment
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.
Road access to the facility	Related to earthworks to construct access roads to the intermediate berms and crest of the embankment.	High best		Ruled-out during the workshop (all alternatives score equal).
Seasonality	Sensitivity of the construction to the site-specific climate conditions.	High best	-	Alternative 5 scores better since digging is less affected by seasonality, while other alternatives require dams to be built. EAC submitted option scores slightly better regarding the overall footprint and infrastructure required (compared to alternative 4), and the lower dam height (compared to alternative 2). In terms of liner, all alternatives have similar requirements.
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.
Snow drifting		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Special features	Includes seismicity, avalanches, permafrost, radioactivity.	High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Stream diversion required		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Surplus material storage	Related to the amount of surplus material from the borrow source to be temporary or permanently stacked.	High best	-	
Tailings beach management	Monitoring and surveillance of the tailings beach parameters	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Tailings delivery and deposition system - Pipeline elevation difference between the process plant and the deposition area	Higher pipeline elevation differences represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	m	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Topography	Facilities constructed in complex reliefs and topographies are more complex for the design and construction of the facility, ancillary infrastructure and access roads, pose greater risk and complexities during materials deposition, maintenance and surveillance.	High best	-	Not used - Not assessed due to project characteristics.
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Waste physical characterization	Includes grain size distribution, settlement rate and consolidation parameters.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.

Indicator	Rationale	Rank order	Unit	Comment
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix C.3 Economic Characterization

Indicator	Rationale	Rank order	Unit	Comment
Additional site investigation	Additional studies to determine foundation conditions. Related to the number of studies (e.g. CPT and lab studies) required to better characterize the foundation and deposited materials.	High best	-	Assumed to be related to the overall footprint of the facility.
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.
Borrow source quarry design	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best		Ruled-out during the workshop (no quarry design needed - Added as rip-rap requirements).
Capacity vs Dam construction ratio	Higher ratios indicate a better use of the natural topography for tailings/ materials deposition.	High best		Ruled out prior to the workshop. Since required capacity is considered to be the same for all alternatives, it is assumed the indicator is included within indicator 39 ("Embankment Volume").
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Community/Local community land/mineral use rights	Includes formal or informal agreements and grandfathered agreements	High best	-	Ruled out prior to the workshop for not being applicable to the project characteristics.
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.
Construction time	Related with earthworks, lining placement, ancillary infrastructure, pipeline and pumping	High best	-	Assumed to be related to the embankment volume and the overall footprint (higher liner area requirements, infrastructure construction, etc.).
Containment structure design	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Higher structures require more complex designs.
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.

Indicator	Rationale	Rank order	Unit	Comment
Distance between existing roads and the facility	Related to the need to build new roads or the possibility to use existing ones, depending on the facility location from existing access roads.	High best		Ruled-out during the workshop (all alternatives score equal).
Distance between the Coal Process Plant and the facility	Higher distances represent more complex delivery system designs, higher transportation costs and maintenance.	High best	-	Due to the process plant location, all alternatives pose similar distances. Alternative 5 requires less complex delivery systems and lower transportation costs due to digs backfilling.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Distance to streams/water reservoir/waterbodies	Facilities near streams/ water reservoir/ waterbodies require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. Assumed to be included within "Distance between the nearest waterway and the facility" Indicator.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).
Economic benefits	Partnerships, royalties, lease payments, compensation and benefit agreements	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.
Embankment volume	Volume of material required for the dam raise to provide containment for the target storage capacity.	High best	-	Alternatives 4 and EAC Submitted Option require similar dam and buttress volumes (about 20Mm3), and are both lower than the Alternative 2 requirement (about 27Mm3). The volume for the alternative 5 is the excavation amount required to make the PAG fit in the external holes (which is
Employment	Short and long-term opportunities, 'boom-and-bust' cycles	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Flexibility to expand the storage capacity	Related to the possibility of increasing the storage capacity of the facility considering technical and topographic constraints.	High best	-	Small changes are required in every option for expansion. Alternative 5 will require additional digging for placing material, so it's considered to has the worst scoring. Alternative 4 is the best since construction at north of WMP and EMP is easier due to the relative location of the NMP and TCP. In the EAC Submitted Option, storage capacity might be expanded by placing material over the TCP and constructing a new one northern (downstream).
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.

Indicator	Rationale	Rank order	Unit	Comment
Geotechnical conditions - Cavity formation		High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Impermeabilization Requirements	Related to the design of the liner. More complex liners require greater construction complexities and costs.	High best		Ruled-out during the workshop (covered in the other impermeabilization indicators).
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.
Interference with exploration/exploitation areas	A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.	High best	-	Ruled out prior to the workshop. Considered as a fatal-flaw.
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.

Indicator	Rationale	Rank order	Unit	Comment
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.
Project-specific technologies - Precedents of usage	Related to emerging/ not proven technologies for the project-specific conditions.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.
QA/QC requirements for segregating non-PAG from PAG	Testing requirements for PAG and non-PAG is a critical element for understanding of the alternatives	High best		Added after the workshop. Alt 5 would score the lowest due to the amount of overburden non-Pag material that needs to be tested.
Rip-rap material requirement	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best	-	Added after the workshop. Material for spillway and other ancillary structures.
Road access to the facility	Related to earthworks to construct access roads to the intermediate berms and crest of the embankment.	High best		Ruled-out during the workshop (all alternatives score equal).
Seasonality	Sensitivity of the construction to the site-specific climate conditions.	High best	-	Alternative 5 scores better since digging is less affected by seasonality, while other alternatives require dams to be built. EAC submitted option scores slightly better regarding the overall footprint and infrastructure required (compared to alternative 4), and the lower dam height (compared to alternative 2). In terms of liner, all alternatives have similar requirements.
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.
Snow drifting		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Stream diversion required		High best		Ruled out prior to the workshop. Not applicable to project characteristics.
Surplus material storage	Related to the amount of surplus material from the borrow source to be temporary or permanently stacked.	High best	-	
Tailings beach management	Monitoring and surveillance of the tailings beach parameters	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.

Indicator	Rationale	Rank order	Unit	Comment
Tailings delivery and deposition system - Pipeline length	Larger pipeline length represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	km	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Time of legal and financial requirements and expected legal complexities	Degree of difficulty in obtaining approvals for construction and operation of the facility.	High best	-	The largest disturbance was felt to have the most dificulty in obtaining approvals and alternative 4 was felt more difficult as facilities are spread out.
Topography	Facilities constructed in complex reliefs and topographies are more complex for the design and construction of the facility, ancillary infrastructure and access roads, pose greater risk and complexities during materials deposition, maintenance and surveillance.	High best	-	Not used - Not assessed due to project characteristics.
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Waste physical characterization	Includes grain size distribution, settlement rate and consolidation parameters.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix C.4 Socio-Economic Characterization

Indicator	Rationale	Rank order	Unit	Comment
Aesthetics - Landforming engineering	Facilities with slopes that differ from the natural relief pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the distance between structures of the facility and the overall footprint. Also related to height and number of strutures for reclamation.
Aesthetics - Line of sight (distance)	Facilities near existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best		Ruled-out during the workshop (none of the facilities alternative is visible from either Smithers and/or Telkwa).
Aesthetics - Line of sight (elevation difference)	Facilities with higher elevation differences with existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest structure height and it's distance to Tenas Creek. TCP of alternative 4 is the closest one to Tenas Creek, and alternative 5 has the highest waste rock dumps.
Aesthetics - Re-vegetation	Facilities with slope covers that differ from the natural environment pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest distrubance and variety of slopes and landforms in closure.
Aquatic life and habitat	Facilities that affect aquatic fauna and their natural habitat pose greater environmental impacts.	High best		Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Aquatic life and habitat (endangered/protected fauna)	Facilities near to the presence of endangered/protected aquatic fauna and their habitat pose greater environmental impacts and more complex water quality monitoring and water treatment.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected aquatic fauna and their habitat as there is no endangered aquatic fauna witin the Project Area.
Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	COPC are important to the effects assessment	High best		Added after the workshop. Larger material movement, closenes to waterbodies and size/height of impoundments effect this indicator.
Archaeological and traditional site nearby the facility	Related to the location, type and importance of known archaeological sites nearby the facility and the risk of unidentified archaeological sites.	High best	-	No archaeological and traditional site nearby the facility.
Atmospheric issues due to dam construction	Related to the amount of equipment mobilized for construction (trucks, compactors, blasting equipment, etc.) and its impact to air quality, noise and direct receptors (mine and construction personnel, wildlife, and nearby towns).	High best	-	Related to the materials needed and the dams/embankments volume for each alternative.
Bat and Bat Habitat	Bats have been identified by the regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options.
Bird life and habitat	Facilities that affect birds and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Related to the overall footprint of the facility and the impact on general birds life and their habitat.
Bird life and habitat (endangered/protected species)	Facilities near the presence of endangered/protected birds and their habitat pose greater environmental impacts and more complex air quality monitoring and materials deposition and dust control.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected birds and their habitat as there is no endangered birds and habitat witin the Project Area.
Capacity building	Training opportunities, contracting opportunities, community infrastructure	High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.
Caribou and Caribou Habitat	Caribou have been identified by First Nations, public and regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options

Indicator	Rationale	Rank order	Unit	Comment
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.
Community and stakeholders acceptance	Related to the apparent acceptance or distrust for each alternative.	High best	-	Higher dams are less accepted by community and stakeholders. Alternative 5 do not use embankments as retaining structures for processed materials.
Community safety	Construction methods, operational management of the facility, closure state of the facility.	High best	-	Higher dams pose higher risks (alternative 2 scores as the worst). The TCP of alternative 4 is close to Tenas Creek, and might pose higher risks and operation requirements.
Community/Local community land/mineral use rights	Includes formal or informal agreements and grandfathered agreements	High best	-	Ruled out prior to the workshop for not being applicable to the project characteristics.
Compliance with industry good practice	Compliance with industry good practice includes tailings design guidelines, corporate guidelines and local/ national regulations.	High best	-	Ruled out prior to the workshop. All alternatives are to be designed to comply with good industry practices, guidelines and recommendations.
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.
Distance to the nearest fresh water alluvium or wetland	Facilities near fresh water alluvium or wetlands require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. No recorded fresh water alluvium nor wetlands in the project location.
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).
Embankment height	Higher embankments are more complex, pose greater risks, require more construction material, and require more operation, maintenance and surveillance.	High best	-	Alternative 5 do not require retaining structures. Alternatives 4 and EAC Submitted Option have similar EMP maximum height centerline (about 36m), while the highest Alternative 2 structure is the NMP (about 44m).
Employment	Short and long-term opportunities, 'boom-and-bust' cycles	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.

Indicator	Rationale	Rank order	Unit	Comment
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.
Operational complexity in tailings deposition	Related to the need of adequate tailings freeboards and supernatant pond location during construction and operation	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.
Overall perceived socio-economic consequences, benefits and relative preferences		High best	-	Same for all alternatives.
Physical interference with existing infrastructure (constraints)	Interferences with roads, monitoring systems, fences, surrounding features, pumping systems etc.	High best		Ruled-out during the workshop (none of the alternatives interfere with existing infrastructure).
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds

Indicator	Rationale	Rank order	Unit	Comment
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.
Prevalent wind speed and direction	Facilities whose relative location to the mine camp and mine installations is aligned with the prevailing wind speed and direction present greater risks of affecting air quality and mine personnel.	High best	-	Similar for all alternatives. Alternative 5 scores worse due to the waste rock dumps and the overall footprint.
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.
Tailings delivery and deposition system - Design	Related to the type, capacity, location and containment required.	High best		Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Tailings delivery and deposition system - Pipeline length	Larger pipeline length represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	km	Ruled out prior to the workshop. Tailings are not a by product of the CPP.
Terrestrial life and habitat	Facilities that affect terrestrial fauna and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Third-party reviews	The frequency for third-party reviews will depend on the complexities of the facility in terms of the design, construction, operation and closure.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.

Appendix D Multiple-Accounts Ledges

Appendix D.1 Accounts and Sub-Accounts

Account	Sub-Account	Rationale
A1 - Environmental	Potential air quality impacts	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Appendix D.2 Sub-Accounts and Indicators

Sub-Account	Indicator	Account
Capex Requirements	Additional site investigation	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	A3 - Economic
Capex Requirements	Borrow source location	A3 - Economic
Capex Requirements	Borrow source material availability	A3 - Economic
Capex Requirements	Construction time	A3 - Economic
Capex Requirements	Containment structure design	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	A3 - Economic
Capex Requirements	Embankment volume	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	A3 - Economic
Capex Requirements	Impermeabilization area requirements	A3 - Economic
Capex Requirements	Impermeabilization Thickness	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	A3 - Economic
Capex Requirements	Materials delivery and deposition system	A3 - Economic
Capex Requirements	Number of ponds	A3 - Economic
Capex Requirements	QA/QC Requirements	A3 - Economic
Capex Requirements	Rip-rap material requirement	A3 - Economic
Capex Requirements	Seasonality	A3 - Economic
Capex Requirements	Surplus material storage	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	A3 - Economic
Capex Requirements	Topography	A3 - Economic
Closure and Post-Closure Costs	Closure design	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	A3 - Economic
Closure and Post-Closure Costs	Topography	A3 - Economic
Closure and Post-Closure Costs	Vegetation	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	A3 - Economic
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	A2 - Technical
Closure design and requirements	Overall Catchment Area	A2 - Technical
Closure design and requirements	Overall footprint of the facility	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	A2 - Technical
Closure design and requirements	Closure design	A2 - Technical
Closure plan implementation	Closure design	A4 - Socio-Economic
Closure plan implementation	Number of ponds	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	A4 - Socio-Economic
Closure plan implementation	Water management system design	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Closure plan implementation	Aesthetics - Re-vegetation	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	A4 - Socio-Economic
Community perception and safety	Community safety	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	A4 - Socio-Economic
Community perception and safety	Vegetation	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	A2 - Technical
Complete system flexibility	Topography	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	A1 - Environmental
Design and construction impacts	Borrow source location	A1 - Environmental
Design and construction impacts	Borrow source material availability	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	A1 - Environmental
Design and construction impacts	Number of embankments	A1 - Environmental
Design and construction impacts	Number of ponds	A1 - Environmental
Design and construction impacts	QA/QC Requirements	A1 - Environmental

Sub-Account	Indicator	Account
Design and construction impacts	Risk of cascade embankment failure	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	A2 - Technical
Infrastructure requirements	Topography	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	A2 - Technical
Mine materials management	Materials delivery and deposition system	A2 - Technical
Mine materials management	Operational complexity in materials deposition	A2 - Technical
Mine materials management	Overall footprint of the facility	A2 - Technical
Mine materials management	Surplus material storage	A2 - Technical
Mine materials management impacts	Materials delivery and deposition system	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	A1 - Environmental
Monitoring & Surveillance	Embankment height	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	A2 - Technical
Monitoring & Surveillance	Number of embankments	A2 - Technical
Monitoring & Surveillance	Number of ponds	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	A3 - Economic
Opex Requirements	Groundwater conditions	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	A3 - Economic
Opex Requirements	Materials delivery and deposition system	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	A3 - Economic
Opex Requirements	Pond water management	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	A4 - Socio-Economic
Post closure water management	Groundwater conditions	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	A4 - Socio-Economic
Post closure water management	Pond water management	A4 - Socio-Economic
Post closure water management	Water management system design	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from disch	A4 - Socio-Economic
Post-closure land use	Closure design	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	A1 - Environmental
Post-closure land use	Overall footprint of the facility	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	A1 - Environmental
Post-closure land use	Aesthetics - Re-vegetation	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	A1 - Environmental

Sub-Account	Indicator	Account
Potential groundwater impacts	Distance between the nearest waterway and the facility	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	A1 - Environmental
Potential impacts to receptors	Vegetation	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from disch	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	A1 - Environmental
Potential surface water impacts	Pond water management	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	A2 - Technical
Seepage and groundwater control	Groundwater conditions	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	A2 - Technical
Seepage and groundwater control	Water management system design	A2 - Technical
Storage Facility Construction	Borrow source material availability	A2 - Technical
Storage Facility Construction	Construction constraints	A2 - Technical
Storage Facility Construction	Construction time	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	A2 - Technical
Storage Facility Construction	Embankment volume	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	A2 - Technical
Storage Facility Construction	QA/QC Requirements	A2 - Technical
Storage Facility Construction	Seasonality	A2 - Technical
Storage Facility Construction	Surplus material storage	A2 - Technical
Storage Facility Construction	Topography	A2 - Technical
Storage Facility Design	Borrow source location	A2 - Technical
Storage Facility Design	Borrow source material availability	A2 - Technical
Storage Facility Design	Containment structure design	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	A2 - Technical
Storage Facility Design	Embankment height	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	A2 - Technical
Storage Facility Design	Number of embankments	A2 - Technical
Storage Facility Design	Number of ponds	A2 - Technical
Storage Facility Design	Overall Catchment Area	A2 - Technical
Storage Facility Design	Overall footprint of the facility	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	A2 - Technical
Storage Facility Design	Topography	A2 - Technical
Storage Facility Design	Water management system design	A2 - Technical
Storage Facility Design	Additional site investigation	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	A2 - Technical
Surface water management	Number of ponds	A2 - Technical
Surface water management	Overall Catchment Area	A2 - Technical
Surface water management	Overall footprint of the facility	A2 - Technical
Surface water management	Water management system design	A2 - Technical
Design and construction impacts	Construction methodology of non-PAG storage piles	A1 - Environmental
Storage Facility Construction	Construction methodology of non-PAG storage piles	A2 - Technical
Permitting complexity and delays	Construction methodology of non-PAG storage piles	A4 - Socio-Economic
Potential groundwater impacts	Coverage of Open Pit walls	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	A1 - Environmental
Closure design and requirements	Coverage of Open Pit walls	A2 - Technical
Closure and Post-Closure Costs	Coverage of Open Pit walls	A3 - Economic
Closure plan implementation	Coverage of Open Pit walls	A4 - Socio-Economic

Sub-Account	Indicator	Account
Mine materials management impacts	Design Criteria - maitenance of water cover	A1 - Environmental
Mine materials management	Design Criteria - maitenance of water cover	A2 - Technical
Opex Requirements	Design Criteria - maitenance of water cover	A3 - Economic
Potential surface water impacts	Diversion structures design, construction and maintenance	A1 - Environmental
Community perception and safety	Embankment height	A4 - Socio-Economic
Capex Requirements	Flexibility to expand the storage capacity	A3 - Economic
Design and construction impacts	Impermeabilization area requirements	A1 - Environmental
Design and construction impacts	Impermeabilization Thickness	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	A1 - Environmental
Community perception and safety	Maintenance of traditional lifestyle	A4 - Socio-Economic
Mine materials management impacts	Non-PAG material Segregation	A1 - Environmental
Mine materials management	Non-PAG material Segregation	A2 - Technical
Opex Requirements	Non-PAG material Segregation	A3 - Economic
Closure plan implementation	Non-PAG material Segregation	A4 - Socio-Economic
Community perception and safety	Number of embankments	A4 - Socio-Economic
Mine materials management	Pond water management	A2 - Technical
Closure design and requirements	Pond water management	A2 - Technical
Closure and Post-Closure Costs	Post-closure risk and uncertainties	A3 - Economic
Permitting complexity and delays	Prevalent wind speed and direction	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	A4 - Socio-Economic
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	A2 - Technical
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	A3 - Economic
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	A1 - Environmental
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	A2 - Technical
Capex Requirements	Rip-rap material requirement	A3 - Economic
Community perception and safety	Risk of cascade embankment failure	A4 - Socio-Economic
Opex Requirements	Seepage from the facility to groundwater system	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	A3 - Economic
Community perception and safety	Terrestrial life and habitat	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	A4 - Socio-Economic
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	A2 - Technical
Potential groundwater impacts	Water management system design	A1 - Environmental
Potential surface water impacts	Water management system design	A1 - Environmental
Capex Requirements	Water management system design	A3 - Economic

Appendix E Value-Based Decision Process

Appendix E.1 Scoring for Indicators

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Additional site investigation	Additional studies to determine foundation conditions. Related to the number of studies (e.g. CPT and lab studies) required to better characterize the foundation and deposited materials.	High best	-	Assumed to be related to the overall footprint of the facility.	4	2	3	3
Aesthetics - Landforming engineering	Facilities with slopes that differ from the natural relief pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the distance between structures of the facility and the overall footprint. Also related to height and number of strutures for reclamation.	4	5	3	2
Aesthetics - Line of sight (distance)	Facilities near existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best		Ruled-out during the workshop (none of the facilities alternative is visible from either Smithers and/or Telkwa).				
Aesthetics - Line of sight (elevation difference)	Facilities with higher elevation differences with existing public roads or towns are more visible, representing higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest structure height and it's distance to Tenas Creek. TCP of alternative 4 is the closest one to Tenas Creek, and alternative 5 has the highest waste rock dumps.	5	5	1	2
Aesthetics - Re-vegetation	Facilities with slope covers that differ from the natural environment pose higher aesthetic impacts and perception from the stakeholders.	High best	-	Related to the highest distrubance and variety of slopes and landforms in closure.	5	4	3	2
Ancillary infrastructure design, construction and maintenance	Related to the type, sizing, construction material and substrate required.	High best	-	Assumed to be related to the overall footprint and connections between structures.	5	5	2	2
Aquatic life and habitat	Facilities that affect aquatic fauna and their natural habitat pose greater environmental impacts.	High best		Related to the overall footprint of the facility and the impact on general birds life and their habitat.	5	6	3	1
Aquatic life and habitat (endangered/protected fauna)	Facilities near to the presence of endangered/protected aquatic fauna and their habitat pose greater environmental impacts and more complex water quality monitoring and water treatment.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected aquatic fauna and their habitat as there is no endangered aquatic fauna witin the Project Area.	6	6	6	6
Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	COPC are important to the effects assessment	High best		Added after the workshop. Larger material movement, closenes to waterbodies and size/height of impoundments effect this indicator.	5	3	3	2
Archaeological and traditional site nearby the facility	Related to the location, type and importance of known archaeological sites nearby the facility and the risk of unidentified archaeological sites.	High best	-	No archaeological and traditional site nearby the facility.	6	6	6	6
Atmospheric issues due to dam construction	Related to the amount of equipment mobilized for construction (trucks, compactors, blasting equipment, etc.) and its impact to air quality, noise and direct receptors (mine and construction personnel, wildlife, and nearby towns).	High best	-	Related to the materials needed and the dams/embankments volume for each alternative.	5	5	3	2
Bat and Bat Habitat	Bats have been identified by the regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options.	4	5	3	2
Bird life and habitat	Facilities that affect birds and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Related to the overall footprint of the facility and the impact on general birds life and their habitat.	5	6	3	1
Bird life and habitat (endangered/protected species)	Facilities near the presence of endangered/protected birds and their habitat pose greater environmental impacts and more complex air quality monitoring and materials deposition and dust control.	High best	-	Added after the workshop. The facilities have the same risk to affect endangered/protected birds and their habitat as there is no endangered birds and habitat witin the Project Area.	6	6	6	6
Borrow source location	Borrow sources far away from the facility result in greater haulage costs and construction schedule due to higher haulage distances and the need of more trucks.	High best	-	Borrow source is the open-pit. Scoring related to the relative distance to the pit.	5	5	3	6
Borrow source material availability	The need to use of overburden material and/ or waste rock material from a not-yet exploited open pit results in the need of better understanding the mine plan to ensure material availability when needed. This may also represent the need to construct successive raises to ensure continuous material deposition.	High best	-	Related to the embankment volumes and the overall mine plan. Borrow source is the open-pit, and overburden material is suitable for construction of all alternatives.	5	5	3	2
Borrow source quarry design	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best		Ruled-out during the workshop (no quarry design needed - Added as rip-rap requirements).				
Capacity building	Training opportunities, contracting opportunities, community infrastructure	High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.				
Capacity vs Dam construction ratio	Higher ratios indicate a better use of the natural topography for tailings/ materials deposition.	High best		Ruled out prior to the workshop. Since required capacity is considered to be the same for all alternatives, it is assumed the indicator is included within indicator 39 ("Embankment Volume").				

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Caribou and Caribou Habitat	Caribou have been identified by First Nations, public and regulators as having special significance	High best		Added after the workshop. Larger footprint and spatial sprawl both negatively effect scoring of options	4	5	3	2
Closure design	Includes the closure objectives and tentative construction materials to be used.	High best	-	Alternative 5 has the better scoring since backfilling of digs is achieved during mine operation. Alternatives 2 and 4 have the highest dams and the biggest overall footprint.	4	1	2	6
Community and stakeholders acceptance	Related to the apparent acceptance or distrust for each alternative.	High best	-	Higher dams are less accepted by community and stakeholders. Alternative 5 do not use embankments as retaining structures for processed materials.	3	1	3	6
Community safety	Construction methods, operational management of the facility, closure state of the facility.	High best	-	Higher dams pose higher risks (alternative 2 scores as the worst). The TCP of alternative 4 is close to Tenas Creek, and might pose higher risks and operation requirements.	2	1	4	6
Community/Local community land/mineral use rights	Includes formal or informal agreements and grandfathered agreements	High best	-	Ruled out prior to the workshop for not being applicable to the project characteristics.				
Compliance with industry good practice	Compliance with industry good practice includes tailings design guidelines, corporate guidelines and local/ national regulations.	High best	-	Ruled out prior to the workshop. All alternatives are to be designed to comply with good industry practices, guidelines and recommendations.				
Consequence Category as per ANCOLD / CDA / GISTM / etc	Consequence Category for each alternative and associated flood and seismic design events and slope stability scenarios and target FoS.	High best	-	Ruled out prior to the workshop. Despite having different consequence categories, all alternatives are to be designed to meet the requirements.				
Construction constraints	Related to the potential constraints and complexities related to the different construction tasks.	High best	-	Dam construction might pose higher risks of construction constrains, while alternative 5 do not require retaining structures.	4	4	4	6
Construction methodology of non-PAG storage piles	Constructing the non-PAG storage piles in a bottom up fashion using thinner lifts and allowing low levels of oxygen to ingress into the facilities	High best		Added after the workshop. All will score high as it is possible for options to construction non-PAG material piles in this fashion.	5	5	5	5
Construction time	Related with earthworks, lining placement, ancillary infrastructure, pipeline and pumping	High best	-	Assumed to be related to the embankment volume and the overall footprint (higher liner area requirements, infrastructure construction, etc.).	5	5	3	3
Containment structure design	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Higher structures require more complex designs.	4	3	5	6
Corporate Tailings Engineer involvement	Monitoring and surveillances tasks of the RTFE and the AE.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.				
Coverage of Open Pit walls	Covering the open pit walls is considered a critical mitigation to ensure that they do not generate acid rock drainage in the long term by providing basic drainage for the open pit walls.	High best		Added after the workshop. All will score high as the plan is to cover the walls.	5	5	5	5
Design Criteria - maitenance of water cover	Water cover is critical for keeping PAG materials submerged underwater for permanent storage.	High best		Added after the workshop. Releated to the number of ponds to maintain and if any ponds do not have a passive system for receiving water such as configuration 2.	5	1	3	2
Distance between existing roads and the facility	Related to the need to build new roads or the possibility to use existing ones, depending on the facility location from existing access roads.	High best		Ruled-out during the workshop (all alternatives score equal).				
Distance between the Coal Process Plant and the facility	Higher distances represent more complex delivery system designs, higher transportation costs and maintenance.	High best	-	Due to the process plant location, all alternatives pose similar distances. Alternative 5 requires less complex delivery systems and lower transportation costs due to digs backfilling.	4	4	4	5
Distance between the nearest waterway and the facility	Facilities near waterways require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	-	Waterways are considered to be the Tenas and Four Creeks. Alternative 4 has a lower score since it's TCP is closer to the Tenas Creek at the north of the facility.	2	2	1	2
Distance to streams/water reservoir/waterbodies	Facilities near streams/ water reservoir/ waterbodies require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. Assumed to be included within "Distance between the nearest waterway and the facility" Indicator.				
Distance to the nearest fresh water alluvium or wetland	Facilities near fresh water alluvium or wetlands require more stringent water quality monitoring and surveillance, and more complex surface and groundwater management.	High best	km	Ruled out prior to the workshop. No recorded fresh water alluvium nor wetlands in the project location.				
Diversion structures design, construction and maintenance	Related to sizing, hydraulic capacity, construction materials and substrate required.	High best	-	Alternative 5 scores worst due to the number of structures. Alternatives 2 and the EAC submitted option are quite similar, and differ from alternative 4 since this last one has more separated structures and bigger catchment area.	6	6	4	1

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Ecological/ cultural values	Value of land, value of water, value of aquatic, bird or terrestrial species, value of lifestyle.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks).				
Economic benefits	Partnerships, royalties, lease payments, compensation and benefit agreements	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.				
Embankment height	Higher embankments are more complex, pose greater risks, require more construction material, and require more operation, maintenance and surveillance.	High best	-	Alternative 5 do not require retaining structures. Alternatives 4 and EAC Submitted Option have similar EMP maximum height centerline (about 36m), while the highest Alternative 2 structure is the NMP (about 44m).	4	2	4	6
Embankment length	Larger embankments are more complex, pose greater risks, require more construction materials, require a larger footprint and require more operation, maintenance and surveillance.	High best		Screened-out prior to the workshop. Assumed to be included within indicators related to embankment characteristics, OM&S requirements and overall footprint of the facility.				
Embankment volume	Volume of material required for the dam raise to provide containment for the target storage capacity.	High best	-	Alternatives 4 and EAC Submitted Option require similar dam and buttress volumes (about 20Mm3), and are both lower than the Alternative 2 requirement (about 27Mm3). The volume for the alternative 5 is the excavation amount required to make the PAG fit in the external holes (which is	5	3	5	1
Employment	Short and long-term opportunities, 'boom-and-bust' cycles	High best	-	Ruled out prior to the workshop. Assumed there is no difference between the different alternatives.				
Engineer of Record (EOR) involvement	Monitoring and surveillances tasks of the EOR.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.				
Flexibility to expand the storage capacity	Related to the possibility of increasing the storage capacity of the facility considering technical and topographic constraints.	High best	-	Small changes are required in every option for expansion. Alternative 5 will require additional digging for placing material, so it's considered to has the worst scoring. Alternative 4 is the best since construction at north of WMP and EMP is easier due to the relative location of the NMP and TCP. In the EAC Submitted Option, storage capacity might be expanded by placing material over the TCP and constructing a new one northern (downstream).	4	2	5	1
Geochemical characterization of all construction materials and associated excavation waste	This includes unsuitable soils stripped from foundations, quarries, or other borrow sources. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG for the EACA and planning purposes, however materials will be subject to the verification testing during the Operation phase provided in the ML/ARD management plan for the final determination of PAG and non-PAG materials.	High best	-	Related to the required costs and resources for testing materials. Alternative 5 has a different score due to testing of material extracted from digging for processed material placing.	6	6	6	4
Geographical boundaries	Facilities that affect or are nearby country, provincial, territorial and municipal boundaries, land claim, land use, cadastral or other re-defined boundaries pose more complexities in the design, construction, operation and reclamation stages.	High best	-	Ruled out prior to the workshop. All alternatives are located within the same geographical boundaries (within the Tenas and Four Creeks)				
Geotechnical conditions - Cavity formation		High best	-	Ruled out prior to the workshop. Not assessed due to project characteristics.				
Geotechnical conditions of the foundation	Geological setting, depth of overburden and/ or permafrost, fault/fracture zones. Facilities constructed on poor foundation conditions are more complex, pose greater seepage and stability risks, require more construction material and/ or a more stringent construction procedure and cut and fill works, and require more operation, maintenance and surveillance.	High best	-	Related to the available testing information, which is assumed to be dependant on the overall footprint.	5	4	2	2
Groundwater conditions	Areas with shallow groundwater or the presence of perched water tables and springs/ artesian wells require a more stringent groundwater quality monitoring and groundwater management.	High best	-	Assumed to be related to the water table. Alternative 5 differs from the other ones since digging is needed for placing material, and groundwater management would be more complex.	3	3	3	2
Impermeabilization area requirements	Related to the area that needs to be lined. Higher areas represent greater construction complexities and costs.	High best	-	Related to the area that needs to be lined.	2	3	2	4
Impermeabilization Requirements	Related to the design of the liner. More complex liners require greater construction complexities and costs.	High best		Ruled-out during the workshop (covered in the other impermeabilization indicators).				

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Impermeabilization Thickness	Related to thickness of the liner. Thicker liners require greater construction complexities and costs.	High best	-	Liner thickness requirement assumed to be the same for all alternatives involving retaining structures, but might be lower for the alternative 5 due to the lower hydraulic gradient.	3	3	3	4
Impermeabilization topographic complexities	Related to the topographic constraints for the area that needs to be lined. Steeper slopes represent greater construction complexities and costs.	High best	-	Assumed to be similar for all alternatives, excluding alternative 5 due to the complexities of lining a dig with steeper slopes.	3	3	3	2
Instrumentation requirements and Operation, Maintenance and Surveillance	Instrumentation requirements associated with monitoring and surveillance tasks. Higher and larger facilities and/ or facilities with higher consequence categories require more instrumentation and OM&S tasks.	High best	-	Alternative 5 requires less OM&S since no retaining structure is built.	2	2	2	5
Interference with existing roads	Related to the usage of existing roads affecting local communities circulation.	High best		Ruled-out during the workshop (all alternatives will equally affect the usage of existing roads).				
Interference with exploration/exploitation areas	A candidate alternative that places a permanent storage pile over an area where there are proven indicators of mineralization, or a reasonable indication of possible mineralization based on regional trends, sterilizes these for future generations.	High best	-	Ruled out prior to the workshop. Considered as a fatal-flaw.				
Maintenance of traditional lifestyle	Loss of hunting, fishing or natural food harvesting, loss of access, etc.	High best	-	Considered to be similar for all alternatives, except for alternative 5 that has a greater footprint and largest open pit water footprint after closure.	6	6	5	4
Materials delivery and deposition system	Related to the delivery and deposition of different material streams excluding conventional slurry tailings. This includes hauling's and deposition via haul trucks, conveyor belts, etc.	High best	-	Similar for all alternatives. Alternative 4 has a worse scoring due to the distance to the NMP and TCP.	6	6	5	6
Non-PAG material Segregation	Having the ability to store higher sulphur non-PAG material in the core of storage piles or backfill is an important mitigation for potential metal leaching.	High best		Added after the workshop. Alt 5 will score the highest as it has the most overburden and facilities to store high sulphur non-PAG material within. Others should score relatively similar with the EAC option having a slight advantage with dams altogether.	5	4	4	6
Number of embankments	The need of more than one embankment represent more complexities and greater risks during construction, operation and closure.	High best	-	Alternative 5 has no retaining structures. Alternative 4 requires additional embankments for TCP and NMP when compared to the EAC Submitted Option. Alternative 2 involves digging and backfilling for the WMP.	3	4	1	6
Number of ponds	The need of more than one pond represents more complexities and greater risks during construction, operation, and closure.	High best	-	Alternative 5 involves a greater number of ponds, while the other alternatives require less ponds.	6	6	6	4
Operational complexity in materials deposition	Related to the need of adequate materials segregation during deposition.	High best	-	Less complex for alternative 5 since it involves backfilling of the digs.	4	4	4	6
Operational complexity in tailings deposition	Related to the need of adequate tailings freeboards and supernatant pond location during construction and operation	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Overall Catchment Area	Larger catchment areas represent more complex surface water management and higher surface water management structures (e.g., diversion channels, culverts).	High best	-	Alternative 5 has the biggest catchment area, followed by the alternative 4 option. Related to the overall footprint of the facility.	6	6	4	2
Overall footprint of the facility	Related to the overall affected land footprint size of impoundment, ancillary infrastructure and access roads. Larger footprints represent higher areas affected by the facility, are more complex and pose greater risk.	High best	-	Overall footprint of all required structures and facilities.	6	6	4	2
Overall perceived socio-economic consequences, benefits and relative preferences		High best	-	Same for all alternatives.	5	5	5	5
Physical interference with existing infrastructure (constraints)	Interferences with roads, monitoring systems, fences, surrounding features, pumping systems etc.	High best		Ruled-out during the workshop (none of the alternatives interfere with existing infrastructure).				
Pond water management	Related to the need of adequate pond water management from a physical and geochemical perspective. Water requirements to achieve PAG management and neutralization.	High best	-	Related to number of ponds	6	4	5	6
Post-closure maintenance and monitoring requirements	Related to the amount of effort that is required to ensure a safe and resilient structure(s) into the foreseeable future	High best	-	The higher the embankment, the higher the risks, and though the maintenance and monitoring requirements. Alternative 5 do not require retaining structures.	2	1	2	6
Post-closure risk and uncertainties	Related to the risk and uncertainties that can appear at a post closure stage	High best	-	The higher the embankment, the higher the risks. Alternative 5 do not require retaining structures.	3	3	4	6
Prevalent wind speed and direction	Facilities whose relative location to the mine camp and mine installations is aligned with the prevailing wind speed and direction present greater risks of affecting air quality and mine personnel.	High best	-	Similar for all alternatives. Alternative 5 scores worse due to the waste rock dumps and the overall footprint.	6	6	6	5

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Previous and existing land use	Recreation/ tourism, spiritual well being, mining, industry, hunting, fishing.	High best	-	Related to the overall footprint of the facility and area of open water left in closure.	6	6	5	4
Project-specific technologies - Precedents of usage	Related to emerging/ not proven technologies for the project-specific conditions.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.				
QA/QC Requirements	Related to QA/QC requirements during construction. Embankments constructed with or on top of poor materials require stringent QA/QC.	High best	-	All retaining structures require same QA/QC. Liner installation is the critical aspect during construction and needs a stringent QA/QC.	2	2	2	4
QA/QC requirements for segregating non-PAG from PAG	Testing requirements for PAG and non-PAG is a critical element for understanding of the alternatives	High best		Added after the workshop. Alt 5 would score the lowest due to the amount of overburden non-Pag material that needs to be tested.	6	6	6	4
Quantity of non-PAG materials produced that remain above the closure water table	Non-PAG materials are the main source of contaiminants of concern for the Project. The more of this material above water the more metail leaching is expected to occur.	High best		Added after the workshop. Based on the quantity of Non-Pag materials above final closure water levels	5	5	5	2
Rip-rap material requirement	Related to the size, volumes extracted, development methods, water management and rehabilitation.	High best	-	Added after the workshop. Material for spillway and other ancillary structures.	6	6	4	1
Risk of cascade embankment failure	Related to the risk of a cascade embankment failure	High best	-	EAC Submitted Option has the greater risk of cascade failure. Alternative 4 still has a risk of cascade failure if WMP or EMP fail and the released materials get to the NMP or TCP.	2	3	5	6
Road access to the facility	Related to earthworks to construct access roads to the intermediate berms and crest of the embankment.	High best		Ruled-out during the workshop (all alternatives score equal).				
Seasonality	Sensitivity of the construction to the site-specific climate conditions.	High best	-	Alternative 5 scores better since digging is less affected by seasonality, while other alternatives require dams to be built. EAC submitted option scores slightly better regarding the overall footprint and infrastructure required (compared to alternative 4), and the lower dam height (compared to alternative 2). In terms of liner, all alternatives have similar requirements.	4	3	3	6
Seepage from the facility to groundwater system	Related to the potential impacts to the groundwater system.	High best	-	Alternative 4 places the TCP next to the Tenas Creek, involving higher potential risk of seepage impacting the groundwater system. Alternative 5 follows in scoring due to the overall footprint.	4	5	1	3
Snow drifting		High best		Ruled out prior to the workshop. Not applicable to project characteristics.				
Special features	Includes seismicity, avalanches, permafrost, radioactivity.	High best		Ruled out prior to the workshop. Not applicable to project characteristics.				
Stream diversion required		High best		Ruled out prior to the workshop. Not applicable to project characteristics.				
Surplus material storage	Related to the amount of surplus material from the borrow source to be temporary or permanently stacked.	High best	-		4	4	4	3
Tailings beach management	Monitoring and surveillance of the tailings beach parameters	High best	-	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Tailings delivery and deposition system - Design	Related to the type, capacity, location and containment required.	High best		Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Tailings delivery and deposition system - Pipeline elevation difference between the process plant and the deposition area	Higher pipeline elevation differences represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	m	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Tailings delivery and deposition system - Pipeline length	Larger pipeline length represent more complex pipeline layout, the need of more valves and pumps, pose greater risks and greater maintenance and surveillance.	High best	km	Ruled out prior to the workshop. Tailings are not a by product of the CPP.				
Terrestrial life and habitat	Facilities that affect terrestrial fauna and their natural habitat pose greater environmental impacts.	High best	-	Added after the workshop. Larger distrubance plans were scored lower and more spread out plans were also scored lower.	6	6	5	4
Third-party reviews	The frequency for third-party reviews will depend on the complexities of the facility in terms of the design, construction, operation and closure.	High best	-	Ruled out prior to the workshop. Considered as the same for all alternatives.				
Time of legal and financial requirements and expected legal complexities	Degree of difficulty in obtaining approvals for construction and operation of the facility.	High best	-	The largest disturbance was felt to have the most dificulty in obtaining approvals and alternative 4 was felt more difficult as facilities are spread out.	6	6	5	4

Indicator	Rationale	Rank order	Unit	Comment	EAC Submitted Option	Alternative Configuration 2	Alternative Configuration 4	Alternative Configuration 5
Topography	Facilities constructed in complex reliefs and topographies are more complex for the design and construction of the facility, ancillary infrastructure and access roads, pose greater risk and complexities during materials deposition, maintenance and surveillance.	High best	-	Not used - Not assessed due to project characteristics.	6	6	5	4
Vegetation	Related to the presence of vegetation.	High best	-	Larger distrubance plans were scored lower and more spread out plans were also scored lower.	6	6	5	4
Waste geochemical characterization	Waste material with potential for acid rock drainage and/ or metal leaching and weatherability require more complex waste management and mitigation measures to prevent environmental issues. Materials with NPR ≤2 are considered PAG while materials with NPR > 2 are considered non-PAG.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.				
Waste physical characterization	Includes grain size distribution, settlement rate and consolidation parameters.	High best	-	Ruled out prior to the workshop. Not applicable to project characteristics.				
Water management / treatment to achieve water quality objectives	Effort required to remove TSS (total suspended solids) from run-off water captured in diversions.	High best	-	Slowing down run-off water or developing sedimentation ponds.	6	5	4	1
Water management system design	Includes water balance, discharge strategy, water treatment strategy and recycle strategy.	High best	-	Related to the complexity for the water management system design of each alternative. Alternative 5 has the biggest catchment area, and alternative 2 needs to pump water from the WMP to the EMP. Configuration 4 has separated structures, increasing requirements.	6	5	4	2
Within formerly permitted area / Distance to other landowner properties Socio-Economic Property Ownership & Mineral Rights	Related to the need of expansion of the owners area (property boundary limits).	High best	-	Ruled out prior to the workshop. Considered as a threshold criteria for defining candidate alternatives.				

Appendix E.2 Weighting for Indicators

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	1,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	2,00	A3 - Economic
Capex Requirements	Borrow source location	3,00	A3 - Economic
Capex Requirements	Borrow source material availability	2,00	A3 - Economic
Capex Requirements	Construction time	3,00	A3 - Economic
Capex Requirements	Containment structure design	4,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	3,00	A3 - Economic
Capex Requirements	Embankment volume	5,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	5,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	5,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	6,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	4,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	6,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Capex Requirements	Number of ponds	3,00	A3 - Economic
Capex Requirements	QA/QC Requirements	2,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	1,00	A3 - Economic
Capex Requirements	Seasonality	3,00	A3 - Economic
Capex Requirements	Surplus material storage	1,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	4,00	A3 - Economic
Capex Requirements	Topography	3,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	2,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	2,00	A3 - Economic
Capex Requirements	Water management system design	2,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	6,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	4,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	3,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	6,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	5,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	4,00	A3 - Economic
Closure and Post-Closure Costs	Topography	3,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	4,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	5,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	5,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	2,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	3,00	A3 - Economic
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	5,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	4,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	3,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	3,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	4,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	4,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	6,00	A2 - Technical
Closure design and requirements	Closure design	3,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	3,00	A2 - Technical
Closure design and requirements	Pond water management	2,00	A2 - Technical
Closure plan implementation	Closure design	3,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	3,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	4,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	2,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Closure plan implementation	Aesthetics - Re-vegetation	3,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	3,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	4,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	4,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	5,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	6,00	A4 - Socio-Economic
Community perception and safety	Community safety	6,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	3,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	5,00	A4 - Socio-Economic
Community perception and safety	Vegetation	3,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	3,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	2,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	4,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	5,00	A4 - Socio-Economic
Community perception and safety	Embankment height	3,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	4,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	2,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	3,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	1,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	2,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	6,00	A2 - Technical
Complete system flexibility	Topography	3,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	1,00	A1 - Environmental
Design and construction impacts	Borrow source location	3,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	2,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	5,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	2,00	A1 - Environmental
Design and construction impacts	Number of embankments	2,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Number of ponds	2,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	3,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	2,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	3,00	A1 - Environmental
Design and construction impacts	Impermeabilization Thickness	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	2,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	6,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	4,00	A2 - Technical
Infrastructure requirements	Topography	4,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	3,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	4,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	6,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	6,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	3,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	5,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	5,00	A2 - Technical
Mine materials management	Overall footprint of the facility	4,00	A2 - Technical
Mine materials management	Surplus material storage	3,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	2,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	3,00	A2 - Technical
Mine materials management	Pond water management	4,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	3,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	3,00	A2 - Technical
Mine materials management impacts	Materials delivery and deposition system	4,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	1,00	A1 - Environmental
Mine materials management impacts	Design Criteria - maitenance of water cover	4,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	5,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	3,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	4,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	6,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	3,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	5,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	5,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	4,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	4,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	5,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	5,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	4,00	A3 - Economic
Opex Requirements	Groundwater conditions	5,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	4,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	6,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	2,00	A3 - Economic
Opex Requirements	Pond water management	4,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	6,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	3,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	5,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	2,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	4,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	2,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	4,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	3,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	5,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	6,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	4,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	5,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	6,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	4,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	3,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	4,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	2,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	2,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	2,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	5,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	2,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	2,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	2,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	2,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	5,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	4,00	A4 - Socio-Economic
Post closure water management	Pond water management	2,00	A4 - Socio-Economic
Post closure water management	Water management system design	1,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	6,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	2,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	5,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	4,00	A4 - Socio-Economic
Post-closure land use	Closure design	4,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	6,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	3,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	4,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	5,00	A1 - Environmental
Post-closure land use	Aesthetics - Re-vegetation	2,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	3,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	4,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	3,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	6,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	5,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	5,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	6,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	6,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	4,00	A1 - Environmental
Potential groundwater impacts	Water management system design	2,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	6,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	6,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	6,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	4,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	4,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	6,00	A1 - Environmental
Potential impacts to receptors	Vegetation	4,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	4,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	5,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	2,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	5,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	5,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	6,00	A1 - Environmental
Potential surface water impacts	Pond water management	3,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	4,00	A1 - Environmental
Potential surface water impacts	Water management system design	2,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	6,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	5,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	6,00	A2 - Technical
Seepage and groundwater control	Water management system design	4,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	5,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	5,00	A2 - Technical
Storage Facility Construction	Construction constraints	3,00	A2 - Technical
Storage Facility Construction	Construction time	3,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Storage Facility Construction	Embankment volume	5,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	2,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	6,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	5,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	6,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	3,00	A2 - Technical
Storage Facility Construction	Seasonality	5,00	A2 - Technical
Storage Facility Construction	Surplus material storage	2,00	A2 - Technical
Storage Facility Construction	Topography	4,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	3,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	1,00	A2 - Technical
Storage Facility Design	Borrow source location	2,00	A2 - Technical
Storage Facility Design	Borrow source material availability	5,00	A2 - Technical
Storage Facility Design	Containment structure design	6,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	3,00	A2 - Technical
Storage Facility Design	Embankment height	2,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	6,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	3,00	A2 - Technical
Storage Facility Design	Number of embankments	1,00	A2 - Technical
Storage Facility Design	Number of ponds	3,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	3,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	2,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	4,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	6,00	A2 - Technical
Storage Facility Design	Topography	2,00	A2 - Technical
Storage Facility Design	Water management system design	5,00	A2 - Technical
Storage Facility Design	Additional site investigation	1,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	6,00	A2 - Technical
Surface water management	Number of ponds	3,00	A2 - Technical
Surface water management	Overall Catchment Area	3,00	A2 - Technical
Surface water management	Overall footprint of the facility	3,00	A2 - Technical
Surface water management	Water management system design	5,00	A2 - Technical

Appendix E.3 Weighting for Accounts and Sub-Accounts

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	44,44%
A2 - Technical	Technical	3,00	2	ECCC	22,22%
A3 - Economic	Economic	1,50	3	ECCC	11,11%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	22,22%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	3,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	6,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	6,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	6,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	4,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	3,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	2,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	2,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	3,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	6,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	6,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	3,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	4,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	5,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	2,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	2,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	3,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	2,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	6,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	3,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	3,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	4,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	4,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	6,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	2,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Appendix E.4 Results of the Value-Based Decision Process

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,031	0,032	0,026	0,030
	Mine materials management impacts	0,058	0,042	0,045	0,052
	Post-closure land use	0,073	0,060	0,054	0,056
	Potential air quality impacts	0,060	0,060	0,048	0,037
	Potential groundwater impacts	0,097	0,096	0,071	0,059
	Potential impacts to receptors	0,105	0,111	0,083	0,062
	Potential surface water impacts	0,111	0,102	0,076	0,053
Total C1 - Environmental		**0,535**	**0,504**	**0,402**	**0,348**
C2 - Technical	Closure design and requirements	0,035	0,032	0,026	0,031
	Complete system flexibility	0,029	0,021	0,031	0,012
	Infrastructure requirements	0,017	0,017	0,011	0,008
	Maintenance Requirements	0,016	0,016	0,012	0,012
	Mine materials management	0,024	0,022	0,022	0,020
	Monitoring & Surveillance	0,020	0,019	0,015	0,019
	Seepage and groundwater control	0,037	0,036	0,022	0,019
	Storage Facility Construction	0,019	0,018	0,016	0,015
	Storage Facility Design	0,015	0,014	0,012	0,011
	Surface water management	0,056	0,053	0,040	0,019
Total C2 - Technical		**0,268**	**0,249**	**0,206**	**0,166**
C3 - Economic	Capex Requirements	0,023	0,021	0,019	0,016
	Closure and Post-Closure Costs	0,072	0,065	0,056	0,058
	Opex Requirements	0,035	0,032	0,027	0,027
Total C3 - Economic		**0,131**	**0,119**	**0,102**	**0,102**
C4 - Socio-Economic	Closure plan implementation	0,043	0,034	0,032	0,033
	Community perception and safety	0,076	0,075	0,065	0,071
	Permitting complexity and delays	0,029	0,027	0,024	0,019
	Post closure monitoring	0,045	0,039	0,038	0,034
	Post closure water management	0,056	0,051	0,041	0,029
Total C4 - Socio-Economic		**0,248**	**0,226**	**0,201**	**0,187**
Total		**1,183**	**1,097**	**0,910**	**0,803**

Appendix F Sensitivity Analysis

Appendix F.1 Equal Weighting for Accounts

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	25,00%
A2 - Technical	Technical	1,00	2	ECCC	25,00%
A3 - Economic	Economic	1,00	3	ECCC	25,00%
A4 - Socio-Economic	Socio-Economic	1,00	4	ECCC	25,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,017	0,018	0,015	0,017
	Mine materials management impacts	0,033	0,024	0,025	0,029
	Post-closure land use	0,041	0,034	0,031	0,031
	Potential air quality impacts	0,034	0,034	0,027	0,021
	Potential groundwater impacts	0,055	0,054	0,040	0,033
	Potential impacts to receptors	0,059	0,063	0,047	0,035
	Potential surface water impacts	0,063	0,058	0,043	0,030
Total C1 - Environmental		**0,301**	**0,284**	**0,226**	**0,196**
C2 - Technical	Closure design and requirements	0,040	0,036	0,029	0,035
	Complete system flexibility	0,032	0,023	0,035	0,014
	Infrastructure requirements	0,019	0,019	0,012	0,009
	Maintenance Requirements	0,018	0,018	0,014	0,013
	Mine materials management	0,027	0,025	0,024	0,023
	Monitoring & Surveillance	0,023	0,021	0,017	0,021
	Seepage and groundwater control	0,042	0,041	0,025	0,021
	Storage Facility Construction	0,021	0,020	0,018	0,017
	Storage Facility Design	0,017	0,016	0,013	0,012
	Surface water management	0,063	0,060	0,045	0,021
Total C2 - Technical		**0,302**	**0,280**	**0,232**	**0,187**
C3 - Economic	Capex Requirements	0,052	0,048	0,043	0,037
	Closure and Post-Closure Costs	0,163	0,146	0,125	0,132
	Opex Requirements	0,080	0,073	0,060	0,060
Total C3 - Economic		**0,295**	**0,267**	**0,229**	**0,229**
C4 - Socio-Economic	Closure plan implementation	0,048	0,038	0,037	0,038
	Community perception and safety	0,086	0,084	0,073	0,080
	Permitting complexity and delays	0,032	0,031	0,027	0,022
	Post closure monitoring	0,050	0,044	0,043	0,039
	Post closure water management	0,063	0,057	0,047	0,033
Total C4 - Socio-Economic		**0,279**	**0,254**	**0,226**	**0,211**
Total		**1,177**	**1,084**	**0,912**	**0,822**

Appendix F.2 Equal Weighting for Sub-Accounts

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	1,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	1,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	1,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	1,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	1,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	1,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	1,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	1,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	1,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	1,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	1,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	1,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	1,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	1,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	1,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	1,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	1,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,066	0,068	0,055	0,063
	Mine materials management impacts	0,083	0,060	0,065	0,074
	Post-closure land use	0,078	0,065	0,058	0,060
	Potential air quality impacts	0,086	0,086	0,068	0,052
	Potential groundwater impacts	0,070	0,069	0,051	0,042
	Potential impacts to receptors	0,075	0,079	0,059	0,044
	Potential surface water impacts	0,079	0,073	0,054	0,038
Total C1 - Environmental		**0,537**	**0,501**	**0,410**	**0,374**
C2 - Technical	Closure design and requirements	0,025	0,023	0,018	0,023
	Complete system flexibility	0,026	0,019	0,028	0,011
	Infrastructure requirements	0,031	0,031	0,019	0,014
	Maintenance Requirements	0,029	0,029	0,022	0,021
	Mine materials management	0,029	0,027	0,026	0,024
	Monitoring & Surveillance	0,024	0,023	0,018	0,022
	Seepage and groundwater control	0,022	0,022	0,013	0,011
	Storage Facility Construction	0,023	0,021	0,019	0,019
	Storage Facility Design	0,027	0,026	0,021	0,020
	Surface water management	0,033	0,032	0,024	0,011
Total C2 - Technical		**0,270**	**0,252**	**0,209**	**0,176**
C3 - Economic	Capex Requirements	0,042	0,039	0,035	0,030
	Closure and Post-Closure Costs	0,044	0,040	0,034	0,036
	Opex Requirements	0,043	0,039	0,033	0,033
Total C3 - Economic		**0,130**	**0,118**	**0,102**	**0,098**
C4 - Socio-Economic	Closure plan implementation	0,054	0,043	0,041	0,042
	Community perception and safety	0,048	0,047	0,041	0,045
	Permitting complexity and delays	0,054	0,052	0,045	0,037
	Post closure monitoring	0,042	0,037	0,036	0,033
	Post closure water management	0,053	0,048	0,039	0,028
Total C4 - Socio-Economic		**0,252**	**0,227**	**0,203**	**0,184**
Total		**1,189**	**1,098**	**0,923**	**0,833**

Appendix F.3 Equal Weighting for Indicators

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	1,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Borrow source location	1,00	A3 - Economic
Capex Requirements	Borrow source material availability	1,00	A3 - Economic
Capex Requirements	Construction time	1,00	A3 - Economic
Capex Requirements	Containment structure design	1,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Embankment volume	1,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	1,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	1,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	1,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	1,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	1,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Capex Requirements	Number of ponds	1,00	A3 - Economic
Capex Requirements	QA/QC Requirements	1,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	1,00	A3 - Economic
Capex Requirements	Seasonality	1,00	A3 - Economic
Capex Requirements	Surplus material storage	1,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	1,00	A3 - Economic
Capex Requirements	Topography	1,00	A3 - Economic
Capex Requirements	Water management system design	1,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	1,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	1,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	1,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	1,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	1,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	1,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	1,00	A3 - Economic
Closure and Post-Closure Costs	Topography	1,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	1,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Closure design and requirements	Closure design	1,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	1,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	1,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	1,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	1,00	A2 - Technical
Closure design and requirements	Pond water management	1,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	1,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	1,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	1,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	1,00	A4 - Socio-Economic
Closure plan implementation	Closure design	1,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	1,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	1,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	1,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	1,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	1,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	1,00	A4 - Socio-Economic
Community perception and safety	Community safety	1,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Community perception and safety	Embankment height	1,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	1,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	1,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	1,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	1,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	1,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Vegetation	1,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	1,00	A2 - Technical
Complete system flexibility	Topography	1,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	1,00	A1 - Environmental
Design and construction impacts	Borrow source location	1,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	1,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	1,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	1,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	1,00	A1 - Environmental
Design and construction impacts	Number of embankments	1,00	A1 - Environmental
Design and construction impacts	Number of ponds	1,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	1,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	1,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	1,00	A2 - Technical
Infrastructure requirements	Topography	1,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	1,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	1,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	1,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	1,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	1,00	A2 - Technical
Mine materials management	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Pond water management	1,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	1,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A2 - Technical
Mine materials management	Surplus material storage	1,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	1,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	1,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	1,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	1,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	1,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	1,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	1,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	1,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	1,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	1,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	1,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	1,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Opex Requirements	Groundwater conditions	1,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	1,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	1,00	A3 - Economic
Opex Requirements	Pond water management	1,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	1,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	1,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	1,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	1,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	1,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	1,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	1,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	1,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	1,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	1,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	1,00	A4 - Socio-Economic
Post closure water management	Pond water management	1,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	1,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	1,00	A1 - Environmental
Post-closure land use	Closure design	1,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	1,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	1,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	1,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	1,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	1,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	1,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	1,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	1,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential groundwater impacts	Water management system design	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Vegetation	1,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	1,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	1,00	A1 - Environmental
Potential surface water impacts	Pond water management	1,00	A1 - Environmental
Potential surface water impacts	Water management system design	1,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	1,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	1,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	1,00	A2 - Technical
Seepage and groundwater control	Water management system design	1,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	1,00	A2 - Technical
Storage Facility Construction	Construction constraints	1,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	1,00	A2 - Technical
Storage Facility Construction	Construction time	1,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Construction	Embankment volume	1,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	1,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	1,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	1,00	A2 - Technical
Storage Facility Construction	Seasonality	1,00	A2 - Technical
Storage Facility Construction	Surplus material storage	1,00	A2 - Technical
Storage Facility Construction	Topography	1,00	A2 - Technical
Storage Facility Design	Additional site investigation	1,00	A2 - Technical
Storage Facility Design	Borrow source location	1,00	A2 - Technical
Storage Facility Design	Borrow source material availability	1,00	A2 - Technical
Storage Facility Design	Containment structure design	1,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Design	Embankment height	1,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Design	Number of embankments	1,00	A2 - Technical
Storage Facility Design	Number of ponds	1,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	1,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	1,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	1,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	1,00	A2 - Technical
Storage Facility Design	Water management system design	1,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Surface water management	Number of ponds	1,00	A2 - Technical
Surface water management	Overall Catchment Area	1,00	A2 - Technical
Surface water management	Overall footprint of the facility	1,00	A2 - Technical
Surface water management	Water management system design	1,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,030	0,031	0,025	0,029
	Mine materials management impacts	0,056	0,044	0,047	0,049
	Post-closure land use	0,072	0,059	0,053	0,055
	Potential air quality impacts	0,061	0,061	0,050	0,039
	Potential groundwater impacts	0,102	0,098	0,076	0,060
	Potential impacts to receptors	0,108	0,115	0,082	0,058
	Potential surface water impacts	0,116	0,102	0,080	0,058
Total C1 - Environmental		**0,543**	**0,511**	**0,412**	**0,348**
C2 - Technical	Closure design and requirements	0,036	0,032	0,027	0,032
	Complete system flexibility	0,031	0,025	0,031	0,015
	Infrastructure requirements	0,017	0,017	0,011	0,008
	Maintenance Requirements	0,015	0,015	0,012	0,012
	Mine materials management	0,024	0,021	0,021	0,019
	Monitoring & Surveillance	0,020	0,019	0,015	0,019
	Seepage and groundwater control	0,039	0,037	0,024	0,019
	Storage Facility Construction	0,020	0,019	0,016	0,015
	Storage Facility Design	0,015	0,014	0,011	0,011
	Surface water management	0,056	0,054	0,041	0,020
Total C2 - Technical		**0,273**	**0,252**	**0,209**	**0,172**
C3 - Economic	Capex Requirements	0,024	0,022	0,019	0,016
	Closure and Post-Closure Costs	0,072	0,067	0,057	0,059
	Opex Requirements	0,035	0,032	0,027	0,028
Total C3 - Economic		**0,131**	**0,121**	**0,103**	**0,103**
C4 - Socio-Economic	Closure plan implementation	0,043	0,034	0,033	0,035
	Community perception and safety	0,078	0,079	0,066	0,070
	Permitting complexity and delays	0,030	0,029	0,025	0,021
	Post closure monitoring	0,037	0,033	0,035	0,047
	Post closure water management	0,060	0,054	0,043	0,029
Total C4 - Socio-Economic		**0,248**	**0,229**	**0,203**	**0,202**
Total		**1,195**	**1,112**	**0,927**	**0,825**

Appendix F.4 Equal Weighting for Accounts and Sub-Accounts

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	25,00%
A2 - Technical	Technical	1,00	2	ECCC	25,00%
A3 - Economic	Economic	1,00	3	ECCC	25,00%
A4 - Socio-Economic	Socio-Economic	1,00	4	ECCC	25,00%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	1,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	1,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	1,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	1,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	1,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	1,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	1,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	1,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	1,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	1,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	1,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	1,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	1,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	1,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	1,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	1,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	1,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,037	0,038	0,031	0,036
	Mine materials management impacts	0,046	0,034	0,036	0,042
	Post-closure land use	0,044	0,036	0,033	0,034
	Potential air quality impacts	0,048	0,048	0,038	0,029
	Potential groundwater impacts	0,039	0,039	0,029	0,024
	Potential impacts to receptors	0,042	0,045	0,033	0,025
	Potential surface water impacts	0,045	0,041	0,030	0,021
Total C1 - Environmental		**0,302**	**0,282**	**0,231**	**0,210**
C2 - Technical	Closure design and requirements	0,029	0,026	0,021	0,026
	Complete system flexibility	0,029	0,021	0,031	0,013
	Infrastructure requirements	0,035	0,035	0,021	0,016
	Maintenance Requirements	0,032	0,032	0,025	0,023
	Mine materials management	0,033	0,030	0,029	0,027
	Monitoring & Surveillance	0,027	0,025	0,020	0,025
	Seepage and groundwater control	0,025	0,025	0,015	0,013
	Storage Facility Construction	0,025	0,024	0,021	0,021
	Storage Facility Design	0,030	0,029	0,024	0,022
	Surface water management	0,038	0,036	0,027	0,013
Total C2 - Technical		**0,303**	**0,283**	**0,235**	**0,198**
C3 - Economic	Capex Requirements	0,095	0,088	0,078	0,067
	Closure and Post-Closure Costs	0,100	0,089	0,077	0,080
	Opex Requirements	0,098	0,089	0,074	0,074
Total C3 - Economic		**0,292**	**0,266**	**0,229**	**0,222**
C4 - Socio-Economic	Closure plan implementation	0,061	0,048	0,046	0,048
	Community perception and safety	0,054	0,053	0,046	0,051
	Permitting complexity and delays	0,061	0,059	0,050	0,041
	Post closure monitoring	0,048	0,042	0,040	0,037
	Post closure water management	0,060	0,054	0,044	0,031
Total C4 - Socio-Economic		**0,284**	**0,256**	**0,228**	**0,207**
Total		**1,181**	**1,087**	**0,922**	**0,837**

Appendix F.5 Equal Weighting for Accounts, Sub-Accounts and Indicators

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	25,00%
A2 - Technical	Technical	1,00	2	ECCC	25,00%
A3 - Economic	Economic	1,00	3	ECCC	25,00%
A4 - Socio-Economic	Socio-Economic	1,00	4	ECCC	25,00%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	1,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	1,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	1,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	1,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	1,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	1,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	1,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	1,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	1,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	1,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	1,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	1,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	1,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	1,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	1,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	1,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	1,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	1,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Borrow source location	1,00	A3 - Economic
Capex Requirements	Borrow source material availability	1,00	A3 - Economic
Capex Requirements	Construction time	1,00	A3 - Economic
Capex Requirements	Containment structure design	1,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Capex Requirements	Embankment volume	1,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	1,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	1,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	1,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	1,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	1,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Capex Requirements	Number of ponds	1,00	A3 - Economic
Capex Requirements	QA/QC Requirements	1,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	1,00	A3 - Economic
Capex Requirements	Seasonality	1,00	A3 - Economic
Capex Requirements	Surplus material storage	1,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	1,00	A3 - Economic
Capex Requirements	Topography	1,00	A3 - Economic
Capex Requirements	Water management system design	1,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	1,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	1,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	1,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	1,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	1,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	1,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	1,00	A3 - Economic
Closure and Post-Closure Costs	Topography	1,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	1,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Closure design and requirements	Closure design	1,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	1,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	1,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	1,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	1,00	A2 - Technical
Closure design and requirements	Pond water management	1,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	1,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	1,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	1,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	1,00	A4 - Socio-Economic
Closure plan implementation	Closure design	1,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	1,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	1,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	1,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	1,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	1,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	1,00	A4 - Socio-Economic
Community perception and safety	Community safety	1,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Community perception and safety	Embankment height	1,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	1,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	1,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	1,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	1,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	1,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Vegetation	1,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	1,00	A2 - Technical
Complete system flexibility	Topography	1,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	1,00	A1 - Environmental
Design and construction impacts	Borrow source location	1,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	1,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	1,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	1,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	1,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	1,00	A1 - Environmental
Design and construction impacts	Number of embankments	1,00	A1 - Environmental
Design and construction impacts	Number of ponds	1,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	1,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	1,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	1,00	A2 - Technical
Infrastructure requirements	Topography	1,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	1,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	1,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	1,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	1,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	1,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	1,00	A2 - Technical
Mine materials management	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Pond water management	1,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	1,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A2 - Technical
Mine materials management	Surplus material storage	1,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	1,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	1,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	1,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	1,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	1,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	1,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	1,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	1,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	1,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	1,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	1,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	1,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	1,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	1,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	1,00	A3 - Economic
Opex Requirements	Groundwater conditions	1,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	1,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	1,00	A3 - Economic
Opex Requirements	Pond water management	1,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	1,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	1,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	1,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	1,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	1,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	1,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	1,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	1,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	1,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	1,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	1,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	1,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	1,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	1,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	1,00	A4 - Socio-Economic
Post closure water management	Pond water management	1,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	1,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	1,00	A1 - Environmental
Post-closure land use	Closure design	1,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	1,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	1,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	1,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	1,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	1,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	1,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	1,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	1,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	1,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential groundwater impacts	Water management system design	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	1,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Vegetation	1,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	1,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	1,00	A1 - Environmental
Potential surface water impacts	Pond water management	1,00	A1 - Environmental
Potential surface water impacts	Water management system design	1,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	1,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	1,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	1,00	A2 - Technical
Seepage and groundwater control	Water management system design	1,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	1,00	A2 - Technical
Storage Facility Construction	Construction constraints	1,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	1,00	A2 - Technical
Storage Facility Construction	Construction time	1,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Construction	Embankment volume	1,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	1,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	1,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	1,00	A2 - Technical
Storage Facility Construction	Seasonality	1,00	A2 - Technical
Storage Facility Construction	Surplus material storage	1,00	A2 - Technical
Storage Facility Construction	Topography	1,00	A2 - Technical
Storage Facility Design	Additional site investigation	1,00	A2 - Technical
Storage Facility Design	Borrow source location	1,00	A2 - Technical
Storage Facility Design	Borrow source material availability	1,00	A2 - Technical
Storage Facility Design	Containment structure design	1,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Design	Embankment height	1,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	1,00	A2 - Technical
Storage Facility Design	Number of embankments	1,00	A2 - Technical
Storage Facility Design	Number of ponds	1,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	1,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	1,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	1,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	1,00	A2 - Technical
Storage Facility Design	Water management system design	1,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Surface water management	Number of ponds	1,00	A2 - Technical
Surface water management	Overall Catchment Area	1,00	A2 - Technical
Surface water management	Overall footprint of the facility	1,00	A2 - Technical
Surface water management	Water management system design	1,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,036	0,037	0,030	0,035
	Mine materials management impacts	0,045	0,036	0,038	0,039
	Post-closure land use	0,043	0,036	0,032	0,033
	Potential air quality impacts	0,049	0,049	0,040	0,031
	Potential groundwater impacts	0,041	0,040	0,031	0,024
	Potential impacts to receptors	0,043	0,046	0,033	0,023
	Potential surface water impacts	0,046	0,041	0,032	0,023
Total C1 - Environmental		**0,303**	**0,284**	**0,235**	**0,210**
C2 - Technical	Closure design and requirements	0,029	0,026	0,022	0,026
	Complete system flexibility	0,031	0,025	0,031	0,016
	Infrastructure requirements	0,035	0,035	0,023	0,017
	Maintenance Requirements	0,030	0,030	0,024	0,024
	Mine materials management	0,032	0,028	0,028	0,026
	Monitoring & Surveillance	0,027	0,025	0,020	0,026
	Seepage and groundwater control	0,026	0,025	0,016	0,013
	Storage Facility Construction	0,027	0,026	0,022	0,020
	Storage Facility Design	0,030	0,028	0,023	0,023
	Surface water management	0,038	0,036	0,028	0,014
Total C2 - Technical		**0,306**	**0,285**	**0,237**	**0,204**
C3 - Economic	Capex Requirements	0,099	0,091	0,079	0,066
	Closure and Post-Closure Costs	0,099	0,092	0,078	0,082
	Opex Requirements	0,097	0,088	0,075	0,076
Total C3 - Economic		**0,295**	**0,271**	**0,232**	**0,224**
C4 - Socio-Economic	Closure plan implementation	0,061	0,048	0,047	0,050
	Community perception and safety	0,056	0,057	0,047	0,050
	Permitting complexity and delays	0,063	0,062	0,053	0,044
	Post closure monitoring	0,040	0,035	0,038	0,050
	Post closure water management	0,064	0,058	0,046	0,031
Total C4 - Socio-Economic		**0,284**	**0,259**	**0,231**	**0,225**
Total		**1,188**	**1,099**	**0,934**	**0,863**

Appendix F.6 Inverse Weighting for Accounts, Sub-Accounts and Indicators

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	1,00	1	ECCC	7,41%
A2 - Technical	Technical	4,00	2	ECCC	29,63%
A3 - Economic	Economic	4,50	3	ECCC	33,33%
A4 - Socio-Economic	Socio-Economic	4,00	4	ECCC	29,63%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	4,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	1,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	1,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	3,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	4,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	5,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	5,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	4,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	1,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	4,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	3,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	2,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	5,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	5,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	4,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	5,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	1,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	4,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	4,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	3,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	3,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	1,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	5,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	6,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	5,00	A3 - Economic
Capex Requirements	Borrow source location	4,00	A3 - Economic
Capex Requirements	Borrow source material availability	5,00	A3 - Economic
Capex Requirements	Construction time	4,00	A3 - Economic
Capex Requirements	Containment structure design	3,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	4,00	A3 - Economic
Capex Requirements	Embankment volume	2,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	5,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	2,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	2,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	1,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	3,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	1,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	6,00	A3 - Economic
Capex Requirements	Number of ponds	4,00	A3 - Economic
Capex Requirements	QA/QC Requirements	5,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	6,00	A3 - Economic
Capex Requirements	Seasonality	4,00	A3 - Economic
Capex Requirements	Surplus material storage	6,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	3,00	A3 - Economic
Capex Requirements	Topography	4,00	A3 - Economic
Capex Requirements	Water management system design	5,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	1,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	2,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	3,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	4,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	2,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	5,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	3,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	4,00	A3 - Economic
Closure and Post-Closure Costs	Topography	4,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	3,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	2,00	A3 - Economic
Closure design and requirements	Closure design	4,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	4,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	2,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	3,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	4,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	4,00	A2 - Technical
Closure design and requirements	Pond water management	5,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	3,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	3,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	1,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	4,00	A4 - Socio-Economic
Closure plan implementation	Closure design	4,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	4,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	4,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	4,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	3,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	3,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	2,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	4,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	5,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	3,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	2,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	1,00	A4 - Socio-Economic
Community perception and safety	Community safety	1,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Community perception and safety	Embankment height	4,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	3,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	5,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	4,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	2,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	4,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	6,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	5,00	A4 - Socio-Economic
Community perception and safety	Vegetation	4,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	1,00	A2 - Technical
Complete system flexibility	Topography	4,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	6,00	A1 - Environmental
Design and construction impacts	Borrow source location	4,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	5,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	5,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	2,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	5,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	4,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	6,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	5,00	A1 - Environmental
Design and construction impacts	Number of embankments	5,00	A1 - Environmental
Design and construction impacts	Number of ponds	5,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	4,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	6,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	1,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	3,00	A2 - Technical
Infrastructure requirements	Topography	3,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	4,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	3,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	4,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	1,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	1,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	5,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	4,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	2,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	4,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	2,00	A2 - Technical
Mine materials management	Overall footprint of the facility	3,00	A2 - Technical
Mine materials management	Pond water management	3,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	4,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	4,00	A2 - Technical
Mine materials management	Surplus material storage	4,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	3,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	3,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	2,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	6,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	6,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	4,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	3,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	1,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	4,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	2,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	2,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	3,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	4,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	3,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	2,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	2,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	3,00	A3 - Economic
Opex Requirements	Groundwater conditions	2,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	1,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	2,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	5,00	A3 - Economic
Opex Requirements	Pond water management	3,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	5,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	3,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	1,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	5,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	3,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	4,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	5,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	2,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	1,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	3,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	2,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	1,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	3,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	6,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	5,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	5,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	4,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	3,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	2,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	5,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	5,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	5,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	5,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	2,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	3,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	5,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	2,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	3,00	A4 - Socio-Economic
Post closure water management	Pond water management	5,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	6,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	5,00	A1 - Environmental
Post-closure land use	Closure design	3,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	4,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	1,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	4,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	3,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	2,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	3,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	4,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	3,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	2,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	2,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	1,00	A1 - Environmental
Potential groundwater impacts	Water management system design	5,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	4,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	3,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	2,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	4,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	5,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	2,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	3,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	1,00	A1 - Environmental
Potential impacts to receptors	Vegetation	3,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	2,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	3,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	1,00	A1 - Environmental
Potential surface water impacts	Pond water management	4,00	A1 - Environmental
Potential surface water impacts	Water management system design	5,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	2,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	1,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	2,00	A2 - Technical
Seepage and groundwater control	Water management system design	3,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	2,00	A2 - Technical
Storage Facility Construction	Construction constraints	4,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	4,00	A2 - Technical
Storage Facility Construction	Construction time	4,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	5,00	A2 - Technical
Storage Facility Construction	Embankment volume	2,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	5,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	1,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	2,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	1,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	4,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	6,00	A2 - Technical
Storage Facility Construction	Seasonality	2,00	A2 - Technical
Storage Facility Construction	Surplus material storage	5,00	A2 - Technical
Storage Facility Construction	Topography	3,00	A2 - Technical
Storage Facility Design	Additional site investigation	6,00	A2 - Technical
Storage Facility Design	Borrow source location	5,00	A2 - Technical
Storage Facility Design	Borrow source material availability	2,00	A2 - Technical
Storage Facility Design	Containment structure design	1,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	4,00	A2 - Technical
Storage Facility Design	Embankment height	5,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	1,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	1,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	4,00	A2 - Technical
Storage Facility Design	Number of embankments	6,00	A2 - Technical
Storage Facility Design	Number of ponds	4,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	4,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	5,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	3,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	5,00	A2 - Technical
Storage Facility Design	Water management system design	2,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Surface water management	Number of ponds	4,00	A2 - Technical
Surface water management	Overall Catchment Area	4,00	A2 - Technical
Surface water management	Overall footprint of the facility	4,00	A2 - Technical
Surface water management	Water management system design	2,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,019	0,020	0,016	0,019
	Mine materials management impacts	0,019	0,016	0,017	0,016
	Post-closure land use	0,014	0,011	0,010	0,011
	Potential air quality impacts	0,022	0,022	0,018	0,014
	Potential groundwater impacts	0,005	0,005	0,004	0,003
	Potential impacts to receptors	0,005	0,005	0,004	0,002
	Potential surface water impacts	0,005	0,004	0,004	0,003
Total C1 - Environmental		**0,089**	**0,084**	**0,072**	**0,068**
C2 - Technical	Closure design and requirements	0,021	0,018	0,016	0,019
	Complete system flexibility	0,037	0,034	0,033	0,022
	Infrastructure requirements	0,064	0,064	0,045	0,031
	Maintenance Requirements	0,045	0,045	0,038	0,043
	Mine materials management	0,044	0,037	0,038	0,034
	Monitoring & Surveillance	0,038	0,034	0,026	0,039
	Seepage and groundwater control	0,010	0,009	0,007	0,004
	Storage Facility Construction	0,040	0,039	0,031	0,026
	Storage Facility Design	0,051	0,048	0,040	0,042
	Surface water management	0,013	0,013	0,010	0,005
Total C2 - Technical		**0,364**	**0,340**	**0,283**	**0,266**
C3 - Economic	Capex Requirements	0,204	0,186	0,159	0,130
	Closure and Post-Closure Costs	0,039	0,038	0,032	0,033
	Opex Requirements	0,155	0,137	0,123	0,129
Total C3 - Economic		**0,397**	**0,362**	**0,314**	**0,292**
C4 - Socio-Economic	Closure plan implementation	0,089	0,071	0,070	0,080
	Community perception and safety	0,021	0,022	0,018	0,018
	Permitting complexity and delays	0,122	0,121	0,104	0,088
	Post closure monitoring	0,036	0,032	0,039	0,069
	Post closure water management	0,076	0,068	0,054	0,035
Total C4 - Socio-Economic		**0,345**	**0,314**	**0,284**	**0,291**
Total		**1,195**	**1,100**	**0,953**	**0,917**

Appendix F.7 Random Weighting for Accounts, Sub-Accounts and Indicators

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	4,00	1	ECCC	33,33%
A2 - Technical	Technical	1,00	2	ECCC	8,33%
A3 - Economic	Economic	1,00	3	ECCC	8,33%
A4 - Socio-Economic	Socio-Economic	6,00	4	ECCC	50,00%

Account	Sub-Account	Weight	Rationale
A1 - Environmental	Potential air quality impacts	2,00	Alternatives that are close to and/ or in the prevalent wind speed and direction to the mine camp, mine installations and /or viallages may pose higher risk of transporting vectors for dust contaminants and fugitive gases. Larger facilities are less desirable due to the dust generation during construction.
A1 - Environmental	Potential groundwater impacts	5,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A1 - Environmental	Potential impacts to receptors	4,00	Facilities that have impacts or implications on the different receptors and/ or impact the existence value of the natural habitat and ecosystem are less desirable.
A1 - Environmental	Potential surface water impacts	5,00	Facilities with larger or more complex surface water management structures and requirements are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A1 - Environmental	Post-closure land use	6,00	Alternatives that would most closely return land use to premining conditions would be more palatable to the landowner.
A1 - Environmental	Mine materials management impacts	2,00	Facilities with more complex mine materials management requirements are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A1 - Environmental	Design and construction impacts	6,00	Larger or more complex facilities in terms of design and construction are less desirable. Refer to the 'Storage Facility Design' and 'Storage Facility Construction' sub-accounts for more detail.
A2 - Technical	Storage Facility Design	6,00	Larger or more complex facilities pose higher complexities during the design stage. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, topographic and geographical constraints, larger overall catchment areas and/ or footprint of the facility, the need of several embankments and/ or different facilities, interferences with existing infrastructure.
A2 - Technical	Storage Facility Construction	2,00	Larger or more complex facilities pose higher complexities during the construction stage. The term 'more complex facilities' consideres unfavorable foundation conditions, distance, storage and management of borrow material, topographic, geographical and seasonal constraints, the need of several embankments and/ or different facilities, interferences with existing infrastructure and the need of stringent QA/QC.
A2 - Technical	Seepage and groundwater control	1,00	Larger facilities and alternatives near waterways, streams and/ or wetlands, and shallow groundwater conditions may pose higher risks to the groundwater system.
A2 - Technical	Surface water management	4,00	Facilities with larger or more complex surface water management are less desirable. This includes facilities with larger overall cathcment area(s) and/ or footprints, the need of several embankment and or/ different facilities, and more complex topographies.
A2 - Technical	Mine materials management	5,00	Facilities with more complex mine materials management are less desirable. This consideres alternatives with higher haulage distances, the need of adecquate materials segragation during deposition and temporary or permanent storage of surplus materials.
A2 - Technical	Complete system flexibility	5,00	Mine materials characteristics and production could change over the life of the project, which could implicate changes in the storage requirements, physical stability and water management strategies. Alternatives that are least susceptible to risks associated with these changes and are more flexibile to accomodate the additional amount of mine materials are preferred.
A2 - Technical	Closure design and requirements	1,00	Larger or more complex facilities may require more complex and stringent closure design requirements. This includes facilities with larger overall catchment area(s) and/ or footprint, the need of several embankments and/ or facilities, the complexity of the mine material, and surface and groundwater management, monitoring and surveillance and risk and uncertainties for the post-closure condition.
A2 - Technical	Infrastructure requirements	5,00	Facilities that require more and/ or pose more complex ancilliary infrastructure (e.g., roads, powerline, drainage chambers, instrumentation, etc.)a re less desirable. Interferences with existing infrastrcuture, topographic constraints overall catchment area and/ or footprint, and the need of several embankments and/ or facilities may impact in the infraestructure requirements.
A2 - Technical	Maintenance Requirements	5,00	Larger or more complex facilities pose higher complexities during the construction stage. Maintenance requirements are related to ancilliary infraestructure, the need of several embankments and/ or different facilities, larger overall catchment areas and/ or footprints and monitoring instrumentation.
A2 - Technical	Monitoring & Surveillance	3,00	Larger or more complex facilities require more stringent monitoring and surveillance. The term 'more complex facilities' consideres unfavorable geotechnical properties and geochemical composition of the foundation, borrow and/ or deposited materials, larger overall catchment areas and/ or footprint of the facility, higher embankment heights and the need of several embankments and/ or different facilities.
A3 - Economic	Capex Requirements	6,00	Greater pre-production expenditure affects early cash flow and the ability to generate capital to execute the project.
A3 - Economic	Closure and Post-Closure Costs	4,00	Due to the short life of mine, capital intensive closure costs directly affect the internal rate of return.
A3 - Economic	Opex Requirements	5,00	The project has a short lifespan and therefore benefits of delaying sustaining capital are not easily realized. Higher operational costs are less desirable as the ore grade reduces rapidly over the life of the mine.
A4 - Socio-Economic	Closure plan implementation	5,00	Facilities with more complex and stringent closure design requirements may pose more complex stringent controls for an effective closure plan implementation. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure monitoring	4,00	Facilities with more complex and stringent closure design requirements and with stringent maintenance, monitoring and surveillance requirements may pose more complex and stringent post-closure monitoring and surveillance. This could be perceived negative by the local communities.
A4 - Socio-Economic	Post closure water management	2,00	Facilities with more complex and stringent closure design requirements and more susceptible to groundwater and surface water impacts may pose more complex post-closure water management. This could be perceived negative by the local communities.
A4 - Socio-Economic	Community perception and safety	2,00	Mine materials, irrespective of their geochemical composition, are generally perceived negative by the local communities. Therefore, facilities where receptors could have contact with mine materials, or communities thay are neraby the facility area are less desirable. In addition, it would be less desirable to impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem.
A4 - Socio-Economic	Permitting complexity and delays	5,00	Facilities that have impacts or implications on the different receptors and people's way of life, culture, community and well being pose higher complexities and delays in permitting. Alternatives that impact areas which have direct use values (e.g., agriculture, recreation, tourism and functional ecosystem benefits) as well as passive values such as the existence value of the natural habitat and ecosystem pose higher complexities and delays in permitting.

Sub-Account	Indicator	Weight Indicator Entry	Account
Capex Requirements	Additional site investigation	4,00	A3 - Economic
Capex Requirements	Ancillary infrastructure design, construction and maintenance	6,00	A3 - Economic
Capex Requirements	Borrow source location	4,00	A3 - Economic
Capex Requirements	Borrow source material availability	1,00	A3 - Economic
Capex Requirements	Construction time	1,00	A3 - Economic
Capex Requirements	Containment structure design	1,00	A3 - Economic
Capex Requirements	Diversion structures design, construction and maintenance	5,00	A3 - Economic
Capex Requirements	Embankment volume	2,00	A3 - Economic
Capex Requirements	Flexibility to expand the storage capacity	6,00	A3 - Economic
Capex Requirements	Geochemical characterization of all construction materials and associated excavation waste	4,00	A3 - Economic
Capex Requirements	Geotechnical conditions of the foundation	5,00	A3 - Economic
Capex Requirements	Impermeabilization area requirements	3,00	A3 - Economic
Capex Requirements	Impermeabilization Thickness	3,00	A3 - Economic
Capex Requirements	Impermeabilization topographic complexities	6,00	A3 - Economic
Capex Requirements	Materials delivery and deposition system	3,00	A3 - Economic
Capex Requirements	Number of ponds	5,00	A3 - Economic
Capex Requirements	QA/QC Requirements	2,00	A3 - Economic
Capex Requirements	Rip-rap material requirement	2,00	A3 - Economic
Capex Requirements	Seasonality	5,00	A3 - Economic
Capex Requirements	Surplus material storage	4,00	A3 - Economic
Capex Requirements	Time of legal and financial requirements and expected legal complexities	3,00	A3 - Economic
Capex Requirements	Topography	1,00	A3 - Economic
Capex Requirements	Water management system design	2,00	A3 - Economic
Closure and Post-Closure Costs	Closure design	6,00	A3 - Economic
Closure and Post-Closure Costs	Coverage of Open Pit walls	2,00	A3 - Economic
Closure and Post-Closure Costs	Groundwater conditions	4,00	A3 - Economic
Closure and Post-Closure Costs	Maintenance of traditional lifestyle	3,00	A3 - Economic
Closure and Post-Closure Costs	Overall footprint of the facility	6,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure maintenance and monitoring requirements	1,00	A3 - Economic
Closure and Post-Closure Costs	Post-closure risk and uncertainties	3,00	A3 - Economic
Closure and Post-Closure Costs	Previous and existing land use	6,00	A3 - Economic
Closure and Post-Closure Costs	Seepage from the facility to groundwater system	6,00	A3 - Economic
Closure and Post-Closure Costs	Topography	3,00	A3 - Economic
Closure and Post-Closure Costs	Vegetation	6,00	A3 - Economic
Closure and Post-Closure Costs	Water management / treatment to achieve water quality objectives	2,00	A3 - Economic
Closure design and requirements	Closure design	3,00	A2 - Technical
Closure design and requirements	Coverage of Open Pit walls	4,00	A2 - Technical
Closure design and requirements	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Closure design and requirements	Geotechnical conditions of the foundation	4,00	A2 - Technical
Closure design and requirements	Overall Catchment Area	6,00	A2 - Technical
Closure design and requirements	Overall footprint of the facility	3,00	A2 - Technical
Closure design and requirements	Pond water management	3,00	A2 - Technical
Closure design and requirements	Post-closure maintenance and monitoring requirements	4,00	A2 - Technical
Closure design and requirements	Post-closure risk and uncertainties	6,00	A2 - Technical
Closure design and requirements	Seepage from the facility to groundwater system	6,00	A2 - Technical
Closure plan implementation	Aesthetics - Re-vegetation	1,00	A4 - Socio-Economic
Closure plan implementation	Closure design	4,00	A4 - Socio-Economic
Closure plan implementation	Coverage of Open Pit walls	1,00	A4 - Socio-Economic
Closure plan implementation	Non-PAG material Segregation	2,00	A4 - Socio-Economic
Closure plan implementation	Number of ponds	4,00	A4 - Socio-Economic
Closure plan implementation	Post-closure maintenance and monitoring requirements	4,00	A4 - Socio-Economic
Closure plan implementation	Water management / treatment to achieve water quality objectives	4,00	A4 - Socio-Economic
Closure plan implementation	Water management system design	5,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Landforming engineering	3,00	A4 - Socio-Economic
Community perception and safety	Aesthetics - Line of sight (elevation difference)	4,00	A4 - Socio-Economic
Community perception and safety	Archaeological and traditional site nearby the facility	1,00	A4 - Socio-Economic
Community perception and safety	Bat and Bat Habitat	2,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat	1,00	A4 - Socio-Economic
Community perception and safety	Bird life and habitat (endangered/protected species)	5,00	A4 - Socio-Economic
Community perception and safety	Caribou and Caribou Habitat	1,00	A4 - Socio-Economic
Community perception and safety	Community and stakeholders acceptance	4,00	A4 - Socio-Economic
Community perception and safety	Community safety	4,00	A4 - Socio-Economic
Community perception and safety	Distance between the nearest waterway and the facility	6,00	A4 - Socio-Economic
Community perception and safety	Embankment height	3,00	A4 - Socio-Economic
Community perception and safety	Maintenance of traditional lifestyle	2,00	A4 - Socio-Economic
Community perception and safety	Number of embankments	5,00	A4 - Socio-Economic
Community perception and safety	Overall footprint of the facility	1,00	A4 - Socio-Economic
Community perception and safety	Overall perceived socio-economic consequences, benefits and relative preferences	6,00	A4 - Socio-Economic
Community perception and safety	Previous and existing land use	4,00	A4 - Socio-Economic
Community perception and safety	Risk of cascade embankment failure	4,00	A4 - Socio-Economic
Community perception and safety	Terrestrial life and habitat	4,00	A4 - Socio-Economic
Community perception and safety	Vegetation	2,00	A4 - Socio-Economic
Complete system flexibility	Flexibility to expand the storage capacity	5,00	A2 - Technical
Complete system flexibility	Topography	6,00	A2 - Technical
Design and construction impacts	Ancillary infrastructure design, construction and maintenance	2,00	A1 - Environmental
Design and construction impacts	Borrow source location	4,00	A1 - Environmental
Design and construction impacts	Borrow source material availability	6,00	A1 - Environmental
Design and construction impacts	Construction methodology of non-PAG storage piles	3,00	A1 - Environmental
Design and construction impacts	Geochemical characterization of all construction materials and associated excavation waste	2,00	A1 - Environmental
Design and construction impacts	Geotechnical conditions of the foundation	4,00	A1 - Environmental
Design and construction impacts	Impermeabilization area requirements	3,00	A1 - Environmental

Sub-Account	Indicator	Weight Indicator Entry	Account
Design and construction impacts	Impermeabilization Thickness	2,00	A1 - Environmental
Design and construction impacts	Impermeabilization topographic complexities	2,00	A1 - Environmental
Design and construction impacts	Number of embankments	4,00	A1 - Environmental
Design and construction impacts	Number of ponds	1,00	A1 - Environmental
Design and construction impacts	QA/QC Requirements	3,00	A1 - Environmental
Design and construction impacts	Risk of cascade embankment failure	1,00	A1 - Environmental
Infrastructure requirements	Ancillary infrastructure design, construction and maintenance	4,00	A2 - Technical
Infrastructure requirements	Overall footprint of the facility	3,00	A2 - Technical
Infrastructure requirements	Topography	3,00	A2 - Technical
Maintenance Requirements	Distance between the Coal Process Plant and the facility	5,00	A2 - Technical
Maintenance Requirements	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Maintenance Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A2 - Technical
Maintenance Requirements	Materials delivery and deposition system	3,00	A2 - Technical
Maintenance Requirements	Overall footprint of the facility	3,00	A2 - Technical
Mine materials management	Design Criteria - maitenance of water cover	6,00	A2 - Technical
Mine materials management	Distance between the Coal Process Plant and the facility	4,00	A2 - Technical
Mine materials management	Geochemical characterization of all construction materials and associated excavation waste	2,00	A2 - Technical
Mine materials management	Materials delivery and deposition system	6,00	A2 - Technical
Mine materials management	Non-PAG material Segregation	5,00	A2 - Technical
Mine materials management	Operational complexity in materials deposition	6,00	A2 - Technical
Mine materials management	Overall footprint of the facility	5,00	A2 - Technical
Mine materials management	Pond water management	1,00	A2 - Technical
Mine materials management	QA/QC requirements for segregating non-PAG from PAG	2,00	A2 - Technical
Mine materials management	Quantity of non-PAG materials produced that remain above the closure water table	3,00	A2 - Technical
Mine materials management	Surplus material storage	1,00	A2 - Technical
Mine materials management impacts	Design Criteria - maitenance of water cover	5,00	A1 - Environmental
Mine materials management impacts	Materials delivery and deposition system	3,00	A1 - Environmental
Mine materials management impacts	Non-PAG material Segregation	6,00	A1 - Environmental
Mine materials management impacts	Operational complexity in materials deposition	4,00	A1 - Environmental
Mine materials management impacts	Quantity of non-PAG materials produced that remain above the closure water table	6,00	A1 - Environmental
Monitoring & Surveillance	Embankment height	5,00	A2 - Technical
Monitoring & Surveillance	Geotechnical conditions of the foundation	4,00	A2 - Technical
Monitoring & Surveillance	Instrumentation requirements and Operation, Maintenance and Surveillance	3,00	A2 - Technical
Monitoring & Surveillance	Number of embankments	1,00	A2 - Technical
Monitoring & Surveillance	Number of ponds	4,00	A2 - Technical
Monitoring & Surveillance	Overall footprint of the facility	2,00	A2 - Technical
Opex Requirements	Ancillary infrastructure design, construction and maintenance	6,00	A3 - Economic
Opex Requirements	Design Criteria - maitenance of water cover	3,00	A3 - Economic
Opex Requirements	Distance between the Coal Process Plant and the facility	4,00	A3 - Economic
Opex Requirements	Distance between the nearest waterway and the facility	6,00	A3 - Economic
Opex Requirements	Diversion structures design, construction and maintenance	5,00	A3 - Economic
Opex Requirements	Geochemical characterization of all construction materials and associated excavation waste	2,00	A3 - Economic
Opex Requirements	Groundwater conditions	5,00	A3 - Economic
Opex Requirements	Instrumentation requirements and Operation, Maintenance and Surveillance	5,00	A3 - Economic
Opex Requirements	Materials delivery and deposition system	5,00	A3 - Economic
Opex Requirements	Non-PAG material Segregation	1,00	A3 - Economic
Opex Requirements	Operational complexity in materials deposition	6,00	A3 - Economic
Opex Requirements	Pond water management	5,00	A3 - Economic
Opex Requirements	QA/QC requirements for segregating non-PAG from PAG	6,00	A3 - Economic
Opex Requirements	Seepage from the facility to groundwater system	6,00	A3 - Economic
Opex Requirements	Water management / treatment to achieve water quality objectives	3,00	A3 - Economic
Permitting complexity and delays	Aesthetics - Landforming engineering	3,00	A4 - Socio-Economic
Permitting complexity and delays	Archaeological and traditional site nearby the facility	4,00	A4 - Socio-Economic
Permitting complexity and delays	Atmospheric issues due to dam construction	5,00	A4 - Socio-Economic
Permitting complexity and delays	Construction methodology of non-PAG storage piles	6,00	A4 - Socio-Economic
Permitting complexity and delays	Distance between the nearest waterway and the facility	4,00	A4 - Socio-Economic
Permitting complexity and delays	Geochemical characterization of all construction materials and associated excavation waste	1,00	A4 - Socio-Economic
Permitting complexity and delays	Groundwater conditions	5,00	A4 - Socio-Economic
Permitting complexity and delays	Impermeabilization area requirements	5,00	A4 - Socio-Economic
Permitting complexity and delays	Overall Catchment Area	5,00	A4 - Socio-Economic
Permitting complexity and delays	Overall perceived socio-economic consequences, benefits and relative preferences	5,00	A4 - Socio-Economic
Permitting complexity and delays	Pond water management	5,00	A4 - Socio-Economic
Permitting complexity and delays	Prevalent wind speed and direction	1,00	A4 - Socio-Economic
Permitting complexity and delays	Previous and existing land use	3,00	A4 - Socio-Economic
Permitting complexity and delays	Terrestrial life and habitat	6,00	A4 - Socio-Economic
Permitting complexity and delays	Vegetation	5,00	A4 - Socio-Economic
Permitting complexity and delays	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic
Permitting complexity and delays	Water management system design	6,00	A4 - Socio-Economic
Post closure monitoring	Groundwater conditions	6,00	A4 - Socio-Economic
Post closure monitoring	Instrumentation requirements and Operation, Maintenance and Surveillance	2,00	A4 - Socio-Economic
Post closure monitoring	Post-closure maintenance and monitoring requirements	6,00	A4 - Socio-Economic
Post closure monitoring	Post-closure risk and uncertainties	6,00	A4 - Socio-Economic
Post closure monitoring	Water management / treatment to achieve water quality objectives	5,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat	5,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat (endangered/protected fauna)	2,00	A4 - Socio-Economic
Post closure water management	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	1,00	A4 - Socio-Economic
Post closure water management	Distance between the nearest waterway and the facility	1,00	A4 - Socio-Economic
Post closure water management	Diversion structures design, construction and maintenance	2,00	A4 - Socio-Economic
Post closure water management	Groundwater conditions	1,00	A4 - Socio-Economic
Post closure water management	Overall Catchment Area	1,00	A4 - Socio-Economic
Post closure water management	Pond water management	5,00	A4 - Socio-Economic
Post closure water management	Water management / treatment to achieve water quality objectives	1,00	A4 - Socio-Economic

Sub-Account	Indicator	Weight Indicator Entry	Account
Post closure water management	Water management system design	4,00	A4 - Socio-Economic
Post-closure land use	Aesthetics - Re-vegetation	1,00	A1 - Environmental
Post-closure land use	Closure design	2,00	A1 - Environmental
Post-closure land use	Coverage of Open Pit walls	4,00	A1 - Environmental
Post-closure land use	Maintenance of traditional lifestyle	5,00	A1 - Environmental
Post-closure land use	Overall footprint of the facility	4,00	A1 - Environmental
Post-closure land use	Post-closure maintenance and monitoring requirements	2,00	A1 - Environmental
Post-closure land use	Water management / treatment to achieve water quality objectives	4,00	A1 - Environmental
Potential air quality impacts	Atmospheric issues due to dam construction	4,00	A1 - Environmental
Potential air quality impacts	Prevalent wind speed and direction	1,00	A1 - Environmental
Potential groundwater impacts	Coverage of Open Pit walls	3,00	A1 - Environmental
Potential groundwater impacts	Distance between the nearest waterway and the facility	1,00	A1 - Environmental
Potential groundwater impacts	Geochemical characterization of all construction materials and associated excavation waste	3,00	A1 - Environmental
Potential groundwater impacts	Groundwater conditions	4,00	A1 - Environmental
Potential groundwater impacts	Seepage from the facility to groundwater system	1,00	A1 - Environmental
Potential groundwater impacts	Water management / treatment to achieve water quality objectives	2,00	A1 - Environmental
Potential groundwater impacts	Water management system design	3,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	5,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat (endangered/protected fauna)	1,00	A1 - Environmental
Potential impacts to receptors	Aquatic life and habitat. Concentrations of Contaminants of Potential Concern (COPC) from discharges and seepages	2,00	A1 - Environmental
Potential impacts to receptors	Bat and Bat Habitat	4,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	3,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat	1,00	A1 - Environmental
Potential impacts to receptors	Bird life and habitat (endangered/protected species)	2,00	A1 - Environmental
Potential impacts to receptors	Caribou and Caribou Habitat	5,00	A1 - Environmental
Potential impacts to receptors	Previous and existing land use	5,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat	6,00	A1 - Environmental
Potential impacts to receptors	Terrestrial life and habitat (endangered/protected species)	5,00	A1 - Environmental
Potential impacts to receptors	Vegetation	5,00	A1 - Environmental
Potential surface water impacts	Distance between the nearest waterway and the facility	2,00	A1 - Environmental
Potential surface water impacts	Diversion structures design, construction and maintenance	1,00	A1 - Environmental
Potential surface water impacts	Overall Catchment Area	5,00	A1 - Environmental
Potential surface water impacts	Pond water management	6,00	A1 - Environmental
Potential surface water impacts	Water management system design	4,00	A1 - Environmental
Seepage and groundwater control	Distance between the nearest waterway and the facility	1,00	A2 - Technical
Seepage and groundwater control	Groundwater conditions	5,00	A2 - Technical
Seepage and groundwater control	Seepage from the facility to groundwater system	6,00	A2 - Technical
Seepage and groundwater control	Water management / treatment to achieve water quality objectives	6,00	A2 - Technical
Seepage and groundwater control	Water management system design	2,00	A2 - Technical
Storage Facility Construction	Borrow source material availability	3,00	A2 - Technical
Storage Facility Construction	Construction constraints	1,00	A2 - Technical
Storage Facility Construction	Construction methodology of non-PAG storage piles	2,00	A2 - Technical
Storage Facility Construction	Construction time	3,00	A2 - Technical
Storage Facility Construction	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Storage Facility Construction	Embankment volume	4,00	A2 - Technical
Storage Facility Construction	Geotechnical conditions of the foundation	6,00	A2 - Technical
Storage Facility Construction	Impermeabilization area requirements	6,00	A2 - Technical
Storage Facility Construction	Impermeabilization Thickness	4,00	A2 - Technical
Storage Facility Construction	Impermeabilization topographic complexities	4,00	A2 - Technical
Storage Facility Construction	QA/QC Requirements	4,00	A2 - Technical
Storage Facility Construction	Rip-rap material requirement	2,00	A2 - Technical
Storage Facility Construction	Seasonality	5,00	A2 - Technical
Storage Facility Construction	Surplus material storage	2,00	A2 - Technical
Storage Facility Construction	Topography	3,00	A2 - Technical
Storage Facility Design	Additional site investigation	3,00	A2 - Technical
Storage Facility Design	Borrow source location	4,00	A2 - Technical
Storage Facility Design	Borrow source material availability	1,00	A2 - Technical
Storage Facility Design	Containment structure design	6,00	A2 - Technical
Storage Facility Design	Diversion structures design, construction and maintenance	1,00	A2 - Technical
Storage Facility Design	Embankment height	2,00	A2 - Technical
Storage Facility Design	Geochemical characterization of all construction materials and associated excavation waste	6,00	A2 - Technical
Storage Facility Design	Geotechnical conditions of the foundation	4,00	A2 - Technical
Storage Facility Design	Impermeabilization Thickness	4,00	A2 - Technical
Storage Facility Design	Number of embankments	2,00	A2 - Technical
Storage Facility Design	Number of ponds	2,00	A2 - Technical
Storage Facility Design	Overall Catchment Area	3,00	A2 - Technical
Storage Facility Design	Overall footprint of the facility	1,00	A2 - Technical
Storage Facility Design	Risk of cascade embankment failure	4,00	A2 - Technical
Storage Facility Design	Seepage from the facility to groundwater system	1,00	A2 - Technical
Storage Facility Design	Topography	1,00	A2 - Technical
Storage Facility Design	Water management system design	3,00	A2 - Technical
Surface water management	Diversion structures design, construction and maintenance	2,00	A2 - Technical
Surface water management	Number of ponds	3,00	A2 - Technical
Surface water management	Overall Catchment Area	2,00	A2 - Technical
Surface water management	Overall footprint of the facility	4,00	A2 - Technical
Surface water management	Water management system design	3,00	A2 - Technical

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,068	0,070	0,049	0,064
	Mine materials management impacts	0,028	0,022	0,023	0,023
	Post-closure land use	0,087	0,077	0,067	0,059
	Potential air quality impacts	0,029	0,029	0,020	0,014
	Potential groundwater impacts	0,066	0,063	0,055	0,039
	Potential impacts to receptors	0,052	0,056	0,040	0,028
	Potential surface water impacts	0,077	0,065	0,056	0,046
Total C1 - Environmental		**0,407**	**0,381**	**0,309**	**0,273**
C2 - Technical	Closure design and requirements	0,003	0,002	0,002	0,002
	Complete system flexibility	0,014	0,012	0,014	0,007
	Infrastructure requirements	0,016	0,016	0,010	0,007
	Maintenance Requirements	0,013	0,013	0,011	0,012
	Mine materials management	0,014	0,012	0,012	0,012
	Monitoring & Surveillance	0,008	0,006	0,006	0,007
	Seepage and groundwater control	0,003	0,002	0,002	0,001
	Storage Facility Construction	0,005	0,004	0,004	0,004
	Storage Facility Design	0,016	0,014	0,013	0,014
	Surface water management	0,014	0,013	0,010	0,005
Total C2 - Technical		**0,104**	**0,096**	**0,083**	**0,071**
C3 - Economic	Capex Requirements	0,039	0,036	0,031	0,025
	Closure and Post-Closure Costs	0,027	0,026	0,020	0,021
	Opex Requirements	0,031	0,029	0,024	0,025
Total C3 - Economic		**0,098**	**0,091**	**0,075**	**0,071**
C4 - Socio-Economic	Closure plan implementation	0,169	0,131	0,128	0,135
	Community perception and safety	0,058	0,058	0,051	0,060
	Permitting complexity and delays	0,172	0,168	0,142	0,125
	Post closure monitoring	0,091	0,079	0,087	0,110
	Post closure water management	0,075	0,068	0,055	0,040
Total C4 - Socio-Economic		**0,566**	**0,503**	**0,462**	**0,469**
Total		**1,175**	**1,071**	**0,929**	**0,885**

Appendix F.8 Excluding Environmental Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	0,00	1	ECCC	0,00%
A2 - Technical	Technical	3,00	2	ECCC	40,00%
A3 - Economic	Economic	1,50	3	ECCC	20,00%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	40,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,000	0,000	0,000	0,000
	Mine materials management impacts	0,000	0,000	0,000	0,000
	Post-closure land use	0,000	0,000	0,000	0,000
	Potential air quality impacts	0,000	0,000	0,000	0,000
	Potential groundwater impacts	0,000	0,000	0,000	0,000
	Potential impacts to receptors	0,000	0,000	0,000	0,000
	Potential surface water impacts	0,000	0,000	0,000	0,000
Total C1 - Environmental		**0,000**	**0,000**	**0,000**	**0,000**
C2 - Technical	Closure design and requirements	0,063	0,058	0,046	0,057
	Complete system flexibility	0,052	0,037	0,056	0,022
	Infrastructure requirements	0,031	0,031	0,019	0,014
	Maintenance Requirements	0,029	0,029	0,022	0,021
	Mine materials management	0,044	0,040	0,039	0,037
	Monitoring & Surveillance	0,036	0,034	0,027	0,033
	Seepage and groundwater control	0,067	0,065	0,040	0,034
	Storage Facility Construction	0,034	0,032	0,028	0,028
	Storage Facility Design	0,027	0,026	0,021	0,020
	Surface water management	0,100	0,096	0,072	0,033
Total C2 - Technical		**0,483**	**0,448**	**0,370**	**0,299**
C3 - Economic	Capex Requirements	0,042	0,039	0,034	0,029
	Closure and Post-Closure Costs	0,130	0,117	0,100	0,105
	Opex Requirements	0,064	0,058	0,048	0,048
Total C3 - Economic		**0,236**	**0,213**	**0,183**	**0,183**
C4 - Socio-Economic	Closure plan implementation	0,077	0,061	0,058	0,060
	Community perception and safety	0,137	0,134	0,117	0,128
	Permitting complexity and delays	0,051	0,049	0,042	0,035
	Post closure monitoring	0,080	0,071	0,068	0,062
	Post closure water management	0,101	0,091	0,075	0,052
Total C4 - Socio-Economic		**0,447**	**0,406**	**0,361**	**0,337**
Total		**1,165**	**1,067**	**0,914**	**0,819**

Appendix F.9 Excluding Techincal Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	57,14%
A2 - Technical	Technical	0,00	2	ECCC	0,00%
A3 - Economic	Economic	1,50	3	ECCC	14,29%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	28,57%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,040	0,041	0,033	0,038
	Mine materials management impacts	0,074	0,054	0,058	0,067
	Post-closure land use	0,094	0,078	0,070	0,072
	Potential air quality impacts	0,078	0,078	0,061	0,047
	Potential groundwater impacts	0,125	0,124	0,092	0,076
	Potential impacts to receptors	0,135	0,143	0,106	0,080
	Potential surface water impacts	0,143	0,131	0,097	0,069
Total C1 - Environmental		**0,688**	**0,648**	**0,517**	**0,448**
C2 - Technical	Closure design and requirements	0,000	0,000	0,000	0,000
	Complete system flexibility	0,000	0,000	0,000	0,000
	Infrastructure requirements	0,000	0,000	0,000	0,000
	Maintenance Requirements	0,000	0,000	0,000	0,000
	Mine materials management	0,000	0,000	0,000	0,000
	Monitoring & Surveillance	0,000	0,000	0,000	0,000
	Seepage and groundwater control	0,000	0,000	0,000	0,000
	Storage Facility Construction	0,000	0,000	0,000	0,000
	Storage Facility Design	0,000	0,000	0,000	0,000
	Surface water management	0,000	0,000	0,000	0,000
Total C2 - Technical		**0,000**	**0,000**	**0,000**	**0,000**
C3 - Economic	Capex Requirements	0,030	0,028	0,024	0,021
	Closure and Post-Closure Costs	0,093	0,083	0,072	0,075
	Opex Requirements	0,046	0,041	0,034	0,034
Total C3 - Economic		**0,168**	**0,152**	**0,131**	**0,131**
C4 - Socio-Economic	Closure plan implementation	0,055	0,043	0,042	0,043
	Community perception and safety	0,098	0,096	0,084	0,091
	Permitting complexity and delays	0,037	0,035	0,030	0,025
	Post closure monitoring	0,057	0,050	0,049	0,044
	Post closure water management	0,072	0,065	0,053	0,037
Total C4 - Socio-Economic		**0,319**	**0,290**	**0,258**	**0,241**
Total		**1,176**	**1,091**	**0,906**	**0,819**

Appendix F.10 Excluding Economic Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	50,00%
A2 - Technical	Technical	3,00	2	ECCC	25,00%
A3 - Economic	Economic	0,00	3	ECCC	0,00%
A4 - Socio-Economic	Socio-Economic	3,00	4	ECCC	25,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,035	0,036	0,029	0,033
	Mine materials management impacts	0,065	0,048	0,051	0,058
	Post-closure land use	0,082	0,068	0,061	0,063
	Potential air quality impacts	0,068	0,068	0,054	0,041
	Potential groundwater impacts	0,110	0,108	0,080	0,066
	Potential impacts to receptors	0,118	0,125	0,093	0,070
	Potential surface water impacts	0,125	0,115	0,085	0,060
Total C1 - Environmental		**0,602**	**0,567**	**0,453**	**0,392**
C2 - Technical	Closure design and requirements	0,040	0,036	0,029	0,035
	Complete system flexibility	0,032	0,023	0,035	0,014
	Infrastructure requirements	0,019	0,019	0,012	0,009
	Maintenance Requirements	0,018	0,018	0,014	0,013
	Mine materials management	0,027	0,025	0,024	0,023
	Monitoring & Surveillance	0,023	0,021	0,017	0,021
	Seepage and groundwater control	0,042	0,041	0,025	0,021
	Storage Facility Construction	0,021	0,020	0,018	0,017
	Storage Facility Design	0,017	0,016	0,013	0,012
	Surface water management	0,063	0,060	0,045	0,021
Total C2 - Technical		**0,302**	**0,280**	**0,232**	**0,187**
C3 - Economic	Capex Requirements	0,000	0,000	0,000	0,000
	Closure and Post-Closure Costs	0,000	0,000	0,000	0,000
	Opex Requirements	0,000	0,000	0,000	0,000
Total C3 - Economic		**0,000**	**0,000**	**0,000**	**0,000**
C4 - Socio-Economic	Closure plan implementation	0,048	0,038	0,037	0,038
	Community perception and safety	0,086	0,084	0,073	0,080
	Permitting complexity and delays	0,032	0,031	0,027	0,022
	Post closure monitoring	0,050	0,044	0,043	0,039
	Post closure water management	0,063	0,057	0,047	0,033
Total C4 - Socio-Economic		**0,279**	**0,254**	**0,226**	**0,211**
Total		**1,183**	**1,101**	**0,910**	**0,789**

Appendix F.11 Excluding Socio-Economic Account

Account	Label	Weight	Account ID	Source Account	Weight Normalised
A1 - Environmental	Environmental	6,00	1	ECCC	57,14%
A2 - Technical	Technical	3,00	2	ECCC	28,57%
A3 - Economic	Economic	1,50	3	ECCC	14,29%
A4 - Socio-Economic	Socio-Economic	0,00	4	ECCC	0,00%

Sum of Score_Ind_SubAcc_Acc_Cat		Alternative			
Account	Sub-Account	1- EAC Submitted Option	2- Alternative Configuration 2	3- Alternative Configuration 4	4- Alternative Configuration 5
C1 - Environmental	Design and construction impacts	0,040	0,041	0,033	0,038
	Mine materials management impacts	0,074	0,054	0,058	0,067
	Post-closure land use	0,094	0,078	0,070	0,072
	Potential air quality impacts	0,078	0,078	0,061	0,047
	Potential groundwater impacts	0,125	0,124	0,092	0,076
	Potential impacts to receptors	0,135	0,143	0,106	0,080
	Potential surface water impacts	0,143	0,131	0,097	0,069
Total C1 - Environmental		**0,688**	**0,648**	**0,517**	**0,448**
C2 - Technical	Closure design and requirements	0,045	0,041	0,033	0,040
	Complete system flexibility	0,037	0,026	0,040	0,016
	Infrastructure requirements	0,022	0,022	0,014	0,010
	Maintenance Requirements	0,021	0,021	0,016	0,015
	Mine materials management	0,031	0,029	0,028	0,026
	Monitoring & Surveillance	0,026	0,024	0,019	0,024
	Seepage and groundwater control	0,048	0,047	0,029	0,024
	Storage Facility Construction	0,024	0,023	0,020	0,020
	Storage Facility Design	0,019	0,018	0,015	0,014
	Surface water management	0,071	0,068	0,051	0,024
Total C2 - Technical		**0,345**	**0,320**	**0,265**	**0,213**
C3 - Economic	Capex Requirements	0,030	0,028	0,024	0,021
	Closure and Post-Closure Costs	0,093	0,083	0,072	0,075
	Opex Requirements	0,046	0,041	0,034	0,034
Total C3 - Economic		**0,168**	**0,152**	**0,131**	**0,131**
C4 - Socio-Economic	Closure plan implementation	0,000	0,000	0,000	0,000
	Community perception and safety	0,000	0,000	0,000	0,000
	Permitting complexity and delays	0,000	0,000	0,000	0,000
	Post closure monitoring	0,000	0,000	0,000	0,000
	Post closure water management	0,000	0,000	0,000	0,000
Total C4 - Socio-Economic		**0,000**	**0,000**	**0,000**	**0,000**
Total		**1,202**	**1,120**	**0,913**	**0,792**

Appendix G Multi-Disciplinary Workshop Minutes

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Telkwa – PAG Storage Alternatives Assessment

Minutes for the Meeting: SRK Consulting

Held: Microsoft Teams, Feb 28th 2024 at 1:00pm

1 Present and apologies

Sue Bonham Carter- Bathurst
Dan Farmer (DF) - Telkwa
James Henderson (JH) – Telkwa
Victoria Hughes (VH) – Telkwa
Jessy Chaplin – Telkwa
Paul Weber (PW) – MWM
Greg Meiers (GM) – MWM

Rick Palmer – Palmer Environmental
Alexandra LeClair – Palmer Environmental

Calvin Boese – SRK CA
Celine Michiels – SRK CA
Santiago Pastine – SRK AR
Nicolas Alscher – SRK AR

2 Objective of the workshop

The objective of the workshop is to present the overall process for assessing alternatives for the different mine materials from the Tenas Project. This includes:

1. Presenting the methodology adopted for the storage alternatives assessment.
2. Presenting and discussing the candidate alternatives.
3. Presenting the indicators, sub-accounts and accounts considered in the analysis.
4. Discussing the scoring for indicators and weightings for accounts and sub-accounts.

3 Confirmation of agenda

Wednesday, February 28, 2024	Duration	Saskatoon		Vancouver		Buenos Aires	
Opening	5 min	13:00	13:05	11:00	11:05	16:00	16:05
Introductions	10 min	13:05	13:15	11:05	11:15	16:05	16:15
Project Background & Pre-Screening Assessment	15 min	13:15	13:30	11:15	11:30	16:15	16:30
MAA Process Overview	15 min	13:30	13:45	11:30	11:45	16:30	16:45
Sub-Accounts Weighting	15 min	13:45	14:00	11:45	12:00	16:45	17:00
Indicators Scoring	45 min	14:00	14:45	12:00	12:45	17:00	17:45
Coffee Break	15 min	14:45	15:00	12:45	13:00	17:45	18:00
Indicators Scoring	60 min	15:00	16:00	13:00	14:00	18:00	19:00
Break / Compiling results	15 min	16:00	16:15	14:00	14:15	19:00	19:15
Workshop Closure	15 min	16:15	16:30	14:15	14:30	19:15	19:30

4 Opening

- Dan Farmer (Telkwa) advised this is an Information Request (IR) given by the Ministry of Mines through the Environmental Assessment Office (EAO) asking for a materials storage alternatives assessment following the Environment and Climate Change Canada (ECCC) guidelines for federal EAS.
  - Explained today's team consists of a diverse group of people to discuss all considerations.
  - Dan advised that SRK Consulting put together today's presentation and then handed it over to Calvin Boese, Principal Consultant, SRK Consulting.
- Calvin explained the process and background for today's meeting before everyone introduced themselves.

5 Discussion Points – from presentation:

5.1 Project Background & Pre-Screening Assessment

5.1.1 History Review of the Project

- 2018 through 2021 – field programs have been done to investigate the foundation conditions for previous versions of the Management Ponds (MP) design and rock geotechnical investigations for the open pit slopes.
- 2020 – 2021 – Several works were conducted:
  - Geochemical characterization and assessment of management strategies to prevent Acid Rock Drainage (ARD) and Metal Leaching (ML) of the different mine materials.
  - Site-wide water balance and water balance for the management ponds.
  - Alignments for the liner design and construction methodology.
  - Geotechnical assessment of both the management ponds and the Tenas Control Pond at a Feasibility Study level.
- 2022 February – submission of the Environmental Assessment Certificate Application (EACA) to the EAO.
- 2022 November – EAO presented a list of IRs, including a request to complete a detailed review of the PAG material storage alternatives assessed to support the mine plan and management ponds provided in the EACA.
  - Objective for this workshop is to provide a comprehensive review of the different alternatives assessed by Telkwa.
  - Beyond the informal alternatives assessments previously done by Telkwa and SRK. The ministry requires a more compiled and formalized assessment including the MAA and general state conditions.

5.2 Site Conditions

- Project is located in central BC
- Nearest townsite is Telkwa.
- Geotechnical Profile – mainly composed of interceptions of silts and clays commonly stiff to hard in consistency and dense to very dense sands and gravels.
- Seismicity - Relatively stable area (NCR 2015). This is supported by a site-specific seismic hazard assessment conducted by SRK in 2023 – 2024.

5.3 Mine Plan and Mine Materials

- LOM – 21 years
- Coal production rate – 775,000 to 825,000 ton/s annum
- By product of the concentration process – fine and coarse processed rock combined for disposal.

5.4 Mine Materials Characterization

- Geochemical characterization for the EACA and planning purposes based on Acid-Base Accounting (ABA) Tests.
- Criterion: PAG material: NPR≤ 2. – Non PAG > 2.

Q - Paul Weber:
The slides are looking at a classification based on an NPR of two for acid forming vs. non acid forming for the design which will mean partially more non-acid forming material release acid forming materials which contributes to some additional capacity. Any comments?

A - Dan Farmer:
Working with Mike Herrell and his team. Putting forward for classification in the Operations Phase 1.2. The dams will be less, but the idea is we build them in stages and learn from each. May have more than one big facility. Can alter the construction as you go and when you have less PAG then you don't build the next one as big.

- Material enters the Coal Process Plant (CPP) and is divided into streams – coarse and fine.
- Final product is coal.
- Byproduct is fine and coarse processed rock combined for disposal with Potentially Acid Generating (PAG) rock from the open pit.
- Mine waste, some topsoil and overburden also come from the open pit.
- 2020: A geochemical characterization was done based on the acid base account test. Showed the topsoil and overburden materials are Non-PAG while some parts of the mine rock material are PAG.
- Will monitor during the operational phase to determine PAG and Non-PAG.

5.5 Mine Materials Management

An alternatives assessment for ARD/ML mitigation strategy was conducted in 2020 – 2021 for the different mine materials. The outcomes of the study were that:

- Fine processed rock should be dewatered and blended with coarse processed rock for co-disposal with PAG mine rock. This increase the process waste recycling and reduce risks and operational complexities associated with the management of more than one facility for each.
- Open pit walls are PAG. Cover with overburden which is a Non-PAG material and then prepare the landform for the post closure condition.
- The Non-PAG material should be progressively covered with topsoil for post closure. Also, could be a candidate material for the construction of the embankment.
- PAG mine rock should be impounded, with a water cover to minimize oxygen and prevent ARD/ML.
- Construction Materials – Non-PAG rock materials, some topsoil and overburden with the appropriate compaction requirements. An impermeabilization of the full deposition area is needed to ensure a positive water balance in the management ponds and keep water cover of the PAG materials. To achieve this:
    - 0.3 meters thick low permeability soil-bentonite liner – constructed in two stages, 0.15 m.
    - A maximum seepage rate of ~3000 cubic meters per day is needed to keep the positive water balance. A target hydraulic conductivity of $1x10^{-8}$ meters per second to achieve this.

Q - Paul Weber: 2800 cubic meters per day? Is that just the seepage from the PAG cells based on the original design? That could change a little depending on what option goes forward.

A – Dan Farmer: Yes. That's the maximum allowed for seepage out of the management facilities and having a positive water cover. That is the maximum that can come out of the management ponds.

Q – Paul Weber: So that's the managements ponds change? That's the maximum based on the containment load model. That's the goal and anything less works as far as that containment load goes. Any fix on the receiving environment?

A – Dan Farmer: No, it's limited on what keeps a positive water cover in the pond itself. The number might even be smaller if based on load going into the pond but it wasn't.

5.6 Alternatives Assessment

- **First step** – identify the candidate alternatives: Threshold criteria to identify Candidate Alternatives:

    - Protected area
    - Topographic constraints
    - Existing infrastructure
    - TCL property or coal license boundaries
    - Distance to the CPP
    - Distant to the EA Open Pit

    Due to the requirement to store materials – the TCL coal licenses located north of the open pit are the only areas the comply with all threshold criteria and storage requirements. Within this area, 6 configurations were identified.

Q – Paul Weber: What does it mean when you say preserve the deposit for future generations? That it won't be mined as part of this project and therefore, the other scenarios won't be mined, but you'll place material on top of it?
A – Santiago Pastine / Dan Farmer – Yes. Correct.

- **Second step – Pre-Screening Assessment** – using criteria to establish fatal flaws for eliminating options. All options already went through an initial list of about 15 or 20 items each had to meet to qualify. If one gets a "Yes" it is excluded.
    - Infrastructure outside the boundaries of the Tenas and Four Creek.
    - Impacting future resources.
    - Disposal of the fine and coarse processed rock in separate facilities than the PAG rock.

  (EAC / Option 2 / Option 4 received no yes's and move forward).

Q – Calvin Boese: Because these were pre-screened and we are now down to three options, is everyone in agreement that these three configurations move forward to the multiple accounts analysis (MAA) or should there be others carried forward?
Q - Paul Weber: You talk about fine and coarse waste material from the processing plant being stored separately. Does this introduce other geotechnical risks in regards liquefaction due to earthquakes. Was this ticked off and ruled out?
A – Calvin Boese and summarized by Paul Weber: There's no real difference in risk for liquefaction because of the material properties for either coal disposal or separate disposal?
A – Calvin Boese: Correct.
Q – Paul Weber: One of the key issues from all these design options is what is the long-term effect on the receiving environment? It doesn't seem to be anything in the screening that looks at the affect difference from these options either the load coming out or the two streams that run past it.
A – Dan Farmer: No, there isn't one scenario that would have eliminate exceedances. We couldn't see one eliminate exceedances. Could be the criteria, one that doesn't have exceedances in the pre-screening.
Q – Paul con't: Add some commentary that you know the difference wasn't the key driver for the MAA process, it was other parameters.
A – Dan con't: Good point, will add some commentary on it.

Q – Jessy Chaplin – Are SRK jumping too quickly to this location? Will the government say you need to look at span of 50km radius for example? Is it possible to add the economic to this?
A – Dan Farmer – (Shows the map and explains how they limited down to specific area (white)). And stay within the property, eliminating areas that don't make sense.
Q – Jessy – Should you consider damming a river/creek and why did we exclude that? And ensure the government knows why these areas were eliminated.

Comments / Considerations – working through options:

- Look at some of the key concerns, alternative assessment looking at storing PAG underwater
- Quality is an issue
- More disturbance we have, the larger footprints
- Commentary around environment
- Not have facility over top
- Were alternatives looked at for explosive facilities. (yes)
- Facilities need to be other side of creek
- Introduces us to another watershed
- 3 - Separating the waste into two types of facilities. May be way of incorporating that within existing watersheds
- Could put in sub note – it's outside but could be moved.
- Examine alternatives in a larger span – 50km radius or a 25 km radius. (Cost concern)

List of initial goals:

- Goals for developing Configurations:
- Minimize disturbance footprint;
- Promote a water cover to prevent ARD;
- Stable embankments;
- Robust water management for sediment control;
- Contain all PAG material plus contingencies;
- Avoid provincial Agricultural Land Reserve;
- Avoid private lands;
- Avoid municipal boundaries;
- Avoid provincial infrastructure;
- Avoid BC Hydro Infrastructure;
- Avoid PNG infrastructure;
- Avoid Ministry of Transportation roads;
- Prevent potential non-cascading dam failures;
- Avoid steep terrain greater than 4H to 1V or 14%;
- Avoid structures on the east side of Goathorn Creek;
- Avoid structures on the west or north sides of Tenas Creek;
- Avoid structures on the north side of Telkwa River;
- Avoid High Elevation Caribou habitat;
- Avoid placing material directly within a watercourse and/or its riparian zone;
- Do not sterilize potential future coal resources; and
- Minimize haul distance and associated emissions with dust and GHG.

Comments / Considerations con't:

- Minimize potential environmental effect OR minimize the load that would report to those two streams. Could expand on this as needed for what you have looked at.
- Material quantities – would knock out some of the more complex ones. Non acid forming rock.
- Excavated storage – huge external piles that needed placement.
- Pre-screening – material requirements / height of dam under 30 to 35 meters.
- Enough material at the right time – all possible within the mine plan.
- Enough water for PAG storage? (should be able to generate enough water each year to flood when needed and in gross system design).
- Request received – look at alternatives to the PAG management system.
- Potentially all scenarios are within a couple of months of having the right amount of material at the right time to physically build the dams.

- The Tenas Control Pond is oversized to meet our needs to maintain water cover – keep the water level in the active PAG cell managed. Can dump safely and flood as required. (filling of water related to freshet).
- The IR says applications must include an alternatives assessment for the management ponds, tailing storage facilities as per the app information requirements. Provide a detailed review of tailing storage alternatives assessed to support the proposed mine plan.
- (The gov't calls it tailings because it goes through a process – material that came out of a washing is processed material)
- Would we have a tailings stamp – technically under the code, no. Tailings not included in the build – looked at having a separate facility for tailings (more things to manage then).
    - Discussion about separating the waste streams
    - The ARD component of the rock behind the dam, even though submerged, has it's own risks.
    - Memo on why the PAG is underwater vs. not underwater in original application
    - Why we went dry stack vs we for tailings with the main reason water usage. Main drivers was feedback received - we wanted us to use as little water as possible from the community.
- Fish and village driving it to extreme rating – good to see the option is sitting between two creeks and fish on all sides.
    - Both flow and watershed for steelhead especially.
    - Option least impact on watershed, reduced flows.
    - Dam failure consequence is considered. Breach analysis included on the design option submitted.
    - The bigger the project the more water discharge.
    - Proper analysis each area has. MAA all these have been discussed. Adequate options are: 1, 2 & 4.
- Was assessment done on buildings with constructability of liner – risk of geochemical stability if not?
    - Liner – looked at and implemented in other projects. Challenging if done in layers.
    - Feasibility – detailed design – looking at dual drainage system with a geo membrane on top taking most of the head.
- Building assessment – originally planned for above ground – less work.
    - Water cover vs dry cover – is it a potential risk? (Yes – dry cover systems is an option. Challenge is can we demonstrate it will not generate PAG in the next 10000 years?)
    - Hybrid water cover – both dry and wet and being able to discharge and retain. Keeping the geochemical.
- …next slide

5.7 Multiple Account Analysis (MAA)

A method on weighting each indicator to get to the preferred one. Nicolás explained how the process works to get to the end choice. He showed an example to help everyone understand the process.

Four accounts that will be weighted, each having a sub account attached to consider:

- Environmental
- Technical
- Economic
- Socio Economic

Alternatives to Discuss:

- Economic costs have been excluded in others completed, why?
    - Sensitivity analysis is when these components will be removed.
    - Government provided governing guidance on weighting for main accounts.
    - Sub accounts are moving individual depending on team.
    - SRK put in as this is what they would see. Can change later.

- Potential groundwater and receptor impacts – was there a detailed assessment on these?
    - Once we get to these, you will see and understand them better.
    - Potential impact receptors – both fish and wildlife? (Could state that in there).
    - Separate land animals to water. Cross reference on habitat check. Have as Fish and Aquatic Resources.
- How does the weighting work? Surface vs. Groundwater?
    - These can be changed.
    - Impact Receptors fish base and post closure land use impacts wildlife.
    - **Add text around post closure management. How passive it is or how active it is. Have a range.

Technical:

- **Will send a draft around on the weightings and discuss if there should be more changes post meeting.

Economic (lower weight from the IECCC) and Socio Economic:

Discussion around weightings in this area.

- Weightings provided to regulator

COFEE BREAK – 3PM

Calvin/Santiago/Nicolas – included option 5 which was earlier screened out. No dams excavated but larger footprint. It was previously removed for precluding future exploitation or mining of future resources in the center or the deposit. It was decided to include this option for giving a completely different configuration (i.e., no dams vs dams).

Nicolás brought up and explained the spreadsheet and process for weighting with the added option 5.

- 4 indicators – pre-scored to help explain the process. The idea is not to assess the value of the score but the difference between the indicators.
- The list of indicators is brought together by the project team and all here today are able to add/delete to this list.
- Calvin provided an example on how he would weigh each for each option and why to help everyone understand.

Scoring Discussion for each Option:

1. **Additional site investigation**
    - Assumed to be related with the overall footprint of the facility (i.e., facility and ancillary infrastructure).
    - Submitted Option and Alternative Configuration 4 re in the same footprint and a lot of investigation has been done there already.
    - Alternative Configuration 2 has the most work since those dams are the significant part of the design and most of the effort needs to be done.
    - Alternative Configuration 5 has the least work since no dams are needed. Geotechnical investigation for the waste rock dumps should be accounted separately, but some of these areas are already in the feasibility study (i.e., some knowledge of the foundation conditions is available).

2. **Aesthetics – Land forming engineering**
    - Related to the need to create a land forming in accordance with the environment. If land forming differs from natural slopes, it would be a worse solution. This was assumed to be related with the distance between each structure, and the overall footprint of the facility.
    - Option 4 is worse than Option 2 since it has all the distractions and is more distributed.
    - Option 2 has the highest dams and might stick out from topography more than the submitted option because of the height of dams.

- Option 5 - is the worst from a landform perspective, for putting a lot of landforms and changing it quite a bit.

3. **Aesthetics – Line of sight (distance)**
   - All alternatives are visible from Telkwa since they are all behind the ridge that is on the other side of Goathorn Creek.
   - Hence all alternatives have the same scoring.

4. **Aesthetics – line of sight (elevation difference)**
   - Related to the highest structure
   - Town sees no configuration change except from the ski hill.
   - (we can also say, we don't need to consider this)
   - Would see the Tenas Control Pond of Alternative Configuration 4 from Tenas Creek and Telkwa river.
   - Whole project invisible from towns
   - Only ones visibly difference is 4 and 5. 2 and the EAC submitted option are not different from each other.
   - Config 4 most likely to be visible.
   - All four visible from ski hill.
   - Single cross sections could be provided by Telkwa.
   - James explained the perspectives that could be seen and provided already to regulators. You need to be above the project to the high enough degree above the trees which will not be touched.
   - Project practically invisible.

5. **Ancillary infrastructure design, construction and maintenance.**
   - Footprint and connections between structures.
   - Ancillary infrastructure includes roads, powerline, pipelines and pumping systems.

6. **Aquatic life and habitat**
   - Alternative Configurations 4 and 5 are worst since they are much closer to the actual stream.
   - Alternative Configuration 2 also is further away from Fourth Creek.
   - Alternative Configuration 2 looks like a preference, EAC, 4 and 5.
   - Seepage to the groundwater system – how much rock will be disturbed,
   - *will include more to this list. Will distribute indicator list to all after meeting.

7. **Archaeological and traditional site nearby the facility**
   - Heritage sites on property.
   - Far away from archaeology sites.

8. **Atmospheric issues due to dam construction (materials, dam volume)**
   - Distances from borrow.
   - Material to dams.
   - Material moved.

9. **Bird life and habitat**
   - Overall footprint as an indicator of loss of habitat.
   - Water quality – relatively good (Dan) – good water quality for birds to land on.
   - Wildlife habitat restoration.
   - Does not impact habitat – not near any protected habitat.
   - Presence of birds – change wording. Should score low because there is no protected habitats.
   - All these are streams – not a lot of migratory birds. Not habitats they would habitate.
   - Score 6 across the board.
   - Add another indicator for birds not protected.

10. **Borrow source location**
    - Alternative Configurations 4 and 5 worst and Alternative Configurations 1 and 2 are similar.
    - All borrow materials will come from the open pit.

- Material balance – till and overburden – 1/3 1/3 1/3 – go through an area that has overburden in the mine cycle.
- Is the overburden the right quality – and yes, it's a good material.
- Putting in liners – can't just dump on top of liner…how are we layering it prior to the big rock? – foot layer of overburden prior to putting on the rock. Current plan.
- Suitable materials for all options – Paul asked.
    - Config 5 less materials used – dig more holes and no special material
    - Others need more managed materials – compaction, etc.
- Material quantity suitable

11. Borrow source material availability

- "borrow source is the open pit"
- Overburden is suitable for construction – add this comment for those outside reading this.
- Ranking will take place after volumes figured out.
- James to confirm.
- All rock too soft on site

12. ~~Borrow source quarry design~~ Rename – Rip rap material required for water management.

- Related to footprint
- Alternative Configuration 5 will be a challenge.
- Alternative Configuration 4 will have a bit more water management because now you've separated the facilities.
- Quarry rock – Will need to come from outside. Who would provide/where would it come from? This indicator should be considered in the Economic account.

13. Closure design

- The objective of this indicator is to capture if one of these alternatives are more complex than the other ones in terms of closure design.
- Alternative Configuration 5 – closure may be easiest for being excavated facilities.
- Alternative Configuration 4 worst for having separate facilities. Also would be very hard to maintain water cover because they're not in the same watershed as by taking away the cascading failures, we take away the link ability of the different pawns.
- Alternative Configuration 2 – man made solutions at closure. Will be pumping & managing forever.
- EAC Submitted Option better than Alternative Configuration 2 but worse than Alternative Configuration 5.

14. Community and stakeholders acceptance

- Alternative Configuration 5 is the best in terms community acceptance since they don't like dams.
- The smaller the dams, better acceptance. Hence, EAC Submitted Option and Alternative Configuration 4 are equally scored. Alternative Configuration 2 is the worst.

15. Community safety

- Failure modes / cascading failure comes to mind.

16. Construction constraints

- Alternative Configuration 5 is easy to build – no compaction required.
- The three other alternatives are similar. No major construction constraints are expected.

17. Construction time

- Associated with earthworks and impermeabilization area requirements
- Alternative Configuration 5 does not require earthworks but needs total impermeabilization, which is more complex than for the other alternatives.
- All other configurations need both liners and dams.
- Seasonality – snow on ground – liners cannot be placed in the winter. Same with dams.
- James explained the construction plans, timeline, and options for all.
- Management ponds take 5 ½ years in all of them.
- All same for timeline and fairly similar.

- Some may need more to do in the same time – 5-6 years. Time doesn't change but the amount done in the timeline may.
- Alternative Configuration 4 requires more efforts due to the more complex surface water management.
- Alternative Configuration 4 has about the same material cost as Alternative Configuration 1 and 2, but the hulls are significantly longer, committing more resources to doing the job, and Alternative Configuration 5 has the most material to move by a long shot.

18. Distance between the nearest waterway and the facility

- All the same. All have a minimal distance.
- Influence of the footprint on the flow to this creed and the least impact looks like Alternative Configuration 2.
- Highest impact on waterway.
- This may have been touched on with birds and habitat indicator.
- Add definition on waterways to distinct between natural and man-made water courses.

19. Distance between the Coal Process Plant and the facility

- Alternative Configuration 2 has higher dams.
- Alternative Configuration 4 has same dam configuration as the EAC Submitted Option.
- Truck hours considered to move materials.
- Alternative Configuration 5 would be a little bit cheaper because it doesn't go as high, so you save all that elevation gain.
- *Remove from environmental.

20. Geochemical characterization of all construction materials and associated excavation waste

- Due to the increase soil stripping for the Alternative Configuration 5, all that soil needs to be kept and stored for capping it eventually.
- Overburden is non-reactive in assessment
- Associated waste
- Glacial till being reactive – zero
- 40% NAG, 60% overburden
- Sample collection, testing, analysis – very minimal to nil.
- Related to costs and resources associated to geochemical testing requirements – Alternative Configuration 5 requires additional testing. The other alternatives are equally scored for having similar dam volumes.

21. Geotechnical conditions of the foundation.

- Alternative Configuration 4 has a higher risk because there is any drill holes by those two lower facilities.
- Alternative Configuration 5 has a slightly higher risk as well because there's no geotechnical investigation done.
- The EAC Submitted Option and Alternative Configuration 2 has good geotechnical baseline.
- Alternative Configuration 2 could be worse than EAC Submitted Option for being outside a bit more.

22. Groundwater conditions

- All the same for EAC Submitted Option and Alternative Configurations 2 and 4.
- Challenges on the depth of the holes - with liners and constructability for Alternative Configuration 5. Not flow and intermingle.
- Material above groundwater level.
- Liner gives knowledge of flow.
- Modelling shown minimal impact from the liners on facilities.
- Natural level of groundwater – tables aren't modeled.

23. Seepage from the facility to groundwater system.

- Alternative Configuration 4 should have the highest impact.
- Alternative Configuration 2 is a little bit better than the EAC Submitted Option since the configuration two stays further away from Four Creek.

24. Maintenance of traditional lifestyle.
- EAC Submitted Option and Alternative Configurations 2 and 4 are very close.
- Alternative Configuration 5 is worst.

25. Materials delivery and deposition system
- Alternative Configuration 4 is worst for requiring further haulage to the NMP.

26. Number of embankments
- Alternative 4 has 2 distinct areas.
- EAC Submitted Option and Alternative Configuration 2 have only 2 distinct areas.
- Alternative Configuration 2 would be slightly better than EAC Submitted Option since the TCP is excavated.

27. Number of ponds
- Alternative Configuration 5 has the most ponds.
- EAC Submitted Option and Alternative Configurations 2 and 4 are equal.

28. Operational complexity in materials deposition
- Related to the amount of material you need to segregate.
- Alternative Configuration 5 is the easiest. No dams, only holes – no segregation.
- EAC Submitted Option and Alternative Configurations 2 and 4 – all the same due to the dams.

29. Overall Catchment Area
- Alternative Configuration 5 has the highest.
- Alternative Configuration 4 is a bit lower but higher than 2 and EAC Submitted Option.

30. Overall footprint of the facility
- Similar to the above indicator.

31. Pond water management – related to number of ponds
- Related to the management requirements of water level on top of the PAG material. Hence, the more surface area, the greater the risk.
- Below ground – may not be easier to hold water if dry.
- Alternative Configuration 2 is worst since requires pumping to keep the water cover.
- Alternative Configuration 5 has more ponds but pit pond, and other off to the side.

32. Post closure maintenance and monitoring requirements
- Alternative Configuration 2 – need to pump water from one of the management ponds to the other one, hence requiring more maintenance and monitoring.
- EAC Submitted Option and Alternative Configuration 2 and 4 will require comprehensive monitoring on an annual basis, following the requirements of BC.
- Stable – non pollutant
- Address the safe stable and non-pollutant – add comment.

33. Prevalent wind speed and direction
- More dust to mine operators in Alternative Configuration 5 – could also get rid of it as well.
- Not much difference in rest.
- Prevailing wind is NE.

34. Previous and existing land use
- Related to footprint.

35. QA/QC Requirements
- Liner makes them a challenge.
- Alternative Configuration 5 may be a bit less since it does not require dams.
- EAC Submitted Option and Alternative Configuration 2 and 4 are worst for requiring QA/QC for dam construction.

36. Risk of cascade embankment failure
- EAC Submitted Option and Alternative Configuration 2 are the worst.
- Alternative Configuration 4 potential to breach and flow down.
- No risk for Alternative Configuration 5.

37. Terrestrial life and habitat
- Related to footprint.

38. Vegetation
- Related to footprint.

39. Water Management / Treatment to achieve water quality criteria/objectives
- Currently no water treatment.
- 6 OR 7 TREATING FOR TSS currently.
- Slowing down water.

40. Diversion structures design, construction and maintenance.
- Use the same scoring as 'riprap material required for water management' indicator.
- Alternative Configuration 5 – operational nightmare.

41. Impermeabilization area requirements
- Liner requirements include thickness and area requirements.
- Alternative Configuration 5 is thinner and with footprint similar. Best case.
- EAC Submitted Option and Alternative Configuration 2 and 4 have similar requirements. Alternative Configuration 2 is slightly better.

42. Instrumentation requirements and operation maintenance and surveillance
- Monitoring less with dumps.
- EAC Submitted Option and Alternative Configurations 2 and 4 have an 'Extren' Dam Consequence Category, requiring more instrumentation and more rigorous surveillance during operation and closure.

43. Overall perceived socio-economic consequences benefits and relative preferences.
- Perceived socio economic is positive.
- Benefits to people, housing and economy.
-

44. Physical interference with existing infrastructure (constraints)
- All the same for public roads.
- Only one that has to be maintained for public access.
-

45. Post closure risk and uncertainties
- EAC Submitted Option and Alternative Configuration 2 – larger dams with cascading potential.
- Alternative Configuration 4 is slightly better.
- Alternative Configuration 5 is the best.

46. Water management system design
- Touch base with Celine on this.
- Pumping requirements higher for Alternative Configurations 2 and 4.
- Too many ponds.

47. Water Treatment – changed to 39
-TSS treatments required?
- Don't have the dilution.
- Touch base with Celine on this.

48. Containment structure design
- Alternative Configuration 5 is the best since it doesn't have dams.

- Alternative Configuration 4 is better than the EAC Submitted Option and Alternative Configuration 2 for not posing a risk of cascading failure.

49. Distance between existing roads and the facility
- Same for all.

50. Diversion structures design, construction, and maintenance
- Same for all.

51. Flexibility to expand the storage capacity
- Alternative Configuration 5 is hardest to expand.
- Dam options are straightforward for a little bit of height.
- Dam options are more work if higher.
- Redesigning buttressing/building a new dam if expansion is required.
- Alternative Configuration 4 is best – the whole area can be utilized to construct and add space between existing facilities. Best water control.
- EAC Submitted Option is the next – convert the TCP to a PAG material storage facility and expand that and build the TCP as per Alternative Configuration 4.
- Alternative Configuration 2 – the dams are quite large and no spaces applicable.
- Alternative Configuration 5 the hardest to expand but has some options to expand.
- All of them are weak to expanding but potential to expand capacity.
- Changing capacity – small change in every option.

52. Impermeabilization requirements – REMOVE THIS INDICATOR
- Alternative Configuration 5 a bit thinner and lest to construct.
- Less head pressure.

53. Impermeabilization thickness
- Same as above.

54. Impermeabilization topographic complexities
- Alternative Configuration 5 could be a bit more complex due to steeper slopes.
- Dam alternatives are similar.

55. Surplus material storage
- Alternative Configuration 5 is the best.
- The rest are the same.

56. Calvin – will reach out for any further inputs
1. Do a first pass
2. Send to Dan and he will share with certain team members and come back to Calvin.
3. Calvin will meet with SRK

Dan – good first start, send out to all for further input**.**

Conclude 5:45pm

Action item – distribute the indicator list to all for addition submissions.
Action item – come back with rankings. Take home the list. N/A – list completed by end of day.

Minutes taken by: Lisa Thomson, Project Coordinator, SRK Consulting (Canada) Inc.

Signed by: Lisa Thomson Date: March 25, 2024

APPENDIX 22: TENAS PROJECT INFORMATION REQUEST RESPONSES FROM OFFICE OF THE WET'SUWET'EN – FINAL, SRK

Attachment B: Telkwa Mining Response to the follow up information requests from MENV on April 15, 2026

Attachment C: Telkwa Mining Response to the follow up information requests from MCMM on May 15, 2026

Attachment D: Telkwa Mining Response to the follow up information requests 8 and 9 from MENV on May 22, 2026

Attachment E: Telkwa Mining Response to the follow up information request 8 from MENV and MCMM on June 25, 2026