

1.22.3.5.2 Groundwater Conditions

A steady state groundwater flow was computed to determine the pore pressure distribution along the Tenas Control Pond, management ponds, and foundation terrain. **Table 1.22-10** presents the water levels at closure for each facility.

Table 1.22-10: Management and Control Designed Pond Water Elevations

Management Pond	Pond Water Elevation [masl]	Comments
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

Notes: EMP=East Management Pond; m=metre; masl=metres above sea level; NMP=North Management Pond; TCP=Tenas Control Pond; WMP=West Management Pond

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 East Management Pond and West Management Pond, different piezometric levels were considered for the containment materials (e.g., PAG and non-PAG) in East Management Pond and the foundation since it is expected that PAG and non-PAG will be deposited in the West Management Pond before a steady state condition is achieved. **Figure 1.22-15** presents the groundwater conditions assumed for the dividing embankment for subsequent stability assessment which is worst case.

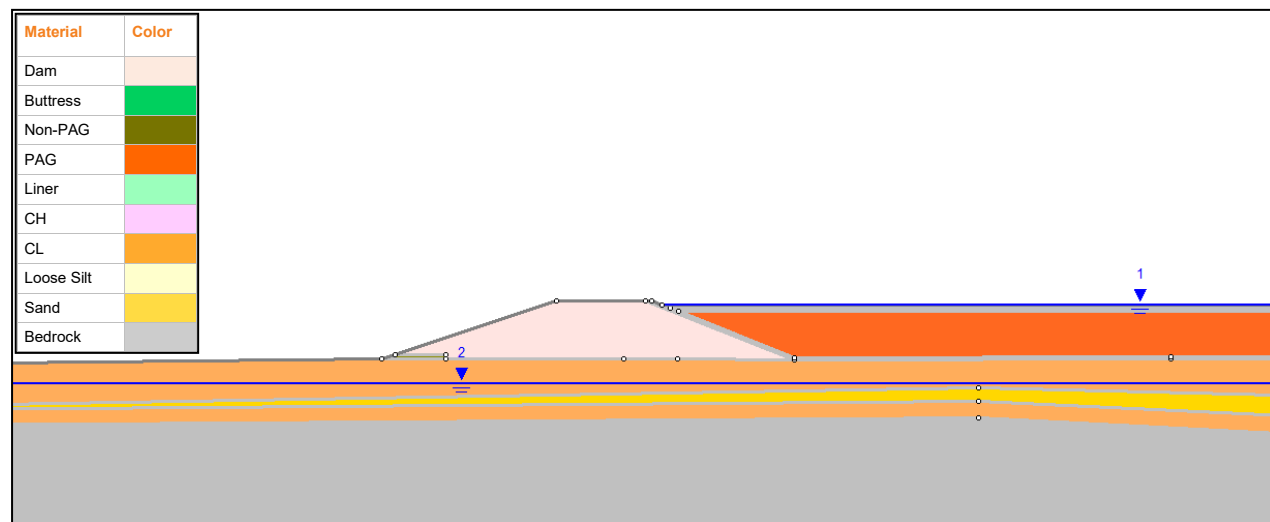


Figure 1.22-15: Dividing embankment groundwater condition for East Management Pond when completed

1.22.3.5.3 *Stability Results*

The results of the limit equilibrium analyses are presented in **Table 1.22-11**. The reported FOS are for the buttress and overall scale failures, based on the foundation conditions previously provided, as per the previous field investigations. The minimum target FOS were achieved in every section. Failure surfaces and the associated FOS for multiple scenarios are included in **Appendix 1.0-L SRK, Tenas Project, Management and Control Pond Stability Assessment**.

Table 1.22-11: Factor of Safety (FOS) for the Upstream and Downstream Stability of the North Management Pond, East Management Pond, and West Management Pond Perimeter Embankments Following Filling with Potentially Acid Generating (PAG) Material and Water

Section	Static Main Embankment (Buttress Embankment)	Pseudo-static Main Embankment (Buttress Embankment)
TCP-01	2.23 (1.85)	1.89 (1.71)
TCP & NMP-01 (TCP)	1.88 (1.80)	1.59 (1.55)
TCP & NMP-01 (NMP)	1.77 (1.86)	1.43 (1.62)
NMP-01	1.99 (1.79)	1.77 (1.65)
NMP-02	1.76 (1.69)	1.58 (1.55)
NMP & WMP-01 (WMP)	1.78 (n/a)	1.65 (n/a)
NMP & WMP-01 (NMP)	2.07 (1.80)	1.80 (1.66)
WMP-01	2.44 (1.81)	2.14 (1.71)
WMP-02	2.40 (1.86)	2.10 (1.75)
EMP & WMP-01	1.85 (n/a)	1.70 (n/a)
EMP-01	1.98 (1.69)	1.70 (1.47)
EMP-02	1.81 (1.69)	1.37 (1.57)
EMP-03	1.63 (n/a)	1.50 (n/a)

Notes: NMP=North Management Pond, EMP=East Management Pond, n/a=not applicable; WMP=West Management Pond.

1.22.3.5.3.1 *Liquefaction Assessment*

SRK has completed a liquefaction assessment on the one region of the West Management Pond where there is a risk of liquefaction and this is provided in **Appendix 1-AB SRK, Tenas Preliminary Liquefaction Potential Assessment**. In summary this area has been assessed as stable based on the review of the liquefaction risk completed to date. As part of the subsequent permit application, a further liquefaction assessment will be carried out based on the field program completed in 2021.

1.22.4 Embankment Details

1.22.4.1 *Embankment Construction*

During the construction procedure (cleaning, excavation, embankment construction and operations), additional information related to foundation characteristics and slope materials can be obtained. This information can contradict the hypotheses previously assumed.

Weather and groundwater conditions during construction can significantly affect the water content of the embankment material or create hydraulic conditions different from those assumed, which could in turn cause changes in the embankment design. For this reason, the Project must be continuously evaluated to make sure that the conditions found during construction are compatible with the final design.

The development of an adequate geotechnical campaign, technical specifications for construction and quality controls allow to mitigate the risk of requiring a re-design during construction. The definition of ranges for acceptable parameters ensures flexibility in design tolerances and enables foreseeing actions on possible variabilities in material quality. The design of adequate constructive methodologies and its correct control can help prevent contingent quality defects due to negligence and the additional associated costs.

1.22.4.1.1 *Material Specification*

Any fine or granular material can be used for the embankment construction if it is insoluble and inorganic.

1.22.4.1.2 *Equipment Requirements*

Haul trucks, water trucks, excavators, graders and vibratory and padfoot rollers shall be used. The most suitable equipment will be selected by TCL based on the soil characteristics and construction requirements.

1.22.4.1.3 *Foundation Preparation*

Reclamation material (surface soil), trunks, roots, and vegetation shall be removed until surface soils are encountered with no appreciable content of organic matter is found.

The surface must be clean, clear and shall be compacted by successive passes of vibratory and/ or padfoot equipment. The type of equipment, number of passes and circulation speed will be determined by the constructor to guarantee the recommended compaction requirements are achieved.

Where subsidence is detected, it shall be necessary to fill the holes with suitable fill material, level the surface and continue with the compaction.

The terrain slope must be uniform to ensure adequate rainwater runoff.

1.22.4.1.4 Material Placement and Compaction

In this subsection, preliminary placement and compaction specifications are provided. This will be studied further and updated during the detailed design engineering.

Compaction equipment and use shall be determined from studies in test fields. From these studies the optimum combination of type of equipment, lift thickness, speed and number of passes shall be specified.

1.22.4.1.5 Lifts

The embankments are divided in three (3) zones with different placement and compaction requirements. Each zone is executed by lifts of uniform thickness, parallel to the design grade, covering the total width of the cross section and in lengths compatible with the spreading, mixing and compaction methods. A typical place and compaction procedure during construction operations is shown in **Figure 1.22-16**.

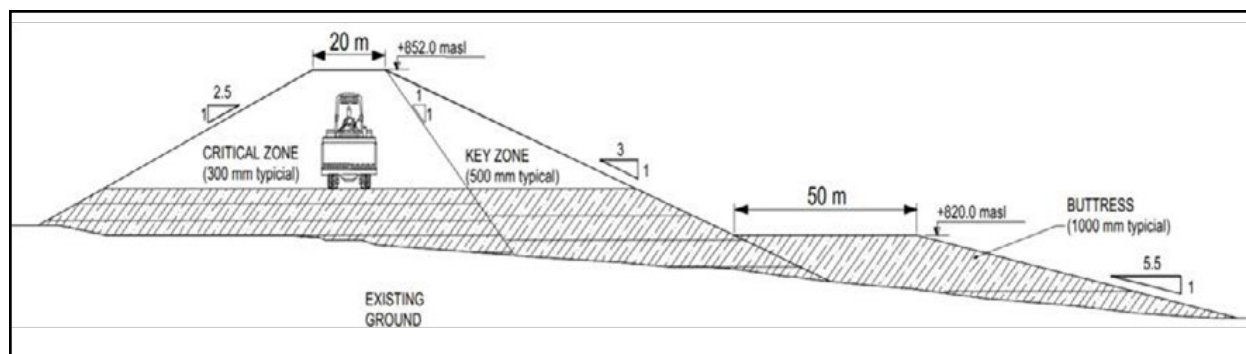


Figure 1.22-16: Typical Compaction Procedure - EMP-01 Section (not at scale)

Recommendations assuming overburden materials:

- ▶ critical zone: lifts of 300 + 100 mm thick and density >94% Modified Proctor (MP);
- ▶ key zone: lifts of 500 + 125 mm thick and density >90% MP; and
- ▶ buttress zone: lifts of 1,000 + 200 mm thick .

In the detailed design report, different materials and lift thicknesses will be considered and a range of acceptable values provided.

Water content during compaction must be in the range $w_{opt} \pm 3\%$, where w_{opt} is the optimum moisture content obtained by Modified Proctor test.

The lift thickness shall be adequate to ensure required degree of compaction is achieved.

Each lift shall be mechanically scarified to ensure breaking of soil clods. Clods that cannot be broken shall be removed before compaction.

The whole surface must be treated with enough passes to achieve a uniform degree of compaction. The compaction procedure shall start from the boundaries of the embankment to the center with parallel passes that overlap at least half the width of the compaction equipment.

Placement of the next fill shall be carried out upon authorization by the Inspector, i.e., after the compaction and state of the previous layer and the material quality were verified by laboratory tests.

1.22.4.1.6 *Wetting of Construction Materials*

If addition of water is needed to achieve the compaction degree, wetting shall be done at the extraction point, or in the lift, ensuring correct soil mixture, with uniform moisture content throughout the thickness.

1.22.4.1.7 *Drying of Construction Materials*

If the water content is greater than the optimum, the soil shall be removed and left to dry, or it shall be mixed with drier material or with appropriate substances.

1.22.4.1.8 *Testing Requirements*

Material parameters and target density shall be determined by the TCL appointed group at the beginning of extraction and tested randomly from haul trucks and on lifts. During embankment construction, insitu density tests shall be required to approve the works. An appointed identity (Inspector) shall be responsible for certifying laboratory test results and may indicate additional tests as required. In case the material is a mixture of overburden and non-PAG rock, tests for different mixes shall be necessary to determine the optimum content of fine soil.

1.22.4.1.8.1 *Routine Tests*

These shall be performed to establish soil type and insitu condition: natural moisture content, Atterberg limits, unit weight and visual-manual inspection according to standards American Society for Testing and Materials (ASTM) D2216, ASTM D2488 and ASTM D4318.

Particle size distribution curves shall be obtained according to standards ASTM D0422 (granular material) and ASTM D2487 (fine material). These shall be obtained for samples of overburden, non-PAG rock and mixtures of both.

1.22.4.1.8.1.1 *Proctor Compaction Tests*

Modified Proctor testing according to standard ASTM D1557 shall be performed on overburden and overburden-non-PAG rock mixture samples.

1.22.4.1.8.1.2 *Permeability Tests*

Permeability tests shall be performed according to standards ASTM D2434 (granular material) and ASTM D5084 (fine material).

1.22.4.2 *Management and Control Pond Liners*

1.22.4.2.1 *Management Pond Liner Design*

A soil-bentonite liner will be constructed over the pond bottom of the North Management Pond, East Management Pond and over the Expit portion of and the overburden open pit slope of the West

Management Pond to limit seepage out of the management ponds. The recommended liner design is a 0.30 m low permeability soil-bentonite liner that will be constructed in two (2) 0.15 m lifts. **Appendix 1.0-AC SRK, Liner Design and Construction Methodology for Tenas Management Pond Liners** provides additional information on the liner design that was completed by SRK. This liner system provides a seepage rate $\leq 2,800 \text{ m}^3/\text{day}$, which corresponds to the maximum allowable seepage rate for the 10-Year Dry scenario determined by the overall site water balance which is provided in **Appendix 1.0-E; SRK, Tenas Project Water and Load Balance Modeling Report** and further information is provided in the subsequent **1.23.4.1.9.2** for the installation of the liner. To achieve this design criteria the soil-bentonite liner system will require a hydraulic conductivity of at least $1\text{E-}10$ metres per second (m/s). Therefore, the hydraulic conductivity used to define the liner and used in the seepage analysis is $1\text{E-}10$ m/s.

1.22.4.2.2 Management Pond Liner Installation

Construction of the liner will be completed by pre-disking the native soil after completing preliminary foundation preparation (clearing and grubbing). Then enough bentonite will be spread over the loosened soil and disked in to meet the target of $\leq 1\text{E-}10$ metre per second (m/s) hydraulic conductivity. Placement of a subsequent lift of 0.15 m of native soil, followed by another application of bentonite and diskling will be completed before the final compaction of the 0.30 m soil-bentonite liner system.

A laboratory study will be performed to determine the optimal proportion of bentonite-soil blend to achieve the hydraulic conductivity criteria after which field trials will be performed to refine the construction methodology, equipment selection, and verify the soil-bentonite liner system performs to specification with an insitu hydraulic conductivity of $\leq 1\text{E-}10$ m/s.

More detail of the liner system is presented in the SRK liner design and constructability memorandum attached in **Appendix 1-AC SRK, Liner Design and Construction Methodology for Tenas Management Pond Liners**.

1.22.4.2.3 Tenas Control Pond Liner Design

TCL worked with Axter Colentanche to develop a design and construction management plan for the liner system that will be installed within the Tenas Control Pond (TCP) to both limit seepage rates and erosion of the internal portions of the TCP. Coletanche is a bituminous waterproof geomembrane with unique design qualities that include a polyester non-woven geotextile reinforcement coupled with a glass fleece that enhances mechanical resistance with an elastomeric binder for waterproofing and strength. **Figure 1.22-17** illustrates the design of the bituminous liner components.

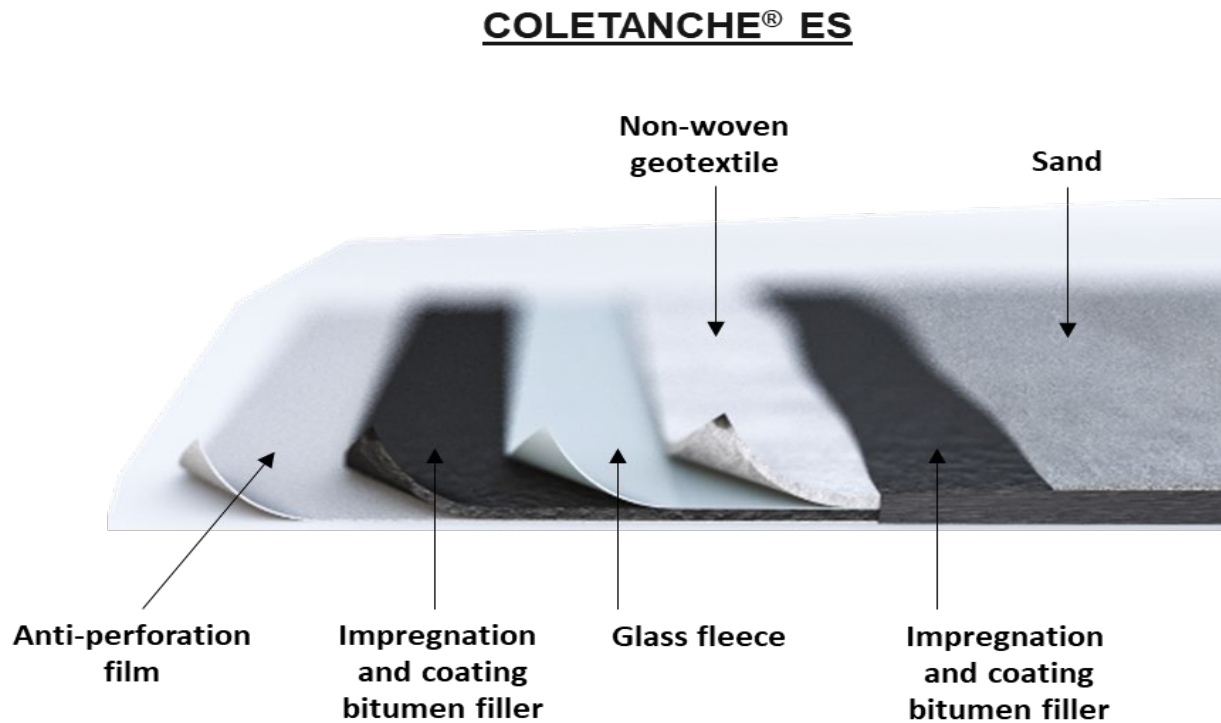


Figure 1.22-17: Coletanche bituminous waterproof geomembrane

Coletanche is available in thicknesses ranging from 3.5 mm (ES1) to 5.6 mm (ES4) and **Table 1.22-12** and **1.22-13** outline the specifications and mechanical properties for an ES4 thickness, and **Figure 1.22-18** shows the water and gas permeability coefficients for all thicknesses.

Table 1.22-12: Coletanche Specifications for Various Bituminous Geomembrane Thicknesses

	Unit	ES1	ES2	ES3	ES4
Thickness	mm	3.50	4.00	4.80	5.6
	mil	140	160	192	224
Width	m	5, 10			
	ft	16.7			
Length	m	90	80	65	55
	ft	295	262	213	180
Geotextile Density	g/m ²	200	250	300	400
	oz/yd ²	5, 9	7, 4	8, 8	11, 8
Surface Density	g/m ²	3,900/4,200	4,400/4,900	5,300/5,800	6,300/6,800
	oz/yd ²	116/130	127/137	146/158	179/187

Notes: ft=foot/feet; g/m²=gram per square metre; m=metre; mil=one-thousandth of an inch; mm=millimetre; oz/yd²= ounce per square yard

Table 1.22-13: Mechanical Properties of Coletanche for Thickness ES4

Properties			Unit	Values
Stress at break	ASTM D 4595-86	Longitudinal direction	kN/m	20-38
			lb/in	118-214
		Transversal direction	kN/m	16-33
			lb/in	93-186
Elongation at break	ASTM D 4585	Longitudinal direction	%	77-95
		Transversal direction	%	82-105
Static Puncture Resistance	ASTM D 4833		kN	450-710
			lb	101-160
Thermal Expansion Coefficient	ASTM D 1204-02	Longitudinal direction	%	-0,15—0,10
		Transversal direction	%	0,16-0,30
Cool Bending: Lowest Temperature	ASTM D746		°C	-30
			°F	-22

Notes: °C=degrees Celsius; °F=degrees Fahrenheit; %=percent; ASTM=American Society for Testing and Materials; kN=kilo newton; kN/m=kilo newton per metre; lb/in=pound per inch

Water	m/s	$< 10^{-13}$	Darcy Law
Gas	m ³ / m ² / day / atm	7.8×10^{-7}	ASTM D 1434 for (C, N ² & CO ²)

Figure 1.22-18: Permeability Coefficients for Coletanche

The above information is used to select the type of Coletanche to use for this Project which is based on the following design criteria

- ▶ life of liner required which is 50 years minimum;
- ▶ application of liner which is for a water only pond;
- ▶ portions of the liner are exposed to sunlight every year;
- ▶ weather conditions at the Project;
- ▶ subgrade material being less than 6 inch minus material; and
- ▶ slope of 2.5H to 1V for application of this liner.

For this project an ES4 (5.6 mm) liner was recommended owing to the longevity of the Project with a life expectancy of 50 year minimum. Coletanche has one of the highest resistances to UV exposure because of the bitumen and binders used during the manufacture of the liners. Coletanche has projects that are over 40 years in operation that have exposed liners that are in excellent condition.

1.22.4.2.4 *Tenas Control Pond Liner Installation*

Coletanche ES4 liner is shipped in rolls that are 5.1 m in width and length of metres with a weight of approximately 2 tonnes.

Delivery to the Project would be in sea containers consisting of 9 rolls or by flat bed truck consisting of up to 12 rolls per truck load. These rolls need to be unloaded using slings if from a flatbed truck and/or by an unloading pin if shipped in sea containers.

Installation is completed using a mechanical beam attached to an excavator or similar vehicle, an installation crew of three (3) to four (4) people and is welded by flame with 20 cm overlap between individual rolls of liner. The excavator holds the roll up from the ground and slowly places the liner while transferring the slope from the bottom up if possible. Anchor trenches are used at the top of the slopes for all applications and mechanically fastened on the lower portion of the slope. The anchor trenches for this project are designed to be 3 m deep and 1 m wide at the bottom and 1 to 1 slopes, which will be filled in and compacted with overburden to hold the liner in place until water fills the pond. **Figure 1.22-19** illustrates a typical installation bituminous geomembrane liner in a large sedimentation pond like the Tenas Control Pond.

Subgrade preparation should consist of compacted soil, or sand or gravel with no sharp edges. There is no geotextile required below Coletanche as there is a geotextile impregnated inside of the liner during the manufacturing process.



Figure 1.22-19: Typical installation of a bituminous liner in a large sedimentation pond

1.22.5 Management Pond Covers

SRK completed a cover design technical memorandum for the proposed cover for the management ponds to be completed in the Decommissioning and Reclamation Phase for any management pond not already covered which is the West Management Pond. **Appendix 1.0-AD SRK, Tenas Project Scoping Level Closure Cover Assessment** attached provides the conceptual cover design developed by SRK.

The cover covers approximately 90% of the surface area of each management pond to reduce the amount of water loss due to evaporation by 20% while allowing unimpeded access to water flowing into the management pond. SRK completed a sensitivity analysis and found that the water balance allowing for no cover to be present at all as provided for in **Appendix 1.0-E SRK, Tenas Project Water and Load Balance Modeling Report** still has a positive water balance for the management ponds under average hydrometeorological conditions. The conceptual cover will consist of three (3) layers above the saturated PAG material layer:

- ▶ non-PAG rock which will have an average maximum thickness of approximately 1 to 2 m;
- ▶ overburden which will have a variable thickness of between 0.50 and 2.5 m; and
- ▶ reclamation materials (surface soils) which will also have a variable thickness but averages approximately 30 cm.

These thicknesses are based on the final elevation of PAG material and the spillway elevation for each management pond.

1.22.5.1 Cover Construction Methodology

The cover materials will be placed in five (5) stages using excavators and trucks summarized below:

1. Will involve pumping down the water in the management pond to be roughly 1.0 m above the PAG material;
2. Non-PAG will be placed in approximately 1.5 m lift in a configuration that matches the approximate cover configuration design;
3. Water level will be kept to 0.5 m below the final non-PAG material elevation;
4. Overburden will be placed in a 2 m lift with local locations only being 0.5 m thick with portions of the management ponds not having overburden placed at all to allow water ingress; and
5. Reclamation materials (surface soils) will be placed in an approximate average lift of 0.30 using the rough mounded technique to encourage vegetation establishment.

1.22.5.2 Management Pond Water Cover Monitoring

Management and control ponds form an integral part of the overall water balance for the Project. Pumping and water level monitoring systems will be put in place with all information being digitally relayed to the CPP control room, the Mine Superintendent, Mine Supervisor, and Environmental Coordinator's computers and phones for decision making. The goal is to maintain at least a 1 m level of water above any PAG material layer deposited in the previous year and at or above the current lift of PAG material being placed into the active management pond. This task will be reported quarterly on in the daily shift reports completed every 12 hours during the Operation Phase. Triggers will be set up if the water level reaches a depth of 2, 1.75, 1.5, 1.25, 1, 0.75, 0.5 m to alert personnel who will have specific actions for each water level such as:

- ▶ mobilizing additional pumps;
- ▶ mobilizing additional personal;
- ▶ reduction of water consumption by temporarily halting CPP and wash bay operation;

- ▶ engaging the contingency water pumping system from Goathorn Creek which can deliver close to 750,000 m³ of water per annum; and
- ▶ mobilizing offsite water providers.

1.22.6 Water Management for Management Ponds and Control Ponds

The water management for this structures in covered in more detail in the **MWMP**. In summary, all water will be directed to the internal portion of these ponds and interim channels constructed during the Construction Phase for each pond will be used to collect contact water from these structure to be pumped back in the internal portion until reclamation efforts have progressed to a point that contact water coming off these structure can be released into the environment.

1.22.7 Maintenance Activities for Management and Control Ponds

1.22.7.1 Preventative Maintenance

Preventative maintenance is the planned, recurring maintenance activities conducted at fixed or approximate frequency and not typically arising from results of surveillance activities. The following preventative maintenance activities are required for the management ponds:

- ▶ service and repair of pumps;
- ▶ repair and replacement of pipelines;
- ▶ calibration and repair of instrument monitoring; and
- ▶ service of electrical system and supply.

Frequency and procedures for maintenance must be according to manufacture instructions. Relevant procedural documents from the manufacturer should be referenced in updated version of this document.

1.22.7.2 Corrective Maintenance

Corrective maintenance is the repair of management ponds components conducted in response to results of surveillance activities or incidents. Corrective maintenance is conducted on an as required basis. The corrective maintenance activities required for the management ponds are presented in **Table 1.22-14**.

Table 1.22-14: Corrective Maintenance Activities

Management Ponds Components	Activity
Embankments crests and outer slopes	Grade over minor cracks.
	Mark, investigate and repair large cracks on slopes or crest. Repair should only commence once investigation into cause has been completed.
	Repair erosion gullies on slope and along crest.
	Maintain the design downstream angle of the perimeter wall.
Spillway	Remove obstructions and vegetation (trees, shrubs, and weeds) in the inlet and chute.
	Maintain design dimensions of spillway and erosion protection measures.
Instrumentation	Repair or replace damaged instruments and associated components, including labels, damage, functionality.

1.22.8 Monitoring Activities for Management and Control Ponds

The following subsection provides a summary of the expected monitoring to complete once the embankments are completed.

1.22.8.1 Inspection and Site Observation

Inspections and site observations are used to identify and track visible changes in the condition of the ponds. Their objective is to identify any conditions that might indicate changes in the facility performance and therefore require maintenance, investigation, documentation and reporting, or emergency responses.

Inspections are to be conducted by personnel with appropriate training and are to target specific activities. They are required on a routine basis and after unusual or extreme events.

Site observation is conducted by all personnel working on or adjacent to a pond as part of their daily activities, including those who do not have specialized training and competencies related to tailings management (e.g., equipment operators, security personnel). All personnel working on or adjacent to the need to be provided with training to understand the changes that, if observed, need to be documented and reported.

If an issue is observed the following actions should be taken:

- ▶ Document all issues in accordance with appropriate management plans and SPPs;
- ▶ Provide maintenance as appropriate in accordance with **Table 1.22-15**;
- ▶ Engage the Engineer of Record for any unfamiliar or significant issues under the discretion of the management pond manager;
- ▶ Increase inspection frequency according to the magnitude of the issue under the discretion of the management pond manager or geotechnical engineer; and
- ▶ Record safety hazards (e.g., cracks in roads and embankments, spillages of any nature, etc.), mark and/or block access and implement the appropriate health and safety procedures.

1.22.8.2 Routine Inspections

Inspection items and their frequencies are presented in **Table 1.22-15**. The frequency of inspections should be increased for items where issues are detected. The frequency would depend on the magnitude of the issue under the discretion of the management pond manager or geotechnical engineer.

Table 1.22-15: Inspection Activities and Frequencies

Management Pond Component	Inspection Item/Potential Issues	Frequency
Embankment Crests and Outer Slopes	General management pond inspection from vehicle	daily
	Available operational and pond freeboard along the perimeter of the management pond	daily
	Appearance of new movement, cracks, erosion, seepage, bulging, deformations.	weekly

Management Pond Component	Inspection Item/Potential Issues	Frequency
	Status of existing cracks, erosion, seepage, or deformations.	daily
Spillway	Debris and significant vegetation in spillway inlet and chute	weekly
	Erosion protection condition	monthly
	Inlet and chute cracks, bulging, deformations	monthly
Instrumentation	Condition of monitoring instrumentation and associated components, including labels, damage, functionality	monthly

1.22.8.3 *Event Driven Inspections*

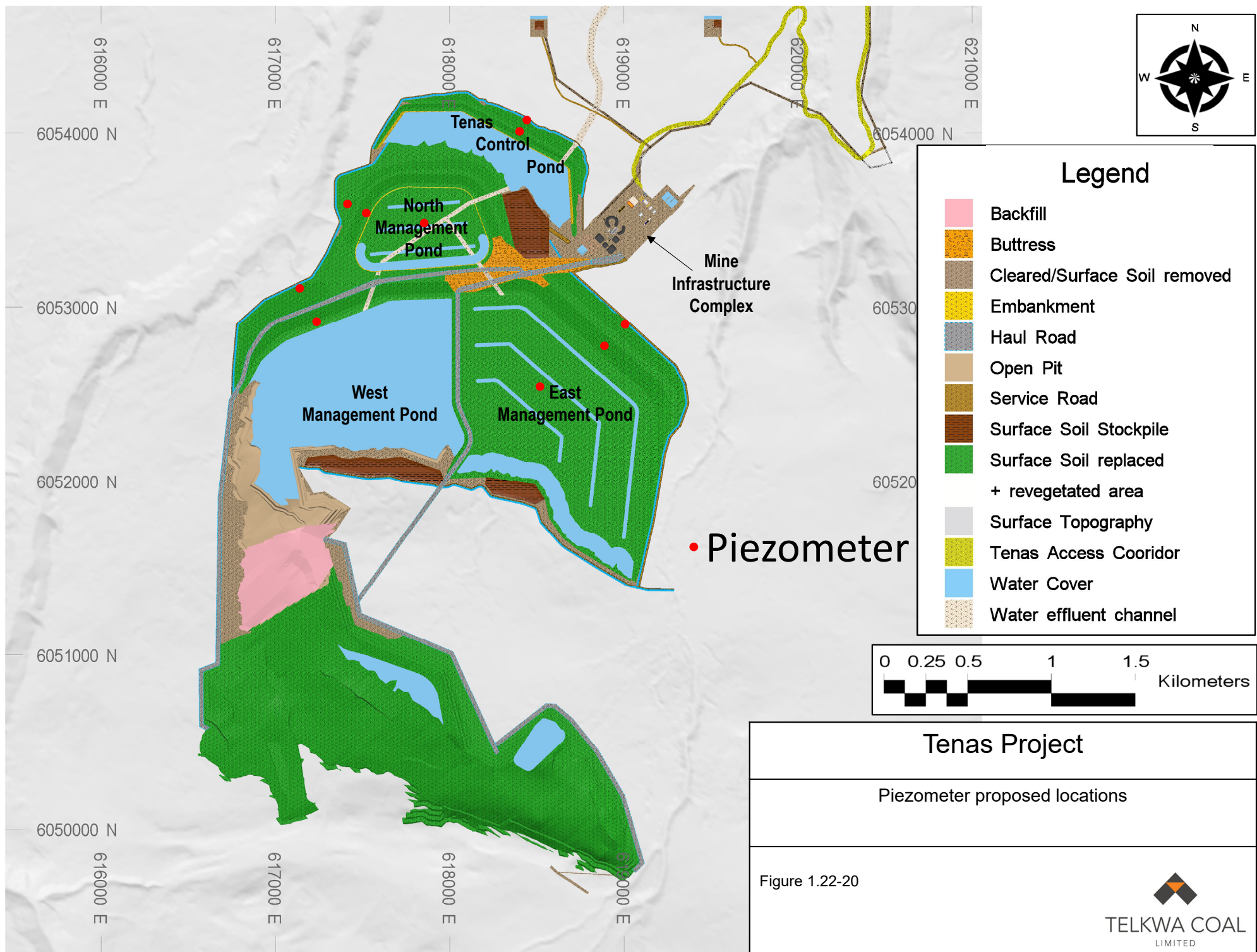
Event driven inspections are conducted during (if safe and practical to do so) and after unusual or extreme events that may impact the facilities (e.g., heavy rainfall, windstorms, rapid snow melt, seismic events, exceedance of minimum freeboard). Inspections should also be conducted in response to significant changes to normal operations, nearby construction activity, or other unusual events.

If a major event occurs, all activities listed in **Table 1.22-15** should be conducted. A qualified geotechnical engineer should be engaged to inspect the facilities immediately.

1.22.8.4 *Instrument Monitoring*

Instrument monitoring provides information on parameters or characteristics that cannot be detected through site observation or inspections, cannot be observed with sufficient precision and accuracy, or needs to be monitored at high frequency or continuously.

A location for piezometers was selected based on the critical section of each management pond. Piezometers will be located at the dam body and the buttress, as presented in **Figure 1.22-20** and **1.22-21**. There will either be piezometers installed in the middle of each management pond or level gages installed in the open water portions of the management pond covers to monitor water levels versus PAG material elevation.



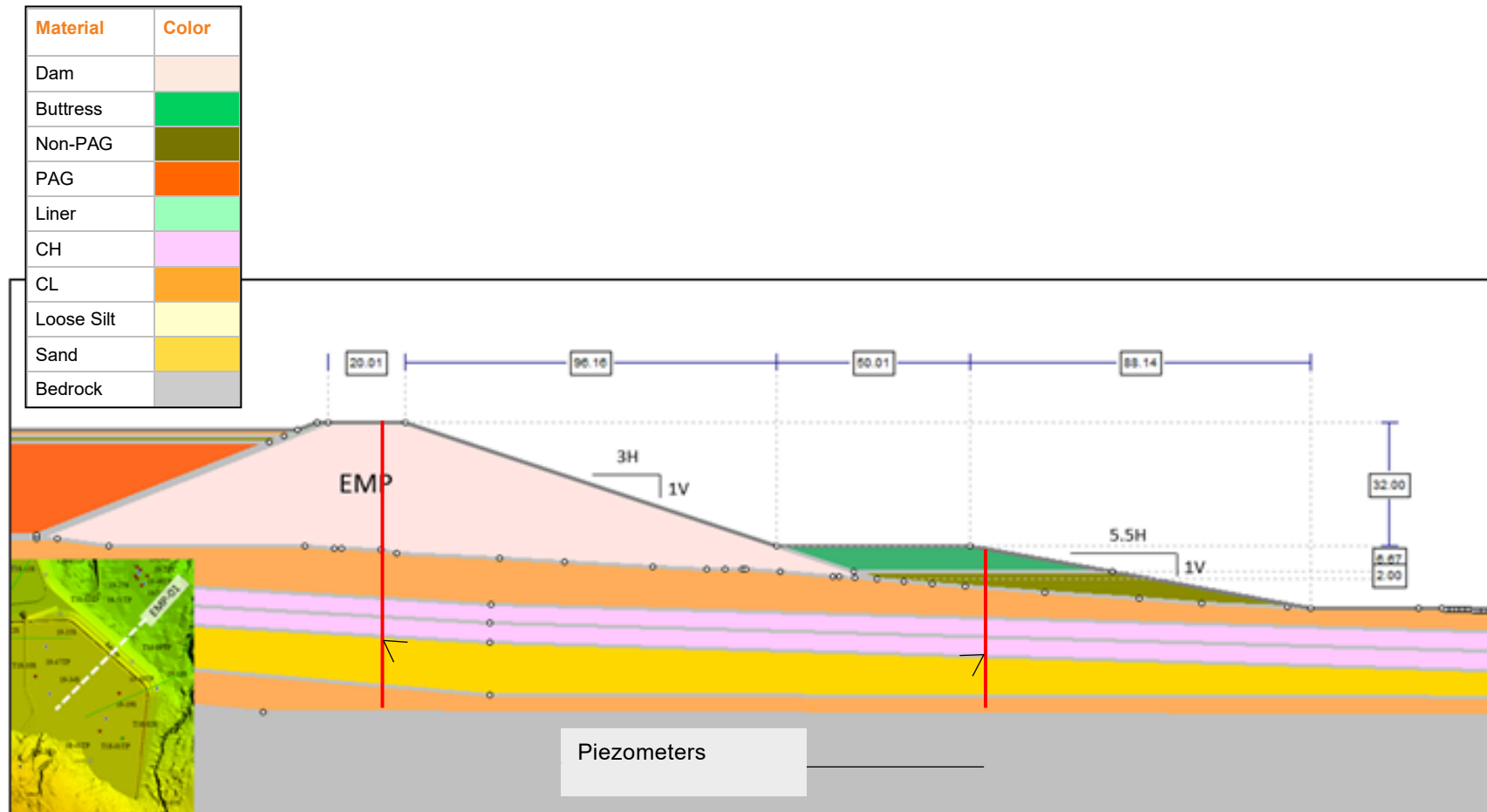


Figure 1.22-21: Piezometer proposed locations section view (illustrative)

1.22.8.5 Monitoring Parameters and Schedule

The monitoring parameters applicable to the management ponds, their method of data acquisition, and frequency of data acquisition are presented in **Table 1.22-16**. Monitoring data is to be documented and reported.

Table 1.22-16: Monitoring Parameters, Methods and Frequency of Data Acquisition

Parameter	Method	Frequency
Climate		
Wind speed and direction	Measured on site weather station	hourly
Precipitation	Measured using rain gauge on site weather station	daily
Evaporation	Measured using evaporation pan on site weather station	daily
Elevations and freeboards		
Pond level	Measured using a vertical stake or digital system in the ponds	daily
Pond freeboard	Calculated from pond elevations and dam crest and spillway elevation	daily
Embankment		
Pore pressures (piezometers)	Measured using piezometers located in the embankment	weekly
Crest settlement	Measured using manual survey equipment with survey beacons located at regular intervals on the crest and face of the downstream embankments.	weekly
Seepage	Measured using piezometers and wells located within the center of the ponds and via a downstream array to detect groundwater flows and quality	weekly
Survey		
Management pond survey	Surveyed using manual survey equipment or Lidar drone, includes impoundment surface, embankments, and auxiliary features such as the buttresses.	Annual or weekly during construction

1.22.8.6 Compliance Audits

The purpose of the compliance audit is to ensure ongoing compliance with the design intent. These audits are to focus on the identification of deficiencies by visual examination of the management pond embankments and all appurtenant structures, as well as a review of all surveillance and monitoring data.

Compliance audits shall be conducted by a suitably qualified geotechnical consultant annually and in accordance with the facilities permit conditions, at minimum.

1.22.8.7 Dam Safety Reviews

A dam safety review (DSR) is a systematic review and evaluation of all aspects of design, construction, operation, maintenance, and surveillance, and governance affecting the dams, to evaluate the design

criteria with current standards, operational compliance with design intent, stability, and functionality of the dams, and to identify appropriate remedial measures.

A DSR is to be conducted by a suitably qualified geotechnical consultant (different from the Engineer of Record) and is to comply with the CDA guidelines (CDA 2014).

1.22.9 Documentation and Reporting

Surveillance, monitoring and maintenance activities are to be documented as they assist in the identification of trends as well as changing conditions at the facility. Site staff should develop checklists or templates to record pertinent information in a consistent manner. Routine maintenance records should include:

- ▶ relevant inspection reports;
- ▶ monitoring data record sheets (piezometers, freeboards, etc.);
- ▶ maintenance activity records, memos, reports;
- ▶ quality control records;
- ▶ photographs of all issues identified through inspection and site observations;
- ▶ equipment logs, inventories of spares, materials, tool, and equipment; and
- ▶ maintenance schedules.

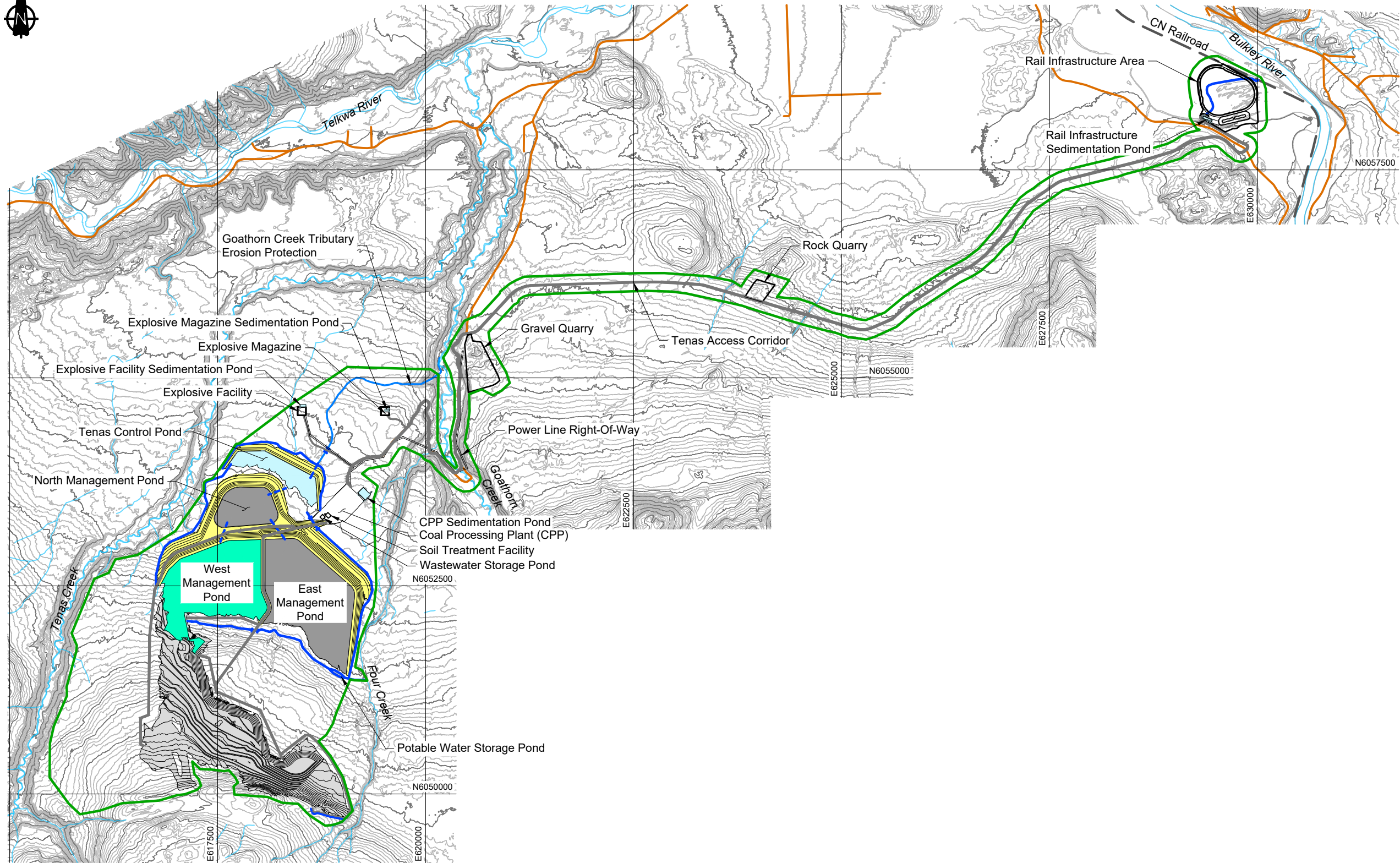
These records will document the frequency of problems that may be important when assessing the site conditions and reliability of various components.

1.22.10 Geohazards for Management and Control Ponds

The management and control ponds for the Project are located on a shallow sloping plateau located between the Tenas and Goathorn creeks and is not subject to any hazards due to adverse terrain. Furthermore, there are no large water courses at the upslope end of the management and control ponds that would cause mudflows and/or debris flows. Lastly with the shallow slope present, the area is not at risk from avalanches. The only hazards the management and control ponds face are the ones induced by the construction of upstream management ponds and the management and control ponds themselves which are addressed through the geotechnical analysis conducted by SRK.

1.23 Gravel Quarry

The Gravel Quarry is located near the TAC in the middle of the overall Project Area as illustrated on **Figure 1.23-1** below. The Gravel Quarry will further expand the existing approved quarry under Permit # G-2-48 issued to TCL and is named Goathorn Pit located in District lot 401, Range 5, Coast District. There are two (2) pit areas planned, identified and Gravel Quarry Pit 1 (Pit 1) and Gravel Quarry Pit 2 (Pit 2). Based on the test pit program completed in 2021 for the area, there is approximately a 10 m depth of gravel below the reclamation materials (surface soils and overburden) layer. The Gravel Quarry will operate primarily between June 1 and September 30 to generate sufficient material to last for the remainder of the year. All reclamation materials (surface soils, overburden) are placed into stockpiles for the reclamation phases of Pits 1 and 2. Based on the field testing programs completed to date, no overburden is expected to be salvaged and placed into stockpile, while a total of 2,263,873 BCM reclamation materials (surface soil) is placed into stockpiles.



LEGEND

- Water Management Feature
- Spillway
- Existing Watercourse
- Existing Road
- Proposed Road
- Project Area
- Dam and Buttress
- Sedimentation and Control Pond
- Active Management Pond
- Backfill / NAG Pile
- Covered Inactive Management Pond

NOTES

- Contours shown at 5.0m intervals.
- All dimensions shown in meters unless otherwise stated.
- Mine Infrastructure designs by Telkwa Coal Limited (TCL).

REFERENCE

NAD83 UTM Zone 9.



SRK JOB NO.: 1CT027.003
FILE NAME: 1CT027.003 Overview.dwg



Telkwa Coal

Environmental Assessment

Location of Gravel Quarry

DATE:
2022/04/05

APPROVED:
SAB

FIGURE:
1.23-1

1.23.1 Gravel Quarry Pit 1

Pit 1 has been mined in the past for gravel material and is currently authorized at a production rate of 2,499 m³ of material per annum. Pit 1 has approximately 15,000 m³ of recoverable gravel material. If the Project obtains regulatory approvals Pit 1, will be used to supply some of the gravel requirements for the TAC road surfacing. Two (2) products will be produced by Pit 1 which are listed below:

- ▶ OGB course gravel; and
- ▶ HFSA course as per BC MOTI 2016.

Laboratory testing has been completed on the material recovered from the test pit program and has demonstrated that gravel materials present can meet the specifications for the two (2) products required. A standard crushing and screening plant will be set up in the pit, to produce the two (2) desired products, and fines product. The fines product will be used for sanding purposes for roads in winter conditions or will be placed as backfill within the open pit or will be placed as backfill within Pit 1 itself. All slopes will be mined at approximately 2 to 1 for stability purposes which is deemed acceptable given that the depth of the pit is a maximum of 10 m.

During the operation of Pit 1, the following temporary stockpiles will be constructed and used on an annual basis:

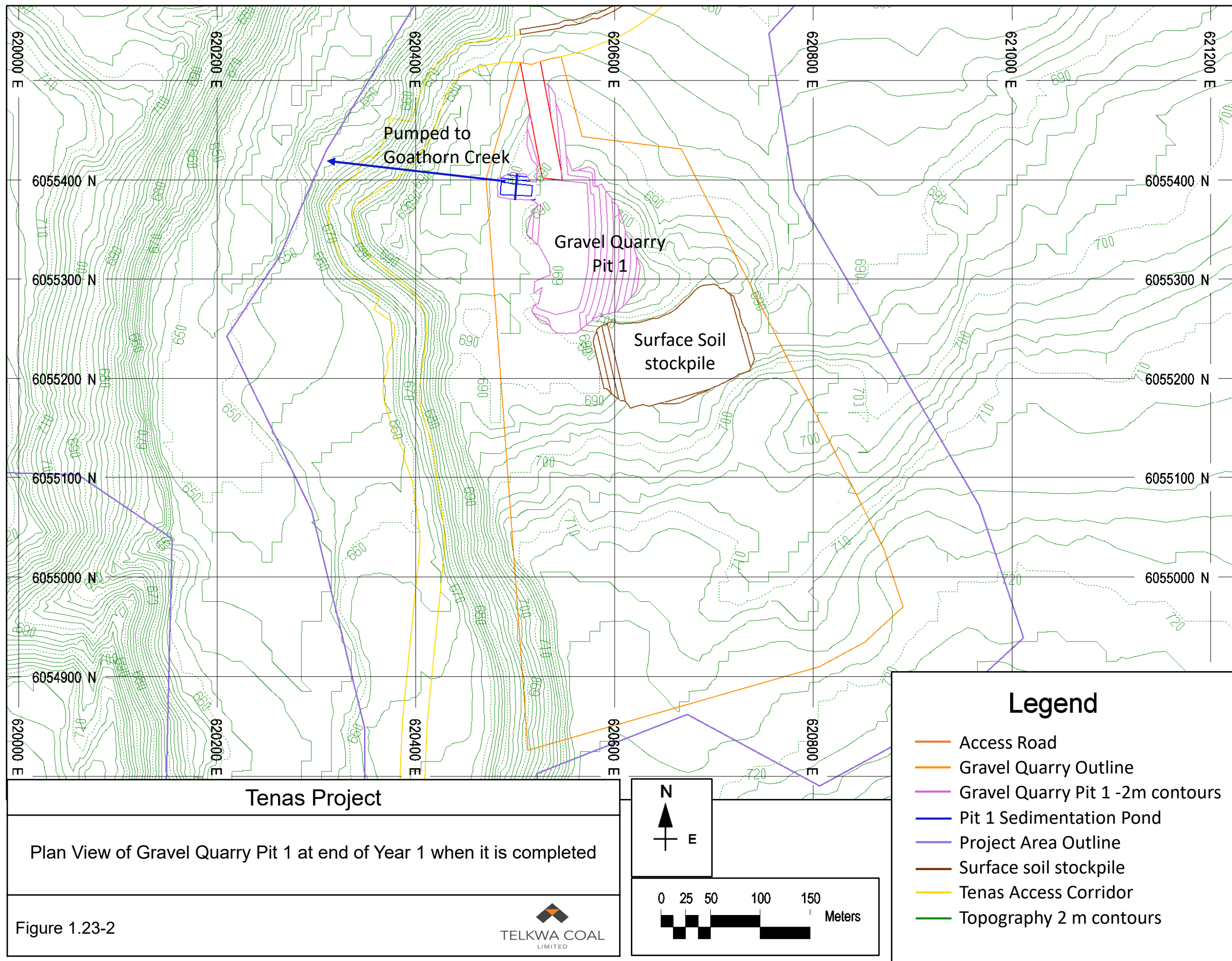
- ▶ 2,500 m³ of OGB course gravel;
- ▶ 2,500 m³ of HFSA;
- ▶ 250 m³ of fines that do not qualify for OGB, and/or HFSA; and
- ▶ 100 m³ of oversize material that requires secondary breaking.

A two (2)-cell sedimentation pond lined with gravel will be developed on the west side of Pit 1 through excavation only into the sandy/gravel floor, however it is unlikely it will be required as any water entering Pit 1 will likely infiltrate through the sandy floor of quarry. Based on the materials present and the temporary nature of stockpiles and that is surficial materials being recovered no water quality issues are expected except for total suspended solids which will be addressed by the Pit 1 Sedimentation Pond. No water quality predictions were completed for this feature given the small volume of material being recovered by Pit 1 and that all materials will be used for the Project. Furthermore, a portion of Pit 1 has been exposed for over 10 years and no water quality issues have been observed and there are no obvious signs any issues with the slopes. Details on the sedimentation pond for Pit 1 are provided in **1.17.1.1.2**, the **MWMP**, and the **SRK Water Management Design Technical Report** provided in **Appendix 1.0-F**.

If there is standing timber above gravel resources, it will be logged in the same manner as the remainder of the Project and reclamation materials will be salvaged and placed in a stockpile on previously developed areas that do not contain gravel resources.

Material within Pits 1 and 2 have been tested for ARD potential via static testing during the test pit program and materials were found to have a NPR above 2 to 1 which would classify these materials as non-PAG, which is expected for surficial materials. All material recovered from the Gravel Quarry will be subject to confirmatory testing as recommended in the **ML/ARDMP**.

Figure 1.23-2 below illustrates Pit 1 when gravel material is fully recovered at the end of Year 1.



1.23.2 Gravel Quarry Pit 2

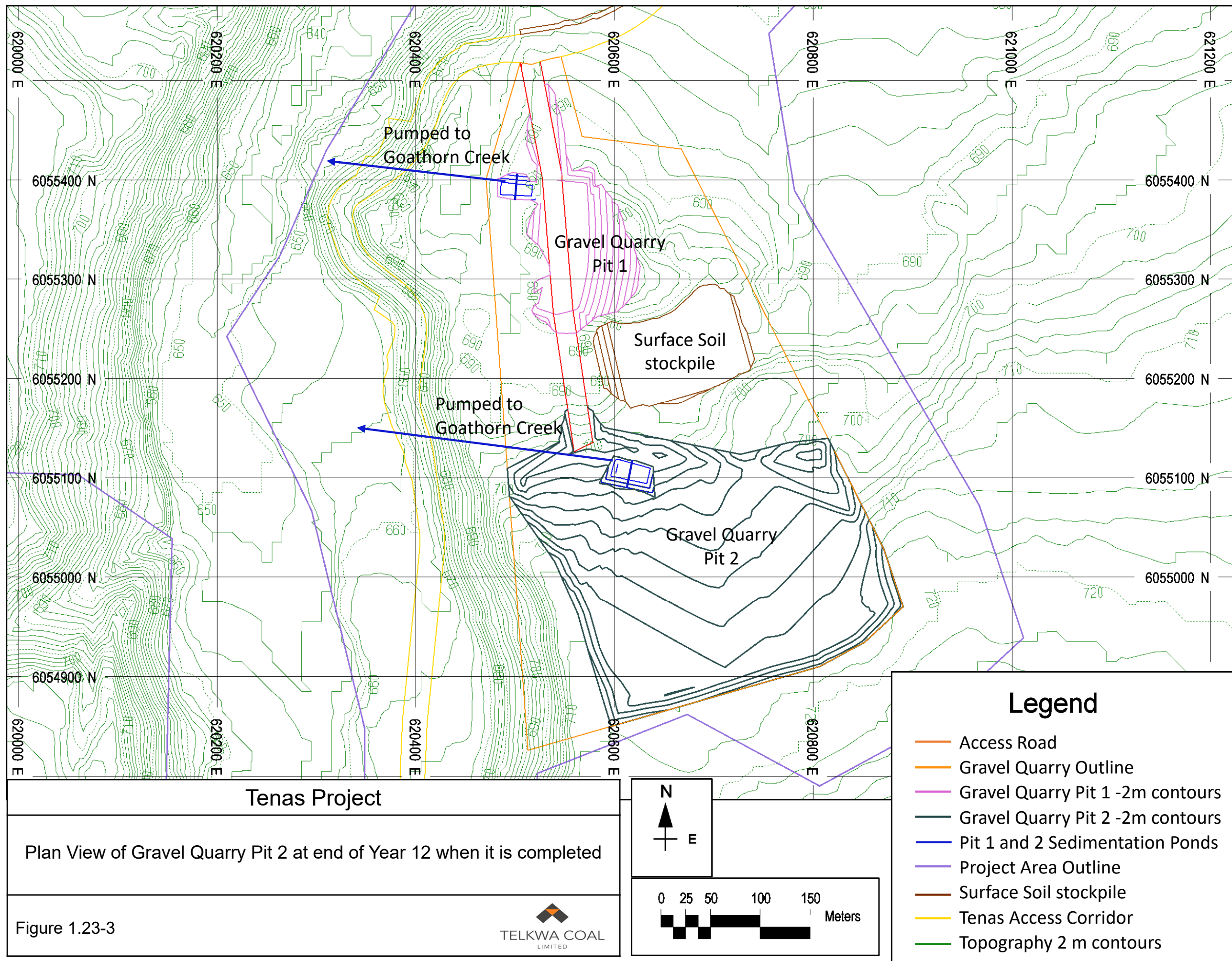
Once Pit 1 is completed it will be reclaimed as much as possible while still maintaining an area for crushing and screening of material from Pit 2. Pit 2 will be developed in much the same manner as Pit 1, except that Pit 2 is a larger with an overall estimated 40,000 m³ of recoverable gravel materials. However, Pit 2 is shallower than Pit 1 having a depth of only 5 m maximum based on the test pit program completed. Again this material has been tested in the same manner as materials for Pit 1. The depth of gravel materials is again approximately 5 m below the existing topography. The materials have been tested via test pits and are also suitable for the two (2) materials required for the TAC.

Pit 2 will have its own two (2) cell sedimentation pond identified as Pit 2 Sedimentation Pond. Pit 2 will be developed in a very similar manner as Pit 1. Details on the sedimentation pond for Pit 2 are provided in **1.17.1.1.2** and the **MWMP**.

Pit 2 will utilize the same slopes as Pit 1 and undergo similar development activities such as logging and reclamation materials (surface soil, overburden) salvage and stockpiling. Pit 2 is shown on **Figure 1.23-3** when gravel material is fully recovered at the end of Year 12.

During the operation of Pit 1, the following temporary stockpiles will be constructed and used on an annual basis:

- ▶ 2,500 m³ of OGB course gravel;
- ▶ 2,500 m³ of HFSA;
- ▶ 250 m³ of fines that do not qualify for OGB, and/or HFSA; and
- ▶ 100 m³ of oversize material that requires secondary breaking.



1.23.2.1 *Geohazards for the Gravel Quarry*

The Gravel Quarry for the Project is located on a shallow sloping plateau above Goathorn Creek and is not subject to any hazards due to adverse terrain. Furthermore, there are no large watercourses at the upslope end of the Gravel Quarry that would cause mudflows and/or debris flows. Lastly with the shallow slope present, the area is not at risk from avalanches. The only hazard the Gravel Quarry faces is the one induced by the slopes constructed which were addressed by using a slope of 3H to 1V for all quarry slopes.

1.24 Rock Quarry

The Rock Quarry is located towards the eastern side of the Project Area, adjacent to the Bypass Road portion of the TAC as illustrated by **Figure 1.24-1**. This area was identified during the field reconnaissance programs for the design of the TAC as potential suitable material that could be used for surfacing material for the TAC and there is an estimated volume of 280,000 BCM of material that can be recovered within the quarry pit shell provided in **Figure 1.24-2** with typical cross sections shown in **Figures 1.24-3** and **1.24-4**. Two (2) field programs were completed. One (1) involved taking several grab samples for ARD and material testing, and the other was a coring program where two (2) holes of 7 m depth each were drilled using a backpack drill to sample the material at depth. Based on the materials recovered, the rock has been identified as a granitic rock and no obvious structural features have been identified. The recovered core was sent for laboratory testing for materials suitability and ARD potential via static testing. The tests confirmed that the rock was suitable for the following two (2) products:

- ▶ OGB course gravel; and
- ▶ HFSA course as per BC MOTI 2016.

The static tests also confirmed that this material is non-PAG with a NPR above 2 to 1. All material recovered from the Rock Quarry will be subject to confirmatory testing as recommended in the **ML/ARDMP**.

The Rock Quarry will be developed with the TAC to provide some of the materials required for construction. The Rock Quarry will be developed via conventional drill and blast activities followed by a crushing and screening plant.

Currently the Rock Quarry exists as large rock outcrop that is accessible via the access road constructed for the 500 kV powerline. There is very little vegetation to remove if any and reclamation materials (surface soil, overburden) are also expected to be very thin given that bedrock is right at surface. Any reclamation materials that are salvaged will be placed within the same windrow that is developed for the TAC.

The maximum depth of the Rock Quarry is approximately 20 m, and it is expected 280,000 m³ will be able to be recovered from this location. Like the Gravel Quarry, the Rock Quarry will be targeted to operate between June 1 and September 30 of any given year. All material recovered by the Rock Quarry will be used by the Project for various requirements.

The Rock Quarry will be developed with 3H to 1V slopes to allow for reclamation activities without the need to either reslope these walls or cover them with overburden prior to placing surface soils on them.

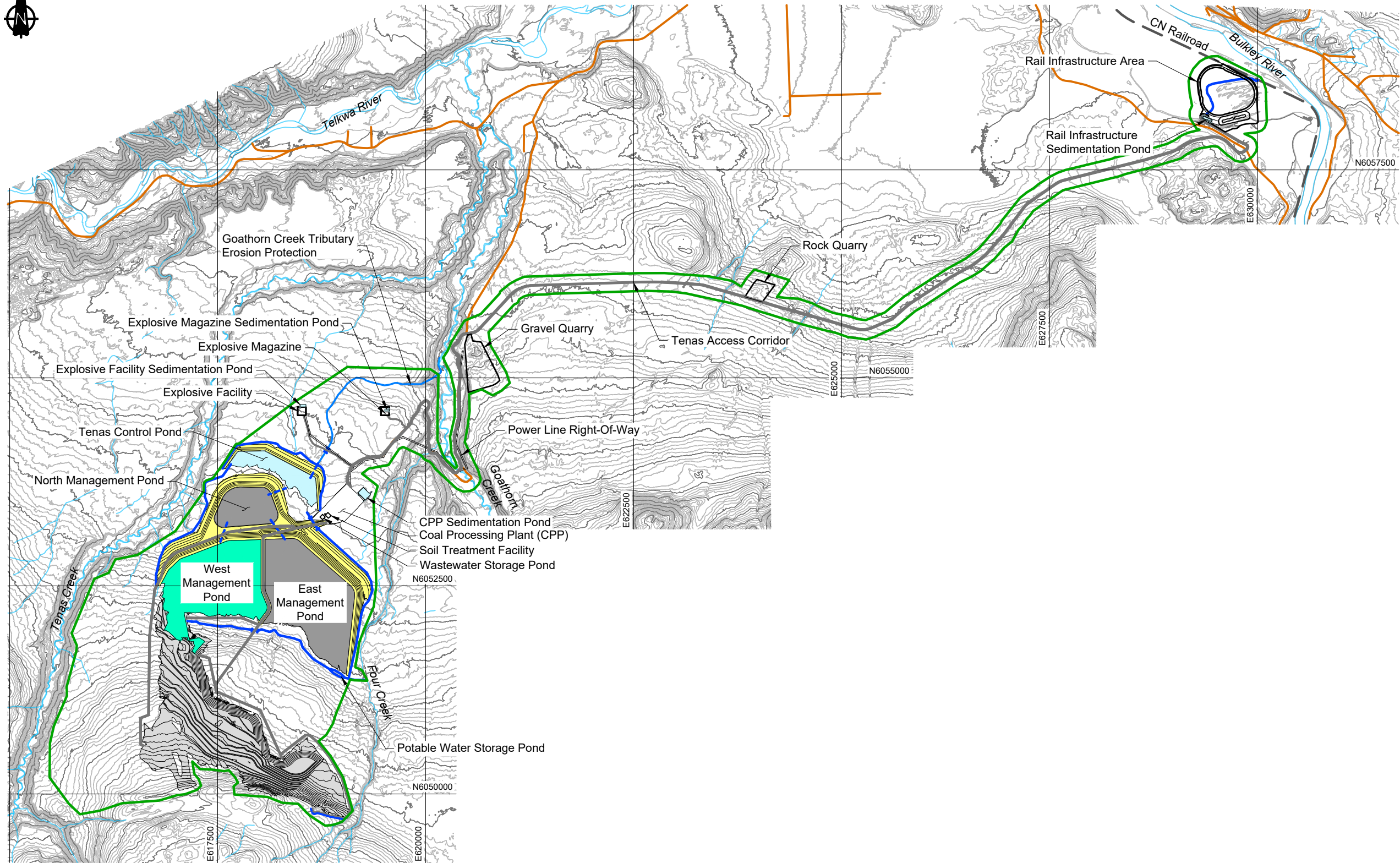
A sedimentation pond will be constructed on the north side of development via an excavation into the rock without the need for any embankments as all water flows this way due to topography. The sedimentation

pond will discharge to the northeast through an existing forested land feature into a tributary of Helps Creek. Given that Rock Quarry is composed of competent rock there is a low risk of erosion and subsequent mobilization of sediment. The Rock Quarry is also at least 2 km away from the nearest annual flowing water course. Details on the sedimentation pond for the Rock Quarry are provided in **1.17.1.1.2** and the **MWMP** and **SRK, on Tenas Project Water Management Design Technical Report** provided in **Appendix 1.0-F**.

Based on the materials present within the Rock Quarry, the temporary nature of stockpiles, and the static test work completed, no water quality issues are expected except for total suspended solids which will be addressed by the Rock Quarry Sedimentation Pond. No water quality predictions were completed for this feature given the small volume of material being recovered by the Rock Quarry and that all materials will be used as surfacing agents for the TAC. **Figures 1.24-1** through **1.24-4** below show the plan view and typical cross sections for the Rock Quarry.

During the operation of Rock Quarry, the following temporary stockpiles will be constructed and used on an annual basis:

- ▶ 2,500 m³ of OGB course gravel;
- ▶ 2,500 m³ of HFSA;
- ▶ 1,000 m³ of blasted pit run material that requires crushing and screening;
- ▶ 250 m³ of fines that do not qualify for OGB, and/or HFSA; and
- ▶ 100 m³ of oversized material that requires secondary breaking.



LEGEND

- Water Management Feature
- Spillway
- Existing Watercourse
- Existing Road
- Proposed Road
- Project Area
- Dam and Buttress
- Sedimentation and Control Pond
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- Backfill / NAG Pile
- Covered Inactive Management Pond

NOTES

- Contours shown at 5.0m intervals.
- All dimensions shown in meters unless otherwise stated.
- Mine Infrastructure designs by Telkwa Coal Limited (TCL).

REFERENCE

NAD83 UTM Zone 9.



SRK JOB NO.: 1CT027.003
FILE NAME: 1CT027.003 Overview.dwg



Telkwa Coal

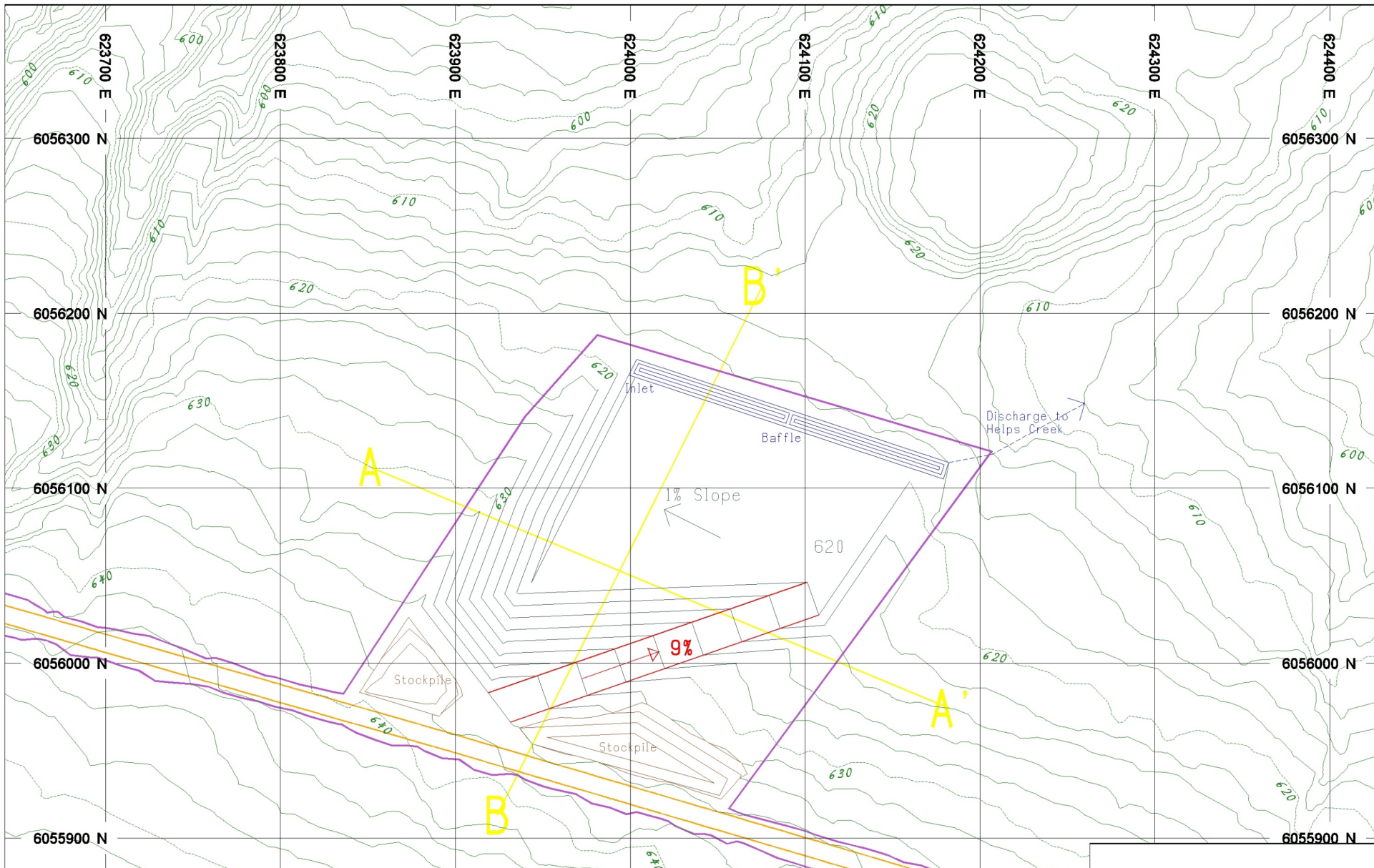
Environmental Assessment

Location of Rock Quarry

DATE:
2022/04/05

APPROVED:
SAB

FIGURE:
1.24-1



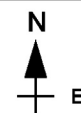
Tenas Project

Plan View of Rock Quarry at end of Operation Phase

Figure 1.24-2



1 : 3000



Legend

- Topography - 2m Contours
- Rock Quarry - 2m Contours
- Project Area
- Ramp Lines (9%)
- Tenas Access Corridor
- Section Lines

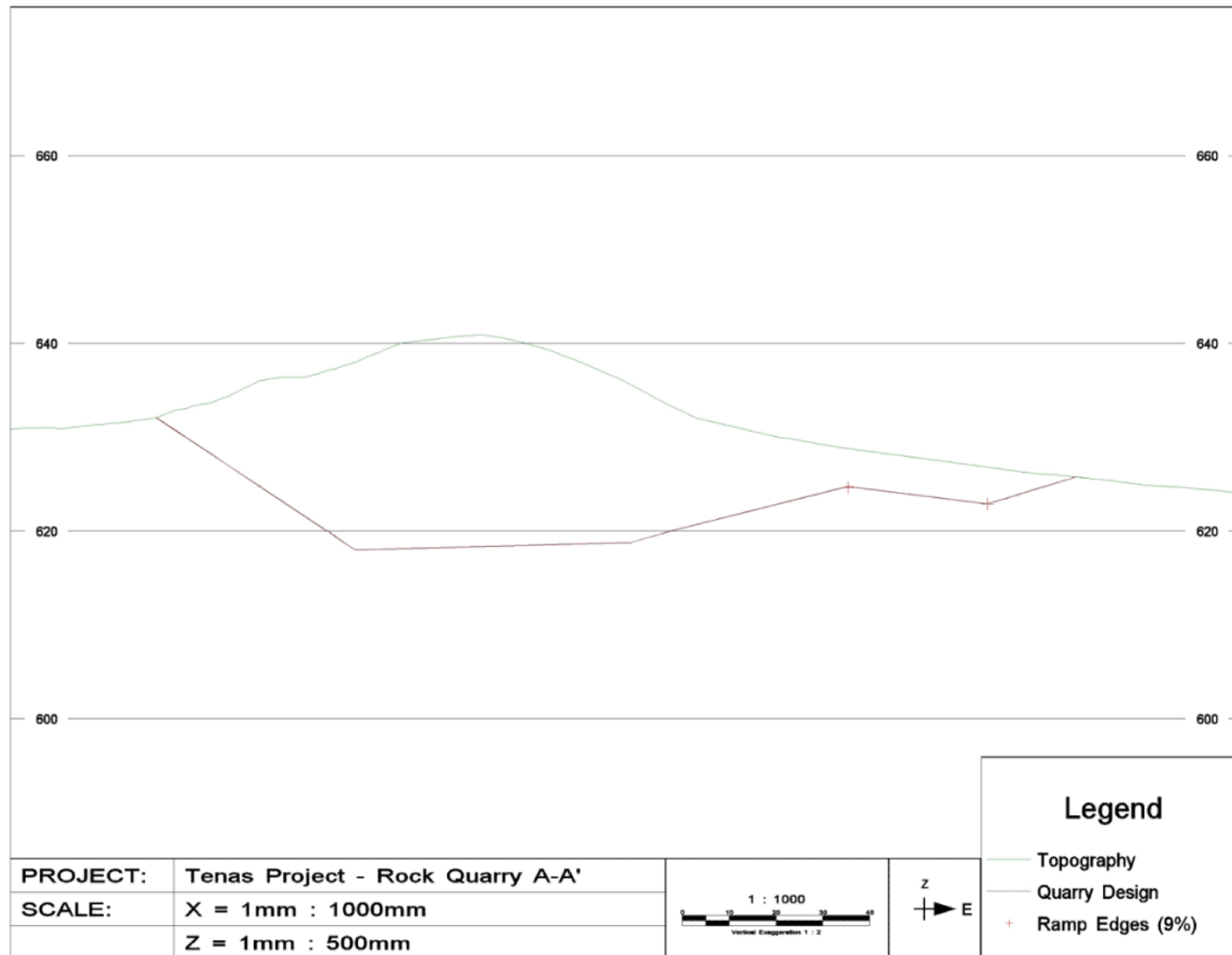


Figure 1.24-3: Cross section A-A' for the Rock Quarry

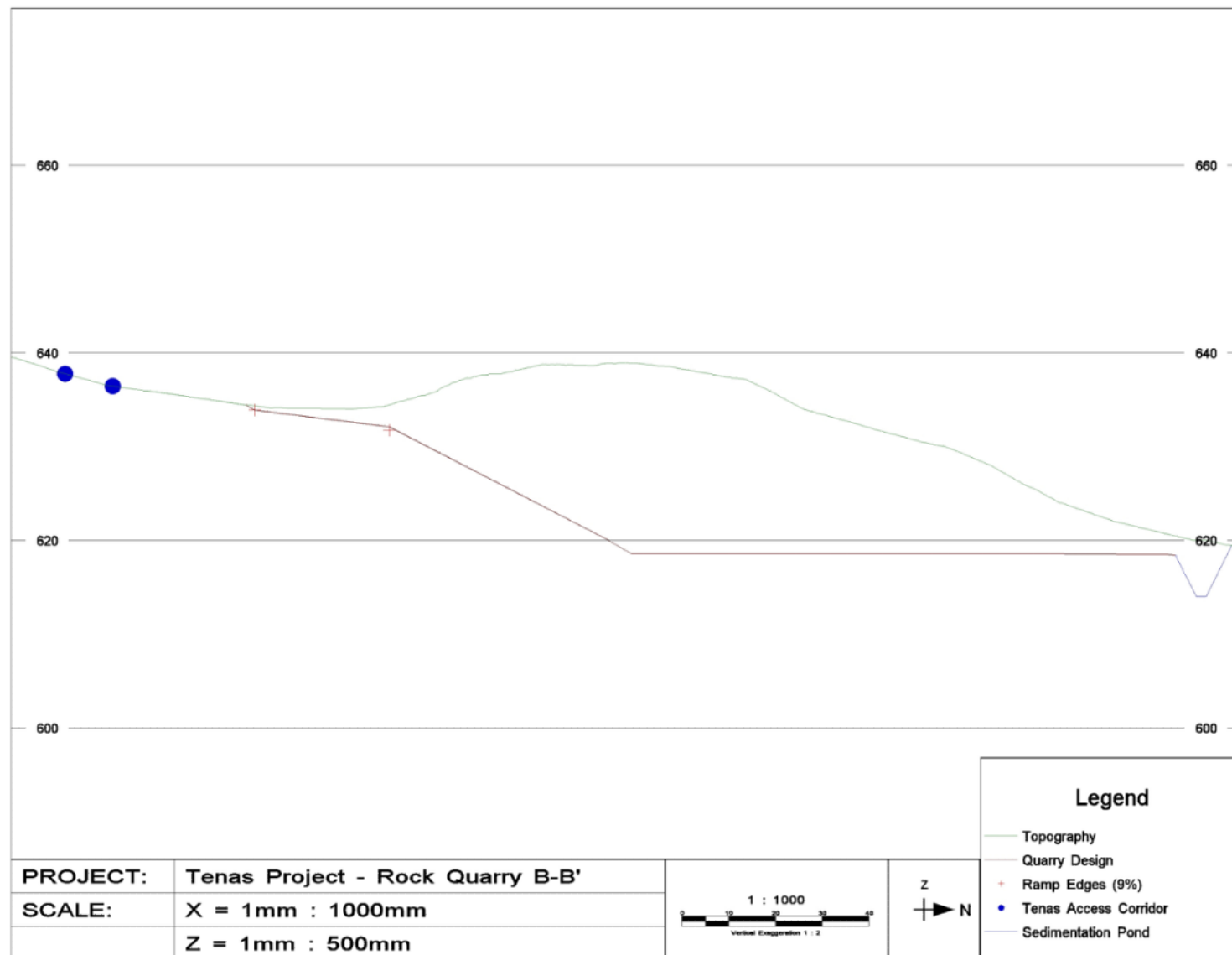


Figure 1.24-4: Cross section B-B' for the Rock Quarry

1.24.1 Geohazards for the Rock Quarry

The Rock Quarry for the Project is located on a shallow sloping plateau above Helps Creek and is not subject to any hazards due to adverse terrain. Furthermore, there are no large water courses at the upslope end of the Rock Quarry that would cause mudflows and/or debris flows. Lastly with the shallow slope present, the area is not at risk from avalanches. The only hazard the Rock Quarry faces is that induced by the slopes constructed which were addressed by using a slope of 3H to 1V for all quarry slopes.

1.25 Offsite Parking Lot

TCL has identified various private entities for providing a parking lot for approximately 70 vehicles on the east side of Goathorn Creek. One location is in the Village of Telkwa itself while another is just outside of Village limits to the west of the Village. **Figure 1.25-1** below provides the location of the two (2) options identified to date. The parking lot will be comprised of compacted gravel without fines in two (2) 75 mm lifts. No other infrastructure will be provided in terms of lighting, vehicle plug ins, rails, or water management for the parking lot.

