

2. PROJECT EMISSIONS

2.1 Airborne Emissions

Airborne emissions generated by the Project include:

- ▶ criteria air contaminants (CACs) and greenhouse gases (GHG) due to the operation of vehicles and heavy machinery, including CO², nitrogen oxide (NO_x), sulfur oxides (SO_x), and particulates;
- ▶ fugitive dust emissions (total suspended particles [TSP], particles with aerodynamic diameter smaller than 10 micrometres (PM₁₀), particles with aerodynamic diameter smaller than 2.5 micrometres (PM_{2.5}), associated with blasting, coal crushing and material handling by mining equipment and transfer activities, coal stockpiles, and road use; and
- ▶ methane gas associated with the coal deposit.

An **AQMP** has been developed for this Project. Mitigation for airborne emissions may include measures such as the use of cyclones and wet scrubbers for particulate collection, stabilization and revegetation of soil stockpiles, the watering of haul roads during non-freezing conditions, covers on loaded and empty coal haul truck beds, and minimizing the use of diesel generators.

The effects assessment for **Atmospheric Environment VC** is provided in **S4.0-C1** which provide an assessment of all relevant parameters such as dust, GHGs, and noise. As part of this evaluation the following contingencies were included with this assessment.

The contingencies discussed below have been included in the air quality model for this Project.

2.1.1 Current Contingencies Included with Air Quality Results

- ▶ Larger equipment fleet numbers and amount of equipment hours than specified in the mine plan was used to ensure values predicted are above average measured values during the Operation Phase;
- ▶ A larger footprint was used for the dust and noise to ensure values provided are above average measured levels during the Operation Phase;
- ▶ The largest activity and production year was selected to represent dust and noise values for all years including construction to ensure values provided are above measured average levels during the Operation Phase for all other years;
- ▶ No effect of progressive reclamation activities was considered for dust modelling;
- ▶ No effect of employee uptake of electric car and/or wood/oil burning conversion initiatives was considered for dust and air quality modelling;
- ▶ No effect of cessation of whistling at the rail crossing in Telkwa was considered for noise modelling;
- ▶ No effect of possible use of electric vehicles for the Project or employees working at the Project was considered for noise, or dust or air quality modelling; and

- ▶ Largest explosive charge per blasthole was used in modelling versus the expected average explosive charge per blasthole to ensure values provided are above those expected from blasting operation.

2.1.2 Additional Future Mitigations

If monitoring for the Project indicates that actual values are above air quality guidelines, then the following can be investigated and implemented during the Operation Phase

- ▶ The Project can add specialized mufflers to all mining vehicles to reduce noise emissions by up to another 10% based on published papers;
- ▶ The Project can further modify blasting practices to reduce vibration, noise, and dust emissions from this activity by simply reducing the diameter of the blast holes and/or increasing stemming thickness;
- ▶ Additional amounts of chemical agents can be added process coal and the TAC to further reduce emissions;
- ▶ Varying types of chemical agents can be used that have a higher effectiveness on dust emissions; and
- ▶ Moving to covered stockpiles for processed coal to reduce dust emissions.

2.2 Liquid Emissions

Liquid emissions from the Project include washwater associated with vehicle washing and sewage water from the Sewage Treatment Plant, as well as surface water discharges from Project infrastructure such as the management ponds.

2.2.1 Regulatory Requirements and Commitments

For a discussion of the general environmental regulatory setting for the Project, refer to **S2.0-C1 Provincial and Federal EA Process** of the **EAC Application**. Water withdrawals for the Project are expected to be subject to the provincial *Water Sustainability Act*, B.C. Reg. 36/2016 via a license to divert, store and use specific quantities of water from surface or groundwater. The Project is expected to be subject to the federal *Fisheries Act*, 1985, c F-14, as well as the provincial *Environmental Management Act*, SBC 2003, c 53 (*EMA*) via a Waste Discharge Authorization (permit).

In the BC provincial jurisdiction, “end-of-pipe” limits for discharge of excess water to the environment may be specified in a Waste Discharge Authorization (permit) issued by the BC MECCS under the provincial *EMA*, in addition to established Surface Water Quality Guidelines for receiving environments.

The long-term average British Columbia Approved Water Quality Guidelines (BC AWQG) (GovBC 2018) and the British Columbia Working Water Quality Guidelines (BC WWQG) (BC MOE 2015a) for freshwater aquatic life were applied for the evaluation of results from the load balance. Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (WQG) are applied for parameters for which there is no BC AWQG or BC WWQG established.

Site performance objectives (SPOs) were developed for the constituents of potential concern by Windward Environmental and Borealis Environmental including nitrite, total selenium, total cobalt, dissolved cadmium, total thallium, nitrite, and total aluminum are provided in the Appendices of the **DMP**.

The SPOs are presented with the proposed in-stream guidelines, however all screening was prepared with respect to the approved BC MOE and/or CCME guidelines.

TCL have calculated end-of-pipe concentrations to meet the proposed in-stream guidelines for nitrate and total selenium. In the case of total selenium, the SPO of 0.008 milligrams per litre (mg/L) was applied as the final in-stream concentration, while the BC AWQG of 3.0 mg/L was applied for nitrate. The resultant end-of-pipe limits under these conditions were calculated to be 0.050 mg/L and 18.8 mg/L for total selenium and nitrate, respectively.

2.2.2 Project Discharges

Evaluation of Project discharge rates was performed using the water and load balance model (**Appendix 1.0-E SRK, Tenas Project Water and Load Balance Modeling Report** as well as an initial dilution zone model (**Appendix 1.0-AE SRK, Tenas Project Initial Dilution Zone Modeling Memo**).

Discharges from the following locations were not explicitly quantified as only weathered materials are expected to be captured by these discharges, flows are very localized and there is no measurable effect to water quality beyond TSS. The components are:

- ▶ Explosive Magazine;
- ▶ Explosive Facility;
- ▶ TAC;
- ▶ Rock Quarry;
- ▶ Gravel Quarry; and
- ▶ Powerline.

TSS is expected to be mitigated by the water management and soil and erosion control measures adopted for these components.

Process water will be recycled or reused as much as possible and there is no planned liquid discharges from the CPP.

Site runoff from mining will be diverted into sedimentation ponds that are designed to discharge via pumping systems up to the 1 in 10-year event, and via spillway up to the 1 in 200-year event. Water quality will be monitored at the point of discharge and in the receiving environment, including existing monitoring stations WQS04 on Tenas Creek, WQS03DS on Four Creek and WQS06 on Goathorn Creek. Monitoring data will be evaluated against model results and adjustments to the discharge plans made accordingly.

No water treatment is anticipated for the Project beyond normal sediment control systems and applying approved flocculants to reduce TSS levels as-needed. Discharge water from the site will achieve water quality criteria required to protect drinking water, fish, and aquatic life downstream of the Project.

2.2.3 Contingencies in the Water and Load Balance for Quality and Quantity

The current water and load balance included the following contingencies in the predicted concentrations of parameters in the surrounding watercourses:

- ▶ The current model does not account for progressive reclamation with subsequent decrease in infiltration rates, oxidation rates, and loading from the non-PAG material during the Operation Phase as the current assumption has this occurring in the Decommissioning and Reclamation Phase;
- ▶ The current model does not include any geochemical attenuation related to operating the management ponds as saturated rock backfills which will reduce nitrate and selenium and other parameter concentrations seeping out from these structures into the groundwater;
- ▶ The current model does not include any geochemical attenuation related to seepage going through an anoxic deep groundwater system; and
- ▶ The current model does not account for non-PAG material being saturated underwater during the Operation phase, as the current assumption has this not occurring until the Post-closure Phase.

2.2.4 Additional Mitigations for Water Quality and Quantity

If during the Operation Phase monitoring shows that the Project produces water quality results that are above the SPOs provided in this EAC the following additional mitigations can be investigate and incorporated in further years of the Operation Phase to lower actual parameter concentrations. See **Appendix 13.5-I Selenium Management Plan** of the **DMP** for additional information on these additional mitigations.

- ▶ Place PAG material into saturated conditions faster than the 6 month average proposed for the Project to decrease the amount of parameters flushed from this material which will decrease some parameter concentrations in both non-point and point source effluents and subsequently decrease these same parameter concentrations in the receiving environment;
- ▶ Increase the thickness on the bentonitic liner to reduce seepage volumes from management ponds to reduce parameter concentrations in non-point source loads to surrounding creeks in low flow winter conditions which will reduce some parameter concentrations in non-point source effluents and subsequently decrease these same parameter concentrations in the receiving environment;
- ▶ Cover non-PAG material with geomembranes during the Operation Phase until the Decommissioning and Reclamation Phase when this material is permanently covered with overburden and reclamation materials (surface soils) to reduce infiltration water volumes and oxygen ingress which will decrease some parameter concentrations in both non-point and point source effluents and subsequently decrease these same parameter concentrations in the receiving environment;
- ▶ Incorporate attenuation from saturated backfills that are being constructed in the management ponds which will decrease some parameter concentrations in both non-point and point source effluents and subsequently decrease these same parameter concentrations in the receiving environment;
- ▶ Allow more water to flow into the Project to assist with maintaining water covers which will further reduce parameter concentrations which is expected to improve water quality for both non-point and point source effluents and subsequently decrease these parameter concentrations in the receiving environment;
- ▶ Construct semi-active biochemical reactors for pumped open pit water and seepage from the embankments and buttresses for the management and control ponds prior to discharge into the management and control ponds which will decrease some parameter concentrations in both non-

point and point source effluents and subsequently decrease these same parameter concentrations in the receiving environment; and

- ▶ Construct approved active water treatment systems of SeHawk or Selen-X or other approved technology that are currently in operation in North America for treating water pumped from the open pit during the operation phase which will decrease some parameter concentrations in both non-point and point source effluents and subsequently decrease these same parameter concentrations in the receiving environment.

2.3 Solid Emissions

Solid emission streams will be segregated according to standard industry practices. Recyclable materials will be separated and collected onsite and shipped to the nearest suitable recycling facility. Industrial waste materials that can be recycled, including lubricants, fuels, metals, plastics, wood, and batteries will be shipped to an appropriate facility for disposal. Organic wastes will be composted onsite or disposed of in the onsite landfill.

A miscellaneous solid disposal landfill will be incorporated within the non-PAG material forming the buttress of the dams around the management ponds or in the backfill lifts for the open pit for dealing with all material generated by the mine that cannot be recycled and/or composted or consist of hydrocarbons or hazardous materials.

This site will move as the non-PAG pile expands and will be incorporated into the individual lifts of the backfills and/or buttresses on an as-required basis. No liner will be required for the material planned to go into the disposal site as it will not be hazardous and will primarily be made up non-recyclable items like plastic, styrofoam products, etc. TCL will have extensive recycling programs for:

- ▶ paper and cardboard products;
- ▶ glass;
- ▶ metal;
- ▶ recyclable plastics; and
- ▶ wood.

For further information please refer to the **Waste Management Plan for Refuse and Emissions (S13.0-C20) (WMPRE)**.

If landfills in the surrounding area get to a point that they are allowed to accept materials from industrial sites, TCL will investigate this option as an alternative to onsite disposal.

2.3.1 Hazardous Material Emissions (Liquid and Solid)

Contaminated materials, such as soils or materials containing hydrocarbons will be stored temporarily at the onsite hazardous waste transfer facility for transport offsite if the onsite Soil Treatment Facility is not capable of dealing with this material.

A Soil Treatment Facility for the onsite remediation of materials contaminated from hydrocarbon spills and is located on the MIC pad. This will be a lined facility and will use best practices to encourage bacterial growth to remediate the hydrocarbons that are present. If the contamination is deemed to be too high of concentration or too much effected material for the onsite Soil Treatment Facility the materials will be

temporarily stored on a lined area and will be covered with a geomembrane to prevent precipitation ingress until the materials can be safely transported offsite for disposal in a licensed facility.

Testing will be done of the treated materials to ensure compliance with regulatory requirements. Once material meets regulatory limits, they will then be used for reclamation purposes. The Hazardous Waste Regulation, BC Reg. 63/88 allows treatment of hydrocarbon contaminated soils under various conditions.

Appendix 1.0-AF SRK, Tenas Project Soil Treatment Facility Management Plan attached provides additional information Soil Treatment Facility that was prepared by SRK.

Other hazardous waste products, such as from explosive spills or other spilled materials, will be collected if a spill happens and disposed of through detonation in blasts or at a suitable offsite hazardous waste facility respectively. The proposed hazardous waste transfer facility is provided in **Figure 2.3-1** below.



Figure 2.3-1: Example of hazardous waste facility that will be used for the Tenas Project

3. PROJECT BENEFITS

This subsection provides a summary of the benefits that are expected to be provided to the local region, the Province of BC, and Canada as a whole. All dollar values are in Canadian dollars, based on a 2019 real dollar amount with no inflation and/or discount rates applied.

3.1 Capital Costs

A full capital cost estimate was completed for the project and **Tables 3.1-1 a-c** below summarize the capital payments over the life of the Project. The capital cost estimate was based on the Definitive Feasibility plus additional quotes obtained from vendors between 2019 and 2020.

3.2 Operating Costs

A full operating cost estimate was completed from first principles for the Project and **Tables 3.2-1 a-c** provide an annual summary of these amounts.

Table 3.2-1 a-c: Summary of Capital Expenditures Years -0.5 through 21 (2019 Canadian Dollars)

a: Years -0.5 through 6

Year	Years -0.5 and 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Primary Mine Equipment	\$0	\$33,664,847	\$1,855,719	\$7,947,816	\$0	\$0	\$0
Ancillary Mine Equipment	\$0	\$5,407,283	\$357,841	\$0	\$204,079	\$518,906	\$307,500
Coal Processing Plant and Mobile Equipment	\$4,258,300	\$17,836,992	\$0	\$372,900	\$0	\$200,000	\$15,399
Rail Infrastructure	\$2,627,844	\$4,691,073	\$125,000	\$525,000	\$125,000	\$125,000	\$155,000
Site Infrastructure	\$0	\$2,959,307	\$5,389,712	\$0	\$0	\$0	\$0
Powerline, Communications, and Substation	\$0	\$3,307,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Tenas Access Corridor	\$2,000,000	\$7,262,512	\$0	\$0	\$0	\$0	\$0
Mine Development	\$1,232,000	\$38,368,799	\$9,453,029	\$9,211,508	\$8,999,005	\$4,531,762	\$5,012,990
Total	\$10,118,144	\$113,352,038	\$17,191,301	\$18,067,224	\$9,338,083	\$5,385,668	\$5,500,889

Note: \$=Canadian dollar

b: Years 7 through 13

Year	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Primary Mine Equipment	\$4,161,703	\$0	\$0	\$0	\$14,604,002	\$1,258,486	\$0
Ancillary Mine Equipment	\$0	\$0	\$0	\$446,241	\$2,235,259	\$1,949,718	\$0
Coal Processing Plant and Mobile Equipment	\$1,626,920	\$97,968	\$200,000	\$0	\$537,774	\$4,807,792	\$1,229,198
Rail Infrastructure	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000
Site Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Powerline, Communications, and Substation	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Tenas Access Corridor	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Mine Development	\$8,734,115	\$3,502,865	\$548,625	\$548,625	\$548,625	\$3,114,625	\$548,625
Total	\$14,687,738	\$3,765,833	\$913,625	\$1,159,866	\$18,090,660	\$11,295,621	\$5,005,640

Note: \$=Canadian dollar 2019 basis

c: Years 14 through 21

Year	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21
Primary Mine Equipment	\$3,062,817	\$0	\$1,098,886	\$0	\$0	\$0	\$0	\$0
Ancillary Mine Equipment	\$0	\$0	\$307,500	\$761,069	\$0	\$0	\$0	\$0
Coal Processing Plant and Mobile Equipment	\$0	\$297,968	\$407,248	\$672,232	\$0	\$1,154,688	\$0	\$0
Rail Infrastructure	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000
Site Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Powerline, Communications, and Substation	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Tenas Access Corridor	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Mine Development	\$365,750	\$365,750	\$365,750	\$365,750	\$182,875	\$0	\$24,151	\$0
Total	\$1,629,636	\$828,718	\$1,245,498	\$1,964,051	\$347,875	\$1,319,688	\$189,151	\$165,000

Note: \$=Canadian dollar

Table 3.2-2 a-c: Summary of Operating Expenditures Years -0.5 through 21 (2019 Canadian Dollars)

a: Years -0.5 through 6

Year	Years -0.5 and 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Telkwa Labour	\$7,182,394	\$12,020,196	\$11,365,741	\$14,994,943	\$15,111,394	\$15,107,008	\$15,135,549
Fuel and Lubes (Contracts)	\$1,542,433	\$3,429,995	\$3,177,266	\$4,780,841	\$4,851,198	\$4,921,061	\$4,747,936
Equipment Costs (Contracts)	\$1,437,260	\$4,553,165	\$9,032,566	\$8,747,142	\$16,559,085	\$7,432,950	\$13,262,126
Contracts and Contractors	\$3,895,474	\$17,849,209	\$16,860,966	\$17,437,224	\$16,439,536	\$16,680,934	\$19,021,688
Consumables except fuel (Contracts)	\$1,169,048	\$5,034,493	\$5,037,021	\$5,058,192	\$5,044,550	\$5,045,165	\$5,046,637
Total	\$15,226,609	\$42,887,058	\$45,473,560	\$51,018,343	\$58,005,763	\$49,187,119	\$57,213,937

Note: \$=Canadian dollar

b: Years 7 through 13

Year	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Telkwa Labour	\$14,861,760	\$13,827,659	\$13,627,931	\$14,576,309	\$14,545,564	\$13,634,863	\$12,379,037
Fuel and Lubes (Contracts)	\$4,671,925	\$4,225,622	\$4,064,587	\$4,484,038	\$4,498,401	\$4,042,471	\$3,522,902
Equipment Costs (Contracts)	\$5,958,451	\$7,611,703	\$10,521,863	\$11,151,321	\$8,044,803	\$13,280,176	\$6,590,216
Contracts and Contractors	\$15,849,289	\$14,661,796	\$15,350,551	\$16,323,172	\$17,710,876	\$15,697,552	\$16,189,775
Consumables except fuel (Contracts)	\$5,041,957	\$5,023,009	\$5,037,238	\$5,038,487	\$5,048,083	\$5,041,345	\$5,057,076
Total	\$46,383,383	\$45,349,790	\$48,602,170	\$51,573,327	\$49,847,727	\$51,696,406	\$43,739,006

Note: \$=Canadian dollar

c: Years 14 through 21

Year	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21
Telkwa Labour	\$12,065,615	\$12,044,441	\$12,079,116	\$11,633,208	\$11,882,676	\$10,825,167	\$11,051,409	\$7,488,573
Fuel and Lubes (Contracts)	\$3,403,531	\$3,393,404	\$3,462,993	\$3,260,456	\$3,332,171	\$2,899,153	\$2,990,524	\$1,640,816
Equipment Costs (Contracts)	\$4,408,471	\$10,251,607	\$10,284,894	\$5,282,296	\$10,091,792	\$4,985,612	\$4,827,277	\$3,463,738
Contracts and Contractors	\$16,630,542	\$16,141,872	\$16,069,268	\$16,103,235	\$14,963,037	\$14,324,772	\$15,250,799	\$11,584,280
Consumables except fuel (Contracts)	\$5,062,598	\$5,055,685	\$5,052,827	\$5,058,254	\$5,029,035	\$5,021,446	\$5,041,865	\$3,621,525
Total	\$41,570,757	\$46,887,008	\$46,949,099	\$41,337,450	\$45,298,711	\$38,056,151	\$39,161,875	\$27,798,932

Note: \$=Canadian dollar

3.3 Decommissioning, Reclamation, and Closure Costs

An **RCP** was developed that provides details of the plan for reclamation and closure. These activities will take place mostly during the Decommissioning and Reclamation Phase, with the remainder, including monitoring, continuing into the Post-closure Phase.

Table 3.3-1 summarizes the expected reclamation, decommissioning, and closure direct costs for the life-of-mine disturbance.

Table 3.3-1: Summary of Reclamation, Decommissioning, and Closure Direct Costs (2020 Canadian Dollars)

Item	Cost
Equipment Removal	\$887,548
Structure Demolishment	\$2,376,388
Foundation Breakup	\$18,623
Contaminated Soil Removal	\$180,000
Resloping and Ripping	\$1,720,585
Material Movement for Final Reclamation Landform	\$2,356,353
Growth Medium Placement	\$10,160,314
Woody Debris Placement	\$0
Pond Decommissioning	\$121,784
Liner Decommissioning	\$100,000
Water Removal	\$50,000
Sediment Removal	\$35,000
Support Vehicles	\$1,242,995
Equipment Mobilization and Demobilization	\$60,000
Vegetation	\$4,400,000
Maintenance Activities	\$1,142,500
Monitoring Activities	\$3,832,140
Supplemental Personnel	\$2,460,782
General and Administration	\$2,173,709
District Taxes	\$1,269,670
Total Direct Costs	\$34,588,390
2019 Canadian Dollar Equivalent	\$33,023,407.50

Note: \$=Canadian dollar

3.4 Direct Employment

Direct employment is the employment and personal income generated directly by the Project, including the effects generated by industries directly contracted to supply the onsite goods and services used by the Project. For the Construction, Decommissioning and Reclamation, and Post-closure phases, direct

effects in the RDBN and direct effects in the rest of BC include the direct TCL employees and direct Project contractors, as well as other direct positions that the British Columbia Input-Output Model (BC IOM) estimated for direct supplier industries.

The average all-in salaries by phase for Direct jobs within the RDBN are summarized by **Table 3.4-1** below:

Table 3.4-1: Average Direct Salaries for Direct Jobs with Regional District of Bulkley-Nechako (RDBN) for Project Phases

Phase	Average All-in Salary
Construction	\$84,700
Operation	\$94,613
Decommissioning and Reclamation (Year 22)	\$90,381
Decommissioning and Reclamation (Years 23 to 25)	\$95,477
Post-closure	▪ \$94,703 (active) ▪ \$95,564 (passive) ▪ \$95,081 (active and passive)

Note: \$=Canadian dollar

The subsections and tables below provide details such as anticipated job categories, the number of FTE jobs that will be created, and the origin of employees for each phase of the Project.

For further details see **S5.0-C1 Labour Market VC** of the **EAC Application**.

3.4.1 Construction Phase

The Construction Phase (Years -0.5 to 0) is expected to provide a total of 118.3 full-time equivalents (FTEs) of contractor employment with labour cost of \$12.4 million over the 1.5 years, and 9.6 FTEs for TCL employees with labour cost of \$1.2 million over the 1.5 years. Another 9.0 FTE employees are required in Year 1 to finish off all of related commissioning activities associated with construction, which was also included as part of Construction to give a total of 136.9 FTE distributed as follows:

- ▶ 83.4 local which is the RDBN electoral Area A and B;
- ▶ 37.3 province of BC;
- ▶ 14.1 rest of Canada (likely Alberta); and
- ▶ 2.1 international associated with the CPP

Construction Phase activity is expected to peak at 186 jobs in June of the second year of Construction Phase activities (Year 0).

See **Tables 3.4-2** and **3.4-3** for direct jobs by project component, employment category and effects on employment and personal income within the RDBN for the Construction Phase (Years -0.5 to 0).

Table 3.4-2: Direct Employment (full-time equivalent [FTE]) by Project Component over Years - 0.5 and 0 within the RDBN, Rest of BC, Canada and Internationally

Project Component	Contract and TCL Employment (FTE)
Coal Processing Plant	12.66
Maintenance Shop	2.14
Light Vehicle Maintenance Shop	0.65
Administration Building and Mine Dry	4.02
Tenas Access Corridor	16.22
Powerline	4.02
Explosive Facilities	1.17
Rail Loop	14.01
Water Management	15.57
Heavy Equipment (Minesite Operation, Technical, and Maintenance)	8.24
Light Equipment	2.98
Coal Lab	1.36
Coal Haul Equipment and Rail Loadout	0.00
Minesite, Coal Processing Plant Pad, and Maintenance Pad Development including Pre-strip of Open Pit	7.46
Minesite Development	37.40
Technical Equipment	0.00
Total	127.9

Notes: FTE=full-time equivalent; TCL=Telkwa Coal Limited

Table 3.4-3: Direct Employment (full-time equivalent [FTE]) by Category Over Years -0.5 and 0 within the RDBN, Rest of BC, Canada and Internationally

Project Component	Employment (FTE)
Heavy Equipment Operators	46.71
Equipment Maintenance Personnel	15.6
Crane Operators	2.34
Iron workers/Electricians	12.38
Pipefitters/welders	6.46
Labourers	19.46
Concrete and related	3.9
Technical	3.9
Project Management/Accounting	3.9
Environmental	3.9
Supervisory	7.79

Project Component	Employment (FTE)
Safety	1.56
Total	127.9

Note: FTE=full-time equivalent

Additional employment effects would be realized in supplier industries and through workers spending their income. In general, for the purpose of analysis, we distinguish between the following effects of the Project:

1. Direct effects are the employment and personal income generated directly by the Project, including the effects generated by industries directly contracted to supply the onsite goods and services used by the Project. For the Construction, Decommissioning and Reclamation, and Post-closure phases, direct effects in the RDBN and direct effects in the rest of BC include the direct TCL employees and direct Project contractors, as well as other direct positions that the BC IOM estimated for direct supplier industries;
2. Indirect effects are the employment and personal income associated with all industries that are ultimately supplying the goods and services used by the industries supplying the Project and includes all transactions to the beginning of the supply chain (excluding direct onsite suppliers to the Project and the Project itself); and
3. Induced effects are the employment and personal income associated with economic activity because of workers spending their incomes on goods and services, including those directly and indirectly employed because of the Project.

Related to the Construction Phase, the direct, indirect, and induced effects on employment and personal income are summarized in **Table 3.4-4** based on the model prepared by BC stats preparation of the BC IOM for this Project.

Table 3.4-4: Direct Effects of Construction Phase on Employment and Personal Income

		Employment (jobs)	Employment (FTEs)	Average Wages and Salaries	Total Wages and Salaries (Millions \$)	Labour Income (Millions \$)
RDBN	Direct	164.3	160.0	\$84,700	\$13.55	\$15.65
Rest of BC	Direct	151.9	135.8	\$87,230	\$11.85	\$13.94
Rest of Canada	Direct	-	-	-	-	-

Notes: \$=Canadian dollar; BC=British Columbia; FTE=full-time equivalent; n/a=not applicable; RDBN=Regional District of Bulkley-Nechako. Direct effects in the RDBN and direct effects in the Rest of BC include the direct TCL employees and direct Project contractors, as well as other direct positions that the BC IOM estimated for direct supplier industries. Wages and salaries do not include burden and are based on FTEs measures. Burden refers to the total cost of hiring and maintaining an employee beyond their direct compensation in wages/salaries and can include items such as training, benefits, sick leave, pension contributions, among several others. The employment (jobs) estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. The FTEs estimates are calculated based on the assumption that a full-time employee works 40 hours a week, for 50 weeks of the year (a total of 2,000 hours a year). Labour income includes wages and salaries, mixed income, and employer's social contributions. BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the Local Study Area (LSA).

Table 3.4-5 below summarizes the expected locations where employees will be sourced from during the Construction Phase.

Table 3.4-5: Summary of Employee Origin for Construction Phase Labour

Area	Local (Witset to Smithers to Houston)	Provincial	Canada	International
Coal Processing Plant	50%	20%	20%	10%
Maintenance Shop	40%	50%	10%	0%
Light Vehicle Maintenance Shop	50%	25%	25%	0%
Administration Building and Mine Dry	25%	75%	0%	0%
Tenas Access Corridor	75%	20%	5%	0%
Powerline	90%	10%	0%	0%
Explosive Facilities	50%	0%	50%	0%
Rail Loop	25%	75%	0%	0%
Water Management	65%	35%	0%	0%
Heavy Equipment (Minesite Operations, Technical, and Maintenance)	0%	20%	80%	0%
Light Equipment	80%	10%	10%	0%
Coal Lab	0%	80%	0%	20%
Coal Haul and Rail Loadout	n/a	n/a	n/a	n/a
Minesite, Coal Processing Plant Pad, and Maintenance Pad Development Including Pre-strip of Open Pit	80%	20%	n/a	n/a
Minesite Development	80%	20%	0%	0%
Technical Equipment	n/a	n/a	n/a	n/a

Notes: %=percent; n/a=not applicable; Witset=formerly Moricetown

3.4.2 Operation Phase

An estimated 90% of all direct jobs during the Construction Phase are expected to be filled by workers from the LSA including RDBN A and RDBN G with the remaining hired from the rest of BC and no direct jobs are expected to be from the rest of Canada for this Project. Most operational workforce (up to 131 FTEs of the 145 total) are expected to be hired from the LSA, RDBN A, and RDBN G so that employment benefits can be realized by local labour force, to reduce the pressure on housing in Smithers, Telkwa, Houston and Witset, and to allow people to safely get to work with a drive no longer than an hour.

During the Operation Phase, the Project is expected to provide up to 145 direct FTEs for TCL employees, with an estimated 60 people working onsite at any given time due to shift rotations for all workers. In addition to employment held by TCL employees, contractors working at the Project site during the

Operation Phase (primarily related to coal haul and load-out, with an average of 17 contractors) represent a total of 363.4 person-years¹ of employment during the 21-year duration of the Operation Phase.

See **Table 3.4-6** for the total FTE jobs created and the wage effect, and **Table 3.4-7 a-b** for a breakdown of jobs by category during the Operation Phase

Table 3.4-6: Number of Direct Jobs Created and Value of Wages and Salaries During the Operation Phase

Year	Direct Number of FTE Jobs Created in RDBN	Direct Effects on Wages and Salaries (in Millions \$) in RDBN
0	59.7	\$5.63
1	144.6	\$13.46
2	129.7	\$12.23
3	162.2	\$15.31
4	166.5	\$15.70
5	162.2	\$15.32
6	165.5	\$15.64
7	158.3	\$14.95
8	147.5	\$13.93
9	146.8	\$13.87
10	161.9	\$15.29
11	162.5	\$15.32
12	148.6	\$14.04
13	137.1	\$12.94
14	134.7	\$12.72
15	134.2	\$12.66
16	134.6	\$12.72
17	129.5	\$12.26
18	130.4	\$12.37
19	119.9	\$11.35
20	123.2	\$11.65
21	85.5	\$8.08
Total	N/A	\$287.46
Average Wage/Salary	N/A	\$94,613

Notes: \$=Canadian Dollar; FTE=full-time equivalent; RDBN=Regional District of Bulkley-Nechako

¹ Employment effects over more than one (1) year are expressed in person-years where one (1) person-year represents 2,000 hours of work performed by one (1) or more workers each year. Thus, one (1) person-year could be equivalent to one (1) person having a full-time employment for one (1) year, or for example, two (2) workers, each working part-time (1,040 hours each) that year. The person-year estimate of 6,495 years results from the summation of all FTEs over all years of Project Operation Phase.

Table 3.4-7 a-b: Years 1 through 21 Operation Phase Labour by Department (Jobs)**a: Years 1 through 10 Operation Phase**

Year	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Minesite Operations	30	52	48	71	72	72	72	70	64	62	68
Minesite Support, Technical, and Supervisory	5	12	12	12	12	12	12	12	12	12	12
Maintenance Operations	6	20	18	27	27	27	27	27	24	24	26
Coal Processing Plant Operations	6	22	22	22	22	22	22	22	22	22	22
Coal Haul	3	12	12	12	12	12	12	12	12	12	12
Contractors (Rail, Maintenance, Logging, and Reclamation)	9.7	26.1	17.3	17.6	20.9	16.6	19.9	14.7	13	14.3	21.3
Total	59.7	144.1	129.3	161.6	165.9	161.6	164.9	157.7	147	146.3	161.3

b: Years 11 through 21 Operation Phase

Year	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21
Minesite Operations	68	62	54	52	52	53	50	51	45	46	28
Minesite Support, Technical, and Supervisory	12	12	12	12	12	11	11	11	11	11	11
Maintenance Operations	26	24	21	20	20	20	19	20	17	18	11
Coal Processing Plant Operations	22	22	22	22	22	22	22	22	22	22	16
Coal Haul	12	12	12	12	12	12	12	12	12	12	9
Contractors (Rail, Maintenance, Logging, and Reclamation)	22	16.1	15.7	16.2	15.7	16.1	15.1	14	12.5	13.7	10.2
Total	162	148.1	136.7	134.2	133.7	134.1	129.1	130	119.5	122.7	85.2

During the Operation Phase it is expected that most of the workforce will reside in the local region. **Table 3.4-8** below summarizes the expected locations where employees will be sourced from.

Table 3.4-8: Summary of Employee Origin for Operation Phase

Area	Local (Witset to Smithers to Houston)	Provincial	Canada (Alberta)	International
Coal Processing Plant	90%	10%	0%	0%
Maintenance Shop	100%	0%	0%	0%
Light Vehicle Maintenance Shop	100%	0%	0%	0%
Administration Building and Mine Dry	100%	0%	0%	0%
Tenas Access Corridor	75%	25%	0%	0%
Powerline	100%	0%	0%	0%
Explosive Facilities	100%	0%	0%	0%
Rail Loop	25%	75%	0%	0%
Water Management	90%	10%	0%	0%
Heavy Equipment (Minesite Operations, Technical, and Maintenance)	90%	10%	0%	0%
Light Equipment	90%	10%	0%	0%
Coal Lab	100%	0%	0%	0%
Coal Haul and Rail Loadout	90%	10%	0%	0%
Minesite, Coal Processing Plant Pad, and Maintenance Pad Development including Pre-strip of Open Pit	90%	10%	0%	0%
Minesite Development	80%	20%	0%	0%
Technical Equipment	90%	10%	0%	0%

Notes: %=percent; Witset=formerly Moricetown

3.4.3 Decommissioning and Reclamation Phase

During Decommissioning (Year 22), the Project is expected to provide 20.6 FTEs for TCL employees with an estimated total income effect (including burden) of \$2.4 million, and 10 FTEs for contractors with an estimated total income effect (including burden) of \$1.1 million.

During Reclamation (Year 23-25), the Project is expected to provide 18.2 FTEs (for a total of 54.6 person-years of employment over that phase) and an estimated total income effect (including burden) of \$5.9 million.

See **Tables 3.4-9** for the number of FTE jobs and **Table 3.4-10** for the labour breakdown by job category.

Table 3.4-9: Number of Direct Jobs/Full-time Equivalents and Income Effect during Decommissioning and Reclamation Phase

	RDBN	Rest of BC
Jobs		
Decommissioning	36.2	1.3
Reclamation	70.5	36.4
FTEs		
Decommissioning	34.2	1.2
Reclamation	66.0	32.7
Wages and Salaries		
Decommissioning (total)	\$3,091,033	\$105,160
-Estimated Average Wages	\$90,381	\$87,633
Reclamation (total)	\$6,301,486	\$2,829,411
-Estimated Average Wages	\$95,477	\$86,526

Notes: BC=British Columbia; FTE=full-time equivalent; RDBN=Regional District of Bulkley-Nechako

Direct effects in the RDBN and direct effects in the Rest of BC include the direct TCL employees and direct Project contractors, as well as other direct positions that the BC IOM estimated for direct supplier industries. Wages and salaries in this table do not include burden and are based on FTEs measures. Burden refers to the total cost of hiring and maintaining an employee beyond their direct compensation in wages/salaries and can include items such as training, benefits, sick leave, pension contributions, among several others. The employment (jobs) estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. The FTEs estimates are calculated based on the assumption that a full-time employee works 40 hours a week, for 50 weeks of the year (a total of 2,000 hours a year). BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the LSA.

Table 3.4-10: Years 22 through 25 Decommissioning and Reclamation Phase Labour Full-time Equivalent (FTE)

Year	Year 22	Year 23	Year 24	Year 25
Minesite Operations	11	12	12	12
Minesite Support, Technical, and Supervisory	3	3	3	3
Maintenance Operations	4	4	4	4
Coal Processing Plant Operations	3	0	0	0
Coal Haul	0	0	0	0
Contractors (Rail, Maintenance, Logging, and Reclamation)	9.9	5.1	5.1	5.1
Total	30.9	23.1	23.1	23.1

During the Decommissioning and Reclamation Phase it is expected that the workforce will mostly reside in the local region. **Table 3.4-11** below summarizes the expected locations where employees will be sourced from during the Decommissioning and Reclamation Phase.

Table 3.4-11: Summary of Employee Origin for Decommissioning and Reclamation Phase

Area	Local (Witset to Smithers to Houston)	Provincial	Canada (Alberta)	International
Coal Processing Plant	90%	10%	0%	0%
Maintenance Shop	100%	0%	0%	0%
Light Vehicle Maintenance Shop	100%	0%	0%	0%
Administration Building and Mine Dry	100%	0%	0%	0%
Tenas Access Corridor	75%	25%	0%	0%
Powerline	100%	0%	0%	0%
Explosive Facilities	100%	0%	0%	0%
Rail Loop	25%	75%	0%	0%
Water Management	90%	10%	0%	0%
Heavy Equipment (Minesite operations, technical, and maintenance)	90%	10%	0%	0%
Light Equipment	90%	10%	0%	0%
Coal Lab	100%	0%	0%	0%
Coal Haul and Rail Loadout	90%	10%	0%	0%
Minesite, Coal Processing Plant Pad, and Maintenance Pad development including Pre-strip of Open Pit	90%	10%	0%	0%
Minesite Development	80%	20%	0%	0%
Technical Equipment	90%	10%	0%	0%

Notes: %=percent; Witset=formerly Moricetown

3.4.4 Post-closure Phase

During the Post-closure Phase of the Project, one (1) part-time employee will be required for Minesite support, specifically including annual monitoring requirements for water, reclamation, and geotechnical programs. During Post-closure it is expected that the single employee will reside in the local region (from Witset [formerly Moricetown] to Smithers to Houston).

Table 3.4-12: Number of Direct Jobs/Full-time Equivalents (FTEs) and Income Effect during Post-closure Phase

	RDBN	Rest of BC
	Direct	Direct
Jobs		
Active Post-closure	8.3	2.7
Passive Post-closure	6.5	2.7

	RDBN	Rest of BC
	Direct	Direct
FTEs		
Active Post-closure	7.8	2.4
Passive Post-closure	6.1	2.4
Wages and Salaries		
Active Post-closure (total)	\$738,681	\$206,402
-Estimated Average Wages	\$94,703	\$86,001
Passive Post-closure (total)	\$582,938	\$206,223
-Estimated Average Wages	\$95,564	\$85,926

Notes: BC=British Columbia FTEs=full-time equivalent; RDBN=Regional District of Bulkley-Nechako

Direct effects in the RDBN and direct effects in the Rest of BC include the direct TCL employees and direct Project contractors, as well as other direct positions that the BC IOM estimated for direct supplier industries. Wages and salaries in this table do not include burden and are based on FTEs measures. Burden refers to the total cost of hiring and maintaining an employee beyond their direct compensation in wages/salaries and can include items such as training, benefits, sick leave, pension contributions, among several others. The employment (jobs) estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. The FTEs estimates are calculated based on the assumption that a full-time employee works 40 hours a week, for 50 weeks of the year (a total of 2,000 hours a year); BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the Local Study Area (LSA).

3.5 Indirect and Induced Employment

The following summarizes the provision of indirect and induced employment to be generated by each Project phase.

3.5.1 Construction Phase

Indirect and induced effects would be realized in supplier industries and through workers spending their income:

- ▶ Indirect effects are the employment and personal income associated with all industries that are ultimately supplying the goods and services used by the industries supplying the Project and includes all transactions to the beginning of the supply chain (excluding direct onsite suppliers to the Project and the Project itself); and
- ▶ Induced effects are the employment and personal income associated with economic activity because of workers spending their incomes on goods and services, including those directly and indirectly employed because of the Project.

Related to the Construction Phase, the indirect and induced effects on employment and personal income are summarized in **Table 3.5-1**

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Table 3.5-1: Indirect and Induced Effects of Construction Phase (Year -0.5, and Year 0) on Employment and Personal Income

		Employment (jobs)	Employment (FTEs)	Average Wages and Salaries	Total Wages and Salaries (Millions \$)	Labour Income (Millions \$)
RDBN	Indirect	28.8	25.1	\$62,551	\$1.57	\$1.95
	Induced	24.1	18.2	\$50,394	\$0.91	\$1.17
	Total RDBN	217.2	203.3	\$78,899	\$16.04	\$18.77
Rest of BC	Indirect	151.4	129.1	\$58,324	\$7.53	\$9.56
	Induced	75.1	56.5	\$49,244	\$2.78	\$3.64
	Total Rest of BC	378.4	321.4	\$68,944	\$22.16	\$27.14
Rest Of Canada	Indirect	79.1	75.9	\$60,309	\$4.58	\$5.51
	Induced	57.9	55.4	\$47,050	\$2.61	\$3.17
	Total Rest of Canada	137.0	131.3	\$54,717	\$7.18	\$8.67
Grand Total		732.5	655.9	n/a	\$45.38	\$54.58

Notes: \$=Canadian dollar; BC=British Columbia; CDN=Canadian; FTE=full-time equivalent; n/a=not applicable; RDBN= Regional District of Bulkley-Nechako
Wages and salaries do not include burden and are based on FTEs measures. Burden refers to the total cost of hiring and maintaining an employee beyond their direct compensation in wages/salaries and can include items such as training, benefits, sick leave, pension contributions, among several others. The employment (jobs) estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. The FTEs estimates are calculated based on the assumption that a full-time employee works 40 hours a week, for 50 weeks of the year (a total of 2,000 hours a year). Labour income includes wages and salaries, mixed income, and employer's social contributions. British Columbia Input-Output Model (BC IOM) can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the Local Study Area (LSA).

3.5.2 Operation Phase

Indirect and induced employment effects would be realized in supplier industries and through workers spending their income. Related to the Operation Phase, indirect and induced effects on employment are summarized in **Table 3.5-2** (jobs) and **Table 3.5-3** (FTEs). Indirect and induced effects on personal income are summarized in **Table 3.5-4**.

Table 3.5-2: Number of Indirect and Induced Jobs During the Operation Phase

Year	RDBN		Rest of BC		Rest of Canada		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
0	2	4.3	11.8	12.9	2.3	1.7	16.1	19
1	18.3	15.3	108.3	44.7	19.1	14.5	145.8	74.4
2	19.9	15.6	110.7	43.5	19.5	15.4	150.1	74.6
3	16.3	16.3	90.9	45.7	16.2	12.7	123.4	74.7
4	18	17.2	100.6	48.2	17.8	14	136.4	79.5
5	13.6	15.2	77.1	43.3	14	10.9	104.8	69.3
6	22.2	18.1	127.2	53.6	24.2	18.4	173.6	90.1
7	12	14.2	68.2	41	12.6	9.7	92.8	64.9
8	11.2	13.1	63.7	38.3	12	9.1	86.8	60.6
9	12.7	13.8	71.8	39.6	13.2	10.2	97.7	63.6
10	21.7	18.4	120.2	51	21	16.7	162.8	86.1
11	17.6	15.8	103.5	49	20.7	15.3	141.8	80
12	16.2	15.2	91	43.5	16.6	12.9	123.8	71.6
13	10.7	12.3	61	36	11.5	8.7	83.2	57
14	13.9	13.5	78	38.6	14.3	11	106.1	63.1
15	12.4	12.8	70.2	37.1	13.1	10	95.7	59.9
16	12.8	13	72.8	37.7	13.6	10.4	99.1	61.1
17	9.3	11.2	53.5	33.4	10.3	7.7	73.1	52.3
18	12.4	12.5	70.6	36.7	13.4	10.1	96.4	59.3
19	8.8	10.4	50.8	31.2	9.8	7.4	69.5	48.9
20	8.8	10.6	50.9	31.8	9.9	7.4	69.6	49.7
21	6.1	7.3	35.4	22.1	6.9	5.1	48.4	34.5

Notes: BC=British Columbia; RDBN=Regional District of Bulkley-Nechako

The employment (jobs) estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the Local Study Area (LSA).

Table 3.5-3: Number of Indirect and Induced Full-time Equivalent (FTE) Positions During the Operation Phase

Year	RDBN		Rest of BC		Rest of Canada		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
0	1.9	3.3	10.6	9.7	2.2	1.6	14.7	14.6
1	16.9	11.5	97.1	33.6	18.1	13.7	132.1	58.8
2	18.4	11.8	99.4	32.8	18.6	14.6	136.3	59.1
3	15	12.2	81.7	34.4	15.4	12.1	112.2	58.7
4	16.7	13	90.3	36.3	16.9	13.3	123.9	62.5
5	12.6	11.4	69.5	32.6	13.4	10.4	95.5	54.3
6	20.7	13.6	115.1	40.3	23.1	17.4	158.9	71.4
7	11.2	10.7	61.4	30.8	12	9.2	84.6	50.7
8	10.4	9.9	57.5	28.8	11.4	8.7	79.3	47.4
9	11.8	10.4	64.6	29.8	12.5	9.7	89	49.8
10	20	13.9	107.8	38.4	20	15.8	147.8	68
11	16.5	11.9	94.1	36.8	19.7	14.5	130.4	63.3
12	15	11.4	82	32.7	15.8	12.2	112.8	56.4
13	10	9.2	55.1	27	10.9	8.3	76	44.6
14	12.8	10.1	70.2	29	13.6	10.5	96.6	49.6
15	11.5	9.6	63.3	27.9	12.4	9.5	87.3	47
16	11.9	9.8	65.6	28.4	12.9	9.9	90.4	48
17	8.7	8.4	48.3	25.1	9.8	7.3	66.8	40.9
18	11.5	9.4	63.8	27.6	12.7	9.6	88	46.6
19	8.2	7.8	46	23.4	9.4	7	63.6	38.3
20	8.2	8	46	23.9	9.4	7	63.6	38.9
21	5.7	5.5	32	16.6	6.6	4.9	44.3	27

Notes: BC=British Columbia; RDBN=Regional District of Bulkley-Nechako

The full-time equivalent (FTEs) estimates are calculated based on the assumption that a full-time employee works 40 hours a week, for 50 weeks of the year (a total of 2,000 hours a year). BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the LSA.

Table 3.5-4: Indirect and Induced Effects of the Project on Wages and Salaries During the Operation Phase (in Millions Canadian Dollars [CDN\$])

Year	RDBN		Rest of BC		Rest of Canada		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
0	\$0.23	\$0.16	\$0.80	\$0.48	\$0.13	\$0.08	\$1.16	\$0.72
1	\$1.76	\$0.58	\$6.98	\$1.64	\$1.08	\$0.65	\$9.82	\$2.87
2	\$2.13	\$0.59	\$7.81	\$1.59	\$1.12	\$0.70	\$11.06	\$2.88
3	\$1.77	\$0.62	\$6.38	\$1.67	\$0.93	\$0.58	\$9.08	\$2.87

	RDBN		Rest of BC		Rest of Canada		Total	
Year	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
4	\$1.95	\$0.65	\$7.07	\$1.76	\$1.02	\$0.64	\$10.04	\$3.05
5	\$1.50	\$0.57	\$5.37	\$1.59	\$0.81	\$0.49	\$7.68	\$2.65
6	\$2.57	\$0.69	\$8.68	\$1.98	\$1.41	\$0.83	\$12.66	\$3.50
7	\$1.34	\$0.54	\$4.70	\$1.51	\$0.73	\$0.44	\$6.77	\$2.49
8	\$1.26	\$0.50	\$4.38	\$1.41	\$0.69	\$0.41	\$6.33	\$2.32
9	\$1.41	\$0.52	\$4.97	\$1.45	\$0.76	\$0.46	\$7.14	\$2.43
10	\$2.32	\$0.70	\$8.50	\$1.86	\$1.20	\$0.76	\$12.02	\$3.32
11	\$2.11	\$0.60	\$6.94	\$1.81	\$1.21	\$0.69	\$10.26	\$3.10
12	\$1.80	\$0.58	\$6.32	\$1.60	\$0.96	\$0.58	\$9.08	\$2.76
13	\$1.21	\$0.47	\$4.19	\$1.32	\$0.66	\$0.39	\$6.06	\$2.18
14	\$1.53	\$0.51	\$5.41	\$1.42	\$0.82	\$0.50	\$7.76	\$2.43
15	\$1.39	\$0.48	\$4.84	\$1.36	\$0.75	\$0.45	\$6.98	\$2.29
16	\$1.44	\$0.49	\$5.01	\$1.39	\$0.78	\$0.47	\$7.23	\$2.35
17	\$1.06	\$0.42	\$3.63	\$1.23	\$0.59	\$0.35	\$5.28	\$2.00
18	\$1.41	\$0.47	\$4.83	\$1.35	\$0.77	\$0.46	\$7.01	\$2.28
19	\$1.01	\$0.39	\$3.44	\$1.15	\$0.57	\$0.33	\$5.02	\$1.87
20	\$1.01	\$0.40	\$3.45	\$1.17	\$0.57	\$0.33	\$5.03	\$1.90
21	\$0.70	\$0.28	\$2.39	\$0.81	\$0.40	\$0.23	\$3.49	\$1.32
Total	\$32.93	\$11.22	\$116.05	\$31.56	\$17.96	\$10.80	\$166.94	\$53.58
Average Wage/Salary	\$119,417	\$50,357	\$76,276	\$48,857	\$60,518	\$47,541	\$256,211	\$146,755

Notes: \$=Canadian dollar; BC=British Columbia; RDBN=Regional District of Bulkley-Nechako

Wages and salaries in this table do not include burden and are based on full-time equivalent (FTEs) measures. Burden refers to the total cost or hiring and maintaining an employee beyond their direct compensation in wages/salaries and can include items such as training, benefits, sick leave, pension contributions, among several others. Data is provided in millions of Canadian dollars except for the average wage/salary estimate. BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the LSA.

3.5.3 Decommissioning and Reclamation Phase

The Decommissioning and Reclamation Phase consists of Decommissioning, planned for Year 22, and Reclamation, planned for Years 23 to 25. Indirect and induced effects on employment and income are summarized in **Table 3.5-5**.

Table 3.5-5: Number of Indirect and Induced Jobs/Full-time Equivalents (FTEs) and Income Effect During Project Decommissioning and Reclamation Phase

	RDBN		Rest of BC		Rest of Canada	
	Indirect	Induced	Indirect	Induced	Indirect	Induced
Jobs						
Decommissioning	0.4	2.1	1.8	6.9	1.0	0.7

	RDBN		Rest of BC		Rest of Canada	
	Indirect	Induced	Indirect	Induced	Indirect	Induced
Reclamation	3.7	7.5	18.3	20.6	10.2	8.1
FTEs						
Decommissioning	0.4	1.6	1.5	5.2	0.9	0.6
Reclamation	3.1	5.6	15.3	15.5	9.8	7.7
Wages and Salaries						
Decommissioning (total)	\$24,681	\$80,035	\$89,244	\$255,642	\$55,508	\$30,467
-Estimated Average Wages	\$61,703	\$50,022	\$59,496	\$49,162	\$61,676	\$50,778
Reclamation (total)	\$192,764	\$283,582	\$870,765	\$754,026	\$580,257	\$368,854
-Estimated Average Wages	\$62,182	\$50,640	\$56,913	\$48,647	\$59,210	\$47,903

Notes: BC=British Columbia; FTEs=full-time equivalent; RDBN=Regional District of Bulkley-Nechako
Wages and salaries in this table do not include burden and are based on FTEs measures. Burden refers to the total cost of hiring and maintaining an employee beyond their direct compensation in wages/salaries and can include items such as training, benefits, sick leave, pension contributions, among several others. The employment (jobs) estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. The FTEs estimates are calculated based on the assumption that a full-time employee works 40 hours a week, for 50 weeks of the year (a total of 2,000 hours a year) BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the LSA.

3.5.4 Post-closure Phase

For estimating economic benefits of the Project during the Post-closure Phase, this phase can be divided into Active (10 years in duration) and a subsequent Passive (15 years in duration) Post-closure Phase. For both the Active Post-closure and Passive Post-closure phases, indirect and induced effects on employment and income are summarized in **Table 3.5-6**.

Table 3.5-6: Number of Indirect and Induced Jobs/Full-time Equivalents (FTEs) and Income Effect During Post-closure Phase

	RDBN		Rest of BC		Rest of Canada	
	Indirect	Induced	Indirect	Induced	Indirect	Induced
Jobs						
Active Post-closure	0.3	0.7	1.5	2.1	0.8	0.6
Passive Post-closure	0.3	0.6	1.5	1.8	0.8	0.6
FTEs						
Active Post-closure	0.3	0.6	1.5	2.1	0.8	0.6
Passive Post-closure	0.3	0.5	1.5	1.8	0.8	0.6
Wages and Salaries						
Active Post-closure (total)	\$16,621	\$28,093	1.2	1.6	0.8	0.6
-Estimated Average Wages	\$55,403	\$46,822	1.2	1.3	0.8	0.6
Passive Post-closure (total)	\$16,531	\$23,958				

	RDBN		Rest of BC		Rest of Canada	
	Indirect	Induced	Indirect	Induced	Indirect	Induced
-Estimated Average Wages	\$55,103	\$47,916	\$70,537	\$76,326	\$46,638	\$29,040

Notes: BC=British Columbia; FTEs=full-time equivalent; RDBN=Regional District of Bulkley-Nechako
Wages and salaries in this table do not include burden and are based on FTEs measures. Burden refers to the total cost of hiring and maintaining an employee beyond their direct compensation in wages/salaries and can include items such as training, benefits, sick leave, pension contributions, among several others. The employment (jobs) estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. The FTEs estimates are calculated based on the assumption that a full-time employee works 40 hours a week, for 50 weeks of the year (a total of 2,000 hours a year). BC IOM can only estimate Project effects at the Regional District level (RDBN), provincial, and national; Project indirect and induced effects cannot be estimated for the LSA.

3.6 Employment Strategy

TCL will endeavour to fill as many of the positions as possible from the local area through the Project hiring process and by providing additional training and capacity to employees in the region. For further details see **S5.0-C1 Labour Market VC** of the **EAC Application**.

3.7 Contractors and Contracts

To support activities in all phases of the Project, several contractors and contracts will be required. **Table 3.7-1** provides a high level summary of contract expenditures for the four (4) phases of the Project.

Table 3.7-1: Summary of Contractor and Contract Expenditures (Value of Supply and Service Contracts) Over the Four (4) Main Phases of the Project (2019 Canadian Dollars)

Area	Construction (\$)	Operation (\$)	Decommissioning and Reclamation (\$)	Post-closure (\$)
Coal Processing Plant	21,745,292	93,075,195	1,051,459	236,198
Maintenance Facility	1,759,307	5,389,712	139,132	47,019
Light Vehicle Maintenance Shop	200,000	0	26,877	864
Administration Building and Mine Dry	1,000,000	0	2,549	3,512
Tenas Access Corridor	9,262,512	0	45,763	63,041
Powerline	3,307,000	210,000	51,901	23,283
Explosive Facilities	1,300,000	0	50,116	8,770
Rail Loop	7,318,917	20,266,860	155,648	69,771
Water Management	10,000,000	14,978,571	88,556	121,993
Heavy Equipment (Minesite Operations, Technical, and Maintenance)	33,664,847	33,989,429	400,180	503,062
Light Equipment	4,207,283	7,789,381	130,699	83,617
Coal Lab	350,000	0	2,676	1,276
Coal Haul and Rail Loadout	1,200,000	322,860,086	942,112	-2,171
Minesite, Coal Processing Plant Pad, and Maintenance Pad Development including Pre-strip of Open Pit	16,519,334	365,193,473	34,829	1,692,372

Area	Construction (\$)	Operation (\$)	Decommissioning and Reclamation (\$)	Post-closure (\$)
Minesite Development	7,585,747	12,743,762	87,176	120,091
Technical Equipment	300,000	0	1,672	2,303
Total	119,720,239	876,496,469	3,211,345	2,975,000

Note: \$=Canadian dollar

Table 3.7-2 below provides the expected distribution of contract expenditures by location.

Table 3.7-2: Expected Distribution of Contract Expenditures by Location

Project Phase	Decommissioning and Reclamation Phase Years 23 Through 25				Decommissioning and Reclamation (Year 22)				Construction Phase (Years -0.5 To 0)				Operation Phase (Years 0 Through 21)			
Location	Local	Provincial	Canada (Alberta)	International	Local	Provincial	Canada (Alberta)	International	Local	Provincial	Canada (Alberta)	International	Local	Provincial	Canada (Alberta)	International
Project Component																
CPP	90%	10%	0%	0%	50%	20%	20%	10%	10%	35%	6%	49%	42%	38%	14%	6%
Maintenance Shop	90%	10%	0%	0%	40%	50%	10%	0%	10%	65%	25%	0%	80%	10%	10%	0%
LV Shop	90%	10%	0%	0%	50%	25%	25%	0%	25%	25%	50%	0%	100%	0%	0%	0%
Administration and Mine Dry	90%	10%	0%	0%	25%	75%	0%	0%	15%	85%	0%	0%	100%	0%	0%	0%
Tenas Access Corridor	90%	10%	0%	0%	75%	20%	5%	0%	65%	25%	10%	0%	75%	25%	0%	0%
Powerline	90%	10%	0%	0%	90%	10%	0%	0%	30%	70%	0%	0%	80%	20%	0%	0%
Explosive Facilities	90%	10%	0%	0%	50%	0%	50%	0%	25%	50%	25%	0%	80%	0%	20%	0%
Rail Loop	90%	10%	0%	0%	25%	75%	0%	0%	15%	30%	10%	45%	50%	50%	0%	0%
Water Management	90%	10%	0%	0%	65%	35%	0%	0%	50%	50%	0%	0%	80%	10%	10%	0%
Heavy Equipment (Mine Operations, Technical Services, and Maintenance)	90%	10%	0%	0%	0%	0%	10%	90%	2%	5%	0%	93%	90%	10%	0%	0%
Light Equipment	90%	10%	0%	0%	80%	10%	10%	0%	90%	5%	5%	0%	90%	10%	0%	0%
Coal Lab	90%	10%	0%	0%	0%	80%	0%	20%	0%	70%	0%	30%	80%	10%	10%	0%
Coal Haul and Loadout	90%	10%	0%	0%	90%	10%	0%	0%	N/A	N/A	N/A	N/A	90%	10%	0%	0%
Mine, CPP and Maintenance	90%	10%	0%	0%	90%	10%	0%	0%	80%	20%	0%	0%	90%	10%	0%	0%
Mine Development	90%	10%	0%	0%	90%	10%	0%	0%	80%	20%	0%	0%	80%	20%	0%	0%
Technical Equipment	90%	10%	0%	0%	90%	10%	0%	0%	N/A	N/A	N/A	N/A	90%	10%	0%	0%

Notes: %=percent; CPP=Coal Processing Plant; LV=light vehicle

The following is a list of the top 10 contracts and contractor services required for Project support:

1. rail, port, and testing;
2. equipment parts and service;
3. CPP shutdowns and service;
4. fuel and lubricants;
5. electricity;
6. CPP consumables such as magnetite;
7. dust suppression chemical agents;
8. flocculants;
9. professional services; and
10. insurance.

The Project will have a procurement policy focussed on obtaining goods and services from the local region if they exist and will work with groups to ensure that barriers to entry are reduced for contracting opportunities.

This has been reflected in the exploration programs carried out by TCL to date where up to 85% of all dollars spent have gone to local contractors and goods in the region.

3.8 Government Revenues

Table 3.8-1 below provides the anticipated government revenues over the life of the Project for all phases combined.

Table 3.8-1: Direct Government Revenues from the Tenas Project between Year -0.5 and the end of Post-closure in Year 51

Jurisdiction	Revenue	Amount
British Columbia	2% net current proceeds tax	\$3,208,343
	13% net revenue tax	\$127,064,146
	11% corporate tax	\$93,538,760
Federal	income tax	\$127,552,854
Regional District of Bulkley-Nechako Property Taxes		\$13,744,015
Coal Lease Payments		\$660,450
British Columbia Inspections Costs for Ministry of Mines and Environment		\$2,007,884
Total		\$367,776,451

Notes: \$=Canadian dollar; %=percent

3.9 Additional Five (5) Pillar Benefits

The five (5) pillars associated with an EA are as follows:

1. environmental;
2. economic;
3. social;
4. health; and
5. heritage.

The previous subsections presented details on the economic pillar in detail. The Project is expected to deliver the following social benefits:

- ▶ sponsorship and scholarship program;
- ▶ community support such as food bank drives;
- ▶ education and training initiatives; and
- ▶ Minesite tours.

The Project is expected to deliver the following health benefits:

- ▶ sponsoring sports teams;
- ▶ health program at the Minesite that all individuals will be a part of;
- ▶ providing funds for employees to participate in health lifestyle activities; and
- ▶ programs for dealing with substance abuse issues.

See the **SEMP** for further information on TCL's plans regarding the five (5) pillars.

The Project is not expected to deliver any environmental or heritage benefits.

3.10 Project Economic Assumptions and References

.**Table 3.10-1** summarizes some of the key assumptions for the operating cost estimate.

Table 3.10-1: Key Assumptions Pricing

Item	Units	Cost per Unit (2019 Canadian Dollars)
Diesel fuel	\$/L	0.80
Electricity	\$/kWh	0.11
DEF	\$/L	0.75
Engine oil	\$/L	3.20
Gear oil	\$/L	9.30
Hydraulic oil	\$/L	4.70

Item	Units	Cost per Unit (2019 Canadian Dollars)
Coolant	\$/L	3.25
Transmission fluid	\$/L	4.70
Grease	\$/kg	8.50
Magnetite	\$/tonne	275
Frother (MIBC)	\$/kg	3.25
Diesel (flotation)	\$/L	0.80
Diesel (mobile fleet)	\$/L	0.80
Flocculant	\$/kg	5.39
Coagulant	\$/kg	2.22
Dust suppressant for trains	\$/kg	3.69
Dust release for trains	\$/kg	1.55
Dust release for trucks	\$/kg	1.55

Notes: \$=Canadian dollar; DEF=diesel exhaust fluid; kg=kilogram; L=litre; MIBC= methyl isobutyl carbinol

4. APPLICABLE AUTHORIZATIONS

4.1 Introduction

A list of required authorizations, to the extent that was known at the time, is available in **5.6 Federal, Provincial, and Municipal Authorizations** of the original PD, available at https://projects.eao.gov.bc.ca/api/public/document/5be1e5e7c4337d0024da316e/download/Tenas%20Project%20Description_November%202018_Final%20%28reduced%20size%29.pdf.

No regulatory authorizations or permits that would enable the Project to proceed may be released until an EAC has been issued. The review of provincial permit applications for the Project will be coordinated through BC MEMLI's Major Mines Office (MMO).

The Project is subject to a range of provincial and federal legislation, and TCL will be applying for authorizations and permits under the applicable regulatory frameworks. Applicable legislation as well as federal and provincial guidelines that were considered in the preparation of this EAC Application are outlined in **Appendix 1.0-AG TCL, Relevant Federal and Provincial Legislation and Guidelines**.

4.2 Federal and Provincial Permitting

The preliminary list of applicable federal and provincial authorizations, licenses, and permits that may be required for the Project are detailed in **Tables 4.4-1 and 4.4-2** with completed submissions listed where applicable in bold italic.

With these exceptions, permit applications have not yet been drafted, and this list is not intended to be comprehensive; however, TCL will meet with the appropriate federal and provincial government agencies and local governments to discuss permitting requirements as the Project moves forward.

There are no known municipal authorizations currently.

Table 4.2-1: Preliminary List of Federal Authorizations and Permits Likely Required for the Tenas Project

Authorization	Legislation	Authorizing Agency	Purpose
Federal Division 1 Factory License and Permit	<i>Explosives Act</i> , RSC 1985, c E-17 (Government of Canada [GovCan] 1985a), Explosives Regulations 2013, SOR/2013-211 (Part 5 / division 1 of the ER-2013) (GovCan] 2013)	Natural Resources Canada (NRCAN)	Explosive authorizations are required during the Construction and Operation phases. Authorization is required to manufacture and operate an explosives storage facility. Licenses are required by either Telkwa Coal Limited (TCL) or a blasting contractor. (Note: A third party will apply for the authorization and own the facility to be located on TCL tenure. TCL will acquire the explosives license from this third party).
<i>Fisheries Act</i> Authorization	<i>Fisheries Act</i> , 1985, c F-14 (GovCan 1985b), Authorizations Concerning Fish and Fish Habitat Protection Regulations, SOR/2019-286 (GovCan 2019)	Department of Fisheries and Oceans Canada (DFO)	A <i>Fisheries Act</i> , 35(2b) authorization for Four Creek will be required to allow for the harmful alteration, disruption or destruction of fish habitat (HADD) and the fish habitat compensation plan in Goathorn Creek.
Migratory Birds Damage or Danger Permit	<i>Migratory Birds Convention Act</i> , 1994, S.C. 1994a, c. 22 (GovCan 1994), Migratory Birds Regulations, C.R.C. c. 1035 (GovCan 1994b)	Environment and Climate Change Canada (ECCC)	May require an authorization if the Project is shown to affect nesting habitats used by migratory birds or if activities occur during the nesting season (e.g., clearing of vegetation, disturbance to nests).
Navigation Protection Program (NPP) Approval Permit	<i>Canadian Navigable Waters Act</i> , RSC 1985, c N-22 (GovCan 1985)	Transport Canada	May require a NPP approval if TCL proposes to construct or place a major work (such as a bridge) and/or in a navigable water listed in the schedule that is on any navigable water that may interfere with navigation. If TCL proposes to construct or place a work in any navigable water that will not interfere with navigation, TCL will deposit information specified by the Minister and publish a notice.
<i>Species at Risk Act (SARA)</i> Permits, Agreements, and/or Exceptions	<i>Species at Risk Act</i> , SC 2002, c 29 (GovCan 2002) (SARA)	ECCC	Permits, agreements, and/or exceptions may be required if the Project has the potential to affect a species listed on Schedule 1 of <i>SARA</i> , including any part of its critical habitat, or the residences of its individuals.

Table 4.2-2: Preliminary List of Provincial Authorizations and Permits Likely Required for the Tenas Project

Authorization	Legislation	Authorizing Agency	Purpose
Access Permit(s) - Highway	<i>Transportation Act</i> , SBC 2004, c 44 (Government of British Columbia [GovBC] 2004d)	British Columbia Ministry of Transportation and Infrastructure (BC MOTI)	Required for the Telkwa Coal Limited (TCL) haul road crossing on Lawson Road. Permit(s) are also required for: access to an employee parking lot; works within and access to the BC MOTI right-of-way (ROW), and industrial access to the BC MOTI highway for logging trucks during the Construction Phase
Access Permit(s) - Controlled Access Permit	<i>Transportation Act</i> , SBC 2004, c 44 – Section 4 (GovBC 2004d)	BC MOTI	Highway 16 is designated a controlled access highway. Under Section 48 of the <i>Transportation Act</i> , SBC 2004, c 44 (GovBC 2004d), a Controlled Access Permit is required for access to or from a controlled access highway.
Agricultural Land Reserve (ALR) Application	<i>Agricultural Land Commission Act</i> , SBC 2002, c 36 (GovBC 2002a)	Agricultural Land Commission	Required to allow for the construction of the TAC between the Canadian National Railway (CNR) main line and the Goathorn Creek Valley and the construction of the Rail Infrastructure. This approval is also required for registration of a Statutory Right-of-way (SROW) for Crown land parcels to allow construction of the Bypass portion of the Tenas Access Corridor (TAC). <i>Non-farm application and zoning change submitted November 2020.</i>
Approval for Works In and About a Stream	<i>Water Sustainability Act</i> , B.C. Reg. 36/2016, Section 11(1) (GovBC 2016)	British Columbia Ministry of Forests, Lands and Natural Resource Operations and Rural Development (BC MFLNRORD)	Regulates work in and about a stream (i.e., stream crossings). <i>The temporary Goathorn Creek bridge was approved for Changes In and About a Stream, in December 2017 and bridge deactivation was completed in March 2019.</i> Installation of a backup water system in Goathorn Creek to be applied for unless installation is authorized under a water license.
Coal Lease	<i>Coal Act</i> , SBC 2004, c 15 (GovBC 2004)	British Columbia Mineral Titles Branch, British Columbia Ministry of Energy, Mines and Low Carbon Innovation (BC	Converts licenses to a coal lease for production purposes.

Authorization	Legislation	Authorizing Agency	Purpose
		MEMLI)	
Drinking Water Treatment Plant Construction and Operating Permits	Drinking Water Protection Regulations, BC Reg 200/2003 (GovBC 2003)	British Columbia Ministry of Health - Drinking Water Officer	Regulates the provision of water in the Administration Building and Maintenance Facility.
Environmental Assessment Certificate (EAC)	<i>Environmental Assessment Act, SBC 2018, c 5</i> (GovBC 2018)	British Columbia Environmental Assessment Office (BC EAO)	To minimize or avoid adverse environmental, heritage, health, social and economic effects and incorporate environmental factors and Indigenous and stakeholder consultation into decision making.
Explosives Magazine Storage and Use Permit	<i>Mines Act, RSBC 1996, c 293 (GovBC 1996c)</i> , and Health, Safety and Reclamation Code for Mines in British Columbia (Part 8) (British Columbia Ministry of Energy, Mines and Low Carbon Innovation [BC MEMLI] 2021)	BC MEMLI	Authorizes explosives magazine storage and use onsite.
Hazardous Waste Authorization	<i>Environmental Management Act, SBC 2003, c 53</i> (GovBC 2003) Hazardous Waste Regulation, BC Reg. 63/88 (GovBC 1988)	British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS)	Authorizes temporary storage of hazardous waste.
Heritage Investigative Permit	<i>Heritage Conservation Act, RSBC 1996, c 187</i> (GovBC 1996)	BC MFLNRORD	Authorizes mitigation of impacts to sites (should any be identified) through systematic data recovery after an impact assessment has been completed.
<i>Mines Act, RSBC 1996, c 293 (GovBC 1996c)</i> Permit	<i>Mines Act, RSBC 1996, c 293 (GovBC 1996c)</i> , and Health, Safety and Reclamation Code for Mines in British Columbia (Part 10) (BC MEMLI 2021)	BC MEMLI	Provides approval for the site preparation, and all phases of Project development subject to conditions, provision of further detailed information and assessment as it becomes available and sets out closure and reclamation obligations and security through the Joint <i>Mines Act, RSBC 1996, c 293</i> and <i>Environmental Management Act, SBC 2003, c 53 (MA/EMA)</i> permit process.
No Unauthorized Entry and No Hunting / Shooting	Ministerial Order under the <i>Wildlife Act, RSBC 1996, c 488</i> (GovBC 1996e) Closed Areas Regulation, BC Reg 76/84	BC MEMLI and BC MFLNRORD	Establishes No Unauthorized Entry and Hunting/Shooting prohibition over Project Area.

Authorization	Legislation	Authorizing Agency	Purpose
Zone over Project	(GovBC 1984)		
Occupant License to Cut	<i>Forest and Range Practices Act</i> (GovBC 2002c)	BC MFLNRORD	Regulates cutting and harvesting trees of merchantable size. To be discussed with BC FLNRORD, regarding the Bulkley Timber Supply Area (TSA) and the area tree farm licensee.
Permit to Construct and Operate a Sewage Treatment system	<i>Public Health Act, SBC 2008, c 28.</i> (GovBC 2008), Sewerage System Regulation, BC Reg 326/2004 (GovBC 2004)	Public Health Inspector/Officer of Northern Health	Regulates the disposal of sewage from the Administration Building, Maintenance Facility and Mine Dry.
Rail Infrastructure Rezoning	Regional District of Bulkley-Nechako Zoning Bylaw No. 1800, 2020 (RDBN 2020) of the Smithers Telkwa Rural Official Community Plan (RDBN 2014), under the <i>Local Government Act</i> , RSBC 2015, Chapter 1 (GovBC 2015b)	Regional District of Bulkley Nechako (RDBN)	Required for RDBN land use rezoning for the Rail Infrastructure parcel (to be completed concurrently with the ALR Non-farm Use application). Letter detailing the Rail Infrastructure rezoning of Property Lot (A) District Lot 1143 Range 5 Coast District Plan 1056 except Plan 9828 within the RDBN, Rail Infrastructure overview, and proposed Application for Amendment to a Plan, Bylaw, Permit, or Floodplain Exemption submitted February 2, 2021.
Railway Minister's Certificate and Operating Permit	<i>Railway Act, RSBC 1996, Chapter 395</i> (GovBC 1996d) <i>Railway Safety Act, SBC 2004, Chapter 8</i> (GovBC 2004)	BC MOTI and Technical Safety BC	Required for construction and operation of the Industrial Rail Infrastructure.
Road Use Permit	<i>Forest and Range Practices Act</i> , SBC 2002, c 69 (GovBC 2002)	BC MFLNRORD	Authorizes use of a Forest Service Road (FSR). Road Use Permit issued December 2018.
Sand and Gravel Permit G-2-48 for Gravel Quarry	<i>Mines Act, RSBC 1996, c 293</i> (GovBC 1996c)	BC MEMLI	Authorizes excavation of gravel material, screening and crushing at Goathorn Gravel Pit for road construction or use by cement industry. Permit G-2-48 issued October 2020.
Site Alteration Permit	<i>Heritage Conservation Act, RSBC 1996, c 187</i> (GovBC 1996a)	BC MFLNRORD	Regulates alteration or removal of archaeological or paleontological items (should any be identified and impacted by the Project).
Statutory Right-of-way (SROW)	<i>Land Act</i> , RSBC 1996, c 245 (GovBC 1996b)	Crown Lands, Land Tenure Branch	Authorizes the construction and use of the Bypass Road portion of the TAC. Authorizes occupation of Crown land for a rock quarry in the

Authorization	Legislation	Authorizing Agency	Purpose
			TAC ROW. <i>SROW application submitted June 11, 2021.</i> <i>Application updated on January 14, 2022, to address proposed reclamation. SROW application was advertised under the Land Act Notice of Application for a Disposition of Crown Land, with comments due to BC FLNRORD up to March 17, 2022.</i> <i>Note: This application won't be finalized until a decision is made on the Environmental Assessment Certificate (EAC).</i>
Waste Discharge Permit - Effluent	<i>Environmental Management Act</i>, SBC 2003, c 53 (GovBC 2003) Waste Discharge Regulation, B.C. Reg. 320/2004 (GovBC 2004)	BC MECCS	Authorizes discharge of liquid effluent to the environment through the Joint MA/EMA permit process.
Waste Discharge Permit - Emissions	<i>Environmental Management Act</i>, SBC 2003, c 53 (GovBC 2003) Waste Discharge Regulation, B.C. Reg. 320/2004 (GovBC 2004)	BC MECCS	Authorizes discharge of airborne emissions to the environment through the Joint MA/EMA permit process.
Waste Discharge Permit - Solid Wastes	<i>Environmental Management Act</i>, SBC 2003, c 53 (GovBC 2003) Waste Discharge Regulation, B.C. Reg. 320/2004 (GovBC 2004)	BC MECCS	Authorizes discharge from the Project of solid industrial refuse through the Joint MA/EMA permit process.
Water License	<i>Water Sustainability Act</i>, BC Reg. 36/2016 (GovBC 2016) Groundwater Protection Regulation, BC Reg 39/2016 (GovBC 2016)	BC MFLNRORD	Authorizes storage, use or diversion of surface water, including installation of works for a backup water system in Goathorn Creek. If groundwater wells are proposed, water license(s) will be applied for.

4.3 Concurrent Permitting Versus Coordinated Permitting

TCL will not be seeking concurrent permitting pursuant to the Concurrent Approval Regulation (BC Reg. 371/2002) (GovBC 2002b) as per a request from the Wet'suwet'en during early consultation.

As an alternative to concurrent permitting, the coordinated permitting (authorizations) process will allow TCL to advance primary and secondary applications for all required authorizations while the EAC Application process proceeds; however, the EAC Application process must be completed, and an EAC issued before other authorizations can be issued.

A third option to permitting is the sequential approach which basically has the entire EA process complete including the issuance of an EAC to the proponent prior to the permitting process starting. At this time TCL has advanced the Project sufficiently to allow the coordinated approach to be followed.

4.3.1 Pre-Application Coordinated Authorizations

The starting point for this pre-Application phase of the coordinated authorizations process for permitting began in September 2021 with the Major Mines Office (MMO) and the Chair of the Mine Review Committee (MRC). The MMO will coordinate the MRC's review of TCL's Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (BC MEMPR and BC MECCS 2019) (JAIR) application and any associated ancillary authorizations such as those that may be required from BC FLNRORD.

The process will comprise steps including:

1. TCL completes a preliminary application form and pays associated fees for an *EMA* permit;
2. TCL completes the Information Requirements Table (IRT) (Sept 2019) and submits it with a PD that includes a list of required authorizations to the MMO;
3. An MRC, made up of provincial technical reviewers with expertise in each aspect of the Joint Application, along with representatives from impacted Indigenous groups, local health authorities and local government is assembled. Who will participate on the MRC will be informed by the PD and the IRT provided by TCL;
4. The MRC will review the drafts of the PD and IRT and will provide comments to TCL in an Issues Tracking Table (ITT);
5. TCL responds to each comment in the ITT and submits it to the Senior Project Lead at MMO;
6. TCL's responses are reviewed by the MRC and comments provided to TCL. TCL will compile the comments received from the MRC into the ITT and manage the ITT for this pre-Application task and throughout the review process;
7. A meeting between the MRC and TCL will be held to clarify aspects of the IRT and PD as necessary;
8. The IRT will be finalized and signed off by the BC MECCS and provided to TCL for use in preparing the Joint Application. While BC MEMLI does not sign off the IRT, this same version will be used by BC MEMLI technical reviewers to screen the Joint Application;
9. BC MECCS will issue an Application Instruction Document (AID) informed by the IRT to TCL. The AID outlines the requirements necessary for the *EMA* permit including public notification and Indigenous groups engagement. The IRT will also address these requirements for BC MEMLI;

10. Once the requirements in the AID are complete, TCL will submit a report outlining how each AID requirement was met for review by BC MECCS;
11. Once BC MECCS is satisfied the AID requirements have been met the Joint Application may be submitted by TCL for screening;
12. When TCL is close to this step, the Senior Project Lead will advise TCL where to submit the screening application using both BC MECCS/BC MEMLI portals and a SharePoint site, and will also provide TCL with information about any fees associated with this step; and
13. After the Joint Application is submitted correctly, the MRC will screen the Joint Application against the IRT to ensure all required information is present before the Joint Application is accepted for detailed technical review.

TCL will work closely with the MRC in the pre-Application stage to identify which applications for permits, licenses, and other authorizations, if any, can be effectively bundled in the coordinated authorizations process. The Proponent Guide to Coordinated Authorizations for Major Mine Projects (GovBC 2013) was used to inform this subsection.

4.3.2 Environmental Management Plans

To enable permitting during the coordinated authorizations process, guidance in the JAIR, and the Code were used to inform the development of the environmental management plans that underlie the overarching **EMS** in **S13.0-C1** of the **EAC Application**.

The JAIR indicates that management plans are required to address environmental, operational, and health and safety issues noted throughout the EAC Application and that they are presented in a manner that reflects site-specific operational management and monitoring requirements.

To assist in the implementation of the coordinated authorizations process, TCL has developed twenty (20) environmental management plans that are included in **S13.0-C1** to **21** of the **EAC Application**. The plans have been developed to be deployed during the Construction, Operation, Decommissioning and Reclamation and Post-closure phases of the Project, and will be updated as needed. These plans will also be submitted and reviewed, approved and/or amended, if required, by BC MEMLI, BC MECCS, BC FLNRORD, and the OW prior to implementation.

4.3.3 Comparison to 2021 Metallurgical Coal Environmental Assessment Certificates (EAC) Issued by the British Columbia Environmental Assessment Office (BC EAO)

TCL has completed a review and comparison of a recent EAC granted to a surface coal mine in 2021 and it is provided in **Appendix 1.0-AH Comparison of Conuma Coal Limited – Wolverine Coal EAC # M04-01-A to Tenas EAC Application**.

As demonstrated in the concordance table (**Appendix 1.0-AH**), TCL believes we are in harmony with this recent coal mine EAC. Most of the items, such as Wolverine Coal's conditions related to environmental management plans, are already included as part of our EAC Application submission. Several will be integrated into the coordinated authorization process, if applicable, while others will be developed further based on review and approval and/or amendment by BC MEMLI, BC MECCS, BC FLNRORD, and the OW. In addition, monitoring programs associated with the environmental management plans provided in **S13.0** of this **EAC Application**, particularly the **AQMP**, **MWMP**, **RCP**, and **WMP**, and others that the OW would like to be involved with developing and implementing, will be used to develop an Indigenous-led Monitoring Program, decided jointly by TCL and the OW, and which will be submitted to regulatory bodies for review and input prior to the Project Construction Phase.

5. LAND USE

5.1 Introduction

The current land use is primarily commercial forestry operations with some minor agricultural improvements in the footprint of the TAC and Rail Infrastructure. Most of the existing disturbance is a result of the forestry operations active in the area and consists of many all-weather FSRs, cut blocks, and seasonal trails. In the past, evidence of underground mining was present on the landscape along with some small scale surface mining operations. These disturbances have been completely reclaimed by natural forces and currently are not easily found on the landscape. The key infrastructure already in place near the Project is:

- ▶ Village of Telkwa;
- ▶ 25 kV powerlines;
- ▶ CNR main line; and
- ▶ FSRs and provincial roads.

5.2 Land Ownership

The Project is located on provincial Crown land, three (3) freehold land parcels owned by TCL, and 11 coal licences held by TCL. There are no federal lands existing within the Project Area. The nearest federal land to the Project is the Witset First Nation's (formerly known as Moricetown Band) Jean Baptise 28 reserve (**Figure 4.2-3** in **S6.0-C4** of the **EAC Application**), located 18 km northeast of the Project. No Project-related effects to federal lands are anticipated.

There is private land near to the Project, including along the TAC and adjacent to the Rail Infrastructure (**Figure 5.2-1**).

5.3 Local Government Zoning or Plans

The Project is located outside of the Village of Telkwa, and thus not subject to Village bylaws and zoning.

5.4 Tenures, Licenses, Permits or Other Authorizations

Project is located within the Bulkley Valley Timber Supply Area which covers approximately 736,000 ha of the Skeena River eastern drainage. TCL holds a Licence to Cut for the Minesite. While there are multiple pending licences to cut near the Project, there is currently no active logging occurring within the Project Area and no pending forest harvest authorizations (GovBC 2019). Large sections of the LSA have been previously logged and additional information including a figure are provided in the Land and Resource Use VC chapter (**S6.0-C4** of the **EAC Application**).

Range tenures are areas of Crown land where the *Forest and Range Practices Act*, SBC 2002, c 69 (GovBC 2002c) tenure applies and is administered by BC FLNRORD. This includes grazing and hay cutting licenses and permits. The Project overlaps with two (2) range tenures and this is discussed further in **S6.0-C4** of the **EAC Application**.

Traplines tenures are areas for which registration is granted to one or more licensed trappers for the trapping of fur bearing animals under the *Wildlife Act*, RSBC 1996, c 488 (GovBC 1996e). Traplines are designated by a regional manager of the recreational fisheries and wildlife programs. The Minesite and much of the TAC overlap with one (1) trapline, and small portion of the Rail Loop overlaps with an other trapline. This is discussed further in **S6.0-C4** of the **EAC Application**.

One (1) guide outfitter licence overlaps with the Project Area. A guide outfitter is licensed to guide resident and non-resident hunters in an exclusive guide area with clearly defined and legally described boundaries. Guide outfitting areas vary considerably in size and availability of big game species. A guide outfitter licence can be issued for a term of one (1) year or five (5) years (GovBC 2021). Guide outfitting is discussed further in **S6.0-C4** of the **EAC Application**.

Portions of the Project are also within the ALR of BC:

1. Bypass Road, which is a portion of the TAC; and
2. Rail Infrastructure .

The land will have to be rezoned to a “Non-farm use” via an application to the Agricultural Land Commission (ALC) and the Regional District of Bulkley Nechako (RDBN). Furthermore, a SROW will need to be obtained under the *Land Act*, RSBC 1996, c 245 (GovBC 1996b) to allow the construction of the Bypass Road. Lastly the land that the Rail Infrastructure is located on will need to be rezoned for this use by the RDBN.

No permits have been identified within the Project Area.

5.5 Non-tenured Current Land Uses

Non-tenured land use of the area occurs in the form of various types of outdoor recreation such as wildlife harvesting, angling, horseback riding, hiking, mudbogging as well as limited snowmobile and quad riding opportunities. Refer to the Land and Resource Use VC chapter (**S6.0-C4** of the **EAC Application**) for more information on recreation.

5.6 Current and Planned Land Use Plans

The Project is located within the Smithers Telkwa Rural Official Community Plan (OCP). Prepared by the RDBN, the OCP covers RDBN Electoral Area A and contains objectives to help guide land use planning and development of a variety of topics. The OCP also provides an overview of the communities found in Area A and a general plan vision. There are eight (8) different land designations in the OCP. Project components straddle two (2) of the designations: Agriculture and Rural Resources. The Minesite is found on private parcels and the Rail Infrastructure is within the Agriculture designation. The Bypass road is within both Agriculture and Rural Resources designations. A diversified economy and industrial land use are two (2) stated goals of the OCP (RDBN 2014). Refer to the Land and Resource Use VC chapter (**S6.0-C4 of the EAC Application**) for more information.

5.7 Provincial Land Use Plans and Provincial Land Use Designations

The Project is located with the Bulkley Land and Resource Management Plan (LRMP) area (**Figure 2.2-1 in S6.0-C4 of the EAC Application**). The Bulkley LRMP, created by the BC Government in 1998, directs the management of 760,000 ha of Crown land and provides general management direction related to eleven (11) categories: biodiversity, access, timber, water quality, fish and wildlife habitat, visual quality, range, outdoor recreation and tourism, subsurface resources, cultural heritage resources, and future planning processes, establishing six (6) resource management zones and protected areas. The Project is located within the Private Zone and the Integrated RMZ, in Planning Unit 11 (Telkwa) and Sub-Unit 11-4 (Goathorn Creek). The Integrated RMZ was created to “recognize a full range of resource values and activities, including timber harvesting, mining, grazing, tourism, wildlife and recreation”. Planning unit objectives for Sub-Unit 11-4 include development of a comprehensive plan to sustain a viable caribou population and manage caribou habitat, discourage a circle route to the Morice District, and potential creation of a Telkwa River and Scallion Creek access control point. Specific management direction for Subsurface Resources in this Sub-Unit 11-4 include maintaining “opportunities for coal exploration and extraction” (GovBC 1998).

The Project also overlaps with the Bulkley Valley Sustainable Resource Management Plan (SRMP) which presents objectives and strategies for resource management within the Bulkley Valley portion of the Bulkley LRMP. The Bulkley Valley SRMP establishes objectives and strategies for resource management within the Bulkley Valley. The objective of the Bulkley Valley SRMP is to further break down the large Bulkley Valley into more specific planning areas (GovBC 2005). The Minesite is located outside of the SRMP, but the TAC overlaps with the SRMP boundary (see **Figure 2.2-1 in S6.0-C4 of the EAC Application**). Bulkley Valley SRMP objectives include mining as a resource value within the Integrated RMZ (GovBC 2005).

The ALR is a provincial zone in which agriculture is recognized as the priority use. Farming is encouraged and non-agricultural uses are restricted (ALC 2021). The Minesite is located outside of the ALR, but the TAC overlaps with a small portion of ALR land and TCL has submitted a non-farm application and zoning change to the ALC for the TAC (see **Figure 4.2-11 in S6.0-C4 of the EAC Application**). Refer to the Land and Resource Use VC chapter (**S6.0-C4 of the EAC Application**) for more information on agricultural land use.

Old Growth Management Areas (OGMA) are defined areas that contain, or are managed to attain, specific structural old-growth attributes and that are delineated and mapped as fixed areas. The Project does not overlap with any OGMA. OGMA are illustrated on **Figure 4.2-5 in S6.0-C4 of the EAC Application**.

Under the *Forest and Range Practices Act*, SBC 2002, c 69 (GovBC 2002c), the Government Actions Regulation, BC Reg 582/2004 (GovBC 2004) (GAR) provides direction for establishment of land designations and features that require special management such as Wildlife Habitat Areas (WHA), Ungulate Winter Range (UWR) and fisheries sensitive watersheds. The Project overlaps with a WHA 6-333 for the Telkwa Caribou Herd was established as a legal order under the GAR in 2015 and amended in 2018 (British Columbia Ministry of Attorney General [BC MAG] 2004). The Project does not overlap with any UWR and the nearest UWR is more than 3 km from the Project. More information regarding WHAs and UWRs is provided in the Wildlife VC chapter (**S4.0-C8** of the **EAC Application**). The Project does not overlap with any fishery's sensitive watersheds.

5.8 Any Other Development or Activities, Directly Related to the Project or Not

The Project is in an area in northwestern BC where there is a variety of tenured and non-tenured land use, private land, parks, and protected areas. Resource-based industries are important drivers of the local and regional economy. Forestry, agriculture, and grazing are important in the region.

Agricultural activities in the Bulkley Valley are predominantly ranching and forage country. The region has high timber values, and the Project is located within the Bulkley Valley Timber Supply Area (TSA) which covers approximately 736,000 ha of the Skeena River eastern drainage.

Natural resource extraction and mineral exploration are also important to the regional economy, with an increase in these activities in recent years. In the RDBN there are two (2) active mines: Endako and Huckleberry, both of which are in care and maintenance (C&M) (BC Mine Information 2020). There are currently no operating mines in the RDBN A and RDBN G.

Tourism and the service sector in the region are becoming increasingly important components of the economy, with significant monetary contributions. Tourism in the region is primarily focused on various recreation pursuits, such as hunting, fishing, and hiking (RDBN 2017).

TCL conducted a full review of expected foreseeable Projects that may occur during the timeline of the Construction, and Operation phases of the Project based on TCL's understanding potential activities and in consultation with stakeholders, and third party consultants. Each VC chapter provides a list of Projects that were considered in their cumulative effects assessment (CEA) as some Projects were outside of the respective study area of the VC in question. A list of Projects considered for the cumulative effects assessments is as follows:

- ▶ Agricultural Activities;
- ▶ Maple Leaf Cannabis production facility;
- ▶ Hudson Bay Mountain Estates;
- ▶ Smithers, Houston, Telkwa, Witset, Hudson's Bay Estates, and any miscellaneous developments;
- ▶ Forestry Activities;
- ▶ Berg Copper-Molybdenum Silver Mine;
- ▶ Big Onion Project;
- ▶ Blackjack Mineral;
- ▶ Buck;

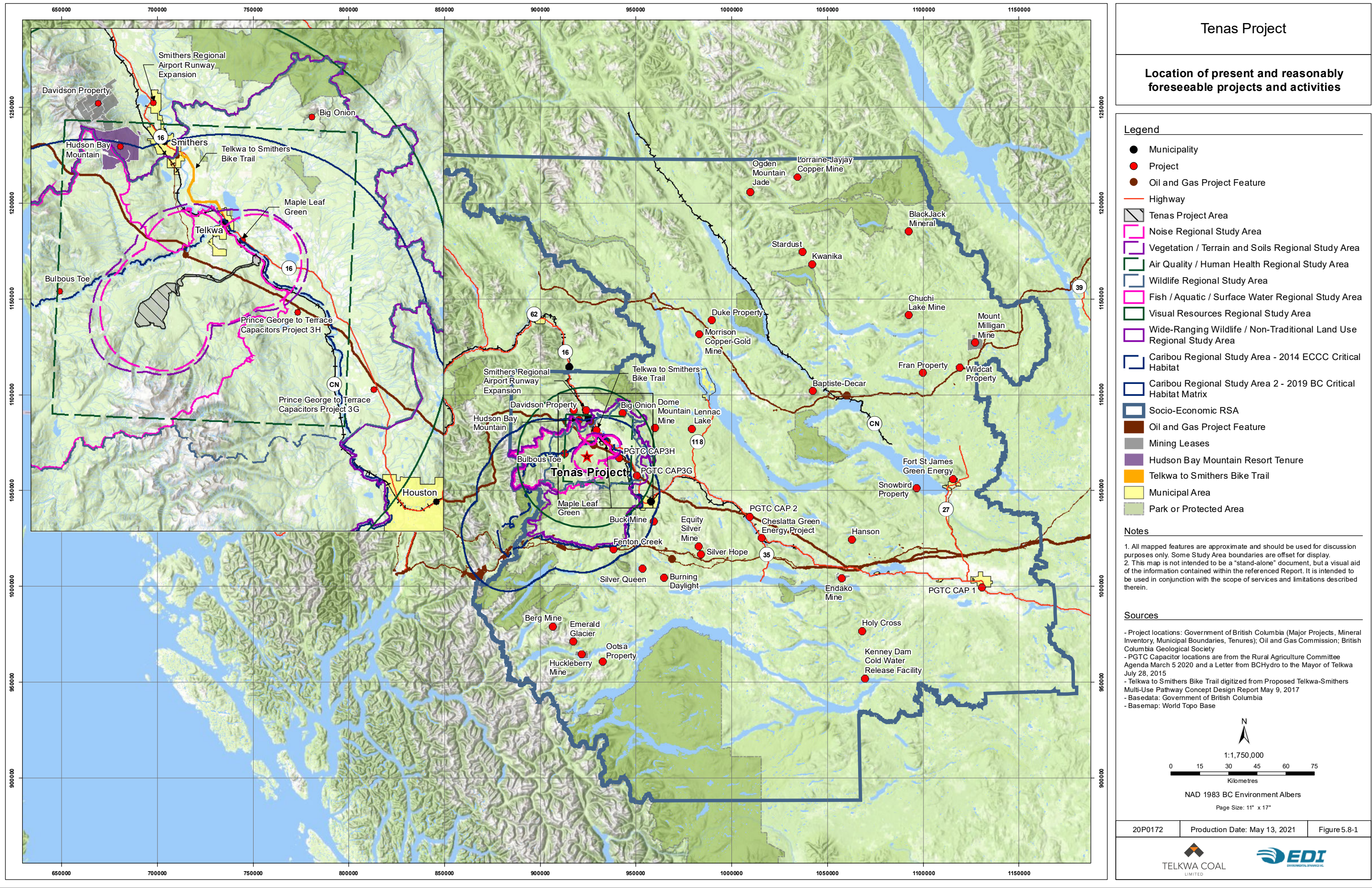
- ▶ Burning Daylight Quarry;
- ▶ Chuchi Lake Mine;
- ▶ Decar;
- ▶ Dome Mountain;
- ▶ Duke Property;
- ▶ Emerald Glacier;
- ▶ Endako;
- ▶ Equity Silver;
- ▶ Fenton Creek;
- ▶ Fran Property;
- ▶ Hanson;
- ▶ Holy Cross;
- ▶ Huckleberry;
- ▶ Kwanika
- ▶ Lennac Lake
- ▶ Lorraine-Jajay Copper Mine
- ▶ Morrison Copper/Gold
- ▶ Mount Milligan
- ▶ Ogden Mountain Jade
- ▶ Ootsa Property
- ▶ Silver Hope
- ▶ Silver Queen Property
- ▶ Snowbird Property
- ▶ Stardust Project
- ▶ Wildcat Property
- ▶ Recreation activities
- ▶ Telkwa to Smithers Bike Trail
- ▶ Harvesting (including fishing, hunting, trapping)
- ▶ Bulbous Toe
- ▶ Cheslatta Green Energy Project
- ▶ Coastal Gaslink

- ▶ Fort St. James Green Energy
- ▶ Kenney Dam Cold Water Release Facility
- ▶ Pacific Northern Gas Looping Pipeline
- ▶ Pacific Trails Pipeline
- ▶ Prince George to Terrace Capacitors Project
- ▶ Prince Rupert Gas Transmission Project

Figure 5.8-1 below provides the location of all Projects that were identified by this Process.

Additional information on land and resource use, and economic activities within the vicinity of the Project is provided in **S6.0-C4** and **S5.0-C2** of the **EAC Application** respectively.

Path: L:\PROJECT\S2018\BP\2421_Tenas_Maps\map\REPORTING\EA Methodology\Fig021_CurrentFutureProjects_Sketches_20170512.mxd



6. ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

6.1 Summary

An alternatives assessment for various Project components has been completed and is presented in **Table 6.1-1** below. The preferred alternative is presented in this EAC Application; however, with additional consultation on the Project during the post-Application stage, further alternatives may be identified and investigated. The following table summarizes some of the alternatives reviewed and the option that was carried forward into this EAC Application.

Table 6.1-1: Alternatives Assessment Summary

Component	Alternatives Considered
Mining Method	Surface
	Underground
Surface Mining Method	Truck/shovel
	Contour and highwall
	Dragline
Production Rate for Project	<250,000 tonnes of processed coal per annum
	775,000 to 825,000 tonnes of processed coal per annum
	>1,500,000 tonnes of processed coal per annum
Processed Coal Transport from CPP to Port	Truck
	Rail
Mine Equipment Selection – Loading Equipment	Backhoe
	Shovel
Mine Equipment Selection – Equipment Size	6 m ³ backhoe/45 tonne trucks
	12 m ³ backhoe / 90 tonne trucks
	15 m ³ backhoe / 135 tonne trucks
	22 m ³ backhoe / 180 tonne trucks
	29 m ³ backhoe / 205 tonne trucks
CPP Location	CPP located on the east side of Goathorn Creek.
	CPP located on the west side of Goathorn Creek
Rail Infrastructure Location	Rail Loop on private land parcel east of Lawson Road
	Rail Loop on Crown land parcel east of Lawson Road
	Rail Loop on Crown land west of Lawson Road
	Linear siding along existing CNR right-of-way
	Linear siding on Crown land west of Lawson Road
Processed Coal Transport Methodology from CPP to Rail Infrastructure	Truck haulage
	Conveyor transport
	Slurry pipeline transport
Processed Coal Truck Haul and Project Access	Tenas Access Corridor (TAC)

Component	Alternatives Considered
	Existing road network
	Powerline road
Fine Processed Rock Dewatering	Filter press and haul with trucks
	Conventional wet processed rock (tailings) disposal
Potentially Acid Generating (PAG) Material Management	Material blending
	Passive treatment
	Active treatment
	Dry covers
	Water covers
Water Cover Methodology	Use existing water body
	Construct a water body using excavation only
	Construct a water body using a combination of excavation and dams
	Construct a water body using dams only
Office and Mine Dry Location	Offsite
	Onsite
CPP Plant Flowsheet	Standard three (3) stage circuit consisting of Heavy Media Cyclones, Reflux Classifiers and Floatation
	Two (2) stage circuit consisting of Heavy Media Cyclones and Floatation
Process Water Supply for the Project	Precipitation only
	Precipitation and surface water
	Precipitation and groundwater
Potable Water Supply	Surface water
	Groundwater
	Offsite supplier
Sewage Treatment Methodology	Trucking to offsite disposal
	Sewage Treatment Plant
	Septic field
Employee Transport	Bus from designated parking lot
	Bus using designated route through communities
	Employees using private vehicles
Employee Parking Lot Location	East side of Bulkley River
	West side of Bulkley River
	Extend three-phase 25 kV along Lawson Road
	New 138 kV to 25 kV transformer west of Rail Infrastructure
	2 m
	2.5 m

Notes: >=greater than; <=less than; %=percent; CNR=Canadian National Rail; CPP=Coal Processing Plant; EA=environmental assessment; kV=kilovolt; m=metre; m³=cubic metre; ROM=run-of-mine

6.2 Purpose of the Project

The purpose of this Project is the production of approximately 16.2 million processed metallurgical coal tonnes over an approximately 21 year Operation Phase in an environmentally and socially responsible and sustainable manner that will return economic and social benefits to TCL, the Wet'suwet'en, employees of TCL and their families, local communities, and the regional, provincial, and national economies.

6.3 Alternative Means Rating Methodology

This subsection provides the methodology for rating the alternative means for carrying out the Project.

Alternatives were assessed based on several performance objectives, including:

- ▶ effects on the natural environment;
- ▶ technical applicability, system integrity, and reliability;
- ▶ cost effectiveness; and
- ▶ community effects and input including human health.

As part of the review of alternatives, performance objectives for the alternatives reviewed have been identified and summarized in **Table 6.3-1**.

Table 6.3-1: Criteria Used in the Review of Alternatives

Performance Objective	Ratings		
	Preferred	Acceptable	Unacceptable
Minimize or avoid effects on the natural environment	Minimizes or avoids effects on the natural environment with few mitigations that are easy to implement. Effects to the natural environment are primarily based on the relative disturbance area for the options reviewed, and/or level of activity required. If another environmental factor was used for selecting an option it will be provided.	Minimizes or avoids effects on the natural environment with reasonable mitigations. Effects to the natural environment are primarily based on the relative disturbance area for the options reviewed, and/or level of activity required. If another environmental factor was used for selecting an option it will be provided.	Likely to cause significant effects on the natural environment that will be more difficult to be mitigated. Effects to the natural environment are primarily based on the relative disturbance area for the options reviewed, and/or level of activity required. If another environmental factor was used for selecting an option it will be provided.
Be cost effective	Facilitates a competitive return on investment	Facilitates an acceptable return on investment	Cannot be financially supported by the Project.
Be technically applicable, with system integrity, and reliability	Predictably effective with contingencies if the alternative does not perform as expected	Appears effective based on modelling or theoretical results, and contingencies area available if the alternative fails to perform as expected	Effectiveness appears dubious our relies on unproven technologies

Performance Objective	Ratings		
	Preferred	Acceptable	Unacceptable
Community effects and input including human health.	Matches input Telkwa Coal Limited (TCL) heard from the community and minimizes and/or avoids effects on the community that can be mitigated. No human health issues brought up by engagement.	Matches input TCL heard from the community in most aspects and minimizes and/or avoids effects on the community that can be mitigated. Human health concerns brought up by community can be adequately mitigated.	Does not match input TCL heard from the community and has high effects on the community that cannot be mitigated. High level of concern on human health brought by the community.

6.4 Alternative Means of the Project

Various alternative means of carrying out the Project were examined during Project development through the Pre-feasibility, Feasibility and Post-feasibility Studies to identify a configuration that optimizes the Project's environmental, social, and economic performance. Primary alternatives that were considered included alternatives for:

- ▶ mining method;
- ▶ surface mining method;
- ▶ production rate;
- ▶ processed coal transport from CPP to port;
- ▶ Minesite equipment selection:
 - ▶ loading equipment type; and
 - ▶ equipment size.
- ▶ CPP location;
- ▶ Rail Infrastructure location;
- ▶ processed coal transport method from CPP to Rail Infrastructure;
- ▶ processed coal truck haul and Project access;
- ▶ fine processed rock;
- ▶ PAG material management;
- ▶ water cover methodology;
- ▶ Administration Building and Mine Dry location;
- ▶ process water supply for the Project;
- ▶ potable water supply for Project;
- ▶ sewage treatment methodology;
- ▶ employee transport; and
- ▶ parking lot location.

6.4.1 Mining Method

The first item reviewed was what type of mining method to use to recover the coal resources for the Tenas Deposit. Both underground and surface mining methods were reviewed for recovering the coal resources onsite and the following performance objectives were selected as relevant for this review:

- ▶ Be cost effective;
- ▶ Be technically applicable, with system integrity, and reliability; and
- ▶ Minimize effects on the natural environment.

The mining method selection alternatives were not expected to have effects on the following performance objectives:

- ▶ community effects and input including human health.

6.4.1.1 *Be Technically Applicable, with System Integrity, and Reliability*

The key parameter that ruled out underground mining for this deposit was that it was not technically applicable. This was based on the following reasons:

- ▶ The depth of cover is too shallow for underground as a significant portion of the deposit is shallower than 50 m in cover;
- ▶ The presence of several faults would require underground mining to have a 50 m offset from these zones and coal would not be recovered;
- ▶ The dip of coal seams for a significant portion of the open pit would be greater than 15 degrees which is the limit for room and pillar mining and would not be recoverable for this deposit;
- ▶ Minimum seam thickness of 1.2 m; and
- ▶ Underground mining would only recover approximately 50% of the available coal, which would allow for stable roof conditions and eliminate potential subsidence implications.

Using the limits above, the Tenas Deposit would have only 5.0 Mt of ROM coal available for mining, which would not justify the capital expenditure associated with this Project. Furthermore, based on evidence from operations in the USA, surface mining operations are generally safer to operate than an underground mine.

6.4.1.2 *Be Cost Effective*

Given the low ratio for the Tenas Deposit, underground mining is expected to have a higher operating and capital cost of mining than the proposed surface method when taking into the account the presence of numerous faults and the dip of the coal seams.

6.4.1.3 *Effects on the Natural Environment*

For assessing the two (2) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. Surface mining of any size will have some effects on the environment while in general, underground mining has a lower effect on the natural environment due to its limited above ground disturbance footprint and lower surface activity levels in

terms of equipment. The proposed surface mine will be designed to minimize its potential effects on the natural environment. Based on this assessment underground mining would be preferred based on this performance objective.

6.4.1.4 Overall Assessment

As summarized in **Table 3.4-1**, the proposed surface mining methodology was rated as Acceptable for both being amenable to reclamation and effects on the natural environment. The surface mining methodology was rated as Preferred for cost effectiveness and technical applicability. Therefore, the overall rating for the proposed mining methodology was rated as Acceptable.

The alternative of underground mining was rated as Unacceptable for technical applicability and being cost effective for this deposit resulting in an overall rating of Unacceptable.

Based on the overall ratings provided in **Table 6.4-1**, surface mining methodology was the selected alternative. The selected alternative provides the highest net present value while still being amenable to reclamation and having manageable adverse environmental effects.

Table 6.4-1: Assessment of Mining Methodology

Performance Objective	Surface Mine Methodology	Underground Mine Methodology
Be Cost Effective	Method provides the highest net present value for the Project Rating: Preferred	Method will not provide a positive net present value for the Project Rating: Unacceptable
Be Technically Applicable, with System Integrity, and Reliability	Method provides for the highest recovery of the resource Rating: Preferred	Method is not technically applicable for the deposit due to the reduced amount of tonnage that can be recovered by this method Rating: Unacceptable
Minimize or Avoid Effects on the Natural Environment	Method has higher effects on the natural environment than underground mining due to surface disturbance and activity. Rating: Acceptable	Method has a lower effect on the natural environment than surface mining due to limited surface disturbance activity. Rating: Preferred
Overall Assessment	Rating: Acceptable	Rating: Unacceptable

6.4.2 Surface Mining Methodology

Once surface mining was selected as the preferred option for the Tenas Deposit, three (3) different surface mining methods were reviewed to determine the preferred case for this EAC Application:

1. conventional truck and shovel mining;
2. contour and highwall mining; and
3. strip mining.

The following performance parameters were selected for this review:

- ▶ be cost effective; and
- ▶ be technically applicable, with system integrity, and reliability.

The surface mining method selection alternatives were not expected to have effects on the following performance objectives:

- ▶ minimize effects on the natural environment; and
- ▶ community effects and input including human health.

6.4.2.1 Be Technically Applicable, with System Integrity, and Reliability

Of the three (3) methods that were reviewed, only conventional truck and shovel mining was technically applicable. Due to the depth and dip of the coal and size of the deposit, strip mining would be Unacceptable. Due to the dip of the coal at surface much of the deposit is not amenable to highwall mining as the dip is too steep for this method.

6.4.2.2 Be Cost Effective

Conventional truck and shovel mining for this deposit provides the highest net present value for the Project versus the other two (2) methods. While strip mining would have the lowest operating costs of any surface mining method due to the small size of the deposit, there would be a high capital cost associated with this method to purchase a dragline, so it was only rated as Acceptable. Contour and highwall mining would provide a low operating and capital cost; however, most of the deposit would not be amenable to this method which makes this method only Acceptable.

6.4.2.3 Overall Assessment

As summarized in **Table 6.4-2** below, the proposed truck and shovel method was rated as Preferred for both being technically applicable and cost effective. Therefore, the overall rating for the proposed surface mining method was rated as Preferred.

The alternative of strip mining was ranked as Unacceptable for being cost effective due to the high capital requirements and low technical applicability due to the depth and dip of the coal seams at the Tenas Deposit.

The alternative of contour and highwall mining was ranked Unacceptable for technical applicability as much of the coal has too steep of a dip to be recovered using this method.

Based on the overall ratings provided in **Table 6.4-2**, the surface mining method was the selected alternative. The selected alternative provides the highest net present value while still being amenable to reclamation and having manageable adverse environmental effects.

Table 6.4-2: Assessment of Surface Mining Methodology

Performance Objective	Conventional Truck and Shovel	Strip Mining	Contour and Highwall Mining
Be Cost Effective	Method provides the highest net present value for the Project Rating: Preferred	Method will not provide a positive net present value for the Project due to the high capital cost associated with a dragline and the small deposit size Rating: Unacceptable	Method will provide a positive net present value for the Project but less than conventional truck and shovel method Rating: Acceptable
Be Technically Applicable, with System Integrity, and Reliability	Method provides for the highest recovery of the resource Rating: Preferred	Method is not technically applicable for the deposit due to the reduced amount of tonnage that can be recovered by this method and due to the depth and dip of the coal seams present Rating: Unacceptable	Method is technically applicable for the deposit; however, it does not recover as much as a conventional truck and shovel Rating: Unacceptable
Overall Assessment	Rating: Preferred	Rating: Unacceptable	Rating: Unacceptable

6.4.3 Production Rate for Project

With the mining method and methodology selected, the preferred production rate for the Tenas Deposit was then assessed. Three (3) production rates were selected based on the available modular plant feed rates which are provided below:

1. <250,000 processed tonnes produced per annum;
2. 775,000 to 825,000 processed tonnes produced per annum; and
3. >1,500,000 processed tonnes produced per annum.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment;
- ▶ community effects and input including human health; and
- ▶ cost effective.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ be technically applicable, with system integrity, and reliability.

6.4.3.1 Be Cost Effective

The first element reviewed was the cost effectiveness of the options. Based on the work completed, the larger production case was the preferred case from a net present value analysis as it has the highest revenue for the capital employed. The mid-range case was rated Acceptable from a net present value

case while the low production case had an Unacceptable net present value due to the capital required to construct a full Rail Loop and the TAC needed to avoid hauling coal through the Town of Telkwa.

6.4.3.2 Community Effects and Input Including Human Health

The next element reviewed was community effects. As a mine's production rate increases the relative effect on the community in the terms of bringing in a large workforce also increases. This is due to the increased operations and construction workforce numbers and resultant stresses on community services that need to be mitigated by the Project. Also, there is an effect when the operation closes due to the number of people that have been brought into the community which are no longer needed as part of the operation. Based on this analysis the smaller the operation the less of effect and/or disruption to the local community. Feedback obtained from many community members indicted a preference for a small operation. Three (3) production rates were reviewed:

1. <250,000 processed tonnes per annum;
2. 775,000 to 825,000 processed tonnes per annum; and
3. >1,500,000 processed tonnes per annum.

The production rate of >1,500,000 was ruled out as it required the largest increase to workforce in the area and had the shortest mine life and needed the largest disturbance all of which was Unacceptable based on the input gathered by TCL. Between the two (2) remaining production rates it was felt both rates could be accommodated by the region with mitigations. The lower production rate was rated Preferred by the region due to the lower level of changes in workforce required and the longest mine life.

TCL has made a point to engage with the local community often and on any issue to ensure we have a good understanding of the region's concerns, and to receive input related to the Project. From TCL's very first interaction with local groups, it became evident that the region did not endorse a large mining operation close to their community and would rather have a smaller operation running for a longer period. Using this input, the large production operation was ranked as Unacceptable, the mid-range production case was ranked as Acceptable, and the lower production case was ranked as Preferred

Lastly from a human health perspective a small production rate also would reduce COPC concentration in receptors such as water, air and subsistence food so a lower production rate is more preferred from this performance objective.

6.4.3.3 Effects on Natural Environment

For assessing the three (3) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. The smaller the disturbance footprint for a proposed project, the lower the potential effect on the natural environment a project should have for all VCs. For the options considered, the lowest production case had a much smaller disturbance footprint than the two (2) other production cases. Based on this, the lowest production case received a Preferred ranking for effect on the natural environment, while the other two (2) production rates were rated as Acceptable in terms of effects on the natural environment as both are expected to have an effect that should be able to be mitigated.

6.4.3.4 Overall Assessment

As summarized in **Table 6.4-3**, the 775,000 to 825,000 processed tonne production rate was the only option that was rated as Acceptable for the four (4) performance objectives selected.

The smallest production rate was rated Preferred for three (3) of the four (4) performance objectives and was go forward case up to requiring a newly constructed 11 km Bypass Road and a 2.5 km Rail Loop required to be built due to stakeholder input and CNR requirements which rendered this option no longer economically viable for this production rate due to the increased capital requirements.

The largest production rate was rated as Unacceptable due to feedback TCL received from local stakeholders.

Based on the overall ratings provided in **Table 3.4-3**, the 775,000 to 825,000 processed coal tonne per annum production rate was the selected alternative. The selected alternative provided an acceptable net present value while still being supported by local stakeholders.

Table 6.4-3: Assessment of Production Rates

Performance Objective	<250,000 Processed Tonnes Per Annum	775,000 to 825,000 Processed Tonnes Per Annum	>1,500,000 Processed Tonnes Per Annum
Be Cost Effective	Method will not provide a positive net present value for the Project given the Bypass Road and Rail Loop additions Rating: Unacceptable	Method will provide a positive net present value for the Project but less than higher production case Rating: Acceptable	Method will provide a positive net present value for the Project but less than conventional truck and shovel method Rating: Preferred
Community Effects and Input Including Human Health	Method provides for the least change to local community Production rate provides for the longest mine life and lowest number of new employees. Would generate the lowest emissions of the three (3) options that could potentially affect human health. Rating: Preferred	Method provides an acceptable change to local community with mitigations Production rate provides for a reasonable mine life and acceptable level of employment Rating: Acceptable	Method provides an acceptable change to local community with mitigations in place however was viewed as unacceptable based on feedback from engagement with stakeholders. Production rate provides the shortest mine life and highest number of new employees into the region and effects to the community. Also has the highest expected effect on human health. Rating: Unacceptable
Minimize or Avoid Effects on the Natural Environment	Production rate provides the lowest disturbance footprint and subsequent effects. Rating: Preferred	Production rate provides a disturbance footprint that should be acceptable with reasonable mitigations. Rating: Acceptable	Production rate provides a disturbance footprint that should be acceptable with reasonable mitigations. Rating: Acceptable
Overall Assessment	Rating: Unacceptable	Rating: Acceptable	Rating: Unacceptable

6.4.4 Processed Coal Transport from Coal Processing Plant (CPP) to the Port

With the production rate set, the preferred method for transporting processed coal from the mine to the port was then reviewed and a preferred option selected for the EA. Two (2) options were reviewed for transporting processed coal from the Minesite to the port:

1. truck; and
2. rail.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment;
- ▶ community effects and input including human health; and
- ▶ cost effective.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ be technically applicable, with system integrity, and reliability; and
- ▶ minimize effects on socio-economic environment.

6.4.4.1 Be Cost Effective

The closest port is 375 km from the Minesite, and truck haulage is expected to cost approximately three (3) times as much as by rail. Rail will provide the highest net positive value for the Project and hence was rated as Preferred while truck haulage was rated as Acceptable.

6.4.4.2 Minimize Effects to the Natural Environment

For assessing the two (2) options provided, the activity level of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as options with the higher activity are also expected to have the highest potential effect to the natural environment due to increased emissions, such as dust, carbon dioxide, nitrous oxides, and sulfide oxides. To haul the expected production, roughly one (1) train per week will be required to transport coal between the Minesite and Ridley Terminals. This would require four (4) trucks an hour and a fleet of 22 trucks. This is expected to have potentially a much higher effect on the natural environment versus one (1) train per week. Based on this, rail transport was rated as Preferred and truck haul was rated as Acceptable.

6.4.4.3 Community Effects and Input Including Human Health

TCL has engaged often with a wide variety of community stakeholders and the overwhelming response was in favour of using rail transport versus truck haulage for the transport of processed coal from the Minesite to the port, therefore this option was selected as Preferred. Rail transport is also expected to have a lower effect on human health versus trucking due to fewer emissions from transport vehicles.

6.4.4.4 Overall Assessment

As summarized in **Table 3.4-10**, rail transport for processed coal transport was rated Preferred for cost effectiveness and community effects and input including human health and was rated Acceptable for the performance objective of minimizing the effects to the natural environment.

Transporting processed coal from the Minesite to the port via truck was rated as Acceptable for cost effectiveness and minimizing effects on the natural environment while being rated Unacceptable based on the community effects and input including human health.

Based on the overall ratings provided in **Table 6.4-4** below, transporting the processed coal via rail was the selected alternative. The selected alternative received an overall rating of Acceptable for minimizing effects on the natural environment, and cost effectiveness while being rated Unacceptable based on community effects and input including human health.

Table 6.4-4: Assessment of Processed Coal Transport Between the Minesite and the Port

Performance Objective	Transport of Processed Coal Between the Minesite and the Port via Train	Transport of Processed Coal Between the Minesite and the Port via Truck
Be Cost Effective	Train transport provides the highest net positive cashflow for the Project Rating: Preferred	Truck transport provides a net positive cashflow for the Project Rating: Acceptable
Minimize or Avoid Effects on the Natural Environment	Method will provide the lowest effects on the natural environment Rating: Acceptable	Method will provide more of effect on the natural environment than using trains Rating: Acceptable
Community Effects and Input Including Human Health	Transport method was preferred from stakeholders engaged with by Telkwa Coal Limited (TCL). This option is expected to have a lower effect on human health than the trucking option. Rating: Preferred	Transport method was not supported by majority of stakeholders engaged with by TCL and will also have higher effect on human health. Rating: Unacceptable
Overall Assessment	Rating: Acceptable	Rating: Unacceptable

6.4.5 Minesite Equipment Selection

6.4.5.1 Loading Equipment Type

Once the preferred production rate was selected for the Tenas Deposit, the type of loading equipment could be selected for the Project. The two (2) types of loading equipment assessed were a front shovel and backhoe loading equipment configuration. The following performance objectives were used in this assessment:

- ▶ be technically applicable, with system integrity, and reliability; and
- ▶ be cost effective

The following performance objectives were not expected to be relevant for this assessment:

- ▶ minimize effects on the natural environment; and
- ▶ community effects and input including human health.

6.4.5.2 Be Cost Effective

Based on available information, both loading types were determined to be equally cost effective, however, front shovels have a larger pool of experienced operators. They were both ranked as Acceptable for this performance parameter.

6.4.5.3 Be Technically Applicable, with System integrity, and Reliability

The Tenas Deposit is a moderately dipping deposit and coal seams are under 5 m in thickness. Given the size and production rate of the deposit, the loading fleet needs to be flexible enough to load rock, overburden, and coal. The backhoe loading unit was ranked as Preferred. A shovel loading unit does not have the flexibility to deal with the coal seams present at the Tenas Deposit.

6.4.5.4 Overall Assessment

As summarized in **Table 6.4-5** below, the backhoe loading unit was rated as Preferred for the performance objective of being technically applicable.

Both loading equipment types were ranked as Acceptable for cost effectiveness.

Based on the overall ratings provided in **Table 3.4-5** below, the backhoe loading type was the selected alternative. The selected alternative received an overall rating of Acceptable for technical applicability while still being cost effective.

Table 6.4-5: Assessment of Loading Equipment Type

Performance Objective	Backhoe Configured Loading Unit	Front Shovel Configured Loading Unit
Be Cost Effective	Method will provide a positive net present value for the Project. Rating: Acceptable	Method will provide a positive net present value for the Project. Rating: Acceptable
Be Technically Applicable, with System Integrity, and Reliability	Method will provide for flexibility to load rock, overburden, and coal. Also allows for cleaning of coal with same machine. Rating: Preferred	Method does not provide flexibility to deal with rock and coal and would require an additional unit for coal such as a backhoe. Rating: Acceptable
Overall Assessment	Rating: Acceptable	Rating: Acceptable

6.4.5.5 Equipment Size

With the loading equipment type selected, and the production rate determined, the size of the mining equipment fleet could then be selected for the Tenas Deposit. Several equipment sizes were reviewed and are provided below:

- ▶ 6 m³ backhoe/45 tonne trucks;
- ▶ 12 m³ backhoe/90 tonne trucks;
- ▶ 15 m³ backhoe/135 tonne trucks;
- ▶ 22 m³ backhoe/180 tonne trucks; and

- ▶ 29 m³ backhoe/205 tonne trucks.

The following performance objectives were reviewed for this assessment:

- ▶ be technically applicable, with system integrity, and reliability minimize effects on socio-economic environment; and
- ▶ be cost effective.

The following performance objectives are not expecting to be relevant for this assessment:

- ▶ amenable to reclamation;
- ▶ minimize effects on the natural environment; and
- ▶ community effects and input including human health.

6.4.5.6 Be Cost Effective

It was determined that larger equipment in general provides for a higher net present value of a project through reduced costs, so the largest set of equipment would be preferred. Most other equipment configurations provided for an Acceptable ranking for this Project except for the smallest equipment configuration which was not cost effective for the production rate selected.

6.4.5.7 Be Technically Applicable, with System Integrity, and Reliability

The Project's production equipment eliminated most of the equipment configurations as they didn't meet the requirement of having two (2) loading units operational so that one (1) unit is removing non-coal material while one (1) unit is removing coal. Only the 6 m³ and 12 m³ equipment configurations allow having two (2) units operational given the production rates determined. The other options only required one (1) loading unit which is Unacceptable. The 6 m³ had more than three (3) units required which is also deemed as Unacceptable.

6.4.5.8 Overall Assessment

As summarized in **Table 6.4-6**, the 12 m³/90 tonne equipment configuration was rated as Acceptable for the performance objective of being technically applicable and rated Acceptable for cost effectiveness.

All other loading unit and truck equipment configurations were rated as Unacceptable for technical applicability as these options did not allow for two (2) loading units which is a requirement for the production plan.

Based on the overall ratings provided in **Table 6.4-6**, the 12 m³/90 tonne equipment configuration was the selected alternative. The selected alternative received an overall rating of Acceptable for technical applicability while still being cost effective.

Table 6.4-6: Assessment of Equipment Sizes

Performance Objective	6 m ³ /45 tonne trucks	12 m ³ /90 tonne trucks	15 m ³ /135 tonne trucks	22 m ³ /180 tonne trucks	29 m ³ /205 tonne trucks
Be Cost Effective	Method does not provide a positive net present value for the Project given the Bypass Road and Rail Loop additions Rating: Unacceptable	Method will provide a positive net present value for the Project but less than largest equipment case Rating: Acceptable	Method will provide a positive net present value for the Project but less than largest equipment case Rating: Acceptable	Method will provide a positive net present value for the Project but less than largest equipment case Rating: Acceptable	Method will provide the highest positive net present value for the Project Rating: Preferred
Be Technically Applicable, with System Integrity, and Reliability	Equipment selection provides for at least two (2) loading units to allow having one (1) unit in coal and one (1) in rock or overburden Rating: Acceptable	Equipment selection provides for at least two (2) loading units to allow having one (1) unit in coal and one (1) in rock or overburden Rating: Acceptable	Equipment selection does not provide for at least two (2) loading units to allow having (1) one unit in coal and one (1) in rock or overburden Rating: Unacceptable	Equipment selection does not provide for at least two (2) loading units to allow having (1) one unit in coal and (1) one in rock or overburden Rating: Unacceptable	Equipment selection does not provide for at least two (2) loading units to allow having one (1) unit in coal and one (1) in rock or overburden Rating: Unacceptable
Overall Assessment	Rating: Unacceptable	Rating: Acceptable	Rating: Unacceptable	Rating: Unacceptable	Rating: Unacceptable

Note: m³=cubic metre

6.4.6 Coal Processing Plant (CPP) Location

With the Rail Infrastructure location selected for the Project, the CPP location could then be determined. Four (4) possible CPP locations were reviewed.

1. east side of Goathorn Creek, near property identified as Block A District A District Lot 223 Range 5 Coast District;
2. east side of Goathorn Creek, near the proposed Rail Infrastructure;
3. west side of Goathorn Creek, north of the proposed open pit; and
4. west side of Goathorn Creek, southeast of the proposed open pit.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment;
- ▶ community effects and input including human health; and
- ▶ cost effective.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ minimize effects on socio-economic environment; and
- ▶ be technically applicable, with system integrity, and reliability.

6.4.6.1 Be Cost Effective

The first parameter reviewed was the cost effectiveness of the various options. During this review, it was determined that having the CPP on the east side of Goathorn Creek would require raw coal to be hauled from the open pit across this creek using mine equipment, which would add considerable capital and operating costs to the CPP. Furthermore, the processed rock would then also need to be hauled back to the open pit area to dispose of material underwater in the management ponds. This left the two (2) options on the west side of Goathorn Creek as being rated Preferred over the two (2) other options. Between the two (2) west Goathorn options, the one (1) to the north of the proposed open pit would have lower operating costs than the one (1) to the southeast of the open pit, so the north location was rated Preferred.

6.4.6.2 Community Effects and Input Including Human Health

In discussions with stakeholders, the overall feedback was to keep the Minesite Infrastructure as far away from existing residences as possible which again made the two (2) options east of Goathorn Creek receive Unacceptable ratings. There was no preference for CPP location on the west side of the Goathorn Creek.

From a human health perspective the further Project features are away from human receptors should also correspond with lower potential effects on human health.

6.4.6.3 Minimize Effects on the Natural Environment

For assessing the four (4) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. The two (2) east Goathorn Creek CPP locations would require a larger disturbance footprint than the west Goathorn Creek options due to increased road width requirements to comply with the Code for hauling equipment transporting ROM coal and processed rock between the CPP and the open pit. So these two (2) options not only have a larger disturbance footprint they will have a higher level of activity as they require more equipment to carry out the same function. Furthermore, the east Goathorn Creek locations would require a significant bridge structure to be constructed over Goathorn Creek to allow for mining equipment to haul ROM coal to the CPP and processed rock back to the open pit. While the east Goathorn Creek options were rated Acceptable with mitigations to effects on the natural environment, the west Goathorn Creek options were rated Preferred.

6.4.6.4 Overall Assessment

As summarized in **Table 3.4-6**, the CPP location, north of the proposed open pit on the west side of Goathorn Creek was rated as Preferred for the performance objective of minimize effects to the natural environment, and cost effectiveness and Acceptable for inputs from stakeholders.

The east Goathorn Creek location located near the Rail Infrastructure was ranked as Unacceptable for cost effectiveness due to the large road cost to allow coal to be hauled to this location. The other east Goathorn location was ranked as Acceptable by TCL; however, based on community effects and input including human health this location was deemed as Unacceptable for this Project.

In terms of effect on the natural environment, the CPP located north of the proposed open pit had the lowest potential impact of the options reviewed and was rated Preferred.

Based on the overall ratings provided in **Table 6.4-7**, having the CPP located directly north of the proposed open pit on the west side of Goathorn Creek was the selected alternative. The selected alternative received an overall rating of Preferred for minimizing effects on the natural environment and support from stakeholders while still being cost effective.

Table 6.4-7: Assessment of Coal Processing Plant (CPP) Location

Performance Objective	CPP Located on West Side of Goathorn Creek, North of Proposed Open Pit	CPP Located on West Side of Goathorn Creek, Southeast of Proposed Open Pit	CPP Located on East Side of Goathorn Creek	CPP Located on East Side of Goathorn Creek, Adjacent to Rail Infrastructure
Be Cost Effective	This option provided the highest net present value to the Project. Rating: Preferred	This option provided an acceptable net present value for the Project. Rating: Acceptable	This option provided an acceptable net present value for the Project. Rating: Acceptable	This option did not provide an acceptable net present value for the Project due to its high capital cost for road development. Rating:

Performance Objective	CPP Located on West Side of Goathorn Creek, North of Proposed Open Pit	CPP Located on West Side of Goathorn Creek, Southeast of Proposed Open Pit	CPP Located on East Side of Goathorn Creek	CPP Located on East Side of Goathorn Creek, Adjacent to Rail Infrastructure
				Unacceptable
Minimize or Avoid Effects on the Natural Environment	This option provided smallest disturbance footprint and potential environmental impact and related effects. Rating: Preferred	This option provided the second smallest disturbance footprint and potential environmental impact. Rating: Acceptable	This option had a moderate level of disturbance and should be able to be mitigated. However, this option requires ROM coal and processed rock to be hauled further. Rating: Acceptable	This option had the highest additional disturbance but still should be able to be mitigated. This option requires mine equipment to haul ROM mine coal and processed rock at the furthest distance of the three (3) options. Rating: Acceptable
Community Effects and Input Including Human Health	No real concerns from engagement. Human health should be better for this option than east options due to distance from human receptors. Rating: Acceptable	No real concerns from engagement. Human health should be better for this option than east options due to distance from human receptors Rating: Acceptable	Concerns with proximity of the CPP to property owners due to dust and noise. Rating: Unacceptable	Concerns with proximity of the CPP to the Bulkley River. Also, the requirement to haul both ROM coal to the CPP and processed rock back to the open pit. Rating: Acceptable
Overall Assessment	Rating: Preferred	Rating: Acceptable	Rating: Unacceptable	Rating: Acceptable

Note: CPP=Coal Processing Plant

6.4.7 Rail Infrastructure Location

TCL conducted an extensive trade-off assessment of possible Rail Infrastructure locations noting that in designs proposed to the community the location of the rail and potential effects on private property were viewed as undesirable by community members. A limitation placed on this assessment was the requirement by CNR that the selected rail option had to accommodate a 116-car unit train with three (3) locomotives. This requirement limited the options that were feasible for the review undertaken by TCL. The following options were reviewed to determine the preferred location:

- ▶ Rail Loop on private land parcel east of Lawson Road;
- ▶ Rail Loop on Crown land parcel east of Lawson Road;
- ▶ Rail Loop on Crown land west of Lawson Road;
- ▶ linear siding along existing CNR ROW; and

- ▶ linear siding on Crown land west of Lawson Road.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment;
- ▶ community effects and input including human health; and
- ▶ cost effective.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ be technically applicable, with system integrity, and reliability.

6.4.7.1 Be Cost Effective

TCL completed a capital cost comparison of the five (5) options as the operating cost was expected to be similar for these methods. Based on this review the capital cost for the options for highest to lowest are summarized below:

- ▶ linear siding on Crown land west of Lawson Road;
- ▶ Rail Loop on Crown land west of Lawson Road;
- ▶ linear siding along existing CNR ROW;
- ▶ Rail Loop on Crown land parcel east of Lawson Road; and
- ▶ Rail Loop on private land parcel east of Lawson Road.

6.4.7.2 Minimize Effects on the Natural Environment

For assessing the five (5) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. It is expected that the options with higher disturbance footprints will potentially also have the greatest effect on the natural environment and the options ranked in order of disturbance area requirements are summarized below:

- ▶ linear siding on Crown land west of Lawson Road;
- ▶ Rail Loop on Crown land west of Lawson Road;
- ▶ Rail Loop on Crown land parcel east of Lawson Road;
- ▶ Rail Loop on Private land parcel east of Lawson Road; and
- ▶ linear siding along existing CNR ROW.

In the review it was found that the Rail Loop on the Crown land parcel east of the Lawson Road has a significant archeology site which would be completely disturbed by the proposed Rail Loop. Also, this location would require significant earthworks and excavation to construct the proposed infrastructure. Based on these requirements this option was rated as Unacceptable.

6.4.7.3 Community Effects and Input Including Human Health

During the engagement stage of the Project, TCL heard clearly that community members did not want the Rail Infrastructure on their private property, and they wanted the Rail Infrastructure to be located as far away from Telkwa as possible. This requirement eliminated several other alternatives that were initially of interest. Based on a review of the engagement input, all the options reviewed were Acceptable except for the loop on Crown land east of Lawson Road, as the property owners immediately east of the proposed loop were very concerned by the proposed location and noise. Besides this one (1) option, the options that had less disturbance and avoided crossing Lawson Road seemed to be favoured.

All options are expected to have a similar effect on human health due to the similar level of activity.

6.4.7.4 Overall Assessment

As summarized in **Table 6.4-8**, the Rail Loop located adjacent to the CNR line on private land was rated as Preferred for the performance objective of cost effectiveness and was rated Acceptable for both minimize effects to the natural environment, and inputs from stakeholders.

The Rail Loop on Private land parcel east of Lawson Road was ranked as Preferred for cost effectiveness while the Rail Loop on Crown land was rated as Acceptable.

The following three (3) rail locations were ranked as Unacceptable for cost effectiveness:

1. linear siding adjacent to the CNR mainline;
2. linear siding near Goathorn Creek west of Lawson Road; and
3. Rail Loop west of Lawson Road.

Based on the overall ratings provided in **Table 6.4-8**, the Rail Loop adjacent to the CNR line on private land was the selected alternative. The selected alternative was deemed Acceptable for minimizing effects on the natural environment and support from stakeholders while still being cost effective.

Table 6.4-8: Assessment of Processed Coal Transport Between the Minesite and the Port

Performance Objective	Loop Adjacent to CNR Mainline on Private Land	Loop Adjacent to CNR Mainline on Crown Land	Loop West of Lawson Road on Crown Land	Linear Siding Adjacent to the CNR Mainline	Linear Siding Near Goathorn Creek West of Lawson Road
Be Cost Effective	This option provided the highest net present value to the Project. Rating: Preferred	This option provided an acceptable net present value for the Project. Rating: Acceptable	This option did not provide an acceptable net present value for the Project due to its high capital cost compared to the Project's size. Rating: Unacceptable	This option did not provide an acceptable net present value for the Project due to its high capital cost compared to the Project's size. Rating: Unacceptable	This option did not provide an acceptable net present value for the Project due to its high capital cost compared to the Project's size. Rating: Unacceptable
Minimize or	This option	This option	This option	This option had	This option has

Performance Objective	Loop Adjacent to CNR Mainline on Private Land	Loop Adjacent to CNR Mainline on Crown Land	Loop West of Lawson Road on Crown Land	Linear Siding Adjacent to the CNR Mainline	Linear Siding Near Goathorn Creek West of Lawson Road
Avoid Effects on the Natural Environment	provides the second lowest amount of disturbance of all options. The only drawback is this option is within the 1 and 200-year flood plain for the Bulkley River. CNR states that their line has never been impacted by floods in this area. Rating: Acceptable	provides a low amount of disturbance, but it is greater than the private land option and is considerably more costly to build. Also, it is very close to two residences on the east side. Lastly it disturbs a significant archaeology feature. Rating: Unacceptable	has a moderate level of disturbance and should be able to be mitigated. Rating: Acceptable	the lowest additional disturbance due to it being within the CNR ROW. Rating: Preferred	a moderate level of disturbance and should be able to be mitigated. Rating: Acceptable
Community Effects and Input Including Human Health	No real concerns except the flood plain effects Rating: Acceptable	Property owners east of the development were very concerned by this development due to its proximity to their houses. Rating: Unacceptable	No real concerns except the crossing of the Lawson Road and additional disturbance Rating: Acceptable	Option seemed preferred by stakeholder's engagement due to lower disturbance footprint Rating: Preferred	No real concerns except the crossing of the Lawson Road and additional disturbance Rating: Acceptable
Overall Assessment	Rating: Acceptable	Rating: Unacceptable	Rating: Unacceptable	Rating: Unacceptable	Rating: Unacceptable

Note: CNR=Canadian National Railway; ROW=right-of-way

6.4.8 Processed Coal Transport Between the Coal Processing Plant (CPP) and Rail Infrastructure

With the Rail Infrastructure and CPP locations selected, the transport method for transporting processed coal between the CPP and Rail Infrastructure location can be determined. Three (3) possible transport methods were reviewed:

1. truck haulage;
2. conveyor haulage; and
3. slurry pipeline transport.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment; and
- ▶ cost effective.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ be technically applicable, with system integrity, and reliability; and
- ▶ community effects and input including human health.

6.4.8.1 Minimize Effects on the Natural Environment

For assessing the three (3) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. Of the three (3) options, it is expected that the truck haulage will have the largest disturbance footprint of the three (3) options; however, the slurry pipeline option will require a large increase in water usage to allow processed coal to be transported to the Rail Infrastructure.

6.4.8.2 Be Cost Effective

Conveyor transport provides the lowest operating cost of the three (3) methods; however, due to the low production rate, it has lower overall benefit due to the high capital cost associated with using a conveyor. A slurry pipeline is also capital intensive due to the large dewatering infrastructure required at the Rail Infrastructure and additional water use infrastructure. Truck haulage provides the highest net present value of the three (3) options.

6.4.8.3 Overall Assessment

As summarized in **Table 6.4-9** below, processed coal transport via truck haulage was rated as Preferred for the performance objective of minimize effects to the natural environment, and cost effectiveness.

The other two (2) options were rated lower on cost effectiveness even though both have a lower operating cost, but their capital cost far outweighs their operating cost.

Based on the overall ratings provided in **Table 6.4-9** having processed coal transported via truck haulage is the selected alternative. The selected alternative has an overall rating of Acceptable for minimizing effects on the natural environment, while still being cost effective.

Table 6.4-9: Assessment of Processed Coal Transport Between the Coal Processing Plant (CPP) and Rail Infrastructure

Performance Objective	Processed Coal Transport via Truck from the Plant To Rail Infrastructure	Processed Coal Transport via Slurry Pipeline from the CPP To Rail Infrastructure	Processed Coal Transport via Conveyor from the CPP to Rail Infrastructure
Be Cost Effective	This option provided the highest net present value to the Project for the production rate. Rating: Preferred	This option provided the net present value for the Project of the three (3) options. Rating: Acceptable	This option provided an acceptable net present value for the Project for the production rate. This option would be preferred at higher production rates Rating: Acceptable
Minimize or Avoid Effects on the Natural Environment	This option provides largest disturbance footprint and potential environmental impact which can be mitigated. Rating: Acceptable	This option provides the second smallest disturbance footprint, however due to the large water use increase this option would likely have the highest potential impact. Rating: Unacceptable	This option has a moderate level of disturbance and should be able to be mitigated. Rating: Acceptable
Overall Assessment	Rating: Preferred	Rating: Unacceptable	Rating: Acceptable

Note: CPP=Coal Processing Plant

6.4.9 Processed Coal Truck Haul and Project Access

With the transport method for delivering processed coal between the CPP and Rail Infrastructure selected, a review of possible processed coal haulage routes were reviewed, and a preferred route selected. Several possible transport methods were reviewed:

- ▶ Use only the existing road network including provincial, municipal, and private roads, and FSRs;
- ▶ Use the existing road network including provincial, municipal, and private roads, and FSR, and improvement of an existing FSR accessing the west side of the Project;
- ▶ Use the existing road network including only forestry and private service roads and construction of a new access road (Bypass Road) to avoid Telkwa; and
- ▶ Use the existing road network including provincial, municipal, and private roads, and FSR and construction of a new access road accessing the west side of the Project over Tenas Creek and construction of a new access road (Bypass Road) to avoid Telkwa.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment;

- ▶ community effects and input including human health; and
- ▶ cost effective.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ be technically applicable, with system integrity, and reliability.

6.4.9.1 Minimize Effects on the Natural Environment

For assessing the four (4) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. The options with the lowest increased footprint are also expected to have the lowest possible effect on the natural environment including Surface Water (water quality), Vegetation, and Atmospheric VCs. Based on this, using the existing road network was rated Preferred as there is very little increased disturbance associated with this option. However, this option is unacceptable to the community. The largest disturbance footprint option is the fourth option listed above and is the least acceptable option as two (2) newly constructed access roads are required for this option. The other two (2) options are similar in disturbance footprint with the new access road option to avoid Telkwa having a slightly higher disturbance footprint and both were rated as having an Acceptable effect.

6.4.9.2 Community Effects and Input Including Human Health

During TCL's extensive consultation with the community, it was clear residents and elected officials did not want the processed coal haul route to use the existing road network through town due to safety concerns. Furthermore, the option of having a coal haul along Telkwa Coalmine Road was similarly not welcomed due to the processed coal haul being near a subdivision of houses identified as Cottonwood. This consultation basically eliminated three (3) of the four (4) options available. Only the option that involves constructing the road that avoids Telkwa and the subdivision is a valid option.

6.4.9.3 Cost Effective

Again, the option that uses the existing roads is the preferred option as it gives the Project the highest net present value. The other options in descending order of value to the Project are as follows:

- ▶ Use the existing road network and construction of a new road accessing the west side of the Project over Tenas Creek;
- ▶ Use the existing road network and construction of a new road to avoid Telkwa; and
- ▶ Use the existing road network and construction of a new road accessing the west side of the Project over Tenas Creek and construction of a new road to avoid Telkwa.

6.4.9.4 Overall Assessment

As summarized in **Table 6.4-10** below, the option of using existing roads with the newly constructed road bypassing the Village of Telkwa was rated the only Acceptable option.

The existing road option is rated Acceptable from both an economic and environmental performance objectives but is rated Unacceptable to the local community. Similarly, the other two (2) options both

require interaction with residents in Telkwa which is rated Unacceptable based on the engagement conducted to date.

Based on the overall ratings provided in **Table 6.4-10** having processed coal trucked on existing roads with a newly constructed bypass road is the selected alternative. The selected alternative has an overall rating of Acceptable for minimizing effects on the natural environment, while still being cost effective.

Table 6.4-10: Assessment of Processed Coal Transport Between the Plant and Rail Infrastructure

Performance Objective	Use Existing Road Network including Provincial, Municipal, and Private Roads, and Forestry Service Roads (FSR) and Improvement of an Existing FSR Accessing the West Side of the Project	Use Existing Road Network Including Private Roads and FSRs and Construction of a New Access Road (Bypass Road) to Avoid Telkwa	Use Existing Road Network including Provincial, Municipal, and Private Roads, and FSRs and Improvement of an Existing FSR Accessing the West Side of the Project and Construction of a New Road (Bypass Road) to Avoid Telkwa	Use only Existing Road Network and Required Improvement including Provincial, Municipal, and Private Roads, and FSRs
Be Cost Effective	This option provided an acceptable net present value for the Project for the production rate. Rating: Acceptable	This option provided an acceptable net present value for the Project for the production rate. Rating: Acceptable	This option provided and the lowest net present value for the Project for the production rate. Rating: Acceptable	This option provided the highest net present value to the Project for the production rate. Rating: Preferred
Minimize or Avoid Effects on the Natural Environment	This option provides the second smallest disturbance footprint of the options review and should also have the lowest effect on various VCs. Rating: Acceptable	This option provides the third smallest disturbance footprint and potential environmental effects Rating: Acceptable	This option provides the largest disturbance footprint and is expected to have the largest potential environmental effect on a many different VCs. Rating: Unacceptable	This option provides the smallest disturbance footprint as no new access roads are constructed and limited improvements would be completed on the forestry and private service roads within the Goathorn Creek Valley. The option would require infrastructure mitigations to deal with the increased traffic levels on provincially controlled roads to deal with pedestrian and bike safety. Rating: Preferred
Community Effects and Input Including Human Health	This option is not preferred by the community due to having haul traffic go by Cottonwood subdivision on Telkwa Coalmine Road. Rating: Unacceptable	This is the only option based on feedback from the community that is acceptable. Rating: Preferred	This option is not preferred by the community due to having haul traffic go by Cottonwood subdivision on Telkwa Coalmine Road. Rating: Unacceptable	This option is not preferred by the community due to having haul traffic go by Cottonwood subdivision on Telkwa Coalmine Road and having haul traffic go through west portion of the village of

Performance Objective	Use Existing Road Network including Provincial, Municipal, and Private Roads, and Forestry Service Roads (FSR) and Improvement of an Existing FSR Accessing the West Side of the Project	Use Existing Road Network Including Private Roads and FSRs and Construction of a New Access Road (Bypass Road) to Avoid Telkwa	Use Existing Road Network including Provincial, Municipal, and Private Roads, and FSRs and Improvement of an Existing FSR Accessing the West Side of the Project and Construction of a New Road (Bypass Road) to Avoid Telkwa	Use only Existing Road Network and Required Improvement including Provincial, Municipal, and Private Roads, and FSRs
				Telkwa. Rating: Unacceptable
Overall Assessment	Rating: Unacceptable	Rating: Acceptable	Rating: Unacceptable	Rating: Unacceptable

6.4.10 Coal Storage at Rail Infrastructure

The method of storing coal for the Project was reviewed and determined. Two (2) possible options were reviewed:

1. uncovered stockpiles; and
2. covered stockpiles.

The following performance objectives were reviewed for this assessment:

- ▶ cost effective;
- ▶ community effects and input including human health; and
- ▶ minimize effects on the natural environment.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ be technically applicable, with system integrity, and reliability.

6.4.10.1 *Cost Effective*

Given the small size of the Project, covering the proposed stockpiles is very costly. It is felt the use of dust suppression agents on the uncovered coal stockpiles will provide acceptable dust fall levels due to the Project which is demonstrated by the large open coal stockpiles present at the three (3) port terminals in western Canada which are close to population centers.

6.4.10.2 *Community Effects and Input Including Human Health*

Covered stockpiles are rated Preferred over open stockpiles based on TCL's engagement with the community. This option would have a slightly lower qualitative effect on human health outside of the Project Area but it would not be a measurable difference between the two (2) options reviewed.

6.4.10.3 *Minimize Effects on the Natural Environment*

For rating the effect of these two (2) options on the natural environment, dust and noise emissions and subsequent potential effects to water quality and fish and fish habitat were considered the most relevant factors for ranking the options provided. Both methods have acceptable effects on the natural environment, however the covered stockpile method has a lower effect on the natural environment due to lower dust fall levels, and potential effects to water quality so it is rated Preferred.

6.4.10.4 *Overall Assessment*

As summarized in **Table 6.4-11** below, the option of using uncovered processed coal stockpile haulage is the preferred option, though they both received an overall rating of Acceptable.

While covered stockpiles have a reduced environmental effect and is favored by the community, the high capital cost associated with covering these stockpiles rules covered stockpiles out.

Based on the overall ratings provided in **Table 6.4-11** uncovered processed coal stockpiles at the Rail Infrastructure is the selected alternative. The selected alternative has an overall rating of Acceptable for minimizing effects on the natural environment, while still being cost effective.

Table 6.4-11: Assessment of Coal Storage at Rail Infrastructure

Performance Objective	Covered Stockpiles	Uncovered Stockpiles
Be Cost Effective	Capital cost is not supported by Project economics at the current production rate. At a higher production rate covered stockpiles become more feasible. Rating: Unacceptable	Method has the highest net present value for the Project. Rating: Preferred
Minimize or Avoid Effects on the Natural Environment	Method will provide a lower effect to the environment from less dust generation and visual effects. Rating: Preferred	Method will provide more effect on the natural environment than a covered stockpile scenario however with a robust dust control plan this method should result in only minor increases in dust fall levels. Due the size of the Rail Loadout and the temporary nature of the processed coal water quality in the Bulkley River is not predicted to be measurably affected by the coal storage. Rating: Acceptable
Community Effects and Input Including Human Health	Covered stockpiles are favored by community. Rating: Preferred	Open stockpiles are not as favoured by community but is deemed acceptable with mitigations. Rating: Acceptable
Overall Assessment	Rating: Unacceptable	Rating: Acceptable

6.4.11 Fine Processed Rock Dewatering

The selected CPP produces three (3) material streams from the ROM coal feed into it. Stream one (1) is processed coal which is transported offsite to market, fine processed rock, and coarse processed rock. A preferred option selection for the handling of fine processed rock is done based on the following options:

- ▶ standard wet disposal of fine processed rock into the management ponds; and
- ▶ reduce water content of fine processed rock and combine with coarse processed rock for disposal via loaders and trucks into the management ponds.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment; and
- ▶ cost effective.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ be technically applicable, with system integrity, and reliability; and
- ▶ community effects and input including human health.

6.4.11.1 Minimize Effects on the Natural Environment

For assessing the two (2) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. The conventional wet disposal of fine processed rock is expected to have a greater potential effect to the natural environment versus the dry stack methodology as wet disposal will require a larger impoundment and subsequently a larger footprint requirement. Selecting the dry stack system for fine processed rock reduces the amount of makeup water required by the CPP by up to an additional 150 L/tonne of ROM coal processed by the CPP or an additional 15,000 m³ per month in addition to the current consumption rate of 15,000 m³ per month. Furthermore, by not having wet disposal fine processed rock allows the Project to avoid the construction, operation, and maintenance of a dedicated tailings storage facility and associated embankments. Based on these two (2) reasons, the lack of easy groundwater sources, and the goal of the Project to minimize water use and resultant effects on the natural environment, the standard wet fine processed rock (tailings) approach was ruled out.

6.4.11.2 Cost Effective

Both options have very similar cost structure with the standard wet disposal method having a slight economic advantage over the dry stacking and haulage method.

6.4.11.3 Overall Assessment

As summarized in **Table 6.4-12** below, the option of using dry stacked fine processed coal with haulage is rated Acceptable for cost effectiveness and Preferred for minimizing or avoiding effects on the natural environment.

Both options have a similar cost structure, however as the dry stack methodology requires less water it is deemed to have a lower effect on the natural environment.

Based on the overall ratings provided in **Table 6.4-12** dry stacking the fine processed rock and combining it with coarse processed rock for disposal is the selected alternative. The selected alternative has an overall rating of Preferred for minimizing effects on the natural environment, while still being cost effective.

Table 6.4-12: Assessment of Processed Coal Transport between the Minesite and the Port

Performance Objective	Standard Wet Disposal of Fine Processed Rock	Dry Stack of Fine Processed Rock and Disposal with Loaders and Truck
Be Cost Effective	Method has a similar cost structure to dry stack; however, method is slightly less expensive. Rating: Acceptable	Method has a similar cost structure to wet disposal. Rating: Acceptable

Performance Objective	Standard Wet Disposal of Fine Processed Rock	Dry Stack of Fine Processed Rock and Disposal with Loaders and Truck
Minimize or Avoid Effects on the Natural Environment	Method will provide more of effect on the natural environment than using dry stack due to increased water demands. Also, this method is expected to require a larger disturbance area and potential effects on the environment due to this. Rating: Acceptable	Method will provide the lowest effects on the natural environment. Rating: Preferred
Overall Assessment	Rating: Acceptable	Rating: Preferred

6.4.12 Potentially Acid Generating (PAG) Management Methodology

Managing PAG material is the most important trade-off analysis conducted for this Project. Five (5) possible management options were reviewed:

1. blending of PAG and non-PAG material in correct proportions and methodology to prevent ARD;
2. active treatment of acidic drainage produced from PAG material;
3. passive treatment of acidic drainage produced from PAG material;
4. implement dry covers on the PAG material to limit oxygen and water ingress to prevent ARD; and
5. implement wet covers on the PAG material to limit oxygen ingress to prevent ARD.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment;
- ▶ community effects and input including human health;
- ▶ cost effective; and
- ▶ be technically applicable, with system integrity, and reliability.

In addition to this subsection completed by TCL, SRK was commissioned to further explore options for the management of PAG material and the results are provided in **Appendix 1.0-Q SRK, Tenas Project PAG Management Alternatives Assessment Memo**. In summary, SRK reached the same conclusion as TCL that a water cover and source control was the preferred methodology for the management of PAG for this Project.

6.4.12.1 *Minimize Effects on the Natural Environment*

Options that prevent ARD from occurring regardless of footprint requirements were ranked as preferred in terms of minimizing potential effects on the natural environment as these will have better water quality results than options that produce ARD and subsequently affecting receptors such as fish and fish habitat, vegetation and wildlife selecting these options. Next, options that treat all effluent back to pre-mining conditions are ranked next highest as these should prevent downstream water quality effects from the

Project due to the generation of ARD. Options that do not have treatment and still have the potential for ARD occurring from PAG material were ranked as Unacceptable

6.4.12.2 *Be Technically Applicable, with System Integrity, and Reliability*

The key aspect for this evaluation was the requirement of the method selected to work for the managing PAG material. After an extensive review, the blending option of mixing PAG and non-PAG material while being theoretically possible was deemed to unacceptable given the large volumes of PAG material and low NPR values of this material. The blending required to make this method work would need to be near ideal conditions which is not a commitment that can be met by the Project. Due to the volume of effluent and the concentrations of metals in the discharge from the PAG material once ARD occurs being too high for passive treatment systems to work effectively so this method was ruled out. Active treatment and putting in place a wet cover were both ranked the highest from a technically applicable system for management the PAG material and/or effluent from PAG material. With dry covers it is also difficult to achieve 100% effectiveness for stopping ARD due to the ability of oxygen to still access material and cause oxidization, though at very reduced rates.

6.4.12.3 *Community Effects and Input Including Human Health*

In discussions with the community the preference was to have a PAG management method that prevented ARD and subsequent ARD treatment in perpetuity. This is based on experience in the region with Equity Silver which as an active treatment system for ARD. The next most common feedback from stakeholders was that TCL needs to have as robust a methodology for preventing ARD as possible. Based on these discussions, a water cover was viewed as the preferred methodology.

Human health is likely most affected by options that generate ARD and the chance of people coming into contact with this effluent.

6.4.12.4 *Cost Effective*

Again, the methods that prevented ARD while having a higher upfront cost had a lower total cost of treatment over the life of dealing with ARD given the long time frames involved and associated uncertainty. The blending option is the lowest cost option if it can be technically completed, while active treatment has one of the highest costs for managing PAG material due to the subsequent ARD treatment requirements.

6.4.12.5 *Overall Assessment*

As summarized in **Table 6.4-13** below, the option of using water covers is the only option with an Acceptable rating of the options analyzed for managing PAG material for this Project.

Two (2) of the options are not technically feasible, those being using blending and passive treatment.

Options that resulted in ARD had the least acceptance from the community and had the highest cost profile of the options reviewed.

Based on the overall ratings provided in **Table 6.4-13** using a water cover is the selected alternative. The selected alternative has an overall rating of Preferred for technical reliability, while still being cost effective and open to acceptance by community input.

Table 6.4-13: Potentially Acid Generating (PAG) Material Management Alternatives Assessment

Performance Objective	Blending of Potentially Acid Generating (PAG) and Non-PAG Material in Correct Proportions and Methodology to Prevent Acid Rock Drainage (ARD)	Active Treatment of Acidic Drainage Produced from PAG Material	Passive Treatment of Acidic Drainage Produced from PAG Material	Implement Dry Covers on the PAG Material to Limit Oxygen and Water Ingress to Prevent ARD	Implement Wet Covers on the PAG Material to Limit Oxygen Ingress to Prevent ARD
Be cost effective	This option results in the highest net present value for the Project. Rating: Preferred	This option is the most expensive option and would result in the lowest net present value for the Project. Rating: Unacceptable	This method has one of the lowest cost profiles. Rating: Acceptable	This method has an acceptable net present value for the Project. Rating: Acceptable	This method has an acceptable net present value for the Project. Rating: Acceptable
Minimize or avoid effects on the natural environment	Method will provide a lower effect to the environment as it has the lowest additional disturbance footprint of all methods selected. However, due to the technical applicability there is good chance this method may result in ARD and resultant effects on water quality which rates this option as Unacceptable. Rating: Unacceptable	Method may have an effect to surrounding environment for water quality if acidic effluent is not contained to the Project footprint. It is difficult to contain 100% of water in any impoundment or structure and hence there is a risk that acidic effluent will seep into the groundwater system and therefore this option is ranked as Unacceptable. Rating: Unacceptable	Method may have an impact to surrounding environment if acidic effluent is not contained. Again, like active treatment, it is difficult to contain 100% of water in any impoundment or structure and hence there is a risk that acidic effluent will seep into the groundwater system and therefore this option is ranked as Unacceptable. Rating: Unacceptable	This method has a high disturbance footprint due to requiring all material to be adequately covered to limit oxygen and water ingress. Due to the likelihood that ARD may still occur with this method over time and resultant acidic discharge and treatment this method has been ranking as Unacceptable. Rating: Unacceptable	This method has a high disturbance footprint and is the only option that has 100% effectiveness in stopping ARD from occurring for the Project and resultant downstream water quality issues. Rating: Preferred
Be technically applicable, with system integrity, and reliability	The method while theoretically possible, cannot be guaranteed to not have localized ARD. Rating: Acceptable	This is a proven method for the treatment of effluent in BC. Rating: Unacceptable	This method is not proven for the volumes of effluent that would require treatment. Rating Unacceptable	This option is deemed technically feasible but again would be difficult to guarantee 100% effectiveness. Rating Acceptable	This is the only option that is 100% effective and is considered the gold standard for the permanent storage of PAG material. Rating: Preferred
Community effects and input including human health	This option was not accepted by the community in past submissions.	This option was not preferred by community due to experience at	This option was not acceptable to the community due to the	This option was preferred and was most acceptable option.	This option was preferred but was the second most accepted option.

Performance Objective	Blending of Potentially Acid Generating (PAG) and Non-PAG Material in Correct Proportions and Methodology to Prevent Acid Rock Drainage (ARD)	Active Treatment of Acidic Drainage Produced from PAG Material	Passive Treatment of Acidic Drainage Produced from PAG Material	Implement Dry Covers on the PAG Material to Limit Oxygen and Water Ingress to Prevent ARD	Implement Wet Covers on the PAG Material to Limit Oxygen Ingress to Prevent ARD
	Rating: Unacceptable	Equity Silver. Rating: Unacceptable	limitations of the method. Rating: Unacceptable	Rating: Acceptable	Rating: Acceptable
Overall Assessment	Rating: Unacceptable	Rating: Unacceptable	Rating: Acceptable	Rating: Acceptable	Rating: Acceptable

Notes: %=percent; BC=British Columbia; ARD=acid rock drainage; PAG=potentially acid generating

6.4.13 Water Cover Methodology

Having selected the preferred method for mitigating potential ARD from PAG material by using a water cover to prevent oxidization, next, the method for providing a water cover was reviewed and selected. Four (4) possible water cover options were reviewed:

1. Use an existing water body for a cover;
2. Create a water cover using impoundment structures or dams;
3. Create a water cover using a combination of dams and excavations; and
4. Create a water cover using only excavations.

The following performance objectives were reviewed for this assessment:

- ▶ minimize effects on the natural environment;
- ▶ community effects and input including human health;
- ▶ cost effective; and
- ▶ be technically applicable, with system integrity, and reliability.

The following performance objectives were not expected to be relevant for this assessment:

6.4.13.1 *Be Technically Applicable, with System Integrity, and Reliability*

Of the options reviewed creating a water cover using only excavations proved to be technically impossible due to the topography for the Project and the amount of PAG material that needed to be stored. Furthermore, there is no existing water body in the Project's area that technically can be used. Both options were assessed as unacceptable for this category. The remaining two (2) options were both viewed as technically applicable for establishing a water cover.

6.4.13.2 *Community effects and Input Including Human Health*

The clear input from the community was that using an existing water body for the storage of PAG material was not acceptable even if it was available for the Project, so this option was deemed Unacceptable. The other aspect of concern was the presence of large water reservoirs constructed using embankments versus excavations. Based on this, the water cover using excavations only was preferred. The other two (2) options were deemed Acceptable with appropriate mitigations and controls in place. Human health is neutral to the four (4) options presented except it is expected the options with higher disturbance footprints would potentially have higher potential effect on human health.

6.4.13.3 *Minimize Effects on the Natural Environment*

For assessing the four (4) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. In terms of minimizing the effects on the natural environment, using an existing water body would have the lowest impact in terms of disturbance footprint as it does not require one for the water cover. However using an existing water body would potentially negatively effect fish and fish habitat values. Using water covers with only dams and excavations has the least effect on the natural environment due to have the lowest disturbance footprint.

Using just excavations was rated worse than the combination of impoundments and excavations option due to the larger footprint and activity required to implement this option. Only using impoundment was rated as the worst option when considering effect on the natural environment as the excavated open pit cannot be used for the creation of a water cover which would dramatically increase the amount of footprint that would be required for this option.

6.4.13.4 *Cost Effective*

From a cost point of view the options are rated from lowest cost to highest as follows:

- ▶ using an existing water body;
- ▶ using only embankments;
- ▶ using a combination of embankments and excavations; and
- ▶ using only excavations.

6.4.13.5 *Overall Assessment*

As summarized in **Table 6.4-14** below, the option of using a combination of embankments and excavations for the creation of a water cover is viewed as preferred.

Two (2) of the options are not technically feasible, those being of using an existing water body and using only excavations for the storage of PAG material.

One (1) option was rejected by the community based on engagement completed, which was the option of using an existing water body.

Based on the overall ratings provided in **Table 6.4-14** using a combination of embankment and excavations is the selected alternative. The selected alternative has an overall rating of Preferred for minimizing effects on the natural environment, while still being technically possible and cost effective.

Table 6.4-14: Assessment of Water Cover Methodology

Performance Objective	Using an Existing Water Body	Using Excavations Only	Using Embankments Only	Using a Combination of Embankments and Excavations
Be Cost Effective	This option results in the highest net present value for the Project. Rating: Preferred	This method has an acceptable net present value for the Project but is more expensive than the combination of embankment and excavation option. Rating: Acceptable	This method has an acceptable net present value for the Project but is more expensive than the combination of embankment and excavation option. This option is the most expensive option and would result in the lowest net present value for the Project. Rating:	This method has an acceptable net present value for the Project. Rating: Acceptable

Performance Objective	Using an Existing Water Body	Using Excavations Only	Using Embankments Only	Using a Combination of Embankments and Excavations
			Unacceptable	
Minimize or Avoid Effects on the Natural Environment	Method will provide the lowest effect to the environment due to the lowest increase in incremental land disturbance of the four (4) options selected. Rating: Preferred	Method will have the second highest effect on the natural environment due to having the largest disturbance footprint required and subsequent environmental effects to store excavated materials. Rating: Acceptable	This method has the highest effect on the environment due to the disturbance required for the storage requirements for potentially acid generating (PAG) material and largest impoundments required. This method would also not allow the use of the mined-out open pit for creation of a water cover. Furthermore, this option would have the largest amount of equipment requirements and subsequent emissions. Rating: Unacceptable	This method has the third highest effect on the environment due to utilizing the excavated open pit for storing some of the PAG material underwater Rating Acceptable
Be Technically Applicable, with System Integrity, and Reliability	The current Project area does not have a current water body that can be used. Rating: Acceptable	The Project Area can be modified to adequately store all material without the need for dams. Rating: Acceptable	This option is deemed technically feasible and is an option used throughout the world for the long-term storage of reactive materials at mine sites. Rating Acceptable	This option is deemed technically feasible and is an option used throughout the world for the long-term storage of reactive materials at mine sites. It has the advantage of using a planned open pit for some of the storage requirements. Rating Acceptable
Community Effects and Input Including Human Health	This option was not accepted by the community. Rating: Unacceptable	This was the preferred option by the community due to low risk of failures. Rating: Preferred	This option was not preferred but acceptable to the community. Rating: Acceptable	This option was not preferred but was the second most accepted option. Rating: Acceptable
Overall Assessment	Rating: Unacceptable	Rating: Acceptable	Rating: Unacceptable	Rating: Acceptable

6.4.13.6 Administration and Mine Dry Location

There are two (2) locations for placing this infrastructure either offsite, or near the CPP and Maintenance Facility onsite to have most of this infrastructure to take advantage of existing process water, sewage handling and electrical systems.

The following performance objectives were review for this assessment;

- ▶ cost effective; and
- ▶ be technically applicable, with system integrity, and reliability.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ community effects and input including human health, and
- ▶ minimize effects on the natural environment.

6.4.13.7 Be Technically Applicable, with System Integrity, and Reliability

Of the two (2) options having this infrastructure onsite is viewed the preferred method as it allows the workforce to be stationed a lot closer to the mining operation, CPP and Maintenance Facility. If the infrastructure is located offsite, the workforce will need to be transported to their place of work. While this is not preferred it is acceptable as other mines have demonstrated that an operation can be successful even with a remote Administration and Mine Dry Facility.

6.4.13.8 Cost Effective

Of the two (2) options, basing the infrastructure in town should have a lower cost both operating and capital versus having these based onsite due to elimination of the Potable Water Treatment Plant and the Sewage Treatment Plant and underground distribution lines. These will be offset by an increased cost required to tie into the Telkwa Village sewage and potable systems. In addition the timeline for basing this infrastructure in town is expected to take longer due to complying with bylaw and zoning requirements. However, basing the infrastructure offsite is expected to have a preferred rating.

6.4.13.9 Overall Assessment

As summarized in **Table 6.4-15** below, the option of basing the Administration and Mine Dry onsite was selected.

Both options are considered Acceptable to this application with onsite being preferred from a technical applicability and offsite being preferred from a cost side of review. TCL decided to keep the Administration and Mine Dry onsite to ensure they were included in the EA as if they were located with the Village of Telkwa using an existing lot, they would not be part of the assessment.

Based on the overall ratings provided in **Table 6.4-15** basing the Administration and Mine Dry onsite was selected as it has an Acceptable rating and can be part of the overall EA for the Project.

Table 6.4-15: Assessment of Administration and Mine Dry Location

Performance Objective	Administration and Mine Dry Infrastructure Based Onsite	Administration and Mine Dry Infrastructure Based Offsite
Be Cost Effective	This option results in a lower net present value for the Project but is still acceptable as incremental cost is not significant versus the overall capital cost of the Project. Rating: Acceptable	This option results in the highest net present value for the Project. Rating: Preferred
Be Technically Applicable, with System Integrity, and Reliability	Basing the infrastructure on onsite will provide a more cohesive workforce where everyone has same workplace versus two workplaces. Rating: Preferred	Basing the infrastructure on offsite will provide a less cohesive workforce as some groups are based in town versus the Minesite. Rating: Acceptable
Overall Assessment	Rating: Acceptable	Rating: Acceptable

6.4.14 Coal Processing Plant (CPP) Flowsheet

The method of processing the ROM coal produced from the open pit, can be completed via two (2) different flowsheets:

- ▶ Three (3) stage flowsheet consisting of heavy media cyclones (coarse ROM coal), reflux classifier (middling ROM coal) and froth floatation (fine ROM coal); or
- ▶ Two (2) stage flowsheet consisting of heavy media cyclones (coarse and middling ROM coal) and froth floatation (fine ROM coal).

The following performance objectives were reviewed for this assessment:

- ▶ cost effective; and
- ▶ be technically applicable, with system integrity, and reliability.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ community effects and input including human health and
- ▶ minimize effects on the natural environment.

6.4.14.1 Cost Effective

The three-stage flowsheet has a higher operating and capital cost versus the two-stage flowsheet due to extra equipment and personnel requirements. These costs are offset against the additional marginal yield that is expected to be recovered by a three-stage flowsheet versus a two-stage flowsheet. The ROM coal for the Project has a low grindability index of 60 versus other operating metallurgical coal mines in Western Canada that have an average of 85. Given this the ROM coal is expected to be coarser than other operating mines in Western Canada which minimizes that amount of additional yield that can be

generated from having a three-stage flowsheet. As a result the two-stage flowsheet has a preferred rating versus a three-stage flowsheet.

6.4.14.2 *Be Technically Applicable, with System Integrity, and Reliability*

Both the two- and three-stage flowsheets have been successfully applied to ROM coal in Western Canada over the past 30 years with great success. Both two- and three-stage flowsheets have been rated as acceptable for this deposit given the coarseness of the ROM coal. If the ROM coal was finer, a three-stage flowsheet would be rated as preferred due to the additional losses due the fineness of the coal.

6.4.14.3 *Overall Assessment*

As summarized in **Table 6.4-16** below, the option of using a two-stage flowsheet was selected primarily due to the lower cost associated with this option. However, the CPP was designed to allow the addition of a middling material circuit if the coal is found to be finer than predicted.

Both options are considered Acceptable to this application from a technical point of view.

Based on the overall ratings provided in **Table 6.4-16** using a two-stage circuit was selected for this Project.

Table 6.4-16: Assessment of Administration and Mine Dry Location

Performance Objective	Three-stage Flowsheet	Two-stage Flowsheet
Be Cost Effective	This option results in a lower net present value for the Project but is still acceptable as incremental cost is not significant versus the overall capital cost of the Project. Rating: Acceptable	This option results in the highest net present value for the Project. Rating: Preferred
Be Technically Applicable, with System Integrity, and Reliability	This flowsheet provides the most robust processing method for dealing with ROM coal from the Project. However, given the coarseness of the ROM coal for the Project this flowsheet does not provide a significant improvement above the two-stage flowsheet. Rating: Acceptable	This flowsheet has been used as starting position for most of the coal processing plants in Western Canada and given the coarseness of the coal at the Project, the two-stage circuit is expected to be acceptable for the ROM coal. Rating: Acceptable
Overall Assessment	Rating: Acceptable	Rating: Preferred

6.4.15 Process Water Supply

The method of providing process water for the Project was reviewed and determined. Several possible options were reviewed:

- ▶ direct draw from watercourses in the region;
- ▶ groundwater; and

- ▶ precipitation.

The following performance objectives were reviewed for this assessment:

- ▶ cost effective;
- ▶ minimize effects on the natural environment; and
- ▶ be technically applicable, with system integrity, and reliability.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ community effects and input including human health.

6.4.15.1 *Be Technically Applicable, with System Integrity, and Reliability*

Based on the hydrogeology work onsite, groundwater, while have enough overall quantity cannot be extracted from the Project Area at a rate that satisfies the 15,000 m³ per month requirements. A full water balance was completed, and it supports that all process water needs for the Project can be sourced from collecting and storing a portion of the precipitation that falls annually. All the waterways in the region have sufficient flow to support a direct draw application.

6.4.15.2 *Cost Effective*

Of the three (3) options, the use of existing precipitation has the highest net present value to the Project due to its low costs. The most expensive option would be using groundwater while the direct draw options is in between these two (2) options.

6.4.15.3 *Minimize Effects on the Natural Environment*

For assessing the three (3) options provided, the disturbance footprint of each option was selected as the most relevant factor for ranking the options as Preferred, Acceptable, and Unacceptable as the options with the higher disturbance footprints are also expected to have a larger potential effect on the natural environment via Surface Water, Vegetation and Wildlife VCs. Of the three (3) options, the use of existing precipitation that falls within the Project footprint has the lowest effect on the natural environment due to it having the lowest disturbance footprint while the other options are expected to have more of an effect on the natural environment through the direct draw of water either from groundwater and/or surface water. The reason for the higher disturbance footprint is that pipelines, pumping stations and powerlines would be required to allow for the pumping of surface water and/or groundwater. Both surface water and groundwater sourcing were rated as Acceptable while using only existing precipitation that falls within the Project footprint was rated as Preferred.

6.4.15.4 *Overall Assessment*

As summarized in **Table 6.4-17** below, the option of using existing precipitation for process water supply received an overall rating of Preferred.

While use of surface water is technically possible it is viewed to have a higher environmental effect than using precipitation and the use of groundwater is not technically viable for the Project.

Based on the overall ratings provided in **Table 6.4-17** using precipitation is the selected alternative. The selected alternative has an overall rating of Preferred for minimizing effects on the natural environment, while still being technically possible and cost effective.

Table 6.4-17: Assessment of Processed Coal Transport between the Minesite and the Port

Performance Objective	Precipitation	Groundwater	Surface Water
Be Cost Effective	This option results in the highest net present value for the Project. Rating: Preferred	This option is the most expensive option and would result in the lowest net present value for the Project. Rating: Unacceptable	Method has the highest net present value for the Project. Rating: Acceptable
Minimize or Avoid Effects on the Natural Environment	Method will provide a lower effect to the environment. Rating: Preferred	Method will have a higher effect on the natural environment versus using the existing precipitation however given the process water requirements it is expected this option to still be possible. Rating: Acceptable	Method will have a higher effect on the natural environment versus using the existing precipitation however given the process water requirements it is expected this option is still possible. Rating: Acceptable
Be Technically Applicable, with System Integrity, and Reliability	A full site water balance was completed, and option was deemed acceptable. Rating: Acceptable	Based on a review of the groundwater investigation the current Project site does not have sufficient groundwater flows to support the Project. Rating: Unacceptable	Based on a review of the surface watercourses it was deemed feasible for all water courses in the region to supply the annual process water requirements without having a negative effect on these streams. Rating: Acceptable
Overall Assessment	Rating: Preferred	Rating: Unacceptable	Rating: Acceptable

6.4.16 Potable Water Supply

The method of providing potable water for the Project was reviewed and determined. Several possible options were reviewed:

- ▶ trucking water from town;
- ▶ groundwater; and
- ▶ precipitation sources.

The following performance objectives were reviewed for this assessment:

- ▶ cost effective; and
- ▶ be technically applicable, with system integrity, and reliability.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ community effects and input including human health; and
- ▶ minimize effects on the natural environment.

6.4.16.1 *Cost Effective*

Of the three (3) options, using precipitation is the lowest cost of the options reviewed. The use of groundwater and surface water are both expected to have relatively the same cost structure.

6.4.16.2 *Be Technically Applicable with System Integrity and Reliability*

All options are technically applicable with trucking being the simplest option and groundwater use being the most complicated.

6.4.17 Sewage Treatment Methodology

The method of treating sewage for the Project was reviewed and determined. Several possible options were reviewed:

- ▶ trucking sewage water offsite;
- ▶ septic fields; and
- ▶ onsite Sewage Treatment Plant.

The following performance objectives were reviewed for this assessment:

- ▶ cost effective; and
- ▶ be technically applicable, with system integrity, and reliability.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ community effects and input including human health; and
- ▶ minimize effects on the natural environment.

6.4.17.1 *Cost Effective*

Of the options reviewed, trucking is the most expensive option, while a septic field is the lowest cost option.

6.4.17.2 *Be Technically Applicable, with System Integrity, and Reliability*

The ground conditions onsite do not allow for a septic field as the ground has a very low permeability which will not allow for a functioning septic field. After engagement with the region, most sewage treatment plants will not accept trucked-in material from an outside operation. Only the onsite Sewage Treatment Plant is technically possible of the three (3) options.

6.4.17.3 Overall Assessment

As summarized in **Table 6.4-18** below, the option of using an onsite Sewage Treatment Plant is the preferred option for treating sewage produced from the Project.

The other two (2) options are not technically feasible due to ground conditions and the unlikely acceptance of trucked sewage.

Based on the overall ratings provided in **Table 6.4-18** using an onsite Sewage Treatment Plant is the selected alternative for treating sewage. The selected alternative is the only technically possible option given the site conditions, and it received an overall rating of Acceptable.

Table 6.4-18: Assessment of Processed Coal Transport Between the Minesite and the Port

Performance Objective	Trucking Sewage Offsite	Septic Field	Onsite Sewage Treatment Plant
Be Cost Effective	This option results in the lowest net present value for the Project. Rating: Unacceptable	Method has the highest net present value for the Project. Rating: Preferred	Method has an acceptable cost and impact to Project economics. Rating: Acceptable
Be Technically Applicable, with System Integrity, and Reliability	Majority of sewage treatment plants in the region are near capacity and will not accept trucked-in sewage. Rating: Unacceptable	Ground conditions onsite do not allow for an efficient septic field. Rating: Unacceptable	Onsite sewage treatment plant is a proven technology and can easily handle the volumes expected from the Project. Rating: Acceptable
Overall Assessment	Rating: Unacceptable	Rating: Unacceptable	Rating: Acceptable

6.4.18 Employee Transport

The method by which employees get to the Project was investigated and determined based on the following options:

- ▶ bussing/vans for designated parking lot;
- ▶ bussing/vans using designated routes through communities; and
- ▶ employees using private vehicles.

The following performance objectives were reviewed for this assessment:

- ▶ cost effective; and
- ▶ community effects and input including human health.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ minimize effects on the natural environment and

- ▶ be technically applicable, with system integrity, and reliability.

6.4.18.1 Cost Effective

The lowest cost option of the three (3) reviewed is that employees provide their own private vehicles to transport themselves to the Project. The most expensive option is for TCL to provide bussing/vans for their employees using designated routes through the communities while the designated parking lot is the middle of the three (3) options.

6.4.18.2 Community Effects and Input Including Human Health

Based on input from stakeholders the private vehicle option was unacceptable due to the increase in vehicle traffic through the community and over the existing bridge over the Bulkley River. Bussing/vans was preferred option in discussions with stakeholders with both bussing from a dedicated parking lot and via designated routes both being acceptable. From a human health perspective it is also felt the bussing/vans option is preferred as the majority of employees will be working a 12-hour shift and safety-wise there is a lower chance of incidents occurring if employees don't drive to and from work.

6.4.18.3 Overall Assessment

As summarized in **Table 6.4-19** below, the option of using bussing/vans from a designated parking lot was a preferred option.

The other option of using private vehicles was unacceptable to community stakeholder feedback. Both bussing/vans options were viewed similarly.

Based on the overall ratings provided in **Table 6.4-19** using bussing/vans of employees from a designated parking lot was selected. The selected alternative in the only options favoured by stakeholders and the lower cost option, and it received an overall rating of Acceptable.

Table 6.4-19: Assessment of Employee Transport

Performance Objective	Bussing/vans From Designated Parking Lot	Bussing/vans Using Designated Routes Through Communities	Employees Using Private Vehicles
Be Cost Effective	This option results in the second-best net present value for the Project. Rating: Acceptable	This option results in the lowest net present value for the Project. Rating: Unacceptable	Method has the lowest cost to the Project of options assessed. Rating: Preferred
Community Effects and Input Including Human Health	Majority of respondents viewed this option as acceptable method for employee transport. Rating: Acceptable	Majority of respondents viewed this option as acceptable method for employee transport. Rating: Acceptable	Method was received poorly from stakeholders due to increase in traffic. Rating: Unacceptable
Overall Assessment	Rating: Acceptable	Rating: Unacceptable	Rating: Unacceptable

6.4.19 Employee Parking Lot Location

The location of where to put the designated parking lot for employees was investigated and determined based on the following options:

- ▶ east side of the Bulkley River, and
- ▶ west side of the Bulkley River.

The following performance objectives were reviewed for this assessment:

- ▶ community effects and input including human health.

The following performance objectives were not expected to be relevant for this assessment:

- ▶ minimize effects on the natural environment;
- ▶ be technically applicable, with system integrity, and reliability, and
- ▶ cost effective.

6.4.19.1 *Community Effects and Input Including Human Health*

Based on input from stakeholders having the parking lot on the east side of the Bulkley River was preferred to reduce the amount of traffic that needed to use the single-lane bridge over the Bulkley River. The same concern was brought forward by the Village of Telkwa and the RDBN. It was viewed as the preferred alternative to locate the parking lot on the east side of the Bulkley River.

6.4.19.2 *Overall Assessment*

As summarized in **Table 6.4-20** below, the option of having a parking lot on the east side of the Bulkley River was a preferred option.

The selected alternative was not viewed as Unacceptable for most stakeholders.

Table 6.4-20: Assessment of Parking Lot Locations

Performance Objective	Parking Lot located on the East Side of the Bulkley River	Parking Lot located on the West side of the Bulkley River
Community Effects and Input Including Human Health	Majority of respondents viewed this option as preferred location for the parking lot to limit the traffic over the single-lane bridge. Rating: Preferred	Majority of respondents viewed this option as unacceptable for the parking lot location due to increased public traffic over the single-lane bridge to access the parking lot. Human health is likely not a factor for selecting between these two (2) options except for increased risk of car incidents on the single-lane bridge due to the Project, Rating: Unacceptable
Overall Assessment	Rating: Preferred	Rating: Unacceptable

6.5 Summary of Alternative Means of Completing the Project

An alternatives assessment for various Project components has been completed and is presented in **Table 6.5-1** below. The preferred alternative is presented in this EAC Application; however, with additional consultation on the Project during the post-Application stage, further alternatives may be identified and investigated. The following table summarizes some of the alternatives reviewed and the option that was carried forward into this EAC Application.

Table 6.5-1: Alternatives Assessment Summary

Component	Alternatives Considered	Option Selected and Carried Forward Into the Environmental Effects Assessments
Mining Method	Surface	Surface-only was selected due to the dip of the coal structure and presence of numerous faults in the area.
	Underground	
Surface Mining Method	Truck/shovel	The truck/shovel method was selected due to its flexibility and ability to maximize the recovery of the available resource.
	Contour and highwall	Contour and highwall was rejected due to the dip of the coal, presence of faults and low resource extraction levels of 40%.
	Dragline	Dragline was rejected due to the small size of the deposit, and incompatible geometry of the deposit.
Production Rate for Project	<250,000 tonnes of processed coal per annum	Stakeholder input and the requirement to construct the Tenas Access Corridor (TAC) and Rail Infrastructure required capital amounts that a 250,000 tonnes of processed coal per annum operation could justify.
	775,000 to 825,000 tonnes of processed coal per annum	Modular plant design limits the feed rates available to reduce capital costs, as a result the production rate of 775,000 to 825,000 tonnes of processed coal per annum has been selected for this Project.
	>1,500,000 tonnes of processed coal per annum	Community effects and input including human health requested a smaller Project and the ability for the company to finance the Project selected ruled out a production rate greater than 1.50 million tonnes (Mt) of processed coal per annum.
Processed Coal Transport from CPP to Port	Truck	To reduce the amount of traffic on existing road network, rail haulage was selected as each unit train replaces, approximately 305 truck trips.
	Rail	To reduce the amount of traffic on existing road network, rail haulage was selected as each unit train replaces, approximately 305 truck trips.
Mine Equipment Selection – Loading Equipment	Backhoe	A backhoe configured loading equipment was selected for this Project due to its added flexibility when dealing with coal seams.
	Shovel	
Mine Equipment Selection – Equipment Size	6 m ³ backhoe/45 tonne trucks	The Project requires two (2) loading units to be able to produce ROM coal and mine rock at the same time. Given the production schedule required to produce enough ROM coal 1,050,000 tonnes for the CPP, only
	12 m ³ backhoe / 90 tonne trucks	
	15 m ³ backhoe / 135 tonne trucks	

Component	Alternatives Considered	Option Selected and Carried Forward Into the Environmental Effects Assessments
	22 m ³ backhoe / 180 tonne trucks	the 12 m ³ was small enough to provide two (2) units while being large enough to provide an economic Project, so the 12 m³ was selected .
	29 m ³ backhoe / 205 tonne trucks	
CPP Location	CPP located on the east side of Goathorn Creek.	To keep operation activities as far from public property as possible, the west side of Goathorn Creek was selected for the CPP location.
	CPP located on the west side of Goathorn Creek	Furthermore , to keep the ROM coal hauls as short as possible, a CPP location on the west side of Goathorn Creek is preferred .
Rail Infrastructure Location	Rail Loop on private land parcel east of Lawson Road	The Rail Loop location on private land parcel was selected as it did not require disturbing an important archaeological resource that is on Crown land. Secondly the private land Rail Loop location requires less earthwork and related disturbance versus the Crown land Rail Loop location. Lastly, it was generally more acceptable to the community.
	Rail Loop on Crown land parcel east of Lawson Road	Due to the high capital cost of constructing the Rail Loop at this location and having to disturb an important archaeological resource this option was unacceptable.
	Rail Loop on Crown land west of Lawson Road	Due to the high capital cost of bringing the Rail Loop closer to the Minesite, the Rail Loop east of Lawson Road was ruled out.
	Linear siding along existing CNR right-of-way	Due to the higher capital cost of the two (2) linear siding options these were ruled out.
	Linear siding on Crown land west of Lawson Road	
Processed Coal Transport Methodology from CPP to Rail Infrastructure	Truck haulage	Truck haulage was selected due to the high capital cost of using conveyors to transport coal between the CPP and Rail Infrastructure.
	Conveyor transport	Conveyor transport was rejected due to the high capital cost of using conveyors to transport coal between the CPP and Rail Infrastructure.
	Slurry pipeline transport	Pipeline transport was rejected due to the large increase of water that would be required to make this option possible plus the capital cost of dewatering equipment at the Rail Infrastructure and an increased disturbance footprint for the Project.
Processed Coal Truck Haul and Project Access	Tenas Access Corridor (TAC)	Dedicated constructed haul road (TAC) to transport processed coal was selected to reduce potential traffic effects in the area and was requested during Telkwa Coal Limited (TCL)'s discussions with stakeholders.
	Existing road network	Using the existing road network was ruled out due to feedback from community stakeholders.
	Powerline road	The TAC option of using the powerline road was ruled out as it would require the coal haul to go through the Cottonwood neighborhood close to the mine.

Component	Alternatives Considered	Option Selected and Carried Forward Into the Environmental Effects Assessments
Fine Processed Rock Dewatering	Filter press and haul with trucks Conventional wet processed rock (tailings) disposal	The filter press option was selected to reduce the amount of make-up water required by the CPP.
Potentially Acid Generating (PAG) Material Management	Material blending	TCL has spent a significant amount of resources on understanding this issue for the Project, given Equity Silver's issues in the region. Material blending was ruled out as viable option due to the quantity of PAG material present in the deposit and the requirement to get almost perfect blending for this method to work.
	Passive treatment	Passive treatment was ruled out for much the same reason as material blending.
	Active treatment	Active treatment is a viable method for dealing with potential acid rock drainage (ARD) onsite, however, it was ruled out as it would have an unknown duration for treatment.
	Dry covers	Dry covers were ruled out as this method is prone to letting oxygen and water come into PAG material and subsequent ARD. This method is also prone to degradation over time and again causing PAG material to encounter the environment.
	Water covers	Water covers are the best technology for preventing PAG material from going acidic and was selected versus dry covers.
Water Cover Methodology	Use existing water body	There are no existing water bodies available in the Project area that could be used for PAG material storage so one has to be constructed.
	Construct a water body using excavation only	Of the three (3) options, the option of constructing a water body using dams only was selected as it creates the least amount of disturbance and allows the use of an engineered liner to limit groundwater seepage from the structure.
	Construct a water body using a combination of excavation and dams	
	Construct a water body using dams only	
Office and Mine Dry Location	Offsite	Majority of components will be onsite with an administration office in Telkwa at current location to minimize transport of personnel and have a more efficient operation. The option selected is to have this infrastructure onsite for the time being.
	Onsite	
CPP Plant Flowsheet	Standard three (3) stage circuit consisting of Heavy Media Cyclones, Reflux Classifiers and Floatation	Of the two (2) options presented, the two (2) stage CPP Flowsheet was selected as it had a lower capital cost while still maintaining an acceptable CPP yield. However, the CPP has been designed to allow for a second middling circuit in the future if it is found that coal yield is lower than predicted due to the ROM coal being finer than testing to date have provided.
	Two (2) stage circuit consisting of Heavy Media Cyclones and Floatation	
Process Water Supply for the	Precipitation only	Based on the water balance completed, precipitation only will meet all the requirements, so it was selected for the Project. However, for the effects assessment for

Component	Alternatives Considered	Option Selected and Carried Forward Into the Environmental Effects Assessments
Project		the Fish and Fish Habitat Valued Component (VC) it was felt that additional water should be sourced from Goathorn Creek
	Precipitation and surface water Precipitation and groundwater	Precipitation and groundwater was ruled out as available groundwater resources onsite are very limited and not able to supply sufficient water to meet Project requirements.
Potable Water Supply	Surface water	Along with precipitation, a backup surface water source was selected as there is enough and acceptable quality to meet the daily requirement of 16 m ³ .
	Groundwater	Potable water sourced from groundwater sources was ruled out as adequate pump studies have not been completed to verify if enough groundwater is available for potable water.
	Offsite supplier	An offsite supplier was ruled out due the amount of potable water required and associated costs.
Sewage Treatment Methodology	Trucking to offsite disposal	Due to the quantity of sewage water generated onsite, trucking was ruled out.
	Sewage Treatment Plant	A <i>secondary Sewage Treatment Plant</i> was selected for this Project
	Septic field	Site geology does not favor a septic field.
Employee Transport	Bus from designated parking lot	<i>Bus transport from a designated parking lot was selected</i> to: - reduce traffic on local roads and for the safety of employees, and - allow for a more efficient bus transport, with bus service from a designated lot instead of having designated buses going through town doing pickups.
	Bus using designated route through communities	
	Employees using private vehicles	
Employee Parking Lot Location	East side of Bulkley River	The <i>east side</i> of the Bulkley River was selected for the parking lot location to reduce traffic over the existing single-lane bridge to get to the Project.
	West side of Bulkley River	
	Extend three-phase 25 kV along Lawson Road	
	New 138 kV to 25 kV transformer west of Rail Infrastructure	
	2 m	
	2.5 m	

Notes: >=greater than; <=less than; %=percent; CNR=Canadian National Rail; CPP=Coal Processing Plant; EA=environmental assessment; kV=kilovolt; m=metre; m³=cubic metre; ROM=run-of-mine

7. ALTERNATIVES TO THE PROJECT

7.1 Assessment of Alternatives to the Project

An assessment of the alternatives to the Project that were technically and economically feasible that were considered are:

- ▶ no project;
- ▶ alternative Project production rates,
- ▶ use of alternative methods to produce steel, and
- ▶ development of an alternative steelmaking coal resource outside BC.

7.2 No Project

The following provides a summary of the reasons behind developing a metallurgical coal project which are

- ▶ global demand for steel; and
- ▶ fighting climate change.

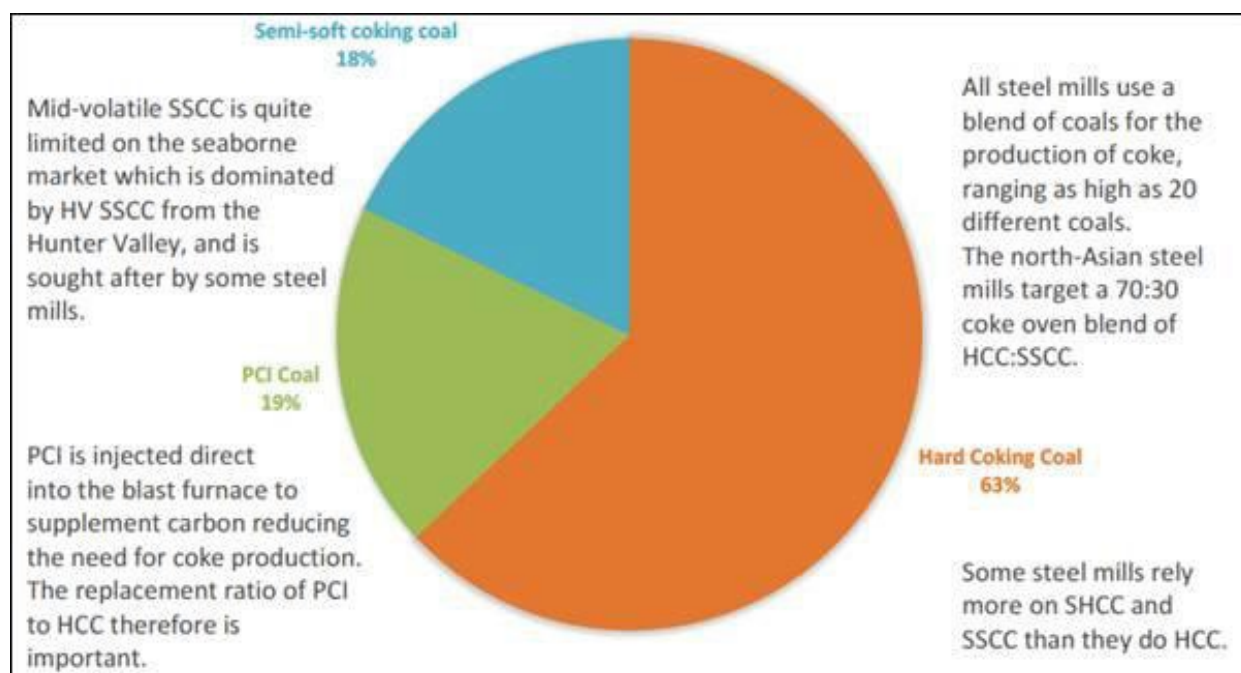
7.2.1 Global Demand for Steel

For countries to meet their desires to have a living standard equal to developed countries such as Canada, the USA, and those in Europe, steel will be required to meet the infrastructure and transportation requirements of development. As shown by the **Figure 7.2-1**, as the living standard of a country's population increases, the amount of steel required also increases.

The Project will produce a total of approximately 16.5 Mt of processed coal for use in overseas steel mills as either a blending coal to produce coke, or as a heating agent, both applications used in blast furnace steel production. The Project is unique in both its product quality and low cost of production. Its proximity to existing infrastructure such as power, rail and port results in a low initial capital expenditure projected to be CDN\$98.6 million with a production cost of CDN\$66.10 per tonne, allowing the Project to withstand global market pressures. Both the rail and powerlines are less than 10 km from the Minesite, and the port is approximately 375 km away. This compares with coal mines in the northeast and southeast BC which are well over 1,000 km from tidewater. The specific coal quality of the Project product is in low supply globally, and therefore expected to be in high demand.

Global steel production was 1,691 Mt in 2017, a 5.3% increase over the previous year with steady growth forecast over the next five (5) years (World Steel Association 2018). Currently, 70% of world steel production uses coking coal in the blast furnace process. Each tonne of steel produced through this process requires approximately 600 kg of coke, which is produced from 770 kg of coking coal. In addition, some coking coals are injected directly into blast furnaces to provide heat for the smelting process.

Global metallurgical coal production was 1,100 Mt in 2017, with around 330 Mt traded on the seaborne metallurgical coal market, the market that BC historically and currently supplies, and which the Project is intended to serve. The seaborne metallurgical coal market comprises three (3) products: hard coking coal, SSCC, and PCI coal, as shown in **Figure 7.2-1** below.



Source: for distribution of seaborne metallurgical coal 2017: Wood Mackenzie.

Figure 7.2-1: Seaborne metallurgical coal market product types

The seaborne market is dominated by Australia accounting for 65%, the USA second with around 15%, and Canada third with around 10%. Canadian metallurgical coal is important to the north Asian steel mills seeking to diversify supply away from Australia because of growing concerns around supply disruptions in Australia. The north Asian steel mills view Canada as a more reliable source of supply and any new production out of Canada, therefore, is of keen interest to these steel mills.

The Project coal is expected to be highly sought after on the seaborne market. It is characterised by the steel mills as a medium-volatile (mid-vol or MV) or SSCC. Such coals are limited in supply on the seaborne market and are preferred by the steel mills as a blending coal for their lower volatiles. The typical SSCC supplied to the seaborne market is higher in volatiles which creates blending problems for the steel mills in trying to keep volatiles below a certain threshold.

There are only three (3) operating mines (soon to be reduced to two [2]), both in Australia, that produce a MV SSCC on the seaborne market. Following the closure of Teck's Coal Mountain Mine, it was understood that there was no longer a producer of MV SSCC in Canada. The Project, therefore, will be the only producer of MV SSCC in Canada, and one of only three (3) suppliers to the seaborne market. It will provide a metallurgical coal that is very limited in supply to a market with very high demand for its quality specifications.

Both China, and increasingly India, are supporting demand for seaborne metallurgical coal, with India poised to become the largest importer of metallurgical coal as shown in **Figure 7.2-2** below. This coupled with a lack of capital investment over the last five (5) years, is supporting strong short to medium-term forward prices for metallurgical coal.

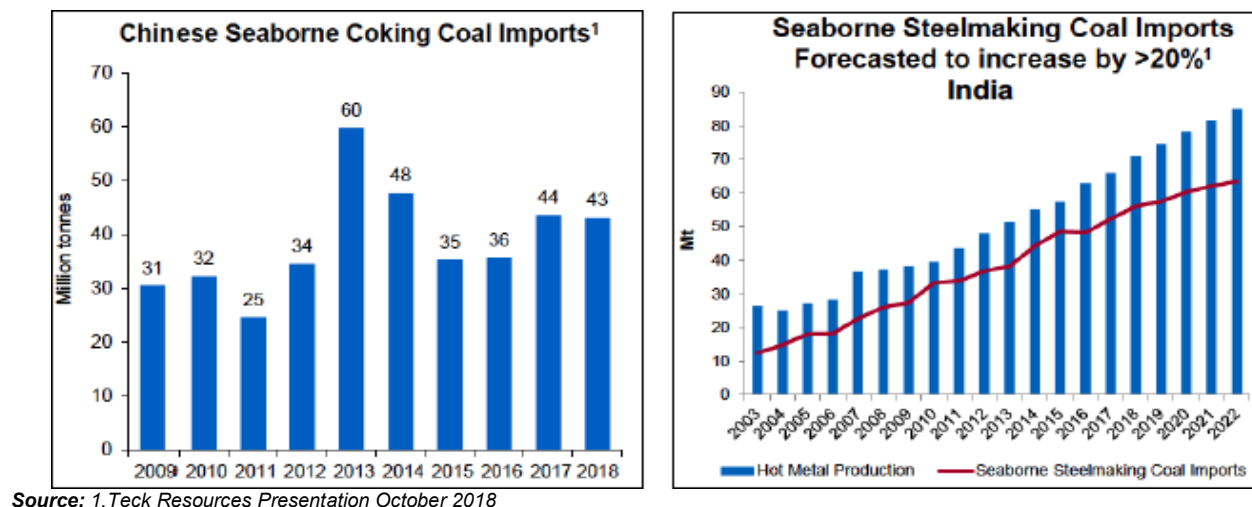
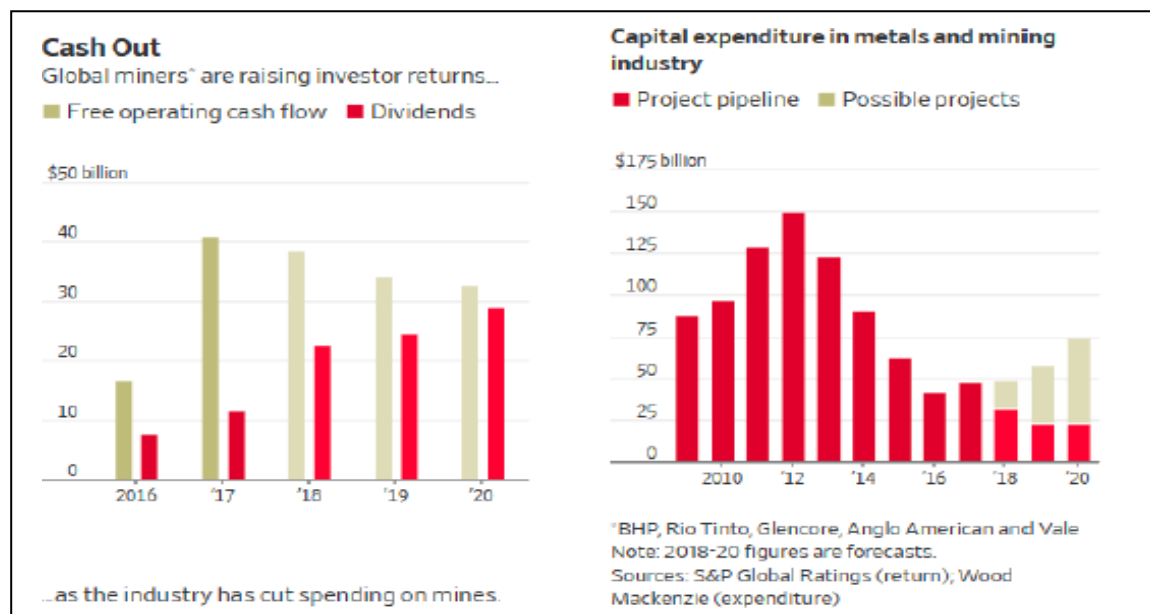


Figure 7.2-2: Seaborne coal imports into China and India

With a retention of profits to reduce debt following the last downturn in the coal market, coupled with a focus on increasing returns to shareholders, global coal miners have ignored capital investment causing a tightening in supply of metallurgical coal in the short to medium-term as shown by **Figure 7.2-3**.



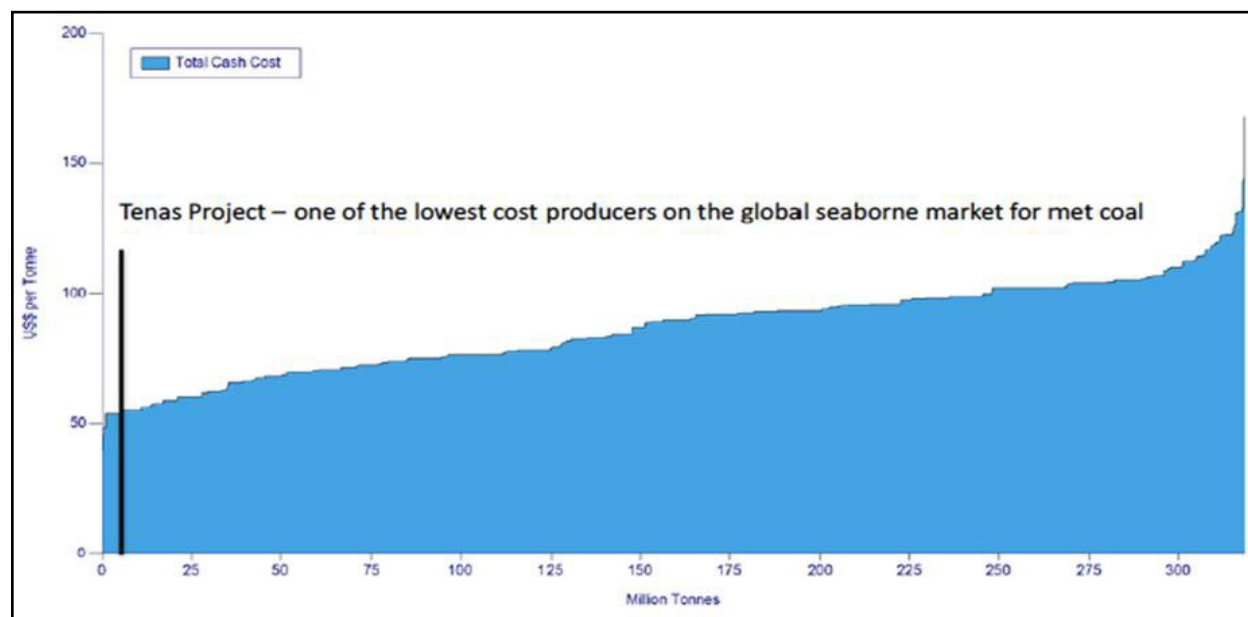
Source: Wall Street Journal, 8, August 2018

Figure 7.2-3: Global trends in mining investor returns and capital expenditures in the metal and mining industry

The Project is well positioned to take advantage of the strong current and medium-term market fundamentals.

The Project will provide employment and economic opportunities to Indigenous groups, the residents of the Bulkley Valley, and the surrounding region, as well as CDN\$250 million in tax revenues for local, provincial, and federal governments. It is important to TCL that in doing so, it can also provide certainty of business continuity to its staff and key stakeholders.

The Project's position on the seaborne metallurgical coal cost curve provides a natural hedge to the volatility and unpredictability of metallurgical coal prices as also shown by **Figure 7.2-4**.



Source: Wood Mackenzie Ltd. Dataset, May 2018.

Figure 7.2-4: Tenas Project position on the seaborne export metallurgical cost curve

7.2.2 Fighting Climate Change

Countries such as Canada have committed to meeting global warming targets at various events such as COP26, and steel is a key building block to allow this to happen by allowing the following:

- ▶ wind turbines;
- ▶ hydroelectric facilities;
- ▶ nuclear reactors;
- ▶ geothermal;
- ▶ solar panels;

- ▶ electric cars;
- ▶ production of lithium, cobalt, and copper for manufacturing; and
- ▶ batteries.

7.2.3 No Project Conclusion

In summary even if this Project were to not be developed in BC, another metallurgical Project would be developed somewhere else across the globe likely in a jurisdiction with fewer regulatory and environmental requirements than this Project would have in BC or in Canada as the global demand for steel continues to increase as countries continue to become more developed and to assist with fighting climate change through the use of renewable electricity options which all require steel.

The No Project option for the reasons stated above was ruled out by TCL as an option for Project Development.

7.3 Alternatives to Produce Steel

The two (2) main routes to produce steel are the integrated blast furnace-basic oxygen furnace (BF-BOF) route which produces about 73% of steel globally, and the electric steelmaking route employing the electric arc furnace (EAF), which produces about 27% of steel.

The integrated BF-BOF route is characterized by a two-step process to first produce iron as liquid hot metal (pig iron) in the BF, which is then processed into steel in the BOF. The EAF route, on the other hand, is characterized by the use of mainly solid materials, like scrap, direct reduced iron (DRI), hot briquetted iron (HBI), or pig iron, that are melted in the EAF.

The following table shows the amounts of raw materials required to produce one (1) tonne of steel using the BF and the EAF methods.

Raw Materials Required to Produce One (1) tonne of Steel		
Raw Material (kg)	BF-BOF	EAF
Coal	780	150
Iron Ore	1,370	586
Steel Scrap	125	710
Limestone	270	88

Source: World Steel Association

Note: BF-BOF=blast furnace-basic oxygen furnace; EAF=electric arc furnace; kg=kilogram

By 2050, steel use is projected to increase by 20% compared to present levels (1,864 Mt in 2020) in order to meet the needs of a growing population.

Blast furnace technology is a mature production system with literally a thousand-year history, and metallurgical coke has unique desirable mechanical properties which makes it difficult to replace with less emitting alternatives.

The BF route also serves to reduce CO₂ emissions from other sectors. Every tonne of steel results in 400 kg of slag, 125 kg from the BOF and 275 kg from the BF. This slag substitutes for virgin materials in

the fertiliser, construction and bulk material industries. BF slag in particular forms a key input to the cement industry, where it substitutes for clinker, the most emissions intensive component. BF slag typically comprises up to 40-50% of the final cement product, reducing the emission intensity of cement production by almost half. The following discussion touches on the main alternatives to the Blast Furnace.

7.3.1 Electric Arc Furnace (EAF)

The EAF is fed mainly by scrap metal containing steel materials, DRI, or HBI. DRI, the major non-scrap ferrous source, is mainly natural gas-based, reformed into syngas (carbon monoxide and hydrogen) that acts as the reductant.

The EAF route includes some technology-based issues which are not a problem in the BF-BOF route:

- ▶ difficulties in understanding scrap heat transfer coefficients;
- ▶ nitrogen and hydrogen pick-up from carbon and ferro alloy sources (detrimental to certain steel grades, so that not all steel products can be technically produced by this method);
- ▶ production and utilisation of EAF dust and residual element enrichment; and
- ▶ aggregation after multiple cycles of materials use.

EAF in its current state is not “green/non carbon producing emissions”, since it uses natural gas to increase its productivity, decrease electricity use and increase electrode life. In addition, current worldwide electricity generation is only 29% renewable.

Proximity to natural gas sources, and the availability of metal scrap is a major obstacle to increasing EAF production. There is currently not enough scrap metal to sustain the extent of EAF facilities required to replace 100% of the steel produced from the BF route.

In theory, all new steel could be made from recycled steel. However, this is not feasible due to the scarcity of scrap, brought about by the long service life of steel products, given steel's strength and durability.

The average life of steel products ranges from a few weeks for steel packaging, 15-20 years for vehicles, and up to 100 years for buildings and infrastructure. The average lifespan of a steel product is 40 years, which leads to considerable delay between production and its availability for recycling.

Steel demand is growing at a faster rate than scrap is being released from the pool of ‘steel in use’. Since all scrap currently collected is recycled, there is only limited scope to increase scrap availability. Looking ahead, further extensions in the useful life of steel products are likely, further suppressing scrap availability.

Continued growth in steel demand means that transitioning the industry to entirely scrap-based production is unlikely during this century.

Post-consumer scrap requires considerable preparation and separation from other materials before it is used in steelmaking. Copper is a persistent contaminant; it can be difficult to separate from steel at a reasonable cost, especially from alternators, generators, motors, and the like. Improved scrap sorting and better separation techniques to reduce contamination (in order to ensure sufficient scrap supplies going forward) is expected to result in increased costs. Estimates show that, while increasingly costly copper separation techniques are able to be managed by the steel industry until 2050, this not only assumes

perfectly coordinated trade and extensive dilution, but is likely to become increasingly impractical in the longer timeframe. (Daehn, Serrenho, Allwood, 2017)

7.3.2 Green Steel

In 2016, three (3) Swedish companies, SSAB (steel producer), LKAB (iron ore producer) and Vattenfall (power company) announced the HYBRIT initiative, whereby the blast furnace process, which causes around 90% of the carbon dioxide emissions originating in the BF-BOF route, will be replaced by EAF using direct reduced iron (also called sponge iron), obtained using Green Hydrogen. The new technology removes the use of coking coal needed for the production of crude iron.

While Green Steel has been technically proven, and its components are being distributed to select European automakers on a trial basis, the first commercial production will only be in 2026. SSAB, its main proponent, has indicated that it will only produce 100% Green Steel by 2045, more than 20 years in the future.

To see the HYBRIT initiative in an industry perspective, one notes that SSAB, the main component of Green Steel, is only the 52nd largest steel producer in the world, responsible for just 0.4% of global steel in 2020.

As to how this will be played out in the rest of the industry, the steel industry is fractured since there is no single, large, dominant producer whose technology advances will readily influence the displacement of the BF. The top ten (10) companies account for just over a quarter of global output, with the top 25 and top 50 accounting for 42% and 56% respectively. This reflects a highly competitive marketplace, with only limited industry consolidation, especially when compared to the aluminum and oil industries.

A key component of green steel technology is the use of hydrogen, and the following provides how hydrogen can be used as follows in steel production:

- ▶ Hydrogen can be used as the sole reducing agent in the direct reduction of iron or DRI (H₂-DRI), to produce sponge iron. Sponge iron is then melted in an EAF to produce liquid steel (DR-EAF route);
- ▶ To a minor degree, hydrogen can be used as an auxiliary reducing agent in the BF-BOF route (H₂-BF). H₂-BF has the potential to reduce emissions in the blast furnace because it reduces the amount of coke (and therefore coal) needed, while producing water instead of carbon dioxide; and
- ▶ Hydrogen produced from electrolysis i.e. Green Hydrogen, can be used in the production of “green steel”, depending on the source of energy.

Green steel from Green Hydrogen i.e. hydrogen produced by electrolysis, requires significant new electrical generating capacity. The production of Green Hydrogen-based steel, even in modest projections of BF steel replacement, would likely require at least a doubling of the electricity consumed by the steel industry versus today’s consumption rates. Electricity in the developed world, where most of the current thrust towards green steel is prevalent, is not affordable, or is not renewable and the cost competitiveness of hydrogen steel vs BF steel going forward has not yet been commercially demonstrated.

Furthermore, to produce fully “green steel” requires that all the electricity needs to be from 100% renewable sources, and the steel and power industries are only at a worldwide level of 29% with many regions forecasting later in this century achieving rates of close to 100%.

7.3.3 Use of Alternative Method to Produce Steel

None of the alternate methods reviewed are expected to readily replace blast furnace steel production within the lifespan of this Project:

- ▶ For the EAF, there is insufficient scrap availability, insufficient renewable energy resources and the technical inability of this method to produce all required steel products; and
- ▶ For Green Steel, there is insufficient affordable, renewable electricity capacity, to produce the Hydrogen required for this type and a long lead time is required to replace a worldwide suite of Blast Furnaces with a relatively young lifespan and which will therefore not be economically replaceable for some decades to come. Furthermore, the technical commercial capability of producing Green Steel has not been proven as a substitute for BF-BOF steel.

While the methods reviewed are all capable of replacing a portion of BF-BOF steel, their challenge is to demonstrate that the requisite raw materials can be sourced, and steel production rates increased economically and sustainably over the long term to replace all BF-BOF steel production given that steel demand is also expected to increase over this time period.

7.4 Alternative Production Rates

As part of the alternative review process, various production rates were reviewed and as per 6.4.3, the final selected rate for the Project was 775,00 to 825,000 metric tonnes of processed coal produced per annum which was based on a consideration of:

- ▶ cost effectiveness;
- ▶ community effects and input including human health; and
- ▶ minimize or avoiding effects on the natural environment.

The production rate alternatives were not expected to have effects on the following performance objectives:

- ▶ be technically applicable, with system integrity, and reliability.

In summary a production rate of approximately 800,000 metric tonnes of processed coal per annum was selected as the preferred option.

7.5 Development of Alternative Steelmaking Coal Resources

TCL completed a review of other potential metallurgical coal projects in the province of BC, Australia and USA and could not identify a greenfield project that would satisfy the following requirements:

- ▶ extensively drilling;
- ▶ low cost of logistics and mining;
- ▶ access to favorable infrastructure such as the BC Hydro electric grid; and
- ▶ acceptable coal quality for steel producers.

Furthermore, the current property is owned by TCL and any other property would require additional capital funds to complete development as TCL would have to purchase the Project first.

7.6 Summary of Alternatives to the Tenas Project

TCL has reviewed several realistic alternatives to developing the Project which are:

- ▶ no project;
- ▶ alternative project production rates;
- ▶ use of alternative methods to produce steel; and
- ▶ development of an alternative steelmaking coal resource outside BC.

Based on the analysis provided above, the No Project alternative was rejected as the current global demand for steel is continuing to increase year-by-year as industrialization continues in countries in South America, and Asia. Furthermore, with the emphasis on reducing carbon emissions through the use of renewable energy resources the requirement for steel is only expected to increase even further as the majority of the technologies required for renewable energy is dependent on steel. These two (2) drivers will require metallurgical coal projects to be developed around the globe and if the Tenas Project is not constructed in jurisdiction with some of the best environmental regulations in the world, another Project will be developed elsewhere with the same or higher effects than the Project.

Another alternative to the Project is to produce steel using non-coal sources for the reduction of iron ore to steel feed products so that metallurgical coal is simply no longer required. TCL conducted a review of this alternative and found that while some technology does exist to produce steel using hydrogen, that fully renewable energy sources are required before this methodology would produce less carbon emissions than the current method of production using a blast furnace. Secondly, the method to produce green steel has not achieved commercial production and is not expected to till later in this decade. Lastly, like renewable energy, it will take a long period of time until the majority of blast furnace production is replaced by hydrogen which will be beyond the expected time frame of this Project. Electric arc furnaces are a proven technology for producing steel directly from scrap metal inputs, however there are several significant constraints to this technology providing all future steel production:

- ▶ lack of sufficient scrap metal inputs, especially in developing countries;
- ▶ lack of renewable energy resources to make EAF truly a non-carbon producing alternative; and
- ▶ inability of this method to produce very high quality structure steel to meet bridge and building requirements

Therefore, it is expected that the demand for metallurgical coal will continue to grow even with the introduction of non coal steel production alternatives.

7.7 Go-forward Statement

Based on an evaluation of the potential development of several other projects, including not developing the Project and given the positive results for pre-feasibility and feasibility studies for the Project, and the market demand for steel and subsequently metallurgical coal for the next thirty years, TCL is proceeding with its plans to develop the Project. Assuming the Project is successful with obtaining an EAC, the Project will proceed with the coordinated authorizations route for permitting.

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