Roman Coal Mine Project

ENVIRONMENTAL ASSESSMENT REPORT

VOLUME 1: INTRODUCTION

Prepared for:
BC Environmental Assessment Office
Victoria, British Columbia

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Preface

Peace River Coal Inc. (PRC), the Proponent, proposes to develop the Roman Coal Mine Project (the Project) adjacent to PRC's operating Trend Coal Mine located in northeastern British Columbia. The proposed project is located approximately 30 km south of Tumbler Ridge. The Project falls within the area covered by the Dawson Creek Land and Resource Management Plan, approved by the Provincial government in 1999, within an area encompassed by Treaty No. 8 and within an area of asserted interest identified by the communities at Kelly Lake.

The Project is designed to mine approximately 30.6 million tonnes (Mt) run-of-mine (ROM) metallurgical coal at an average clean coal production will be about 1.3 to 2.1 Mtpa for the 10 year project life. The total planned production over the life of the Project is 21.5 Mt of metallurgical coal. The coal will be sold on the export market.

Following the submission of a Project Description and request for Project review submitted by PRC to the British Columbia Environmental Assessment Office (EAO) August 23, 2007, the Project is subject to review under the British Columbia *Environmental Assessment Act*, S.B.C. 2002 c.43 (BCEAA), pursuant to an Order issued under Section 10 of the BCEAA on September 11, 2007. The purpose of this document, Roman Coal Mine—Application for an Environmental Assessment (EA) Certificate (Application), is to provide the Project description, environmental baseline data, results of analyses, effects assessments, and environmental management plans needed to satisfy the information requirements for the issuance of an environmental assessment certificate for the project under the BCEAA.

An EA Certificate is required prior to issuance of various operational permits and authorizations needed for the Project, and both the EA certificate and applicable permits are required before Project development can proceed. It has been determined that the project will not be subject to a screening level review or comprehensive study under the Canadian *Environmental Assessment Act* (CEAA), SC 1992, c.37.

The Application has been prepared by PRC and their consultants, and was developed pursuant to the Terms of Reference (TOR) approved by the EAO on May 12, 2009. It also complies with the scope of assessment and relevant instructions provided by the EAO in the Section 11 Order issued by the EAO on October 2, 2008.

Pre-application consultation with the Working Group established by the EAO for the Project, as well as stakeholders and the public, has been integral to Application preparation, including the development of the TOR. A draft version of the TOR was distributed to the Working Group on November 1, 2008 for comment. On February 13, 2009 a second draft incorporating comments from the Working Group was re-distributed to the Working Group. EAO conducted a 30-day public comment period on that draft TOR from February 16, 2009 through March 19, 2009. EAO conducted two well-advertised open houses one in Chetwynd on February 24, 2009 and one in Tumbler Ridge on February 25, 2009, during which Peace River Coal gave presentations and answered questions on the proposed project, and EAO gave presentations on the EA Process and the draft Terms of Reference. No public comments on the draft TOR were received and, based on working group comments collected in this period, the TOR were revised and approved by the EAO on May 12, 2009.

The EAO Working Group includes representatives of provincial, federal and local government agencies, First Nations and the Kelly Lake Communities including:

- BC Environmental Assessment Office
- Ministry of Environment (Environmental Protection, Environmental Quality, Environmental Stewardship, Water Resources, Ecosystems, Water Stewardship)

- Ministry of Energy Mines and Petroleum Resources
- Ministry of Tourism, Sports and the Arts (Recreation, Sites and Trails, Adventure Tourism, and Archaeology)
- Ministry of Forests and Range
- Ministry of Transportation
- Ministry of Agriculture and Lands
- Ministry of Community and Rural Development
- Canadian Environmental Assessment Agency
- Fisheries and Oceans Canada
- Integrated Land Management Bureau
- Peace River Regional District
- District of Tumbler Ridge
- District of Chetwynd
- Doig River First Nations
- Halfway River First Nation
- McLeod Lake Indian Band
- Saulteau First Nations
- West Moberly First Nations
- Kelly Lake Métis Settlement Society
- Kelly Lake Cree Nation

Acknowledgements

Engineering, environmental, mining and socio-cultural consulting companies were tasked with conceptual planning, detailed design, baseline studies, effects assessments and third party review for the Project.

The Proponent directed the Pre-feasibility Study and Environmental Assessment Application and played a key role in coordination and compilation of the Application.

The table below provides a list of the companies and consulting firms that have participated in the planning and assessment work to date for the Project.

Companies Contributing to Planning and Environmental Assessment of the Roman Coal Mine Project

Discipline	Company	Author/ Person Responsible
Project Management/ Senior Review Consultation	Peace River Coal Inc.	Angela Waterman, B.Sc. (Manager, Environment and Regulatory)
	Stantec (formerly Jacques Whitford AXYS Ltd.)	Scott Trusler, M.Sc., R.P.Bio. (Acting Manager, Environment and Regulatory/ Associate, Environmental Management)
Air Quality	RWDI Air Inc.	Mark Milner, M.Eng., P.Eng. (Air Quality and Noise Lead) Kathy Preston, Ph.D, P.Eng. (Director of Resources)
Archaeology	Archer CRM	Remi Farvacque, M.Sc., R.C.P.A. (Archaeology Lead)
Climate and Surface Water Hydrology—Baseline compilation	Clearwater Consultants Ltd.	Peter McCreath, Ph.D., P.Eng. (Hydrology Lead) Patrick Bryan, M.Eng., P.Eng. (Hydrologist)
Climate and Surface Water Hydrology—Effects Assessment	Lorax Environmental Services	Justin Stockwell, M.Sc. (Water and Sediment Quality Lead)
Fish and Fish Habitat, and Periphyton and Benthos	Golder Associates	Barbara Wernick, M.Sc., R.P.Bio. (Fish and Fish Habitat/Periphyton and Benthos Lead)
Geochemistry	SRK Consulting (Canada) Inc.	Kelly Sexsmith, M.S., P.Geo. (Geochemistry Lead)
Geology	Peace River Coal Inc.	Angus Christie, Ph.D. (Manager, Strategy and Resource)
Geotechnical—Dump and pit wall stability; water management structures geotechnical input and site investigation	Norwest Corporation	Sean Ennis, P.Eng. (Geotechnical Lead)
Geotechnical—Dump volumetrics and scheduling	AMEC	Ramon Mendoza, M.Sc. (Mining Engineering Specialist) Ryan Ulansky, M.A.Sc., P.Eng. (Senior Mining Engineer)
Groundwater	SRK Consulting (Canada) Inc.	Dan Mackie, M.Sc. (Groundwater Lead)

Discipline	Company	Author/ Person Responsible
Land Use and Tenure	Stantec (formerly Jacques Whitford AXYS Ltd.)	Scott Trusler, M.Sc., R.P.Bio. (Acting Manager, Environment and Regulatory/ Associate, Environmental Management)
Pre-Feasibility mining and infrastructure design study Open pit mine and dump design, planning and scheduling	AMEC	Les Scovell, (Project Manager) Ramon Mendoza, M.Sc. (Mining Engineering Specialist) Ryan Ulansky, M.A.Sc., P.Eng. (Senior Mining Engineer)
Pre-feasibility Coal Processing and Handling Options Study	Taggart Global LLC	Brian Watters, B.S. (Process Engineer) David J. Morris, P.E., B.S., B.A. (COO Australia-South Africa) Patrick Brindle, B.S (VP Engineering)
Reclamation	Stantec (formerly Jacques Whitford AXYS Ltd.)	Brent Densmore, B.Sc. (Reclamation Lead)
Socio-Economics	Golder Associates	Pascale Mera, M.A. (Socio-economic Lead)
Soils and Terrain	Stantec (formerly Jacques Whitford AXYS Ltd.)	Justin Straker, M.Sc., P.Ag. (Terrain Lead) Natalie Tashe, M.Sc., P.Ag. (Soils Lead)
Surface Water and Sediment Quality	Lorax Environmental Services	Justin Stockwell, M.Sc. (Water and Sediment Quality Lead)
Traditional Interests and Use	Golder Associates	Craig Candler, Ph.D. (First Nations and Kelly Lake Interests and Use Lead)
Vegetation	Stantec (formerly Jacques Whitford AXYS Ltd.)	Harry Williams, M.Sc., R.P.Bio., P.Ag. (Vegetation Lead)
Wildlife	Stantec (formerly Jacques Whitford AXYS Ltd.)	Colleen Bryden, M.Sc., R.P.Bio. (Wildlife Lead)

Executive Summary

Introduction

Purpose of Document

The purpose of this document, the *Roman Coal Mine Project Environment Assessment Report—Application for an Environmental Assessment Certificate*, (the Application) is to describe the interactions between the Roman Coal Mine Project (the Project) and the environment and provide an assessment of the related effects. More specifically, the Application presents baseline data, results of analyses, effects assessments, environmental management plans and information necessary to support a decision regarding issuance of an Environmental Assessment (EA) Certificate for the Project pursuant to the British Columbia *Environmental Assessment Act* (BCEAA), SBC 2002, c.43.

The Application has been prepared pursuant to the Order under Section 10(1) (c) of the BCEAA issued by the British Columbia Environmental Assessment Office (EAO) September 11, 2007 and the Order under Section 11 of the BCEAA issued October 2, 2008. These orders are available for review from the EAO website, Project information Centre—Roman Coal Mine Project.

The Application was prepared in accordance with the approved *Roman Coal Mine Project -Terms of Reference for Peace River Coal Incorporated's Application for an Environmental Assessment Certificate* issued by the EAO on May 12, 2009.

Identification of the Proponent

The Peace River Coal Limited Partnership (the Partnership) was formed on November 29, 2006. The Partnership includes:

- Peace River Coal Inc. (PRC) currently with 75 percent ownership. PRC is wholly owned by Anglo Coal Canada Inc. (ACCI)
- Hillsborough Resources Limited (Hillsborough) currently with 13 percent ownership
- NEMI Northern Energy and Mining Inc. (NEMI) currently with 12 percent ownership

The parties transferred their northeast British Columbia metallurgical coal assets (the Coal Assets) into the Partnership. The Coal Assets are managed by PRC, as general partner of the Partnership. PRC is the Proponent of the proposed Roman Coal Mine Project (the Project).

Hillsborough and NEMI are Vancouver-based mining companies traded on the Toronto Stock Exchange under the stock symbols HLB and NNE, respectively. Hillsborough owns and operates the Quinsam Mine, an underground thermal coal mine on Vancouver Island, which has been operating since 1987.

Anglo American plc's coal interests are held through its wholly owned Anglo Coal business, one of the world's largest private sector coal producers and exporters with mining operations in South Africa, Australia, Colombia, Venezuela and Canada. Anglo Coal produces thermal and metallurgical coals for international customers in the Med-Atlantic and Indo-Pacific markets as well as South African and Australian based local customers. Anglo Coal operates in Canada through Anglo Coal Canada Inc.

PRC's Coal Assets include the Trend, Horizon, Reesor, Bickford, Mesa and Prospect properties and 50 percent of the Belcourt Saxon Limited Partnership.

Glen Koropchuk is the Chief Executive Officer and General Manager of PRC.

Project Setting

The proposed Project is located in the Peace Region of northeast British Columbia, approximately 30 km south of Tumbler Ridge. The Project is bound to the northwest by Babcock Creek and to the southeast by Gordon Creek which drain to Flatbed Creek which in turn drains to the Murray River. In the Peace River Coalfields, the Project is located adjacent to the Trend Coal Mine, which is also operated by PRC.

Existing site access from Tumbler Ridge follows the Heritage Highway southeast to the Canadian Natural Resources (CNRL) Road (PDR-46) then south approximately 14 km. Primary access to the Project is via a non-status road known locally as the Talisman Road.

The Project is located in the southern part of historical Treaty No. 8 lands. Saulteau First Nations (SFN) and the West Moberly First Nations (WMFN) are located 115 km to the north-northwest and the McLeod Lake Indian Band (MLIB) is located 125 km to the west.

The Project is also located within the area of interest of the communities at Kelly Lake. The communities at Kelly Lake include the Kelly Lake First Nation (KLFN), Kelly Lake Cree Nation (KLCN) and Kelly Lake Métis Settlement Society (KLMSS); Kelly Lake is located 70 km to the northeast of the Project.

The Project is in areas covered by the Dawson Creek Land and Resource Management Plan (LRMP) and the Dawson Creek Timber Supply Area Strategic Land Use Plan (draft) which provide guidance regarding resource management decision making in the project area. The Project is also located within the District of Tumbler Ridge, which has an Official Community Plan (OCP) and related zoning bylaw that are used to guide development.

The primary industries in the area include oil and gas extraction, coal exploration and mining, and forestry. Other land uses in the area include: tourism and recreation, trapping (the Project overlaps one registered trapping territory), guide-outfitting (the Project overlaps one licensed guide-outfitting territory) and wind-energy development.

Project Overview

The proposed Project is designed to mine approximately 30.6 million tonnes (Mt) run-of-mine (ROM) metallurgical coal at an average strip ratio of 8.4:1 bank cubic metres of waste per tonne (BCM:t) of ROM coal. With an average yield of 70.4 percent, clean coal production will be between 1.3 to 2.1 Mt per annum (mtpa) for the 10-year project life. The total planned production over the life of the Project is 21.5 Mt of metallurgical coal.

Construction activities associated with the Project include the construction of mining infrastructure and offsite facilities, development of mine access and development of the initial mining area are to be completed over a period of 18 months with construction slated to begin in the fall of 2011. Active mining is scheduled to begin in early 2012 and continue until late 2022. The construction and operations phases will overlap with Roman coal initially being processed and handled by Trend infrastructure (e.g., Trend plant, rail load-out, stockpiles) until new Roman facilities and upgrades are completed. Decommissioning and reclamation is anticipated to continue for a further two years following the completion of all production.

The Project will use a conventional truck and shovel method of open pit mining and will progress predominantly from northwest to southeast. Mining will begin by drilling and blasting waste rock, which will then be loaded into haul trucks and placed in external dumps or backfilled into previously mined pits in the South block of the Trend Coal Mine. The ROM coal will be loaded into haul trucks and transported to the coal processing plant.

As the Project is located directly south of the existing Trend Coal Mine, the Project will use, as much as possible, infrastructure that was built for the Trend Coal Mine, including the roads, powerline and some water management features.

The Project includes the following onsite and offsite components:

- Three linear open pits running southeast to northwest; one large central Gates pit flanked on each side by shallower Gething pits. There are six economically viable coal seams in the Gates formation (D, E, F, G, J and K), and four economically viable coal seams in the Gething formation (Bird, GT1, GT2 and GT3).
- A network of mine access and haul roads. Roman mine roads will tie into existing Trend roads. Both projects with share a common access route (along PDR-46 to the Heritage Highway) as well as common haul route (along PDR-46 to the Trend By-pass Road to the shared rail load-out).
- Associated waste rock dumps north and south of the pits (backfilling of the Trend Coal Mine South block pits will be undertaken where possible).
- Water management structures, including sedimentation ponds and associated collection ditches (RP1 to the south, SP2 and RP2 to the north).
- In-pit tailings impoundment (RP3 – Roman Mine—Phase 1 Gates pit will be used).
- Soil stockpiles in strategic locations to allow for soil replacement during reclamation.
- A modular sewage treatment plant.
- A new processing plant, which will process coal from both the Roman and Trend Coal Mines. The selected coal processing configuration will use a heavy media cyclone to separate coarse coal from coarse refuse. Intermediate-sized material is to be treated in a water-only cyclone used in conjunction with spiral concentrators. All ultra fine coal will be processed by a conventional or column froth flotation. A fluidized bed thermal dryer will be used for secondary drying.
- Existing infrastructure from Trend Coal Mine to be utilized for the Project:
    - a 21 km clean coal haul road to the load-out
    - a 25 kV power line
    - a bulk explosives facility
    - offices, mine dry and maintenance facility
    - rail load-out facility

Some of the existing infrastructure will be upgraded to accommodate greater tonnage or use associated with the infrastructure.

Project Benefits

Coking coal was in high demand in 2008, supported by the global demand for steel as well as supply constraints in Australia. Weakened economies in the United States and the European Union are likely to result in a reduced growth in steel demand in these markets for 2009; however, strong demand associated with rapid urbanization and industrialization in Brazil, Russia, India and China (the BRIC countries) is expected to continue.

In 2009, China alone will account for 37 percent of the global steel demand. Although growth rates for steel should moderate, the trend is upward and is expected to support the price of coking coal going forward.

Coal mining in northeast BC began in 1983. Through the 1980s revenues from the Quintette and Bullmoose metallurgical coal mines comprised 20 percent of the regional economy. These coal mines continued to be important contributors to the local economy until their closure in 2000 and 2003 respectively. With the resurgence in demand for metallurgic coal, coal mining has once again become an important contributor to the regional economy.

PRC is recognized as a supplier of high-value metallurgical coal. PRC's business plan is to continue to be a supplier of high-value metallurgical coal to the international marketplace. The Project aims to maximize potential opportunities for synergies with the existing Trend Coal Mine so as to realize operational efficiencies; lower operating costs and ensure a long-term sustainable business.

Table 1 Sustainable Development for the Roman Coal Mine Project

PRC SD Principle	PRC Plans that Support SD Principles	Description of Key Elements
Water	Pre-feasibility Mine Plan (revised)	• Minimized the adverse effects of the Project on water quality through removal of proposed rock drain in Babcock Creek, reduction in mine footprint and incorporating an in-pit tailings management facility • Reduced the potential for effects on sensitive watersheds by substantially reducing the Project footprint in the Gordon Creek Drainage and avoiding surface disturbance in the Five Cabin Creek drainage
	Sediment and Erosion Control Plan	• Reduced potential for elevated TSS associated with erosion of fine materials into receiving waters through the development and implementation of a Sediment and Erosion Control Plan
	Conceptual Reclamation Plan	• Minimizing the potential for elevated TSS through minimizing the area of exposed soils during operations by committing to progressive reclamation
Biodiversity	Pre-feasibility Mine Plan (revised)	• Reduced potential effects on wildlife habitat and alpine plant communities through reducing the overall mine footprint by about 10 percent and maximizing the overlap with existing disturbance at the Trend Coal Mine • Reduced potential for coal dusting of wildlife habitats and vegetation communities through the selection of covered coal stockpiles (silos) for coal storage at the plant site and rail load-out
	Invasive Plant Management Plan	• Reducing potential for plant species loss through development and implementation of the Invasive Plant Management Plan to mitigate the potential for invasive plant species to establish on site

Table 1 Sustainable Development for the Roman Coal Mine Project (cont'd)

PRC SD Principle	PRC Plans that Support SD Principles	Description of Key Elements
	Rare Plant mitigation measures	• Reduce the potential for adverse effects to rare plant species through transplantation of plant material from rare plant populations to similar off-site habitats
	Conceptual Reclamation Plan	• Substantial efforts to restore alpine ecosystems through implementation of progressive reclamation methods such as the direct placement of sods • Optimize post-closure values for caribou by focusing the reclamation prescriptions on addressing caribou habitat requirements and minimizing the potential for increased predator/prey interactions
Climate change and GHGs	Pre-feasibility Mine Plan (revised)	• Reduced emissions associated with the selection of electric rope-shovels instead of diesel-powered machinery • Minimizing emissions and energy use by making optimal use of shared infrastructure (with the Trend Coal Mine)

The Project is forecast to have a capital cost of $320 million and will employ up to 285 people during construction and up to 375 permanent employees throughout the life of the mine. The total direct mining payroll will be approximately $22.8 million per year. This equates to an additional 451 jobs created indirectly throughout British Columbia as a result of the Project. In addition over the life of the mine the Project is estimated to directly contribute $134 million in provincial and federal income and capital tax.

Information Distribution and Consultation

The Project is located in close proximity to the existing Trend Coal Mine and infrastructure operated by PRC. There are no privately owned properties or residential land users in the project area.

Pre-application Consultation

In August 2007, PRC submitted a project description for the proposed Project to the EAO. On September 11, 2007 an Order was issued to PRC pursuant to Section 10 (1)(c) of the BCEAA, SBC 2002, c43, confirming that an Environmental Assessment Certificate was required for the proposed Project and the project description was posted on the BC EAO website.

Pre-application meetings and consultations were held on the Project with the public, First Nations, communities at Kelly Lake, government agencies and stakeholders before and after submission of the project description in August 2007. During 2004–2006, information presented on the Project was general in nature, with more detailed information available and shared on the Project beginning in early 2007. PRC participated in pre-application public open houses held in Tumbler Ridge on November 14, 2007 and February 24, 2009 and in Chetwynd on February 25, 2009 respectively. Pre-application consultation with First Nations and the communities at Kelly Lake continued to present, continuing the process

outlined in Section 2 and documented therein through 2009. Consultation and consultation meetings will continue during the Application review period.

The EAO organized a Working Group to facilitate the review of the Project. Those invited to participate, as set out in Section 2, included: federal, provincial and local government agencies; eight Treaty No. 8 First Nations; and three communities at Kelly Lake.

On October 2, 2008 the EAO issued an Order pursuant to Section 11 of the BCEAA to PRC outlining the scope of the assessment and the procedures and methods for assessing the Project on October 2, 2008. The Section 11 Order also identified groups that are invited to participate: federal, provincial and local government agencies; First Nations including SFN, WMFN, Halfway River First Nation (HRFN), Doig River First Nations (DRFN), and the MLIB; and Kelly Lake Communities including KLCN and KLMSS. The above First Nations and Kelly Lake Communities have been approached on a number of occasions with offers to provide capacity funding in support of their participation in the Project EA process and review.

Section 2 outlines the range of communication; engagement and consultation methods used by PRC to share information about the Project, and document the details of selected communications and meetings as part of that consultation spectrum.

Identification and Status of Issues

During the pre-feasibility evaluation, a process of mitigation-by-design was implemented to address several issues that were known to be concerns to First Nations and regulators resulting in a number of refinements to the mine plan designed to reduce the potential environmental effects of the Project. These included reducing the total mine footprint by 10 percent (889 to 810 ha); maximizing the extent of dumps on the existing Trend disturbance (39 percent overlap) leading to an incremental disturbance of 498 ha for the Project versus the previously proposed 637 ha; removing the proposed rock drain from upper Babcock Creek; developing an in-pit tailings storage facility; pulling the footprint back from the Five Cabin Creek drainage; minimizing loss of high value caribou habitat wherever possible; focusing the Reclamation Plan on caribou habitat as one of the key end land-use objectives; selecting covered coal stockpiles (e.g., silos) for the processing plant and rail load-out; a new higher efficiency plant with increased coal recovery; and improving the process water recovery from the tailings ponds up to 95 percent.

In addition to efforts to address issues through mitigation-by-design, PRC has worked with each of the First Nations and the Kelly Lake Communities to support their respective participation in the pre-application review process and participation in community-based traditional knowledge or traditional use studies.

Consultation Planned During Application Review

Shortly after PRC submits the Project EA Application to the BC EAO, the EAO will advise if any additional public Open House sessions are required during the EA application review period.

In addition to any open houses, during the EA application review period PRC will make one or more representatives available upon request to provide information, answer questions and/or make presentations relating to the Project or the EA Application to First Nations, Kelly Lake Communities, the public or stakeholders.

PRC will also maintain a tracking list of all comments, issues and concerns raised by members of First Nations, Kelly Lake Communities, the public and stakeholders and will respond to these comments promptly during the EA Application Review Period.

PRC is committed to open communication with communities in the areas where it operates and has worked diligently to engage with First Nations and Kelly Lake Communities during the pre-Application stage. It will continue to do so during the Application Review stage of the Project EA and beyond.

Project Description

Geology

The Roman coal deposit is located directly south and adjacent to the existing Trend Coal Mine and the blocks share similar stratigraphy.

Economic coal seams in the Peace River area are found in Jurassic and Lower Cretaceous strata, which were uplifted during the Laramide Orogeny to form the Rocky Mountains. Thrust faulting and intense folding strongly affected the strata during this mountain-building phase. Economic coal seams are found in the Gates Formation and in the underlying Gething Formation, both of which are of the Lower Cretaceous age. These two phases of continental sedimentation are separated by marine deposits of the Moosebar Formation. The Project will target the coal seams of economic interest located in the Gates and Gething Formations which consist of a large syncline, the axis of which trends northwest–southeast and plunges to the northwest. Typically, the limbs of the syncline drop at angles between 40 and 65°.

Six major coal seams, from the D Seam at the top through the E, F, G, J and K Seams in descending stratigraphic order are present within the Gates Formation. Several subsidiary seams have been identified. Seam nomenclature is consistent with that of Trend Coal Mine and other mines in the area. The characteristic D Seam package persists throughout the southeast half of the deposit. The D2 Seam average thickness remains constant at about 3 to 3.5 m across the deposit. The E Seam package is found throughout the deposit. The E1 Seam varies in thickness from 2 to 2.5 m. Variations in partings and thickness sometimes makes identification of E2 Seam difficult. The F Seam appears to thin slightly to the northwest but retains economic thickness of between 1.9 and 2.1 m throughout the southeast part of the deposit. The G Seam is developed over the entire deposit and varies in thickness between 0.7 and 12 m, with an average of 3.73 m. The upper part of the seam contains thin claystone laminae and the bottom metre grades into a carbonaceous siltstone that forms the base of the seam. The J Seam has a consistent thickness of about 6 m over Roman Mountain. The upper half of the seam might contain thin shaly partings, but the lower half is invariably clean. The J Seam normally forms the base of the economic coal zone. The K Seam package comprises three seams (K1, K2 and K3), each separated by between 1 and 4 m of siltstone. The seam thicknesses are on average 1, 0.8 and 0.6 m, respectively.

The top of the Gething Formation is defined by the Bird Seam. The Bird Seam varies in thickness from 4 to 5 m and only rarely does it contain thin, shaly partings. The parting between the Bird Seam and the GT Coal Zone comprises a 1 to 2 m thick claystone. The GT Coal Zone comprises three well-defined coal seams (the GT1, GT2 and GT3 Seams). At this juncture of the investigation it has been considered prudent to refer to this as the GT coal Zone until the lateral continuity of coal seams is established. The coal zone occurs about 1 to 3 m below the Bird Seam and varies in thickness between 10 and 15 m. Individual coal seams vary in thickness between 1 and 2 m with about 60 to 70 percent of the coal zone comprising coal.

The Murray Syncline is the predominant structural feature on Roman Mountain and is a tight fold typical of the area. The syncline is roughly symmetrical with the northeast limb dipping fairly uniformly at 50 to 60° to the southwest. The southwest limb dips generally steeper, up to 80°. The fold axial trend is 130° T, with the hinge plunging at an average of 7.5° to the northwest.

At least three major steep thrust faults have been mapped on surface along the southwest limb, primarily exposed in trenches as repetitions of the J Seam in the Gates Formation and the Bird Seam in the Gething

Formation. Further evidence of these faults is expressed in boreholes along the entire length of the southwest limb, where the G and J Seams show repetition and truncation.

The total measured and inferred in situ coal resource for the Roman Gates Pit is 26.6 and 2.1 Mt for the Gething Pits.

Geochemical Characterization

Representative samples of waste rock, raw coal, coarse coal rejects (CCR) and tailings were tested to characterize the potential for acid rock drainage and metal leaching from the pit walls, waste dumps, CCR and tailings that will be produced during the Project. The data were used to develop waste rock management plans to minimize the potential for acid rock drainage (ARD) and metal leaching (ML), and to develop estimates of source concentrations (i.e., source-water quality estimates) for seepage and runoff from the waste rock dumps and pit walls for use in the predictions of discharge and receiving water quality.

In general, the results of the ML/ARD predictions indicate that, with appropriate waste management planning and implementation, this site has a low potential for ARD.

The majority of the waste rock has low sulphur and relatively high neutralization potentials and is non-acid generating. Waste rock from above D Seam, which comprises approximately 10 percent of the waste rock that will be produced by the Project, contains variable amounts of sulphur and has low neutralization potential, and is considered to be potentially acid generating. This material will be inter-layered with non-acid generating rocks. Rocks immediately above and below some of the coal seams also contain somewhat elevated amounts of sulphur and are potentially acid generating. As a result of mixing during the mining process, these are expected to be well blended with non-acid generating rocks. The overall ARD potential for the waste rock dumps is low.

Removal of the above D Seam material will remove most of the potentially acid generating material from the Gates Pit. Some of the coal seams and the associated hanging wall and footwall materials might be locally acid generating; however, interaction of those seams with predominantly alkaline materials in the rest of the pit will neutralize these seams within the confines of the pit. Exposures of the Bird and GT seams in the base of the Gething Pits might also lead to some locally acidic seepages; however, alkaline runoff mixing with these waters is expected to neutralize these materials within the confines of these pits as well.

Geochemical testing of coal, CCR and tailings samples indicated a variable potential for ARD, with some seams (F, G, J, K and GT seams) classified as not potentially acid generating and some as potentially acid generating (D, E and Bird Seams). During the first two years of mining, CCR and tailings will be layered with the non-acid generating waste rock to prevent ARD. For the remainder of the mine life, these materials will be placed in an in-pit tailings management facility at the lower end of the Gates Pit. This is expected to greatly reduce any risk of ARD.

Roman Coal Mine Plan

The Project is designed to mine approximately 30.6 Mt run-of-mine (ROM) metallurgical coal at an average strip ratio of 8.4:1 BCM:t of in-situ coal. With an average yield of 70 percent, clean coal production is on average 2 Mtpa and 21.5 Mt of metallurgical coal total for the 10-year project life.

The Project is located directly south of the operating Trend Coal Mine and the Project has been designed to use as much of the Trend Coal Mine infrastructure as possible, including the roads, power line and some water management structures. The maximum disturbance limit for the Project is 810 ha, with approximately 498 ha of new disturbance, and the balance (312 ha) overlapping with pre-existing ground disturbance from the Trend Coal Mine.

The Project includes three linear open pits, one large central Gates pit flanked on each side by shallower Gething pits) which will mine six economically viable coal seams in the Gates formation (D, E, F, G, J and K), and four economically viable coal seams in the Gething formation (Bird, GT1, GT2 and GT3). External waste dumps are planned to the north and south of the open pits. The mine plan allows for backfilling of mined out pit areas where it was deemed feasible. This approach will minimize the incremental footprint of the external dumps, decreases the extent of new disturbed areas and reduce the area of exposed footwalls and hanging walls.

During pre-feasibility planning for the Project, several refinements were made to the Roman Coal Mine Plan which was presented as part of the August 2007 Project Description submitted to the EAO. Several key factors influenced the mine design (including dump placement and extent of mining) throughout the planning process. These included:

- the dip of the coal bearing strata influenced strip ratio used for the design
- steep topography in the area and associated geotechnical concerns constrained pit shells
- integration with the existing Trend Coal Mine operation
- proximity to Babcock and Gordon Creeks
- high value caribou habitat
- acid rock drainage management
- dust management

During the pre-construction and construction phases, areas required for infrastructure, support facilities, and initial mining activities will be cleared and grubbed. Soils will be stockpiled in strategic locations to allow for soil replacement during reclamation. Construction activities will take approximately 18 months to complete and are slated to begin in the fall of 2011. Construction and operation phases will overlap.

The Project will use a conventional truck and shovel method of open pit mining and development will progress from northwest to southeast. Mining will begin with drilling and blasting of waste rock, which will then be loaded into haul trucks and placed in external dumps or backfilled into previously mined pits in the South block of the Trend Coal Mine. The ROM coal will be loaded into haul trucks and transported to the coal processing plant.

Mining activities will begin in 2012 and will be staged in three phases, which outline the progression of the active faces of mining.

The mining schedule calls for initial development of the western most sections of the Gates and Gething Pits (Phase 1), to occur early in the life of the mine. In Year 1 and 2 coal will be extracted from both the Gates and Gething pits with waste rock mainly going to the development of the South dump and the backfilling of the Trend Coal Mine South block pits (later to be covered by the North dump).

In the fourth quarter of Year 2, mining will progress into Phase 2. Phase 2 will consist of a 750 m extension of the Gates and Gething pits to the east and will continue through Year 6. During Phase 2 waste rock will mainly be placed in the North dump, with a small amount of material taken to the south dump.

The upper portion of Phase 3 will start development in the fourth quarter of Year 4 and be mined concurrently with Phase 2 until the first quarter of Year 6, when Phase 2 will be mined out. Waste rock will be placed on both the North and East dumps.

Mine site support facilities for the Project will be shared with the Trend Coal Mine and will be located in brownfield sites adjacent to Trend facilities.

Water Management Plan

The site water management plan for the Project will comprise a network of open channel ditches and sediment ponds strategically located to collect surface runoff and seepage, minimize erosion and remove excessive suspended sediment from flows prior to release to the environment.

Operational Water Management

Initially, surface runoff water from mining activity areas will be conveyed by a series of ditches to two sediment ponds (RP1 to the south and RP2 to the north). RP1 will collect runoff from the Phase 1 Gates open pit area and South dump, and will discharge into Babcock Creek by way of an armoured overflow spillway. RP2 will collect runoff and seepage from the developing North dump area located between the Gates pit and Trend Coal Mine's plant site. RP2 will be active throughout the mine-operating period and will discharge to Babcock Creek. Runoff from the East dump will be directed towards an existing Trend Coal Mine sediment pond (SP4) before release to Gordon Creek.

Once Phase 1 of the Gates pit is complete, the void created will be used as a tailings storage facility. This will allow subaqueous deposition of tailings and some potentially acid generating (PAG) waste material. As development continues, pond RP1 will be decommissioned as the in-pit tailings facility (RP3) becomes available to manage mine-affected drainage. At this time, perimeter collector channels will be extended to also direct all runoff and seepage from the southern dump area into the lower portion of the Gates pit. Pit development towards the east will continue thereafter with all drainage from the operating pit area also directed into the lower western portion of the pit. The western portion of the pit will serve as a combined tailings pond and sediment pond for the pit catchment area and the southern waste dump area with a total available storage volume of about 8 Mm^3.

Discharge and subaqueous deposition of approximately 1.3 Mt of tailings and CCR over an eight-year period will be carried out at the eastern end of the RP3 to maximize settling potential. Water will be reclaimed from the western end of the pit to be recycled at processing plant at a rate of up to 95 percent of the inflowing tailings transport slurry water. Some PAG waste rock will also be dumped by truck into the pond for sub-aqueous storage so that the solids will become submerged underwater as quickly as possible.

Post-closure Water Management

Progressive reclamation of disturbed areas and non-active or completed waste dumps will continue throughout operations. After all mining activities are complete, any non-reclaimed waste dumps and disturbed areas will be reclaimed as per the Conceptual Reclamation Plan provided (Section 4.12). Reclamation material (topsoil and subsoil) will be replaced on the waste dump benches and slopes and contoured and vegetated to shed water and minimize erosion. Topsoil will be replaced on the facilities area and will be re-vegetated in compliance with the Reclamation Plan.

The water management and collection system will continue to operate until such time as the runoff from all areas of the site is deemed acceptable for direct release to the environment without the need for treatment. At that time all ditches and sediment ponds with the exception of RP3, the tailing management facility will be decommissioned and reclaimed. The intent is, that to the greatest degree possible, site drainage patterns will be returned to pre-existing patterns within stable channels that will mimic natural pre-mining flow and runoff processes.

Sediment pond RP3 within the Gates Pit will remain as a permanent pond after closure. Overflows from the pond will be directed into a permanent erosion-resistant spillway and outlet channel into Babcock Creek.

Pond RP2 will be drained, deposited sediment removed, the reservoir and dam embankment reclaimed and re-vegetated, and a stable flow channel established through the pond area along the natural drainage path.

Flows from reclaimed waste dump areas will be returned to or directed into natural gullies and channels wherever possible. All runoff collector channels and unused site roads will be decommissioned by re-grading, removing all culverts and re-vegetating. Permanent erosion protection measures will be installed as required at key locations.

Monitoring and inspections of the post-closure water management system will continue after completion of mining with repairs made as necessary to ensure long-term stability of the system.

Site Water Balance

A continuous simulation monthly spreadsheet water balance model was developed to assess flows at various locations downstream of the Project during the post-closure period. The results indicate that total project post-closure water releases will be distributed by about 73 percent to Babcock Creek and 27 percent to Gordon Creek. On an annual average basis about 6.3 and 2.4 Mm^3 of runoff will be generated from the mining areas to Babcock and Gordon creeks, respectively.

Maximum make-up water demand for the coal processing plant will occur during the first two years of operation, before completion of the Gates pit tailings facility (RP3). During these first two years there will be minimal recycle of process water and the total make-up water demand is estimated to be 82 m^3/hour.

The make-up water demand will be met initially by a combination of pumping from storage in the sediment ponds and pumping from groundwater wells. Simulations of the site water balance indicate that runoff to the sediment ponds will be capable of meeting most of the make-up water demand and that groundwater will only be needed at a sustained rate of about 6.8 m^3/hour over a six-month period each year. The capacity of existing wells at Trend Coal Mine is estimated to be greater than 40 m^3/hour. After the second year of operation, tailings will be deposited into the Gates Pit. At that time, runoff to RP3 and the reclaiming of tailings slurry water from the pit (designated as pond RP3), will essentially eliminate the need for groundwater pumping to satisfy process plant make-up water requirements. Storage within the RP3 pond will meet all plant demands.

Maximum peak and average daily domestic water demands for the process plant, office and maintenance facility, including mine dry, warehouse, and offices are estimated to be: 7.3 L/s, maximum peak flow and 52 m^3/day average (24-hour) flow. Existing wells around the Trend Coal Mine suggest that the above domestic flow requirements will be readily satisfied from wells.

Plant fire suppression water will be stored in separate tanks supplied from groundwater wells or from the sediment ponds. Fire suppression pumps adjacent to the tanks will be designed to supply the fire protection system at the necessary flow rates and pressure. The sediment ponds could be used to provide additional or emergency sources of fire protection water, if necessary.

Water for dust suppression through road watering will be drawn from the sediment ponds. Water demand for road watering will be seasonal and will vary with weather conditions.

Conceptual Reclamation Plan

The conceptual reclamation plan developed for the Project is based on identified end land use capability objectives, soil handling plans and replacement strategies to achieve these objectives, and on resultant predicted post-closure ecosystem units within the Project's maximum disturbance limit (MDL). The MDL includes:

- areas that have forest cover cleared but the underlying vegetation and soils have not been disturbed

- areas that have been cleared of forest cover and the soils disturbed
- previously mined land from the adjacent Trend Coal Mine

The conceptual reclamation plan will emphasize habitat protection and habitat re-establishment for the key wildlife species, including woodland caribou.

In order to minimize the amount of land disturbed at any one time, PRC will practice progressive reclamation, reclaiming areas where active mining is complete as soon as possible. Sufficient topsoil will be stockpiled to meet all reclamation requirements from disturbed areas. Salvaged soil stockpiles will be revegetated to assure minimal erosion and soil loss.

All waste dumps will be resloped to an angle of 27° as soon as practicable. After completion of resloping activities, waste dumps will be capped with salvaged soil material and revegetated to establish a long-term, self-sustaining vegetation cover that will provide erosion and invasive plant control and foster the establishment of productive ecosystems. Soil material will either be supplied as direct placement from active soil salvage operations or from soil stockpiles. Reclamation practices suitable for waste rock dumps will be employed, such as building soil berms and placing rock piles to provide wind protection and snow capture and assist in the establishment of vegetation and creation of small mammal habitat.

If required to stabilize dump slopes, measures such as installation of erosion control blankets, application of a bonded fiber matrix or installation of bioengineering structures such as wattle fences, and modified brush layers may be undertaken.

The mine plan includes some areas where waste dumps will be developed on moderate to high capability caribou habitat in the alpine tundra and forested sub-alpine zones within the MDL. In order to mitigate project effects to caribou habitat, specific reclamation measures may be carried out including: the salvage and transplantation of vegetation layers from high value caribou habitat prior to disturbance, contouring high elevation waste dumps to create variable topography, and planting vegetation clumps on protected portions of ridge slopes and bowls.

After closure, the water management structures, including sedimentation ponds RP2 and SP2, as well as the associated diversion and collection ditches, will remain in place until the reclamation earthwork activities, such as resloping dump faces, have been completed and vegetation has been established to minimize the potential for surface erosion. Once reclamation activities have been completed and there is no longer a need for sediment control, the collection ditches will be backfilled to approximate the original topography and capped with windrowed topsoil, allowing surface waters to flow along the natural local drainage systems where possible. The sedimentation pond containment berms will be removed to pond height so the pond surface will be free draining and no longer impound water.

Because the CCR and PAG waste rock will need to remain submerged, the tailings management facility (RP3) will not be reclaimed and will remain in place after closure. In addition, due to concerns regarding selenium uptake in aquatic vegetation, the establishment of aquatic vegetation will not be encouraged.

Once sites have been capped, they will be revegetated to establish self-sustaining vegetation communities that will provide erosion and invasive plant control and promote the establishment of productive ecosystems. In total, approximately 5.4 ha of sedimentation pond and 3500 m of diversion and collection ditches will be reclaimed.

Where reclamation is feasible and safe access is available for equipment and personnel, the pit floors and in-pit haul roads will also be capped with salvaged soil material and revegetated; approximately 26 ha of these areas will require reclamation. Approximately 3.4 ha of pit walls are constructed in overburden material and will also be resloped, capped with soil, and revegetated. Approximately 3.4 ha of pit walls located in overburden will require reclamation.

To prevent the pit haul roads from becoming travel corridors for caribou predators, hunters and ATVs, the road surface will be roughened, wood debris and rock piles will be distributed along the length of the roads and the road corridor densely planted with trees in order to create line of sight and travel barriers.

Coal Processing, Transport and Load-out

The construction of a new coal processing plant (CPP) to process coal from both the Roman and Trend Coal Mines is proposed. Once the coal is mined, it will be trucked to the CPP. To mitigate dust generated during transport, roads will be watered throughout the mine site as weather allows. At the plant site, fugitive coal dust generation will be controlled by using silos or enclosures for the storage of raw and clean coal.

Raw feed will be crushed using a rotary breaker before entering the plant. The CPP will use a heavy media cyclone to separate coarse coal from coarse refuse for sizes of 50 to 0.50 mm. Intermediate-sized material between 0.50 to 0.15 mm is to be treated in water only cyclones used in conjunction with spiral concentrators. All ultra fine coal (to zero) will be processed by a conventional or column froth flotation. Secondary drying will be undertaken using a fluidized bed thermal dryer. Both coarse and fine coal refuse (CCR and tailings) will be generated during coal processing. Prior to the commissioning RP3, tailings will be dewatered, mixed with CCR and treated as PAG material. Once RP3 is commissioned, CCR and tailings will both report to this facility. CCR will be transported by truck and tailings will be pumped through a pipeline.

Clean coal will be transported by highway-legal, 50-tonne trucks from the CPP to the rail load-out facility approximately 21 km away via PDR-46 to the Trend Bypass Road. To mitigate for fugitive dust, all haul trucks will have covered loads and roads will be watered as appropriate.

Existing infrastructure for the Trend Coal Mine will be expanded at the rail load-out facility to accommodate the extra clean coal tonnage generated by the Project. At the rail load-out coal will stored in over-track silos with integral batch-weigh loading. To minimize coal dust emissions loaded trains will have be sprayed with a latex solution.

Environmental Management Plans

Overview

PRC has developed a series of Environmental Management Plans (EMPs) for the Project. As the Project is adjacent to the Trend Coal Mine and both projects will share common infrastructure, integrated management plans have been developed and will be used at both operations. The EMPs address the environmental supervision, mitigation, environmental effects monitoring, and review required to manage the potential adverse effects of the Project during construction and operations. The EMPs will continually be revised as needed to include any additional permitting requirements and incorporate adaptive management principles determined through the planning and implementation of the Project.

These EMPs integrate existing corporate environmental policies and procedures and provide project-specific environmental management information. Following is a list of EMPs included in the Application:

- Air Quality and Dust Control Plan (Section 5.2)
- Wildlife Protection and Monitoring Plan (Section 5.3) which includes a stand-alone Caribou Protection Plan (Section 5.3.3)
- Invasive Plant Management Plan (Section 5.4)
- Surface Erosion and Sediment Control Plan (Section 5.5)

- Receiving Water Monitoring Plan (Section 5.6)
- Selenium Management Plan (Section 5.7)
- Metal Leaching and Acid Rock Drainage Management Plan (Section 5.8)
- Fish and Fish Habitat Protection Plan (Section 5.9)
- Archaeology Site Protection Plan (Section 5.10)
- Solid and Hazardous Waste Management Plan (Section 5.11)
- Chemical Management Plan (Section 5.12)
- Emergency Response Plan (Section 5.13)
- Access and Traffic Management Plan (Section 5.14)

Environmental Effects Assessment Approach and Methods

This environmental assessment for the Project was conducted using a standard methodological framework to meet the requirements of BCEAA. The environmental effects assessment methodology is based on a structured approach, which:

- focuses on issues of greatest concern
- considers provincial regulatory requirements for the assessment of environmental effects
- considers issues raised by the public, Aboriginal people and project stakeholders
- integrates engineering design and programs for mitigation and monitoring into a comprehensive environmental planning process

For the purposes of this assessment, "environment" refers broadly to the combined biophysical and human environment.

The environmental assessment focuses on valued environmental components (VECs), which are of value or interest to government regulators, the public, Aboriginal people and stakeholders. The following VECs were identified for this Application: Air Quality, Terrain and Soils, Vegetation, Wildlife, Climate and Surface Water Hydrology, Surface Water and Sediment Quality, Groundwater Quality and Quantity, Fish and Fish Habitat, Periphyton and Benthos, Land Use and Tenure, Archaeology, Regional and Local Socio-economic and Health Conditions, First Nations Socio-economic and Health Considerations, First Nations Interests and Use, Kelly Lake Communities Socio-economic and Health Considerations, and Kelly Lake Communities Interests and Use. VECs can have various components that might interact differently with the Project; therefore, the environmental assessment may consider effects on selected key indicators (KIs) for certain VECs (e.g., woodland caribou is a KI for the wildlife VEC).

The environmental assessment addresses project–related effects and, in some cases, cumulative environmental effects. Project-related environmental effects are changes to the biophysical or human environment that are caused by a project or activity arising solely as a result of the proposed principal works and activities, as defined by the scope of the Project. Cumulative environmental effects are changes to the biophysical or human environment that are caused by an action associated with the project under review, in combination with other past, present and reasonably foreseeable future projects and activities.

The environmental assessment for each VEC was structured according to the following factors as defined in Section 6: Effects Assessment Approach:

- Scope of Assessment

- Baseline Conditions
- Assessment of Environmental Effects
- Determination of the Significance of Residual Environmental Effects
- Follow-up and Monitoring

Effects Assessment—Biophysical

Air Quality

The proposed Project has the potential to affect local and regional air quality since mining operations may be a source of dust and fossil fuel combustion emissions. The primary concern regarding degraded air quality is the potential effect on human health. Secondary concerns include deteriorated visibility and nuisance dusting. Emissions from mining operations can also affect vegetation and water quality. Furthermore, the combustion of fossil fuels results in the emission of greenhouse gases (GHGs) that are of concern due to their potential to cause global climate change.

The Project consists of two main components: the rail load-out and the Roman mine site. Activities that could affect air quality at the rail load-out include coal handling, stockpiling and transport. The rail load-out will also include transfer facilities for coal haul trucks and a conveyor rail load-out system. At the Roman mine site, activities that could affect air quality include mining operations, coal and overburden handling and operation of the thermal dryer.

The emission of greatest concern associated with a coal mine is typically particulate matter. Particulate matter is often defined in terms of size fractions: particulate matter of all size classes is referred to as total suspended particulate, particulate less than 10 μm is PM_{10}, and particulate less than 2.5 μm is $PM_{2.5}$. Dustfall refers to the amount of particulate matter of all size classes that settles onto a collection surface in a given amount of time. It is a measure of the amount of particulate present in the ambient air that is deposited on the ground. Measurements of dustfall are available for several locations near the Trend and Roman mine sites and the rail load-out. Measurements of PM_{10} and $PM_{2.5}$ are available from the Tumbler Ridge airport and Tumbler Ridge Industrial Park monitoring stations operated by personnel from the Trend Coal Mine. Measurements of dustfall are available at several locations near the Trend Coal Mine site and rail load-out. Baseline ambient air quality near the Project is assessed in this section by reviewing and evaluating the available dustfall and PM observations.

As onsite background NO_2 and SO_2 concentrations are not available, ambient air quality data from the Beaverlodge monitoring station were reviewed to assess NO_2 and SO_2 contributions from background sources in the study area. The Beaverlodge station was selected to represent background in the study area as this station is the nearest representative station with continuous NO_2 and SO_2 monitoring.

Greenhouse gas emissions may have global effects that cannot easily be measured on a local or regional scale. The Environment Canada report on Canada's Greenhouse Gas Inventory (Environment Canada 2008) provides an estimate of Canada's greenhouse gas releases to the environment on an annual basis. In 2006, Canadians contributed about 721 Mt of greenhouse gases, (expressed as CO_2 equivalent) to the atmosphere, while British Columbia alone generated 62.3 Mt of greenhouse gases (Environment Canada 2008). GHG information from other mine sites such as Trend, Wolverine and Brule were reviewed to establish comparable GHG emissions predictions for the Project.

The following air quality effects were assessed:

- emissions of fugitive coal dust

- increases in ambient concentrations of the following criteria air contaminants (CACs): total particulate matter, particulate matter with a diameter less than 10 µm (PM_{10}), particulate matter less than 2.5 µm ($PM_{2.5}$), nitrogen dioxide (NO_2), and sulphur dioxide (SO_2)
- increases in emissions of GHGs (carbon dioxide, methane and nitrous oxide)

There are no permanent or seasonal dwellings located within 3 km of the mine site and no potential effects from noise are anticipated. The 3-km distance was used because the steady noise level from normal project operations is expected to decrease to typical rural background sound levels at this distance. This is consistent with previous field experience and observations. A best practices approach to environmental noise management will be applied if any noise concerns arise.

With respect to air quality, activities of concern at the rail load-out include coal handling and stockpiling, transfer facilities for coal haul trucks and a conveyor rail load-out system. At the Roman Coal Mine site, the key activity of concern is the operation of a coal dryer.

Particulate Matter—The assessment of PM environmental effects includes evaluation of changes in ambient levels of dustfall, PM_{10}, and $PM_{2.5}$. Activities at the rail load-out that may result in emissions of PM are coal handling, conveyor transferring, and stockpiling. PM emissions from the coal dryer were also considered. On a per tonne coal throughput basis, particulate matter emissions from the Roman Coal mine site are expected to be an order of magnitude less than from Trend and Brule. The maximum predicted dustfall deposition rate for the rail loadout study area is 0.4 $mg/dm^2/d$ over a 30-day period, which is considerably less than the provincial objective of 1.75 $mg/dm^2/d$.

Nitrogen Oxides (NO_x)—During operations, the coal dryer at the Project will emit nitrogen oxides (NO_x), which are converted in the atmosphere to NO_2. The maximum predicted one-hour NO_2 concentration of 66 $\mu g/m^3$ is approximately one-sixth of the federal maximum acceptable objective.

Sulphur dioxide (SO_2)—The coal dryer at the Roman Mine site will emit sulphur dioxide (SO_2) during operations. The maximum predicted one-hour SO_2 concentration of 123 $\mu g/m^3$ is approximately one fourth of the provincial Level A objective.

Greenhouse Gases (GHG)—Emissions of greenhouse gases will result from fuel combustion; for the operation of mobile equipment, the vehicle fleet and coal dryer as well as from coal bed methane releases from the mining and processing of coal. The total annual emission rate of carbon dioxide equivalent greenhouse gas emissions from fuel use is 144,852 tonnes. The peak annual emission rate of carbon dioxide equivalent greenhouse gas emissions due to coal bed methane is 36,540 tonnes. The estimate of annual greenhouse gas emissions from the Project represents a 0.3 percent increase relative to the year 2006 greenhouse gas emissions for British Columbia, and a 0.025 percent increase for Canada. In a per tonne of coal throughput basis, the predicted Project intensity level of 60 kg of GHG emissions per tonne of coal throughput is the lowest when compared to the Trend, Wolverine and Brule mines.

The maximum predicted cumulative NO_2 and SO_2 concentrations are considerably less than the most stringent air quality objectives for NO_2 and SO_2 for all averaging periods. The highest predicted concentrations occur approximately 1 km south of the coal dryer.

Other mine sites such as Trend, Wolverine and Brule generated approximately 24 kilotonnes (kt), 103 kt and 42 kt of GHG emissions, respectively, in 2006. This is equivalent to 79, 242 and 87 kg of GHG emissions per tonne of coal throughput at the Trend, Wolverine and Brule mines respectively.

During the operational phase at the rail load-out, fugitive coal dust emissions will occur from blasting, mining, coal handling activities, conveyor transfer points, coal transport and stockpile wind erosion. Mitigation measures that have been included in the project design include:

- installation of silos for clean and raw coal at the plant site and the rail load-out

- enclosures on conveyor transfer points
- water applied to roads to reduce dust emissions from vehicles and road traffic

The coal dryer will be equipped with a high-energy scrubber, cyclone and mist eliminator to reduce the emissions of PM and SO_2.

The greenhouse gas emissions will be managed to focus on the efficient operation of the vehicle fleet and coal dyer. Fuel efficiency is a priority when purchasing, upgrading or maintaining the vehicle fleet. The amount of time that vehicles idle will be minimized. Shutdowns and start-ups of the coal dryer will be avoided where possible and regular maintenance will be applied.

The particulate matter monitoring program at the Roman Mine site and rail load-out will continue and the Air Quality and Dust Control Plan (Section 5.2) will be implemented. Further mitigation measures will be applied if any exceedances are measured.

Monitoring of NO_x and SO_2 is not recommended for the project since there are no significant environmental effects. However, stack testing for NO_x and SO_2 to validate the emission rates that were assumed for this assessment is recommended.

Monitoring of GHGs is not required; however, GHG reporting will be required on an annual basis in accordance with Environment Canada's GHG Reporting program and proposed provincial reporting requirements.

Overall, the residual Project and cumulative effects on air quality are considered to be not significant.

Terrain and Soils

Terrain

The Project is located in the Central Canadian Rocky Mountain (CCRM) Ecoregion characterized by steep-sided, round-topped mountains and foothills that are lower than ranges of the Rocky Mountains to either the south or the north. The Project is underlain by bedrock consisting of interbedded non-marine sandstones, shales and coals. Surficial sediments resulting from the most recent glaciation cap the shale and sandstone underlying the area.

Approximately 43 percent of the maximum disturbance limit is comprised of areas disturbed by the Trend Coal Mine. In undisturbed areas the dominant surficial material is till comprising 24 percent of the maximum disturbance limit. This cordilleran till has a loamy to silt loam texture and a coarse fragment content below 35 percent with the deposits ranging from thin veneers to thick deposits that masked the underlying bedrock. There are lesser areas of colluvium, bedrock outcrops, weathered bedrock, fluvial and glaciofluvial deposits, organics and a small area of glaciolacustrine. Slopes range from gently sloping (5 percent slopes) to steeply sloping (greater than 70 percent slopes) with the majority of the maximum disturbance limit ranging from 26–50 percent.

Changes in Terrain Stability from project-related activities can result in increased incidence of mass wasting (e.g., debris flows, slumps and earth flows). The rate at which such instability occurs can be exacerbated by project-related activities such as site clearing and stripping, road construction, slope loading, groundwater changes and blasting.

Terrain stability can be mitigated primarily by avoidance of potentially unstable and unstable areas, or through mine design such as grading, contouring and excavating to control terrain instability.

Terrain stability assessments will be carried out in areas mapped as potentially unstable and unstable, and will be completed at the permitting stage before construction and development, as a component of

detailed mine planning. Strain gauges and other monitoring equipment will be in place in areas of concern to monitor terrain stability throughout the life of the Project.

With appropriate mitigation and environmental protection measures, the environmental effects will be contained within the LSA and changes to terrain stability is anticipated to be not significant. No cumulative effects are anticipated with terrain stability, as residual project effects are localized and can be mitigated effectively.

Soils

Reclamation suitability of soils is based on coarse fragment content and texture. Areas with organic deposits are rated as good/fair. Almost 60 percent of the site is rated as unsuitable or disturbed. Of the remaining undisturbed soil the majority of the soil is rated as good to fair for soil salvage. Elevated metal findings in the soil are not limiting to soil reclamation suitability.

Project effects on soils are measured through changes to soil capability and changes to soil distribution. Project-related changes to soil capability can be influenced by changes to the physical and chemical properties of soil caused by admixing, compaction, contamination and alteration of soil fertility.

Soil distribution is a measure of both the quantity and areal extent of soils. Soil erosion may occur during construction following removal of vegetation and during reclamation when soil is being replaced on dump slopes before establishment of vegetative cover. Soil loss occurs where soil salvage will not occur. Soil cover loss concerns the direct loss from retention ponds that are not decommissioned (e.g., flooding).

The primary mitigation measures for effects to soil include soil conservation measures such as soil salvage and erosion control as outlined in the soil assessment. A number of plans exist that have site-specific measures to protect the soil resource and include:

- Air Quality and Dust Control Plan (Section 5.2)
- Emergency Response Plan (Section 5.13) which includes a Spill Response Plan
- Surface Sediment and Erosion Control Plan (Section 5.5)
- Conceptual Reclamation Plan (Section 4.12) including the soil salvage plan

Monitoring of soil will occur primarily at construction and initial disturbance when the risk to the soil resource is greatest. An environmental monitor will be on site during clearing and grubbing and during soil salvage. Monitoring will be for salvaging appropriate reclamation material, proper storage of soil within and observing that all erosion and sediment control measures are in place and maintained. Monitoring for soil will also occur during reclamation. Reclamation will occur progressively, (e.g. after construction of areas that supported construction activities and are no longer required), and during final reclamation at closure. Monitoring soil properties such as topsoil replacement depths, compaction, and soil fertility will occur during reclamation and will be assessed primarily through monitoring revegetation success.

Successful conservation of soil resources and reclamation in the Roman disturbance area is projected to return disturbed soil to meet reclamation objectives. All effects are localized and reversible with use of appropriate mitigation strategies. The environmental effects of the Project on soil are therefore rated not significant in consideration of the planned mitigation and reclamation measures.

The primary mechanism for cumulative effects on soil capability is the interaction of multiple air sheds contributing air-based contaminants resulting in soil contamination. The Trend Coal Mine is located in close proximity to the Project; however, based on analysis of potential dusting from both mines, no metal exceedances in soil are expected to occur during the life of the mine.

Vegetation

The Project is located within the Hart Foothills Ecosection of the Sub-Boreal Interior Ecoprovince—an area of low, rounded mountains and wide valleys on the east side of the Rocky Mountains. The study area ranges in elevation from 740 to 2040 masl and encompasses a broad range of ecosystem types from moist warm, low-elevation boreal forest through alpine tundra.

Seven vegetation KIs were selected for detailed effects assessment: rare plants, rare ecosystems, wetland ecosystems, riparian ecosystems, alpine and parkland ecosystems, old forest and forest productivity.

The LSA is intended to encompass the area within which VEC-specific project effects are most likely to occur. The vegetation field surveys focused on the LSA, and any site-specific project-related effects are discussed in the context of the LSA. The RSA provides broad context for discussion of localized project-related effects, and sets the general boundaries for the collection and review of existing literature and information. A terrestrial ecosystem mapping (TEM) product was developed for the entire RSA.

Field surveys and mapping confirmed the existence of three provincially-listed rare plant species, one provincially listed ecological community, as well as areas of wetland, riparian and alpine ecosystems in the LSA. However, no old forest was identified in the LSA.

Three potential environmental effects on vegetation were identified, including:

- loss of vegetation
- changes in abiotic conditions
- changes in community structure and composition

The following temporal boundaries are used for the assessment of these potential project effects on the vegetation KIs:

- ***Baseline***—Conditions before project-specific developments (note: the entire Trend Coal Mine is considered active at baseline).
- ***Maximum Footprint***—The worst-case vegetation conditions that could occur during the construction and operations phases of the Project (note: the Trend Coal Mine is considered inactive but unreclaimed).
- ***Post-closure***—Conditions following closure assuming that all mitigation measures and the Reclamation Plan have been implemented (note: the entire Trend Coal Mine is considered to be fully reclaimed in this scenario).

The project will result in the loss of populations of three provincially-listed rare plant species in the proposed footprint area. These losses will be mitigated by salvage and transplantation of some of this plant material to suitable sites outside of the area of proposed disturbance.

An area of the provincially listed Subalpine Fir/Alder/Horsetail riparian ecological community will be lost due to project development. This represents a relatively small proportion of the area of this ecosystem mapped in the regional study area

Areas of wetland and riparian ecosystems will be lost due to Project development, but represent very small proportions (less than 1 percent) of wetland and riparian ecosystems mapped in the RSA.

Because much of the Project footprint is proposed for alpine and subalpine areas, the losses of these ecosystems will be more substantial in area and as a proportion of the alpine habitats in the RSA (6 percent). However, this loss will be mitigated through implementation of the reclamation plan which will revegetate disturbed areas and will emphasize the use of native plant species that will support habitat requirements for caribou and other wildlife species.

A very small residual loss of productive forest area is also predicted.

The Reclamation Plan and the Invasive Plants Management Plan are the primary mechanisms for mitigation of project effects on vegetation. In addition, a variety of other mitigation measures, proposed for other disciplines (e.g., Wildlife, Fish and Fish Habitat) or as part of other management plans (e.g., Air Quality and Dust Control Plan, Surface Erosion and Sediment Control Plan) will either directly or indirectly affect vegetation.

In addition, several specific mitigation measures are proposed related to rare plants (i.e., transplant of western Jacob's ladder, seed collection, and flagging and staking rare plant populations located just outside of the maximum disturbance limit). Also, a minimum 30-m undisturbed buffer around wetlands and along stream corridors outside the maximum disturbance limit will be maintained.

A quantitative assessment of the Project contribution to cumulative effects was screened out for all vegetation KIs. With mitigation, residual Project effects to vegetation are considered to be not significant

Wildlife

Fourteen species were selected as KIs for detailed effects assessment: woodland caribou, Rocky Mountain elk, moose, mountain goat, grizzly bear, wolverine, fisher, marten, hoary marmot, northern myotis, northern goshawk, ptarmigan, harlequin duck and songbird communities. Species and wildlife groups not selected for detailed assessment as KIs were either not directly assessed (although potential Project effects are inferable based on the effects assessment results for certain KIs) or were assessed qualitatively (generally based on effects assessment results for one or more representative KIs).

The LSA and RSA are the same as those used for the vegetation section of the assessment. The wildlife field surveys focused on the LSA, and any site-specific project-related effects are discussed in the context of the LSA. Residual project effects are assessed and characterized in terms of their effect within the RSA, and the assessment analytical tools (e.g., habitat suitability mapping) are generally applied to the entire RSA. The RSA also provides a broader context for discussion of localized project-related effects, and sets the general boundaries for the collection and review of existing literature and information.

Woodland caribou—The northern ecotype of the woodland caribou occurs in the RSA. This ecotype is blue–listed in BC and designated as Threatened federally. The caribou found in the RSA are part of the Quintette herd. Telemetry monitoring of this herd is part of an ongoing provincial government study on caribou in the region. The current upper population estimate of the Quintette herd is 218 animals. The mountains in the RSA appear to be important multi–season caribou use areas and windswept alpine ridges are particularly important as winter feeding areas. There is identified winter and summer core area, caribou and goat Ungulate Winter Range (UWR) and caribou calving Wildlife Habitat Area (WHA) within the LSA. The core areas essentially encompass the other designated areas; therefore, they are the focus of this assessment. Winter and summer core areas overlap, with the winter core area being the most restricted in distribution. The core areas include the major mountains in the RSA, plus associated ridges, and portions of several drainages (e.g., Babcock, Gordon Creek and Five Cabin creeks).

Rocky Mountain elk—Elk are not designated as a species of conservation concern. Elk have been observed in the RSA from the rail load-out to the alpine and subalpine areas on Roman Mountain, often along roads. They have also been observed feeding on reclaimed sites in the Shikano Pit slide area and around the Quintette plant site, sometimes in large numbers (e.g., about 100). The MDL is too high elevation to be considered important as elk winter range.

Moose—Moose are not designated as a species of conservation concern. The RSA falls within an area of moderate moose abundance. Moose are one of the most frequently observed large mammals in the RSA. They are generally seen in mid-elevation forested areas or along roadsides, but were also reported from alpine and subalpine areas on the Roman and Quintette mountains. At baseline, the LSA has 205 ha of

moderate or higher value winter feeding habitat and 557 ha of moderate or higher value winter shelter habitat. The higher value areas are primarily found in patches along the Trend Coal Mine Bypass Road close to small creeks, near the Murray River west of the rail load-out, and along Babcock Creek.

Mountain goat—The mountain goat is not designated as a species of conservation concern. Population counts for the RSA have been relatively low in the past (less than 30). No systematic inventory has been conducted in recent years; however, in June 2007, 25 goats were seen on Babcock Mountain and 3 in Shikano pit on the same day. The most important factor influencing habitat use by mountain goats is the availability of escape (security) terrain in the form of cliffs and steep rocky terrain. Quintette and Babcock mountains have been identified as important habitat for mountain goat. These areas are part of the goat and caribou UWR that is located entirely within the RSA. The area of escape terrain identified in the RSA includes some inactive mine features (e.g., Shikano pit). Moderate or better escape terrain is primarily found in association with the local mountains—Quintette, Roman, Kostuik and Terminator.

Grizzly bear—The grizzly bear is blue-listed in BC and federally designated as a species of Special Concern. The RSA is within the Hart Grizzly Bear Population Unit (GBPU). The current population estimate for this GBPU is 386 animals and it is considered viable but at risk of falling to threatened status. Grizzly bears are observed relatively frequently throughout the RSA. Females with cubs have been seen multiple times. The majority of higher value spring habitat is located along Hambler Creek in the east of the RSA. In summer, higher value habitat is located on Roman Mountain in the LSA, and south of Terminator Mountain, along Five Cabin Creek, and Mount Kostuik in the RSA. In the fall, moderately high value habitat is located along Babcock Creek adjacent to the LSA boundary. Most of the higher value habitat in fall is located in the upper Horizon and Barbour creeks.

Wolverine—The wolverine is blue-listed in British Columbia and considered a species of Special Concern federally. The RSA is within the Hart wolverine population management unit. The population estimate for this unit is 101 animals and it has been identified as 'warranting management attention' because harvest was likely unsustainable in the past. Wolverines are solitary animals, for which a relatively undisturbed wilderness setting is considered important. In British Columbia, wolverines rely on ungulate carrion during winter, primarily moose, caribou, and mountain goat. Wolverines have occasionally been observed in the RSA. There are 236.8 ha of habitat with some winter feeding value located outside of high use disturbance buffers in the LSA at baseline.

Fisher—The fisher is blue-listed in British Columbia but is not considered at risk federally. The Peace Region subpopulation is estimated to be 548 to 1300 animals. Suitable natal denning trees are rare across the landscape and are a critical requirement for fishers. Large cottonwoods are almost exclusively selected for natal dens in the SBS and BWBS. In general, the best natal denning habitat will be found in lower elevation mature forests along major riparian corridors. At baseline, there are 198.7 ha of moderate or higher value habitat in the LSA. Most of this habitat is found near small creeks along the Bypass Road and near the Murray River, west of the rail load-out.

Marten—The marten is not designated as a species of conservation concern. Marten occur in forested habitats throughout most of British Columbia and are generally common across their range. Marten are often referred to as old-growth dependent; however, they may occur in second-growth stands, including those that are deciduous-dominated. At baseline, there are 1061.6 ha of moderate or higher value habitat in the LSA. This habitat is found along Babcock Creek north to the start of the Trend Coal Mine Bypass Road.

Hoary marmot—The hoary marmot is not designated as a species of conservation concern. Hoary marmot is widespread in the mountainous regions of the province, and is well known as a resident of the mountains in the RSA. There are 4746.3 ha of potential hoary marmot habitat (i.e., alpine and parkland ecosystems) in the RSA.

Northern myotis—The northern myotis is blue-listed in BC but not listed federally. There is very limited information on the distribution of this species in British Columbia. There are no records from the RSA. The availability of suitable summer roost sites is considered to be a limiting factor for this species in the boreal forest. Crevices behind peeling bark or cavities in partly decayed trees are preferred summer roosts and are typically found in mature and over-mature forest types. In northeast British Columbia the northern myotis has been found roosting primarily in mature stands of deciduous trees and appears to prefer mature and intact forests for foraging. There is no old forest in the LSA at baseline, although mature forest is relatively common.

Northern goshawk—The interior northern goshawk is not designated as a species of conservation. The northern goshawk is rare to uncommon, but is widely distributed and breeds throughout the province. Northern goshawk was not observed in the RSA during field surveys for this project; however, there are historical records. At baseline, moderate or higher value habitat is primarily found at lower elevations along small creeks along the Trend Coal Mine Bypass Road and Babcock Creek and west of the rail load-out.

Ptarmigan—Three species of ptarmigan occur in the area. None are designated as species of conservation concern. All ptarmigan generally inhabit alpine tundra, subalpine forest and high elevation parkland. Ptarmigan, or their sign, were frequently observed on Roman Mountain. There are 4746.3 ha of potential ptarmigan nesting habitat (i.e., alpine and parkland ecosystems) in the RSA.

Harlequin duck—In western Canada, harlequin duck is not listed provincially or federally. This species winters on the coast and breeds primarily along rivers, creeks and glacial streams. Harlequin ducks have been observed on Babcock and Barbour creeks. Gordon, Barbour, Babcock, Hambler and Five Cabin creeks have highest potential as harlequin duck breeding habitat within the RSA. Babcock Creek is intersected by the LSA, and a portion of the upper headwaters of Gordon Creek are within the LSA.

Songbirds—Five songbird communities were identified for the RSA: alpine, coniferous forest, deciduous forest, shrub and sapling, and wetland. Most songbirds in these communities are migratory, occurring in the region in late spring (May) through to August. The exception is the coniferous forest community, where 25 percent of the associated songbirds are resident. There are eleven songbird species of conservation concern that may occur in the RSA. Four of the five songbird communities include these species in their species assemblages. Songbird habitat occurs throughout the RSA although some community types are relatively restricted in distribution (e.g., alpine, deciduous forest, wetlands).

The interaction of the Project with wildlife may result in the four potential environmental effects: loss or alteration of habitat; disruption of movement patterns; increase in mortality risk; and reduction in animal health. Two of these effects are addressed in detail for applicable KIs: loss or alteration of habitat and increase in mortality risk. The other two effects are addressed qualitatively for wildlife in general in the scoping section with species-specific considerations highlighted where applicable.

The following temporal boundaries are used for the assessment of potential project effects on the wildlife KIs:

- ***Baseline***—Conditions before project-specific developments. The entire Trend Coal Mine is considered active at baseline.
- ***Maximum Footprint***—The worst-case wildlife conditions that could occur during the construction and operations phases of the Project (i.e., full mine build-out). The Trend Coal Mine is considered inactive but unreclaimed.
- ***Post-closure***—Conditions following closure. This scenario assumes that all mitigation measures and the Reclamation Plan have been implemented. The entire Trend Coal Mine is considered to be fully reclaimed in this scenario.

Loss or Alteration of Habitat

Woodland caribou—The focus for the determination of significance is the project effect on the summer and winter core areas. The success of reclamation of high elevation caribou feeding habitat is acknowledged to be very uncertain; therefore, for the purposes of this assessment, a worst case will be assumed. That is, while the implementation of some mitigation measures (e.g., minimization of clearing area) will be assumed, the successful reclamation of caribou feeding habitat will not be assumed for the project or Trend Coal Mine (although reclaimed mine sites may be used for other purposes such as travel and resting). Thus, there is predicted to be a permanent loss of 463 ha of winter core area and 470 ha of summer core area at post-closure. However, this is only 3.5 to 4.5 percent, respectively, of the undisturbed core area available in the RSA, and is less than 1 percent of each of the core areas available in the entire Quintette herd range. Therefore, the residual loss of core area is considered to be not significant with respect to the sustainability of the Quintette herd.

Moose—The residual loss of moose winter habitat is small in area and in context of the RSA, and the permanent loss of forested land base is small. Thus, the residual loss of moose winter habitat is predicted to be not significant with respect to the sustainability of the Peace Region population.

Mountain goat—The loss of goat escape terrain at maximum footprint is a relatively small portion of that available within the RSA, and at post-closure the remnant pit walls will provide a much larger area of potential escape terrain than was available at baseline. Further, based on observations at other reclaimed mine sites in the RSA it is very likely that this potential escape terrain will be used by goats in the future. Thus, the residual loss of goat escape terrain is predicted to be not significant with respect to the sustainability of the goat population in the Peace Region.

Grizzly bear—The residual loss of grizzly bear habitat at maximum footprint is small in spring and summer and moderately large in fall, but is small in context of the RSA for all feeding seasons. There is no residual loss of core secure habitat and the current availability is well outside the target threshold for northeastern British Columbia. There is predicted to be a permanent loss of 175 ha of potential grizzly bear feeding habitat at post-closure. This is less than 1 percent of the total potential feeding habitat available in the RSA in all three active seasons. Therefore, the residual loss of grizzly bear feeding habitat is considered to be not significant with respect to the sustainability of the Hart GBPU.

Wolverine—The residual loss of wolverine winter feeding habitat is small in area and in context of the RSA but there will be some permanent loss. There is no residual loss of core secure habitat and the current availability is well outside the non-species specific target threshold for northeastern British Columbia. Thus, the residual loss of wolverine habitat is considered to be not significant with respect to the sustainability of the Hart wolverine population unit.

Fisher—There is no residual loss of moderate or higher value fisher natal denning habitat predicted, therefore, the effect of the project is considered not significant with respect to the sustainability of the Peace Region subpopulation.

Marten—The residual loss of marten living habitat is small in area and in context of the RSA. Under baseline conditions, 30.1 percent of the RSA is non-forested, either naturally or as the result of some human activity (e.g., forestry). At maximum footprint, the percentage of the non-forested area increases only slightly to 30.4 percent. Thus, the RSA is already within the threshold range for marten with respect to cleared vs. forested area, and the predicted residual habitat loss does not substantially change this. Consequently, the residual loss of marten habitat is predicted to be not significant with respect to the sustainability of the Peace Region population.

Hoary marmot—The residual loss of marmot habitat is moderately large in area and regional context at maximum footprint. There will also be a permanent loss of alpine and parkland ecosystems at post-closure. This permanent loss will be countered to some extent by the reclamation of higher elevation portions of the Trend Coal Mine. Marmots will likely begin to use reclaimed mine areas early in the

reclamation process. Thus, the residual loss of marmot habitat is predicted to be not significant with respect to the sustainability of the Peace Region population.

Northern myotis—The residual loss of coniferous forest is moderately large in area but minor in context of the RSA, and the permanent loss of forested land base is small. All the mature forest loss is from the ESSFmv2 and the northern myotis has not been recorded in this variant to date. Thus, the residual loss of summer roosting habitat is considered to be not significant with respect to the sustainability of the northern myotis population in the Peace Region.

Northern Goshawk—There is no residual loss of moderate or higher value goshawk nesting habitat predicted, therefore, the effect of the project is considered not significant with respect to the sustainability of northern goshawks in the Peace Region.

Ptarmigan—The residual loss of ptarmigan breeding habitat is moderately large in area and regional context at maximum footprint. There will also be a permanent loss of alpine and parkland ecosystems at post-closure. This permanent loss will be countered to some extent by the reclamation of higher elevation portions of the Trend Coal Mine. Thus, the residual loss of ptarmigan breeding habitat is predicted to be insignificant with respect to the sustainability of the Peace Region population.

Harlequin duck—There is no residual loss of harlequin duck breeding habitat predicted; however, there may be some further reduction in habitat value due to increased sensory disturbance (indirect) effects related to the increased traffic volume during maximum footprint. However, as most of the coal haul route is located away from water courses known or likely to be suitable harlequin duck breeding habitat (e.g., Babcock Creek) the effect is considered to be relatively minor, and will be reversed at post-closure. Thus, the residual alteration of harlequin duck breeding habitat is predicted to be not significant with respect to the sustainability of British Columbia population.

Songbirds—The loss of only two of the five songbird community habitat types was considered notable at maximum footprint. The residual loss of alpine community habitat is largest in area and regional context. There will also be a permanent loss of alpine and parkland ecosystems at post-closure. This permanent loss will be countered to some extent by the reclamation of higher elevation portions of the Trend Coal Mine. Only common nighthawk, which is one of the eleven listed songbirds likely to occur in the RSA, is included in the alpine community. The residual loss of coniferous forest is moderately large in area but minor in context of the RSA, and the permanent loss of forested land base is small. All the coniferous forest songbird community habitat loss is from the ESSFmv2 and of the four listed species associated with the coniferous forest community only one is likely to occur in the ESSF (olive-sided flycatcher). Thus, the residual loss of songbird community habitat is predicted to be not significant with respect to the sustainability of Peace Region songbird populations.

Increase in Mortality Risk

Woodland caribou—There are several potential project-related sources of mortality risk for caribou (e.g., wolf-caribou interactions) but considered collectively, and either through implementation of mitigation measures (e.g., caribou-focused reclamation) or indirectly through Project design (e.g., coal haul route located away from high value caribou habitat), the residual increase in mortality risk for caribou is predicted to be small and reversible. Thus, the residual increase in mortality risk is considered to be not significant with respect to the sustainability of the Quintette caribou herd.

Rocky Mountain elk—Elk appear to be less susceptible to vehicle accidents than moose and deer although the number of accidents in the province increased between 1993 and 2002. However, the residual increase in elk mortality risk is predicted to be not significant with respect to the sustainability of the Peace Region population.

Moose—The number of moose accidents has increased substantially in BC Ministry of Transportation Region 3 (which includes the RSA) over the last 20 years and moose road mortalities are identified as a serious concern in northern British Columbia. However, the residual increase in moose mortality risk is predicted to be not significant with respect to the sustainability of the Peace Region population.

Grizzly bear—It is likely that few if any grizzly bears will be killed by vehicles in the RSA even over multiple years. For example, there were no road mortalities recorded among 42 collared bears monitored for four years in Montana, along a highway with a traffic volume much higher than any of the roads in the RSA. Thus, the residual increase in traffic-related mortality risk for grizzly bears is considered to be not significant with respect to the sustainability of the Hart GBPU.

Marten—While some level of marten mortality will result from the Project, the residual increase in mortality risk is considered small. Thus, the residual increase in marten mortality risk is predicted to be not significant with respect to the sustainability of the Peace Region population.

Songbirds—While some level of songbird mortality will result from the project the effect is considered minor and within the range of natural variability. Further, there is no evidence to suggest that listed songbird species will be subject to any higher mortality risk than other species. In fact, given their scarcity across the region they are less likely to be struck by vehicles than more common species such as dark-eyed juncos. Thus, the residual increase in mortality risk is predicted to be not significant with respect to the sustainability of Peace Region songbird populations.

In general, a quantitative assessment of the project contribution to cumulative effects was screened out. The only exception was for habitat loss to woodland caribou. In brief, there is predicted to be a permanent loss of 463 ha of winter core area and 470 ha of summer core area in the Project case with no change predicted in the future case. The loss in the Project case is less than 1 percent of each of the total core areas available in the entire Quintette herd range. Therefore, the incremental contribution of the residual project effect to the residual cumulative loss of core area is considered to be not significant with respect to the sustainability of the Quintette herd.

There are two main mechanisms for mitigation and prevention of potential Project effects on wildlife. The first mechanism is the Wildlife Protection and Monitoring Plan. All general and specific mitigation measures mentioned in the wildlife effects assessment section are included in this plan. In addition, a Caribou Protection Plan is a key sub-component of the Wildlife Protection and Monitoring Plan. The second mechanism is the Reclamation Plan. Caribou are a key focus species for the Reclamation Plan. In addition, a variety of other mitigation measures, proposed for other VECs (e.g., Vegetation, Fish and Fish Habitat) or as part of other management plans (e.g., Solid and Hazardous Waste Management Plan, Selenium Management Plan, Access Management and Traffic Management Plan), will either directly or indirectly affect wildlife.

Seven follow-up programs are proposed for wildlife:

- PRC will continue to support the ongoing Central Rockies caribou research project.
- PRC will undertake an RSF analysis to examine in more detail the effect of mining disturbance on the distribution of caribou in the Quintette herd.
- PRC will record and review all Project-related wildlife-vehicle collisions or near misses and report any wildlife mortalities resulting from Project vehicles to the BC Ministry of Environment regional office and the BC Ministry of Transportation.
- PRC will follow-up on all problem wildlife incidents, and if required, the issue will be dealt with according to established protocols developed in consultation with the BC Ministry of Environment.

- PRC will continue to maintain a wildlife observation log for the mine site area, the rail load-out, and along the coal haul route and the information will be submitted to the BC Ministry of Environment and the Central Rockies caribou research team.
- PRC will incorporate wildlife use data collection into the regular reclamation monitoring protocol.
- Follow-up visits to the bat boxes proposed as a mitigation measure for the northern myotis are recommended in order to maintain the boxes and determine bat use.

No compliance monitoring programs specific to wildlife are proposed however, a water bird egg monitoring program is proposed as part of the Selenium Management Plan. In brief, eggs will be collected downstream of the mine site from red-winged blackbirds, spotted sandpipers and/or American dippers along Babcock, Gordon, and Flatbed creeks. First samples will be collected in 2010 to establish a baseline for selenium levels, and then regularly thereafter during the life of the mine, and potentially into the post-closure phase.

A number of monitoring programs identified for other VECs or a part of other management plans have implications for wildlife. These include: ground and surface water quality monitoring, metal concentrations monitoring in soils, surface water, vegetation and fish tissue; reclamation monitoring, and invasive species monitoring.

Climate and Surface Water Hydrology

The LSA defined for the purpose of the surface water hydrology assessment includes the upper catchments of Babcock and Gordon Creeks to Flatbed Creek confluence and is the maximum area where Project environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence.

The catchment area of Babcock Creek upstream of the Heritage Highway is approximately 116 km^2. Elevations within the catchment range from about 790 m at the confluence of Babcock Creek and Flatbed Creek to 2027 m at the peak of Roman Mountain. Flatbed Creek eventually reports to the Peace River via the Murray River at Tumbler Ridge and the Pine River.

Regional data were collected from available Environment Canada climate stations and BC Ministry of Environment snow courses. Regional hydrometric data were obtained from Water Survey of Canada (WSC) hydrometric stations. Local, continuous measurements of precipitation, temperature, barometric pressure, and stream flow were made within the LSA and include nine flow stations.

The records from the regional climate stations and snow courses were used to characterize the mine site baseline climate conditions. Climate stations at Bullmoose (1102 m elevation, 45 km northwest) and Denison Plant Site (854 m elevation, 15 km north) provided data that was particularly representative of conditions at the mine site. Both stations possess reasonably long climate records (18 years +) and are located at a similar distance from the spine of the Rocky Mountains as the Project, thus being influenced to a similar degree by the rain shadow effect of the mountain range.

Regional data were supplemented with climate data collected within the LSA from 2005 to 2008. Manual rainfall gauges were established near the plant site (1425 m) and near the rail load-out (900 m) in the late spring of 2005 to monitor precipitation during construction of the Trend Coal Mine. An automated weather station was installed near the plant site (1434 m) on October 1, 2005 to monitor air temperature, precipitation, relative humidity, atmospheric pressure, global solar radiation, and wind speed and direction. Mine personnel also operate a snow stake to monitor snowpack accumulation and subsequent melt at a sheltered site (1411 m) within the footprint of the Trend Coal Mine.

Mean annual runoff (MAR) is expected to exhibit an elevation variation and to also decrease substantially moving eastward away from the spine of the Rocky Mountains owing to the rain shadow effect. The

streamflow records collected at the WSC stations supplemented by site data collected by PRC were used to examine these variations and to develop an empirical relationship for estimating the MAR of the mine site streams.

Empirical equations were developed using Regional Analysis to estimate four low flow statistics: mean annual minimum 7-day flow (7QMa), 10-year annual minimum 7-day flow (7Q10a), mean summer minimum 7-day flow (7QMs), and 10-year summer minimum 7-day flow (7Q10s). The lowest flows typically occur in the winter after a prolonged period of freezing. The first statistic indicates the lowest 7 day flow during an average year. The second statistic is indicative of drought conditions occurring once every 10 years, on average. The last two statistics represent the average flow during the lowest seven consecutive days between June 1 and September 30.

Regional analysis was used with the WSC database to estimate flood flows. For each of the 30 stations, frequency analyses were carried out on the annual series of maximum daily and peak instantaneous flows to estimate flows with return periods from 10 years to 200 years. The results for each return period were plotted as unit flood discharges ($m^3/s/km^2$) against catchment area. These plots were used to estimate site area flood flows.

Potential residual project effects on surface water hydrology include changes to stream flow quantity and timing. Potential environmental effects associated with changes in surface water hydrology are integrated into other disciplines, namely surface water quality and aquatic resources. As a result, potential environmental effects due to changes in surface water hydrology are presented and evaluated separately in the aquatics sections of the application, including:

- Surface Water Quality (Section 12)
- Periphyton and Benthos (Section 14)
- Fish and Fish Habitat (Section 15)

A Project water balance was developed, which accounts for the effects of mine features including pits and waste rock dumps. The water balance model is described in the Water Management Plan (Section 4.11) and was the primary tool for assessing potential changes to timing and quantity of stream flows resulting from Project development.

Flows in the LSA are expected to change due to mining and waste rock dump development. Development of the Roman pits will result in capture of a small portion of the upper Gordon Creek watershed, causing a small increase in area of the upper Babcock Creek watershed. Flow rates and volumes are anticipated to increase during some months and decrease during others. The largest influence on flow changes is from waste dump construction. Flow increases are predicted to occur due to temporary water storage effects (attenuation) within the waste rock dumps. Snowmelt infiltrating the waste rock dumps in the spring will discharge at a slower, more even rate than previously extending through the summer and into early fall.

Potential changes to flow may also result from operation of the Roman in-pit tailings management facility with controlled discharges to Babcock Creek. Controlled discharge from the tailings management facility may occur at a steady rate over the year, water quality permitting. In the event this occurs, flow increases will be realized over all months of year except during freshet (May and June). The maximum increases will occur during those months that normally have the lowest flow, namely February. Flow increases of up to 200 percent may occur during mean annual winter low flow periods. While monthly flow increases may be substantial relative to baseline, the flow rates will be steady, remain relatively low (i.e., 50 times lower than monthly average freshet flows), and are not expected to alter habitat or cause erosion.

Reductions in flow on Gordon Creek (Station G-2) are predicted to be small as a result of Project development. Maximum flow reductions of approximately 6 percent are predicted to occur in February

and March as a result of attenuation in waste rock dumps and the small reduction in catchment area of the headwaters of Gordon Creek.

During post-closure, when flows are anticipated to reach steady-state conditions, maximum changes in flow are anticipated to occur in Babcock Creek at Station B-5, where development from the Project footprint is the greatest. Maximum increase in flow of approximately 10 percent is anticipated to occur in August and September while an increase of 11 percent is anticipated to occur in October. A maximum decrease in flow of approximately 10 percent is anticipated to occur in November.

Cumulative Effects

Cumulative effects were assessed within the LSA and include effects from the Trend Coal Mine. Flows in the LSA are expected to change due to mining and waste rock dump development from both the Trend Coal Mine and the Project. Using the same water balance methodology that was used to evaluate Project effects, changes to flow rates and timing were estimated. Surface water flows are anticipated to increase during some months and decrease during others. As discussed for Project effects, the largest influence on flow changes is from waste dump construction.

During post-closure, when flow conditions are anticipated to reach steady-state conditions, changes in flow resulting from the Trend Coal Mine and the Project are compared to the base case, which takes into consideration changes resulting from the Trend Coal Mine. This comparison indicates the maximum increase in flow of approximately 10 percent is anticipated to occur in Babcock Creek at Station B-5 in September and October, while maximum decrease in flow of approximately 10 percent is anticipated to occur in November.

The need for mitigation measures to address changes in surface water hydrology will be determined by potential effects on other VECs, namely surface water quality, fish and fish habitat, and periphyton and benthos. The management flexibility in the water management system can support the following mitigation options:

- Increased flows in Babcock Creek may be mitigated by reduction in controlled discharge from the tailings facility. Increased discharge during spring freshet will result in a release of water that is in-phase with the natural hydrograph.
- Reduction in winter low-flows on Babcock (B-5) and Gordon Creek (G-2) may be mitigated through the controlled and strategic discharge of water within open pits and sediment ponds, however reduction in flows resulting from Project-effects are small (e.g., no greater than 10 percent).

A detailed hydrology monitoring plan has been developed for the LSA with particular emphasis on Upper Gordon Creek, which hosts seasonal fish habitat. Monitoring will include continuous, automated stream gauge and turbidity monitoring and is supplemented with regular spot flow measurements. Continuous flow monitoring and spot flow measurements will also be conducted on Babcock Creek.

Additionally, flows will be measured continuously from sediment ponds, including the tailings management facility. Management of discharge from the tailings facility to sediment pond RP2 and Babcock Creek will be integrated with flow and water quality monitoring from the tailings management facility and receiving environment. Water management actions including discharge rates and timing of release will be designed to meet provincial water quality guidelines and be protective of the environment.

Surface Water and Sediment Quality

Surface water quality and sediment quality in receiving watercourses were investigated as part of the assessment of aquatic environments downstream of the Project. The objectives of the surface water and sediment quality assessment were to: 1) provide a baseline database of measurable parameters for

predicting and monitoring potential effects of the Project on downstream aquatic environments; 2) quantify and assess potential residual project and cumulative effects from the Project; 3) develop mitigation strategies to reduce and/or minimize potential Project effects; and 4) provide guidance and rationale for conducting follow-up studies designed to better quantify and assess potential Project effects.

The Project is located within the mountainous Babcock Creek catchment which is within the southwest corner of the Flatbed Creek catchment. The catchment area of the Babcock Creek watershed upstream of the Heritage Highway, where the Project is located, is approximately 116 km^2 and includes the Gordon Creek catchment. Elevations within the catchment range from about 790 m at confluence of Babcock Creek and Flatbed Creek to 2027 m at the peak of Roman Mountain. The drainage from Flatbed Creek eventually makes its way to the Peace River, via the Murray River at Tumbler Ridge and the Pine River.

The LSA extends from the upper catchments of Babcock and Gordon Creeks to Flatbed Creek. The terrain in the LSA is steep and mountainous, and the streams and creeks are steep, high-energy, and fast-flowing, typical of lotic systems. The LSA defines the area where Project environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence.

The RSA extends to the Murray River. All watercourses draining the Project area report to the Murray River via Flatbed Creek.

Compliance points have not been identified for the Project; however, through discussion with BC MOE, the following compliance points were established for the Trend Coal Mine and have been used to characterize and evaluate residual Project effects:

- Water and Sediment Quality—station B-5 on Babcock Creek, G-2 and G-3 on Gordon Creek, B-3 on Babcock Creek below the confluence with Gordon Creek and F-3 on Flatbed Creek below the confluence with Babcock Creek.

Water Quality

Surface water quality sampling included characterization of baseline conditions of water courses in the LSA, which included Babcock, Gordon, and Flatbed Creeks. Surface waters in the LSA are moderately hard, stable and have a slightly alkaline pH, and are seasonally variable. Seasonal minima for alkalinity and conductivity occur during freshet (May to June) due to snowmelt and increased surface runoff. Turbid flow conditions are typical of the freshet period and TSS and total metals typically show seasonal maxima during this period. During low-flow periods, namely late summer and winter, the input of more saline groundwater has a greater influence on water composition. Alkalinity and hardness typically reach seasonal maxima during these periods.

Parameters which occasionally exceed British Columbia Provincial Guidelines for the protection of aquatic life include dissolved aluminum, total iron, total cadmium, total chromium, and total zinc. Total copper and total silver have infrequently exceeded guidelines. Elevated particulate metal fractions (e.g. total metals) show strong correlation with elevated TSS during high flow events (e.g., during freshet) and account for the infrequent exceedances of aquatic life guidelines. Toxicity reference values will be proposed for applicable measureable parameters during high-flow conditions.

Sediment Quality

Physical (particle size distribution) and chemical parameters were measured from streambed sediments collected from depositional zones with the LSA. Bulk samples were collected and analyzed for particle size distribution. Results demonstrated that most streambed sediments sampled were predominantly sandy with silt, gravel and minor clay components.

Finer-grained surface sediments were sampled for chemical parameters. Finer-grained sediments were collected in the field from deposition zones, and then sieved in the lab to less than 2 mm fraction prior to

analysis. Selenium analysis was also conducted in the less than 63 µ fraction. Chemical parameters include major ions, trace elements, and polycyclic aromatic hydrocarbon (PAH).

Major element concentrations are typical of stream-bed sediments in the region and similar to detrital levels observed in weathered crustal rocks. Trace element content is variable, but consistent with other drainages in the region. Streambed sediments in the LSA contained measureable parameters that are nominally above British Columbia Provincial sediment guidelines and include: arsenic, cadmium, nickel, and zinc. Streams in the LSA are typified as lotic systems and are generally zones of erosion and not deposition. As a result, there is a low potential for metal accumulation of sediments from the Project, including selenium in these streams. Sediment concentrations of some PAHs (e.g., naphthalene and phenanthrene) exceed British Columbia Provincial sediment guidelines, which is consistent with other streams in the region and is related to the weathering of coal bearing strata.

Residual project effects to aquatic resources were assessed with respect to surface water quality and sediment quality. Project effects will increase during operations as mine waste volumes and the footprint increase. Project effects are anticipated to peak during post-closure, after flow rates from waste rock dumps have reached equilibrium.

Modeling of Project effects on surface water quality included all measureable parameters associated with coal mine development in the region. The residual effects assessment focuses on measurable parameters for which Project effects were predicted to exceed water quality thresholds (e.g., British Columbia Provincial Guidelines for the protection of aquatic life) and includes sulphate, total selenium, total cadmium, total cobalt, and nitrate. The residual Project effects ratings for these parameters are summarized below.

- Residual project-effects of predicted changes in TSS loadings on surface water quality were evaluated during the operational period, when effects reach a maximum. TSS loadings will be managed through the implementation of Environmental Management Plans (Section 5), are predicted to remain below British Columbia water quality guidelines, and are therefore predicted to not to be significant.
- Sediment quality is implicitly evaluated within the context of TSS. With proposed mitigation and active environmental management, the environmental effect of the Project on sediment quality is considered to be not significant.
- Residual project effects of changes in nitrate concentrations on surface water quality within the local study area were predicted to be negative, moderate in magnitude, local in extent and not significant. The prediction confidence is moderate.
- Residual project effects of changes in cadmium concentrations on surface water quality within the LSA were predicted to be negative, low-moderate in magnitude, local in extent and not significant. The prediction confidence is moderate.
- Residual project effects of changes in sulphate and cobalt concentrations on surface water quality within the LSA was predicted to be negative, moderate-high in magnitude, local in extent and not significant. Prediction confidence is low.
- Residual project effects of changes in selenium concentrations on surface water quality within the LSA were predicted to be negative, high in magnitude, local in extent and significant. Prediction confidence is low.
- Project effects of changes in selenium concentrations were considered to be significant due to the high magnitude rating, high potential for adverse ecological effects, and low level of confidence in the surface water quality threshold (e.g., low confidence that the predicted effect will adversely impact aquatic life). Additional investigations and follow-up have been proposed to address the low confidence and uncertainty in this ranking. Development of site-specific toxicity evaluations and a

risk-based, selenium bioaccumulation study are warranted. These studies are being conducted with input from the BC Ministry of Environment. These studies will be conducted during the review period for this Application. Following their completion, the Project effects rankings for selenium will be revisited.

The potential for the Project to contribute to cumulative effects was evaluated for the both the LSA and the RSA. Estimates of total cumulative effects in the LSA include contributions from the maximum footprint of the Trend Coal Mine. Screening for residual cumulative effects was based on the following criteria: 1) is there a residual project effect; 2) does the effect behave cumulatively; and 3) does the cumulative effect threaten the viability of the key indicator (surface water quality and sediment quality)? Sulphate, total selenium, total cadmium, total cobalt, and nitrate were screened in for cumulative effects characterization in the LSA.

Cumulative effects on surface water quality were estimated in the RSA for the following parameters: sulphate, total selenium, total cadmium, total cobalt, and nitrate. Of these parameters, only selenium was screened in for cumulative effects characterization in the RSA. Cumulative effects in the RSA from the Project were considered negligible due to the relative small incremental footprint of the Project (439 ha) relative to pre-existing operations within the Murray River RSA (6342 ha).

The results of the cumulative effects assessment are summarized below.

Local Study Area (Trend Coal Mine + Project)

- Project contribution to residual cumulative effects on nitrate concentrations in surface waters within the LSA was predicted to be negative, moderate in magnitude, local in extent and not significant. Moderate prediction confidence was associated with this assessment.
- Project contribution to residual cumulative effects on cadmium concentrations in surface waters within the LSA was predicted to be negative, low-moderate in magnitude, local in extent and not significant. Moderate prediction confidence was associated with this assessment.
- Project contribution to residual cumulative effects on sulphate and total cobalt concentrations in surface waters within the LSA was predicted to be negative, moderate-high in magnitude, local in extent and not significant. Low prediction confidence was associated with this conservative assessment.
- Project contribution to residual cumulative effects on selenium concentrations in surface waters within the LSA was predicted to be negative, high in magnitude, local in extent and significant. Prediction confidence was ranked low.

Regional Study Area (Murray River)

- Project contribution toward cumulative effects on total selenium concentrations in surface waters within the RSA was predicted to be negative, low in magnitude, local in extent and not significant. Prediction confidence is low.

The Project contribution to cumulative effects of changes in selenium concentration on water quality in the LSA were considered to be significant due to the high magnitude and ecological context rating and the low level of confidence in the surface water quality threshold (e.g., low certainty in the effects potential risk to aquatic life). Additional investigations and follow-up have been proposed to address the low confidence and uncertainty in these rankings.

Mitigation measures for residual effects to water quality are described in Section 5 (Environmental Management Plans) and include footprint reduction from the original mine plan from 13.2 to 5.7 km^2 (greater than 50 percent). Mitigation measures have been taken into account during derivation of

estimates of residual Project effects on surface water and sediment quality. The environmental management plans, including management of potentially acid generating waste rock, sediment and erosion control, selenium, and water have not been applied to reduce Project effects, but are viewed as adding an additional degree of conservatism to the predictions.

Project effects of changes in selenium concentrations on water quality in the LSA and Project contributions to cumulative effects on selenium in the LSA were considered to be significant due to the high magnitude rating, high potential for adverse ecological effects, and low level of confidence in the surface water quality threshold (e.g., low confidence that the predicted effect will adversely impact aquatic life). Additional investigations and follow-up, including development of site-specific toxicity evaluations and a risk-based, selenium bioaccumulation study, have been proposed to address the areas of uncertainty.

The assessments of sulphate and cobalt also had low confidence, and the assessment of cadmium had low-moderate confidence, all due to uncertainty associated with the toxicity of these substances under site-specific conditions. As a result, additional assessment is warranted. Studies are being conducted with input from the British Columbia Ministry of Environment and will be conducted during the review of this Application. Following their completion, the Project effects rankings will be revisited.

Monitoring currently conducted at the Trend site will continue through operations phase of the Project and will be extended to Project-related sediment ponds and outfalls. A cumulative effects monitoring station on the Murray River is expected to be established by MOE in conjunction with other past and current mine operations in the Murray River drainage. Details of the monitoring program are provided in the Receiving Water Quality Monitoring Plan in Section 5.6.

Groundwater Quality and Quantity

Overburden in the Project area is predominantly comprised of morainal and colluvial materials with thicker deposits found in valley bottoms. Overburden hydraulic conductivity values vary widely, and can typically be considered low for most of the site, with a few dispersed units having relatively high conductivity values. The regional stratigraphy is characterized by inter-layered sequences of sandstones, siltstones, mudstones and coal seams. The overall structure of the coal seams and related lithologies on the Roman block are characterized by a large northwest—southeast striking syncline. The axis of the syncline plunges to the northwest with the limbs of the syncline typically dipping at angles between 40 and 65°. Overburden deposits are limited in the rocky upland areas and groundwater is expected to flow predominantly through the bedrock mass. Groundwater flow through the bedrock will be influenced by the presence of fractures/faults and relatively impermeable strata. Faults typically strike similarly to bedding, roughly northwest—southeast, such that flow directions are likely not significantly modified.

Hydraulic conductivity is assumed to be fracture-controlled, with no clear relationship with lithology. Coal seam hydraulic conductivity qualitatively appears to be typically higher than average, but remains within the overall bedrock average. Likewise, hydraulic conductivities for sandstone and siltstone units are typically lower than average, but wide variation is observed. Hydraulic conductivity values will be affected by the presence or absence of relatively conductive fractures within any given monitoring well screen zone. Hydraulic conductivity data suggest a possible relationship with depth. While variability at almost all depths is observed, the maximum hydraulic conductivity appears to decrease with increasing depth. This hydraulic conductivity vs. depth relationship is generally considered to indicate that the likelihood of intersecting water bearing fractures decrease with depth. Horizontal to vertical anisotropy (parallel-to vs. perpendicular-to bedding, respectively) has been assumed at many sites, though little physical data has been presented to support this assumption. The substantial number of flowing artesian drillholes at Trend does indicate that confining units are present and that bedding-perpendicular anisotropy exists.

Prior to construction of the Trend Coal Mine, water levels and artesian flow rates were recorded for a series of 59 open exploration drillholes between August and October 2004. Of the 59 drillholes included in these surveys, 27 had flowing artesian conditions during one or more monitoring rounds. Drillholes with artesian conditions are typically inclined towards higher elevation, suggesting the artesian conditions represent hydraulic heads from higher elevations. Water level contours constructed from open hole water levels collected during these monitoring rounds suggests that the water table is similar to topography, with groundwater flowing from high to low ground elevation areas and a flow gradient varying from approximately 0.05 to 0.4. Depths to groundwater in the monitoring wells and open exploration drillholes range between approximately 2 to 25 m below the ground surface in the Gates Pit area. At the highest elevation monitoring well, QBR 7582, which is located close to the top of Roman Mountain, groundwater is approximately 7 m below ground surface. As with the Trend Small Mine observations, groundwater levels show a close relationship to the topographical contours, suggesting that groundwater will generally tend to flow in the same direction as surface water runoff with the overprinted effect of bedrock anisotropy.

Seasonal variation in groundwater levels can be pronounced at higher elevations. For example, water levels at TRR-07-007 show a decline of approximately 12 m between October 10 and December 13, 2007 and a decline of 16 m between May 27 and August 12, 2007. Water level decline was more rapid in the first period compared to the second one, which could reflect a difference in precipitation/infiltration between September and May; the former being an effect of only precipitation and the latter a combined effect of precipitation plus spring snow melt.

Monitoring results indicate that the variation in groundwater levels has similar timing to surface water, but is attenuated. Available water level data generally support the overall conclusion of topographic control with groundwater discharging to valley bottom creeks.

Localized Project effects to groundwater quality and quantity are predicted to occur, but are not considered to be significant. Groundwater quality will be affected by water discharging from waste rock dumps and the tailings pond resulting in increased concentrations of sulphate, cadmium, cobalt and selenium in groundwater during operations and into the post-closure phase. Groundwater quantity within the upper Gordon Creek catchment will be permanently reduced due to diversion of a small portion (about 30 percent) of a subcatchment at the top of the Gordon Creek drainage into to Babcock Creek as a result of pit development.

Cumulative effects to groundwater are most relevant in the context of the effects on surface water and are therefore addressed as part of the assessment of water quality in Section 12: Surface Water and Sediment Quality.

Mitigation measures to address changes to groundwater quality and quantity are not anticipated to be required. In terms of groundwater quality, mitigation-by-design will be implemented through efficient placement of waste rock and co-mixing waste with non-acid generating materials, as specified in the Mine Waste Management Plan (Section 4.7). In the case of unexpected changes of groundwater quality requiring contingency mitigation measures to protect surface water quality, fish and fish habitat, or periphyton and benthos, localized mitigation systems, such as interception wells or cut-off walls, could be installed either in close proximity to sources (e.g., dumps) or down hydraulic gradient within valley bottoms. In terms of project effect on groundwater quantity, mitigation has been incorporated in the project design by return of all diverted waters (excepting the small portion of the upper Gordon sub-catchment that is diverted to Babcock Creek) to the original water courses. If unexpected significant effects are realized, contingency mitigation measures could include modified management of water discharge from sediment ponds.

Groundwater monitoring programs for the Project will include:

- Implementation of a program to measure stream flows within the G1 catchment for improving understanding of groundwater contributions to low flows.
- Continued sampling of selected monitoring wells to improve confidence in groundwater quality baseline.
- Additional characterization of materials and groundwater quality within the abutment area between Babcock Creek and the proposed Gates Pit TMF, to improve confidence in groundwater seepage estimates.
- Installation of monitoring wells within the Babcock Creek and Gordon Creek valley bottoms, up and down gradient of Trend, to improve understanding of valley bottom flow systems and groundwater quality.
- A site-wide, effects monitoring system will be designed and implemented in conjunction with surface water monitoring, as part of the comprehensive Environmental Management Plan, to support design of effective mitigation systems, if required.

Benthos and Periphyton

Baseline conditions for benthic (periphyton and invertebrate) communities, and selenium levels within those communities, were characterized based on existing baseline information, collected (September 2004/2005) to support regulatory applications for the adjacent Trend Coal Mine. The purpose of the 2004 sampling program was to establish baseline conditions, and to provide information for an assessment of potential impacts related to the construction and operation of the Trend Coal Mine, as well as for the development of a selenium management plan for that mine. The baseline sampling program was repeated in September 2005 to confirm the results of the 2004 program as well as provide additional information regarding the potential variability in the periphyton community and, given the absence of depositional habitat, to supplement the tissue chemistry data set with benthos samples from riffle habitats.

The benthic invertebrate and periphyton data indicate that both Babcock and Gordon creeks are typical alpine streams with no evidence of disturbance related to human activities. However, benthic community structure and tissue selenium concentrations were variable between 2004 and 2005, and compared to historic data. Despite differences between stations, each station was well characterized and pollution-sensitive taxa dominated at all stations.

The main pathways by which the Project could potentially affect aquatic biota in LSA and/or RSA watercourses fall into four environmental effect categories:

Physical Loss of Habitat and Sedimentation—Direct effects due to habitat loss in LSA watercourses, resulting in loss, decrease or increase of aquatic habitat and productivity; increased TSS and turbidity from general ground disturbance, mining and waste rock disposal, resulting in decreased light penetration and reduced primary productivity, and/or alteration of periphyton and benthic macroinvertebrate communities through infilling of substrate interstices, or substrate blanketing.

Changes to Stream Flow (Quantity and Timing)—Direct effects on periphyton and benthos due to changes in stream flows in LSA watercourses, in terms of the quantity (e.g., higher or lower than average seasonal flows) and timing (e.g., changes in the frequency of high-flow events) resulting in the loss, decrease or increase of aquatic habitat and productivity, and/or short-term decreases in benthic invertebrate abundance. Changes in stream flows may occur in response to project-related flow impacts, channel diversions, changes in groundwater discharge in LSA watercourses.

ARD/ML (selenium, other metals, sulphate)—Contaminant loadings associated with ARD/ML (e.g., metals, anions) resulting in acute or chronic toxic effects with corresponding alteration in periphyton and or benthic macroinvertebrate community density, diversity, composition and productivity; and bioaccumulation of metals in the food chain, with potential for elevated concentrations of metals (in particular selenium in tissue of benthic biota) and related effects on benthic macroinvertebrates.

Leaching of Nutrients—Increased nutrient levels (i.e., nitrates from rock blasted with ANFO explosive, nitrogen compounds and phosphates from sewage treatment and disposal) in watercourses, resulting in increased primary productivity and/or changes in periphyton and benthos community structures.

Parameters predicted by the Surface Water and Sediment Quality Assessment to have a mine related signature at concentrations that exceed applicable water quality guidelines for the protection of aquatic life were assessed (i.e., nitrate, sulphate, selenium, cadmium and cobalt), as well as suspended solid loadings and the effects of changes in flow. High temporal and spatial variability in periphyton and benthos key indicators in LSA watercourses precluded an assessment based solely on biological information. The main findings of the residual Project-effect assessment were as follows: changes in flow, TSS loadings, and modeled nitrate, cadmium, sulphate and cobalt concentrations were predicted to be not significant; and modeled selenium concentrations were predicted to be significant. The assessment of selenium was conservative and the confidence in this prediction was low. The assessments of sulphate and cobalt also had low confidence due to uncertainty associated with the toxicity of these substances under site-specific conditions. As a result, additional assessment is warranted.

Potential residual cumulative effects on periphyton and benthos via the same pathways discussed above were assessed for two scenarios: the cumulative impact of the Trend Coal Mine and the Project on the LSA; and the cumulative impact of historic, existing and near-future mining operations on the RSA (Murray River). In the LSA, the potential for cumulative effects from changes in flow, and modeled nitrate, sulphate, cobalt and cadmium concentrations were predicted to be not significant. The potential for cumulative effects related to modeled selenium concentrations was predicted to be significant. In the RSA, the potential for cumulative effects from modeled selenium concentrations was predicted to be not significant. The assessment of selenium was conservative and the confidence in this prediction was low. The assessments of sulphate and cobalt also had low confidence due to uncertainty associated with the toxicity of these substances under site-specific conditions. As a result, additional assessment is warranted.

Mitigation of potential effects to periphyton and benthos have been considered in a series of management plans, including: the Surface Erosion and Sediment Control Plan (Section 5.5); the Mine Site Water Management Plan (Section 4.11); the Receiving Water Quality Monitoring Plan (Section 5.6); the Fish and Fish Habitat Protection Plan (Section 5.9); the Chemical Management Plan (Section 5.12); the Solid and Hazardous Waste Management Plan (Section 5.11); the Metal Leaching/Acid Rock Drainage Management Plan (Section 5.8); and the Selenium Management Plan (Section 5.7). Application of these plans will contribute to the prevention of changes in flows and water quality that may impair periphyton and benthos in the receiving environment.

The recommended follow-up studies for the assessment of potential effects to periphyton and benthos are: site-specific, risk-based evaluations for selenium, sulphate, and cobalt to reduce uncertainty in predicted effects; and verification of the application of the re-calculated water quality guideline for cadmium. Operational monitoring should include routine monitoring of periphyton biomass and benthic invertebrate community structure in LSA streams. Natural variability in selenium concentrations in periphyton and benthic invertebrate tissues may limit the value of routine monitoring to evaluate spatial or temporal differences in selenium bioaccumulation in these streams. It is therefore recommended that selenium monitoring be focused on fish, per the selenium management plans that have been developed for other coal mines in the area.

Fish and Fish Habitat

Baseline conditions for fish and fish habitats, and tissue selenium levels were characterized based on existing baseline data that were collected to support regulatory applications for the adjacent Trend Coal Mine. Fish habitat and use were characterized in 2004 and 2005 and fish for tissue analysis were collected in 2004, 2006 and 2008. The Trend and Roman Coal Mine Projects have similar footprints that are located in the same previously assessed watersheds (i.e., Babcock and Gordon creeks). The specific objectives of the fisheries field programs were to:

- Confirm and document the location and passability of all barriers to fish movement, and describe the upstream limits of fish distribution in the Babcock and Gordon Creek watersheds.
- Collect baseline ecological data concerning the resident sub-populations of bull trout occupying waters potentially affected by the proposed development.
- Identify critical spawning, rearing and over-wintering habitats used by resident sub-populations occupying waters potentially affected by the proposed development.
- Determine background baseline concentrations of selenium in slimy sculpin and bull trout at sites on Babcock, Gordon and Hambler creeks and develop threshold concentrations for triggering detailed assessments of selenium uptake.

Babcock Creek

Babcock Creek is a 26 km-long, fourth-order watercourse that flows northeastward onto the Kiskatinaw Plateau into Flatbed Creek, approximately 25 km upstream from the Tumbler Ridge town site. Although Babcock Creek has numerous steep first and second-order tributaries that drain its valley walls, its only major tributary is Gordon Creek, a 15-km long, third-order watercourse that joins the Babcock Creek mainstem at a point 10 km upstream from Flatbed Creek. A pair of impassable waterfalls both 2.5 m high is located in Babcock Creek, 8 km upstream from the creek's mouth. However, resident fish can be found between these falls and another impassable 5 m high waterfall, 4 km further upstream (i.e., 12 km upstream from the mouth). This 5 m waterfall prevents fish from accessing areas of the watershed further upstream, and marks the upstream limit of fish distribution in Babcock Creek. Bull trout, slimy sculpin, and mountain whitefish (*Prosopium williamsoni*) are found in the Babcock Creek mainstem between the creek mouth and a cascade 10.1 km upstream. Between this cascade and the 2.5 m waterfalls, only bull trout are present. Bull trout and slimy sculpin occur between the 2.5 and 5 m waterfalls, and these fish are probably genetically isolated from fish below the 2.5 m waterfall.

Gordon Creek

Gordon Creek enters Babcock Creek between the 2.5 m waterfall and the 5 m waterfall, and provides most of the fish habitat available for the resident bull trout and slimy sculpin in the Babcock Creek watershed. Almost the entire 15 km length of the Gordon Creek mainstem is occupied by bull trout, and upstream limit of fish distribution is a 2-m high barrier located at the top of Reach 6, in sub-alpine terrain near the headwaters of the drainage. Sub-adult bull trout in the three- and four-year age classes were collected immediately downstream of this barrier in 2004; however, there was no potential for resident populations above the barrier. High gradients and numerous small cascades downstream of the barrier appear to limit seasonal access by yearling and two-year old juvenile bull trout, and prevent colonization by resident slimy sculpin.

Accessible tributary habitats within the Gordon Creek watershed are limited to the lower reaches of three unnamed streams, where limited seasonal rearing potential exists.

Fish Tissue Chemistry

The mean concentration of selenium in sculpin tissue collected prior to mining activities occurring in the vicinity of Babcock and Gordon creeks was below the applicable tissue residue guideline. On an individual basis, two fish from Upper Babcock Creek exceeded the guideline, whereas fish collected at all other stations had concentrations that were lower than the guideline. These results indicate that selenium in sculpin tends to be higher nearer the coal block than downstream and sculpin in Hambler Creek have much lower selenium concentrations than those from Gordon and Babcock creeks. Overall, the baseline data suggest that selenium released from coal-bearing strata by natural processes is accumulating in the tissues of sculpins in the vicinity of those strata.

These baseline data were used to construct a control chart that provides trigger level concentrations for implementing a more detailed assessment of selenium uptake in aquatic biota. When the results of the 2008 study were compared to the baseline data, Babcock Creek (which had been influenced by construction and mining activities at the time of sampling) samples were found to be not significantly different than the baseline condition whereas Gordon Creek (which had not received any mine inputs to date) samples were significantly higher and exceeded the trigger concentrations for initiating investigative studies. Exceedance of these site-specific thresholds indicates that the 2008 data for Gordon Creek were not consistent with baseline conditions, but does not in itself provide any indication of the potential for adverse effects.

The main pathways by which the Project could potentially affect aquatic biota in LSA and/or RSA watercourses fall into four environmental effect categories:

Sedimentation—Increased TSS and turbidity from general ground disturbance, mining and waste rock disposal, resulting in decreased light penetration and reduced primary productivity, and/or alteration of fish habitat, particularly spawning habitat, through infilling of substrate interstices, substrate blanketing.

Changes to Stream Flow (Quantity and Timing)—Direct effects on fish and fish habitat due to changes in stream flows in LSA watercourses, in terms of the quantity (e.g., higher or lower than average seasonal flows) and timing (e.g., changes in the frequency of high-flow events) resulting in the loss, decrease or increase in availability of habitat and productivity. Changes in stream flows may occur in response to project-related flow impacts, channel diversions, changes in groundwater discharge in LSA watercourses.

ARD/ML (selenium, other metals, sulphate)—Contaminant loadings associated with ARD/ML (e.g., metals, anions) may affect fish populations directly through acute or chronic toxicity, indirectly via toxic effects on lower trophic levels with resultant effects on fish habitat, or via bioaccumulation of metals in the food chain, with potential for elevated concentrations of metals (in particular selenium in tissue of benthic biota and fish) and related effects on fish reproductive health.

Leaching of Nutrients—Increased nutrient levels (i.e., nitrates from rock blasted with ANFO explosive, nitrogen compounds and phosphates from sewage treatment and disposal) in watercourses, resulting in increased primary productivity and/or invertebrate community changes, with resulting effects on fish habitat.

Parameters predicted by the Surface Water and Sediment Quality Assessment to have a mine related signature at concentrations that exceed applicable water quality guidelines for the protection of aquatic life were assessed (i.e., nitrate, sulphate, selenium, cadmium and cobalt), as well as suspended solid loadings and the effects of changes in flow. High temporal and spatial variability in fish and fish habitat key indicators in LSA watercourses precluded an assessment based solely on biological information. The main findings of the residual Project-effect assessment were as follows: changes in flow, TSS loadings, and modeled nitrate, cadmium, sulphate and cobalt concentrations were predicted to be not significant; and modeled selenium concentrations were predicted to be significant. The assessment of selenium was conservative and the confidence in this prediction was low. The assessments of sulphate and cobalt also

had low confidence due to uncertainty associated with the toxicity of these substances under site-specific conditions. As a result, additional assessment is warranted.

Potential residual cumulative effects on fish and fish habitat via the same pathways discussed above were assessed for two scenarios: the cumulative impact of the Trend Coal Mine and the Project on the LSA; and the cumulative impact of historic, existing and near-future mining operations on the RSA (Murray River). In the LSA, the potential for cumulative effects from changes in flow and modeled concentrations of nitrate, cadmium, sulphate and cobalt was predicted to be not significant whereas the potential for cumulative effects from modeled concentrations of selenium was predicted to be significant. In the RSA, the potential for cumulative effects from modeled selenium concentrations were predicted to be not significant. The assessment of selenium was conservative and the confidence in this prediction was low. The assessments of sulphate and cobalt also had low confidence due to uncertainty associated with the toxicity of these substances under site-specific conditions. As a result, additional assessment is warranted.

Mitigation of potential effects to fish and fish habitat have been considered in a series of management plans, including: the Surface Erosion and Sediment Control Plan (Section 5.5); the Site Water Management Plan (Section 4.11); the Receiving Water Monitoring Plan (Section 5.6); the Fish and Fish Habitat Protection Plan (Section 5.9); the Chemical Management Plan (Section 5.12); the Solid and Hazardous Waste Management Plan (Section 5.11); the Metal Leaching / Acid Rock Drainage Management Plan (Section 5.8); and the Selenium Management Plan (Section 5.7). Application of these plans will contribute to the prevention of changes in flows and water quality that may impair fish and fish habitat in the receiving environment.

The recommended follow-up studies for the assessment of potential effects to fish and fish habitat include the following: re-sampling sculpin from Gordon Creek to confirm the elevated selenium concentrations observed in 2008 (this work is currently underway); site-specific, risk-based evaluations for selenium, sulphate, and cobalt to reduce uncertainty in predicted effects; and verification of the application of the re-calculated water quality guideline for cadmium. It is also recommended that a plan be developed, as appropriate and necessary, to monitor fish populations in the receiving waters of the Roman and Trend Coal Mines. A fish monitoring program could include periodic sampling to assess population size, age structure, and body condition, as well as tissue metal concentrations. Operational monitoring should include ongoing fish tissue metals (sculpins) analyses, as a general indicator of project effects and to monitor any project-related effects on selenium bioaccumulation.

Land Use and Tenure

The Project is located within the area covered by the Dawson Creek LRMP. This sub-regional land use plan incorporates the principles of integrated resource management into a long-term plan for Crown land in the Dawson Creek Timber Supply Area (TSA) in consideration of environmental and social values. The Dawson Creek LRMP acknowledges mineral exploration and extraction, and associated mining infrastructure as being acceptable uses of the area proposed for the Project.

Consultations regarding the Project have included meetings, open houses, as well as a variety of correspondence with government agencies, First Nations, Kelly Lake Communities and tenure holders.

Existing resource tenures located near the Project include several coal tenures, oil and gas tenures, one trapping territory and one guide-outfitting territory. Other land uses include a variety of non-commercial recreational activities, such as snowmobiling and hiking. Existing tenures and land uses located near the Project are listed below:

- ***Coal Tenures***—PRC holds all coal licenses within the land use and tenure LSA.
- ***Petroleum and Natural Gas (PNG)***—The land use and tenure LSA will overlap with eight oil and gas tenures owned by seven different tenure holders. All known leaseholders have been notified by

letter. Some leaseholders have not responded to repeated attempts to contact. Although none of the operations within the LSA are active, there are two existing well sites located to the north and an authorized well located to the south of the LSA.

- ***Energy Resources***—Chinook Power Corporation holds an Investigative Use Permit for Wind Exploration over portions of the LSA and has installed a meteorological tower south of the LSA. PRC has updated Chinook Power Corporation regarding the planned project activities.
- ***Mineral Resources***—Elk Valley Coal Corporation/Teck Coal (EVCC/Teck) and Canadian Dehua International Mines Group hold coal tenures that overlap with the LSA and transportation infrastructure. Continuation of existing land use agreements and regular communication regarding operational integration are expected to minimize the potential for effects to these tenure holders.
- ***Forestry***—There are no known forest tenure conflicts within the LSA. PRC is applying for a license-to-cut for removal and sale of timber within the LSA.
- ***Agriculture and grazing***—Land capability for grazing and agricultural uses in the LSA is rated low and there are no agriculture and grazing licenses in the LSA
- ***Guide Outfitting and Trapping***—The LSA is located within a guide outfitting territory and a single trapline license area. The project development area (PDA) comprises a relatively small proportion of these tenures; therefore, effects to the activities of the guide outfitter and trapper are expected to be minimal.
- ***Recreation***—Sporting activity near the LSA includes hiking, snowmobiling, fishing and camping.

The Project has the potential to affect petroleum and natural gas resources, energy resources, mineral resources, hunting and guide outfitting, trapping, and recreational resources. Possible adverse effects include the loss or temporary alienation of resources of importance to tenure holders or land users, access restrictions associated with portions of the Talisman and Core Lodge roads that traverse the mine site, and reduction in quality of resources, such as changes to visual quality for recreational users. The magnitude of these effects varies from low to moderate and duration of effects ranges from short-term to the distant future and most effects are reversible.

Mitigation measures proposed to minimize potential effects include: PRC's ongoing commitment to consultation with potentially affected parties to clearly define issues and work collaboratively towards avoidance, mitigation and/or management of project effects, as well as progressive reclamation, viewpoint signage and the re-design of the affected recreational trail. With mitigation, all project residual effects on land use and tenure are considered to be not significant. Positive effects of the Project include opportunities for mineral and forestry activities associated with enhanced site access during operations.

Archaeology

Archaeological resources considered in the assessment include, archaeological sites, historic period sites and other Heritage remains as defined and protected by the BC *Heritage Conservation Act* (HCA). An archaeological impact assessment (AIA) was done to assess the nature, extent, and context of remains protected by the HCA inside the LSA. An archeological overview assessment (AOA) was completed for the RSA. The focus of archeological investigations was to:

- identify previously unrecorded archaeological resources within the Project area
- evaluate recorded and new-found archaeological resources with respect to cultural, public, historic, economic, and scientific significance
- identify and assess all potential effects on archaeological resources which might result from project construction

The Project area lies in the shared traditional territories (alphabetically) of the KLCN, the KLMSS, the Lheidli T'enneh First Nation, the MLIB, the SFN, and the WMFN.

Seventy-four recorded archeological sites are located in the RSA, and 11 sites within the LSA. Sites within the LSA include a rock shelter, a petroform and lithic fragments.

Project development activities have the potential effect of altering the content or context of archaeological remains and site areas. Specifically, planned disturbances include:

- surface preparation (i.e., vegetation clearing and grading for the Project site, roads, ponds, water intake and other associated facilities)
- construction of proposed water management structures and facilities, particularly in the case of deeply buried archaeological sites

Six archeological sites within the LSA are subject to direct project effects, and two near the footprint are subject to potential project effects. Effective documentation through further archaeological evaluation and other works as required by the Archaeology Branch will enable the retention of archaeological context and integrity information that would otherwise be lost. With proposed mitigation measures, the loss of these sites is anticipated to be not significant.

There is no reasonable expectation that the Project's contribution to cumulative environmental effects will affect the integrity or context of archaeological remains in the RSA. There are no established regional standards or thresholds to exceed, but there is a reasonable expectation for an abundance of unrecorded sites of similar or better scientific significance to exist in the RSA. Several recorded archaeological sites of similar or better scientific significance and equal condition are known to exist in the RSA. With proposed mitigation and protection measures, the cumulative and residual environmental effects of the Project on archaeological resources are considered to be not significant.

Mitigation of project effects on archaeological and heritage sites will be undertaken as per British Columbia Archaeology Branch requirements and standards, including but not limited to, further evaluation and the acquisition of S12 SAPs (Section 12 of the HCA; Site Alteration Permit). This mitigation will minimize project effects on the larger, more complex archaeological sites, and altogether eliminate project effects on the smaller sites. An archeological site management plan will be developed.

There are six archeological sites that require follow-up and monitoring before construction begins. The results of these assessments will determine the need for, and requirements of, S12 SAPs required by PRC to proceed with construction. Monitoring requirements and compliance related to impacts to archaeological remains are determined by the British Columbia Archaeology Branch in its review of S12 SAP applications and final reports, respectively. Periodically, and outside of the S12 process, PRC may employ the services of a professional, appropriately accredited archaeologist to verify that archaeological sites not subject to an S12 SAP experience no loss of context or integrity from proximal changes in environmental conditions related to the Project.

Regional and Local Socio-economic and Health Considerations

The LSA for the Roman Mine Coal Project has two areas of focus:

1. primary LSA: the District of Tumbler Ridge
2. secondary LSA: the City of Fort St. John, the City of Dawson Creek, and the District of Chetwynd

The RSA for the Project is the Peace River Regional District (PRRD).

The project may also affect the socio-community, socio-economic, and public health conditions of the WMFN, SFN, HRFN, DRFN, MLIB, the KLMSS, the KLCN and the KLFN (see Sections 20 to 23).

The following key indicators were selected for the Roman Mine Coal Project socio-economic and health assessment, guiding the focus of the baseline and effects assessment:

- changes to employment
- changes to business opportunities
- changes to income
- changes to government revenue and economic output
- changes to housing and accommodation
- changes to availability and access to local emergency services
- changes to public health and safety
- changes to access to recreational land

In general, the Project LSA is characterized by high employment, relatively low educational attainment, and a relatively young population.

The economy is resource dependent, with mining providing the largest industrial base in the primary LSA and the oil and gas sector dominating in the secondary LSA. Mining in the northeast is mostly coal-based, with the majority of coal beds situated in the Peace River area. In 2007, $10.5 million were spent on exploration in the northeast region of British Columbia. The coal mining industry provides over 2900 direct jobs in northeastern BC and accounts for over $2 billion of the province's $6.6 billion Gross Domestic Product (GDP).

Tumbler Ridge, Fort St. John, Dawson Creek and Chetwynd have businesses capable of providing services to resource development companies (e.g., construction services, ditching, aggregate supply and trucking, vehicle rental).

The growth in coal mining and oil and gas exploration and development led to an estimated 1300 new jobs in Tumbler Ridge and a further 1300 in Chetwynd between 2006 and 2008. At this time, the growth in the coal mining and oil and gas sectors caused a labour shortage in Tumbler Ridge and Chetwynd. It was difficult to attract and retain employees as all regions in western Canada were competing for the same labour force. It is possible that communities will face labour supply challenges similar to conditions in the future.

In 2006, Tumbler Ridge municipal staff indicated that the vacancy rate for houses and condominiums was nearly zero. Over the past few years, Tumbler Ridge has anticipated construction of new housing developments to support an influx of workers and families into the community. In Chetwynd, 40 percent of rental housing is available and 50 houses are for sale. Discussions with municipal representatives indicate that the housing market in Chetwynd is able to support growth.

The fire department in Tumbler Ridge is currently working at capacity. The department is able to meet existing demand; however, additional demand would put a strain on the services.

Crime rates in Tumbler Ridge have increased over the past four years, in part due to resource development in the area. The Tumbler Ridge RCMP Detachment is concerned that the planned production increase at Western Coal Corp. and Peace River Coal properties would add a significant demand for policing services. The Detachment has begun a process to increase personnel and budget to meet the increasing demands for policing.

The Emperor's Challenge, a 20-km race over Roman Mountain, has been identified as interacting with the Project. This major tourism event brings close to 250 participants to the area every summer, and is a source of economic diversification.

The project is expected to have a positive effect on economic output and government revenues, business opportunities, employment and income. Negative effects are expected to be felt in relation to housing, local emergency services, public health and safety, and recreation. The negative effects are rated as low to moderate in magnitude and are not expected to be significant.

PRC has indicated in its Community and Social Policy Statement (June 2008), that they will be committed to:

- seeking mutually beneficial long-term relationships with business partners, contractors and suppliers, based on fair and ethical practices
- enhancing the capabilities of the communities of which the operation is a part (i.e., training and education)
- seeking to make a contribution to the economic, social and educational well-being of communities associated with the operation, including through local business development, and providing opportunities for workers from disadvantaged backgrounds

Section 18.6.1 identifies measures that PRC will implement to mitigate, avoid, or reduce potential negative effects and to enhance potential Project benefits.

To monitor the effectiveness of PRC's commitments and agreements, PRC will provide regular reports on Corporate Social Responsibility indicators. In addition, the PRC Managers intend to hold regular meetings with area residents, First Nations and Kelly Lake Communities, local and regional governments on the project. PRC would notify the parties identified of any changes to the project schedule or implementation plan. This process will also assist in identifying and addressing any unforeseen or emerging socio-economic and health issues or concerns pertaining to the project.

First Nations Setting

The Project is within the area covered by historic Treaty No. 8. Based on the Section 11 Order issued for the project by the BC EAO, it is understood the following First Nations were invited to participate in the project review: SFN, Prophet River First Nation (PRFN), DRFN, WMFN, HRFN, Fort Nelson, and Blueberry River First Nations as well as MLIB. These First Nations, plus the Treaty No. 8 Tribal Association, were invited to participate in the Project Working Group. Of these, the following expressed interest in participation in the Working Group: DRFN, HRFN, SFN and WMFN as well as MLIB.

General Ethnographic and Historical Information

English is the dominant language of business and government in the Project area with the percentage of First Nations or Métis people having fluency in Aboriginal languages declining. The traditional languages of the Aboriginal communities with expressed interests in the Project area include Tse'khene (Sekani) and Dane-Zaa (Beaver), of the Athapaskan language family, as well as Nēhiyawēwin (Cree) and Anishnaubemowin (Saulteau), of the Algonquian language family.

Treaty No. 8 was first signed in 1899 at Lesser Slave Lake, Alberta. In subsequent years, it was signed with First Nations at Moberly Lake and elsewhere in northeast British Columbia. MLIB became a modern day signatory through an adhesion in 2000. The Project is near the southwestern boundary of the Treaty area in British Columbia.

There is very limited early ethnographic studies for the northeastern part of British Columbia, and particularly so for the Project area near Tumbler Ridge; summaries and references are provided in this section. Contact with European in the Tse'khene territory likely began in the 1700s via indirect maritime trade from the west. The first direct European contact in the area was in the late 1700s when explorers, pioneers and traders came in from the east.

Historically, the Project and Tumbler Ridge area was sparsely populated with an annual cycle of land use practices including hunting and trapping for subsistence and trade being the dominant activities in the region. This began to change in the 1960s with the decline in the commercial viability of traplines in the region, the increased availability of wage labour, and increased pressure to settle in permanent on-reserve communities. In the Project area, Tumbler Ridge was established in the early 1980s when the Quintette Coal Mine opened. Since that time, agricultural and industrial developments including road building, hydro-electric dams, oil and gas exploration, pipeline construction and coal mines have had a dynamic effect on land use patters by Aboriginal people in the South Peace area.

First Nations Profiles

Section 19 provides a brief synopsis of each of the First Nations that are included in the Section 11 Order issued by the BC EAO.

First Nations Socio-economic and Health Consideration

The Project is located in an area where the interests of several First Nations and the Kelly Lake Communities intersect. The project area is within the western portion of historic Treaty No. 8. While First Nations communities within the Project area consist primarily of Treaty signatory nations, the Project is also understood to be within the area of interest of the Kelly Lake Communities. This section presents socioeconomic baseline information and effects assessment for First Nations. Kelly Lake Communities socioeconomic considerations are discussed in Section 23 of the Application.

First Nations Communities are interested in understanding the Project's potential positive and negative effects on existing social, cultural and economic conditions and how PRC proposes to avoid, minimize or enhance, and mitigate the potential Project-related effects. First Nations interested in the Project (as identified by the Section 11 order issued by the EAO on October 2, 2008) include: WMFN, SFN, DRFN, HRFN, and MLIB.

Potential First Nations socio-economic, socio-community and public health issues associated with this Project are:

Livelihoods and economic vitality

- employment opportunities
- business opportunities
- income generation
- training and education opportunities

Community well-being

- effects on economic well-being and health and safety
- effects on housing and infrastructure

This section provides aggregate Aboriginal information for the PRRD, and community-specific socio-economic and socio-community baseline conditions for WMFN, SFN, DRFN, HRFN and MLIB, where data is available. In general, the PRRD is characterized by a high Aboriginal population with a high proportion of youth. Aboriginal people represented just over 13 percent of the total population in the Northeast Health Service Delivery Area; 18.5 percent of the region's youth (ages 15–24) were Aboriginal. Eight percent of the population in Tumbler Ridge is Aboriginal, with 14 percent of the town's youth population being Aboriginal. Chetwynd's Aboriginal population is close to double that of Tumbler Ridge, at 26 percent, with 35 percent of the town's youth population being Aboriginal.

Industry characteristics in the First Nations communities are similar to the PRRD as a whole, with agricultural and resource based industries comprising the largest portion of the labour market at 20.8 percent, followed by other services (20.6 percent), business services (13.8 percent), and construction (12.8 percent). Main economic activities of First Nations include:

- forest, retail trade, mining and the oil and gas sectors (WMFN)
- agriculture, silviculture, gravel extraction and sales, and mining contracting, and tourism (SFN)
- logging, forestry, trapping, sports fishing and oil and gas and mining contracting (MLIB)
- road building, general contracting, forestry, seismic, first aid and safety services, and reclamation (DRFN)
- gravel extraction and sales (HRFN)

First Nations have established businesses that provide goods and services relevant to the Roman Coal Mine Project, examples include Dunne-Za (WMFN), 4Evergreen Resources Inc. (SFN), and Duz Cho (MLIB).

While the unemployment rate is low in WMFN, it is reportedly high in the other study area First Nations (where statistics were available). SFN members rely heavily on seismic work that provides seasonal and cyclical employment.

Low educational retention and high school completion rates are a widespread in the six First Nations communities. This is likely due to the need or desire to leave school to find employment and factors that can make it difficult for First Nations members to live outside their community (e.g., the need to return home for ceremonies and traditional activities; cross-cultural barriers; relatively high cost of housing).

According to a British Columbia Vital Statistics Agency report, the health of Status Indians is worse than for non-Aboriginals in the Northeast Health Service Delivery Area. Health data was not readily available for First Nations in the study area; however, representatives of WMFN and SFN raised concerns about increasing drug- and alcohol-related problems among the younger community members.

Community-specific data on justice and safety were not available at the time of writing this report. However, two communities reported concerns about increases in crime, particularly drug-trafficking and drug use.

Housing information was available for WMFN, SFN and MLIB. WMFN and SFN noted housing shortages. Other housing issues included limited telephone lines, high housing costs, limited supply of potable water, and poorly functioning septic system.

Preserving traditional language, diet (consumption of cultural foods), subsistence and economic activities such as hunting, fishing, trapping, and gathering, and cultural values and spirituality are of key importance to community members.

The project is expected to have a positive effect on First Nations employment, business opportunities, income generation and training and skills development. Negative effects could be felt in relation to community well-being. Negative effects are rated as low to moderate in magnitude and are not expected to be significant.

Section 20.6.1 identifies measures that PRC will implement to mitigate, avoid, or reduce potential negative effects and to enhance potential Project benefits.

To monitor the effectiveness of PRC's commitments and agreements, PRC will provide regular reports on Corporate Social Responsibility indicators. In addition, the PRC Managers intend to hold regular meetings with First Nations and Kelly Lake Communities, local residents, and local and regional governments on the project. PRC will notify the parties identified of any changes to the project schedule

or implementation plan. This process will also assist in identifying and addressing any unforeseen or emerging First Nations socio-economic and socio-community issues or concerns pertaining to the project.

First Nations Interests and Use

The project area is within the southern portion of historic Treaty No. 8. First Nations with expressed interests in the Project (interested First Nations), as indicated in the Project Order issued under Section 11 of BCEAA, are WMFN, SFN, HRFN, MLIB, and DRFN.

Consistent with the Project Terms of Reference as well as with the guidance of the EAO and those T8TA First Nations defined in Schedule A of the Section 11 Order, PRC undertook a collaborative approach to supporting First Nations directed Traditional Knowledge and Traditional Use Studies (TK and TUS) including baseline collection and analysis on First Nations Interests and Use. PRC's efforts to work collectively, and to provide capacity funding collectively, with these First Nations was through a proposed scope-of-work agreement with MLIB, as well as The Aboriginal Environment Group (TAEG), and ad-hoc group including several of the T8TA First Nations. To date, only the MLIB have provided a TUS report to PRC for incorporation in the Application. However, PRC has repeatedly offered to work with, and provide capacity funding to, those TAEG member First Nations as defined in Schedule A of the Order Under Section 11, either collectively or individually to complete one or more community-led traditional use or traditional knowledge studies documenting First Nations' interests and use in the Project area. McLeod Lake Indian Band did not participate in the TAEG process and engaged directly with PRC to develop and implement a TUS program for the Project.

In the absence of additional information from Project specific studies by interested First Nations other than MLIB, baseline for understanding First Nations Interests and Use in relation to the Project draws primarily on the *Overview of Mcleod Lake Indian Band Traditional Knowledge of Alpine Ecosystems as Relevant to the Proposed Roman Coal Mine* (Golder 2009), and key ethnographic and archival sources.

The study area for this section includes:

- LSA: the maximum footprint of the Project
- RSA: based largely on watershed features and is a broader area around the Project where there is potential for Project related environmental effects such as noise, dust, effects on water, and community perceived disturbance

Baseline information is presented in the Application for site specific and non-site specific traditional use values associated with areas of past, present, and prospective First Nations use and associated interests. Baseline conditions are provided for the following seven traditional use categories: subsistence values, trapping/commercial values, habitation values, cultural/spiritual values, wildlife/ecological values, transportation values, and indigenous landscape values. A key non-site specific interest noted by the MLIB is the presence of highly valued wildlife/ecological values in the LSA and RSA associated with mountain caribou and alpine ecology.

The residual Project effects on First Nations interests and use, after mitigation measures, are considered to be important, but are not considered to be significant.

Section 21.5.1 summarizes anticipated Project environmental effects on First Nation interests and use and proposed mitigation measures. There are overlaps between some of these mitigation measures where, in some instances, a single mitigation measure will work to mitigate effects to more than one type of traditional use value. Key mitigations include:

- PRC will involve interested First Nations in reclamation planning or in establishing reclamation plan objectives to support long-term future viability of the area for future traditional use practices.

- PRC will work with the interested First Nations to identify and communicate opportunities for First Nations involvement in environmental monitoring during construction and operation.

Kelly Lake Communities Setting

The Project is within the area of interest identified by the KLMSS, the KLCN and the KLFN. Of these, KLCN and KLMSS expressed interest in participating in the Project EA Working Group and Review process. The Section 11 Order issued by the EAO has defined the Kelly Lake Communities as including the KLCN and KLMSS.

General Ethnographic and Historical Information

While the communities at Kelly Lake self-identify to be of Aboriginal descent, none of them are recognized signatories of Treaty No. 8, nor have they established other forms of federal or provincial land claim agreements. The relationship among the communities at Kelly Lake, and between these communities and the Crown, is dynamic and subject to ongoing discussion.

Early ethnographic studies are very limited for the northeastern part of British Columbia, and particularly near Tumbler Ridge and the Project area. What is available is summarized and referenced in Section 22. The expansion of the Nēhiyawēwin (Cree) and Dane-Zaa (Beaver) speaking peoples into the area through the nineteenth century was followed by arrival of Anishnaubemowin (Saulteau) speaking people and then establishment of the Kelly Lake settlement in the nineteenth and early twentieth century.

The families of the KLCN and KLMSS trace their paternal ancestry to Iroquois and French roots in Ontario and Quebec with predominantly Nēhiyawēwin (Cree) maternal ancestry. Their oral history and genealogical records place some Kelly Lake families in the Peace region by the early 1800s.

Historically, the Project and Tumbler Ridge area was sparsely populated with an annual cycle of land use practices including hunting and trapping for subsistence and trade being the dominant activities in the region. This began to change in the 1960s with the decline in the commercial viability of traplines in the region, the increased availability of wage labour, and increased pressure to settle in permanent on-reserve communities. In the Project area, Tumbler Ridge was established in the early 1980s when the Quintette Coal Mine opened. Since that time, agricultural and industrial developments including road building, hydro-electric dams, oil and gas exploration, pipeline construction and coal mines have had a dynamic effect on land use patters by Aboriginal people in the South Peace area.

English is the dominant language of business and government in the Project area with the percentage of First Nations or Métis people having fluency in Aboriginal languages declining.

Kelly Lake Communities Profiles

Section 22 provides a brief synopsis of each of the Kelly Lake Communities that are identified in the Section 11 Order for the Project.

Kelly Lake Communities Socio-economic and Health Considerations

The Project is located 25-km south of Tumbler Ridge and in an area where the interests of communities at Kelly Lake and those of several First Nations intersect. The project area is within the southern portion of historic Treaty No. 8. First Nations communities within the project area consist primarily of Treaty signatory nations; the Project is also within the area of interest indicated by the KLMSS, the KLCN, and the KLFN. This section presents socio-economic baseline information and effects assessment for the Kelly Lake Communities. First Nations socio-economic considerations are discussed in Section 20 of the Application.

The Kelly Lake Communities are interested in understanding the Project's potential positive and negative effects on existing social, cultural and economic conditions and how PRC proposes to avoid, minimize or enhance, and mitigate the potential project-related effects. Potential Kelly Lake Communities socio-economic, socio-community and public health issues associated with this Project are as follows:

Livelihoods and economic vitality

- employment opportunities
- business opportunities
- income generation
- training and education opportunities

Community well-being

- effects on economic well-being and health and safety
- effects on housing and infrastructure

This section provides socio-economic and socio-community baseline information for the Kelly Lake Communities. The information is based on existing data, interviews with representatives of the KLMSS and information from the Kelly Lake Communities Traditional Interests and Use Section (Section 24) of the Application.

Kelly Lake Community members participate in the wage economy through employment in the forestry, oil and gas, and mining sectors. However, even though the economy in the region has been booming, local full-time employment is not readily available to community members. Many community members travel great distances to find work, going as far away as Fort McMurray.

The Kelly Lake Communities have established businesses that provide services relevant to the Roman Coal Mine Project. These include the Kiyanawa Development Corporation that focuses on environmental reclamation and monitoring, seismic projects, cleanup, right-of-way lease construction and road building; Steeprock First Aid and Security; and Ma-M-Way Cooperative.

Educational attainment levels were not available for KLFN or KLCN. However, in the PRRD 47.8 percent of Aboriginal people had not attained a high school certificate or equivalent.

Forty-seven percent of Kelly Lake children have completed elementary school, 33 percent have completed high school, 17 percent have completed college, and 2 percent have a university degree. To access schools, children commute to Alberta.

According to a British Columbia Vital Statistics Agency report, the health of Status Indians is worse than that of non-Aboriginals in the Northeast Health Service Delivery Area. With respect to Métis health in Canada as a whole, Statistics Canada reports that 58 percent of Métis adults rated their health as very good to excellent. Métis adults are more likely to report chronic medical conditions, for example arthritis or asthma, than the general population. The KLMSS website indicates that KLMSS members confront considerable health and health service access challenges. Information on the health status in Kelly Lake Communities was not readily available.

There are no emergency or medical services offered in the community. Kelly Lake receives its police, fire and medical assistance from Dawson Creek. Adequate housing is also lacking.

Preserving traditional language, diet (consumption of cultural foods), subsistence and economic activities, such as hunting, fishing, trapping, gathering, and cultural values and spirituality are of key importance to community members.

The project is expected to have a positive effect on employment, business opportunities, income generation and training and skills development during construction and operations, but negative at closure. Community health and safety effects are expected to be negative. Negative effects are rated as low to high in magnitude and are not expected to be significant.

Section 23.6.1 identifies measures PRC will implement to mitigate, avoid, or reduce potential negative effects and to enhance potential Project benefits.

To monitor the effectiveness of PRC's commitments and agreements, PRC will provide reports monthly and annually on Corporate Social Responsibilities indicators. In addition, the PRC Managers intend to hold regular meetings with Kelly Lake and First Nations communities, local residents, and local and regional governments on the project. PRC would notify the parties identified of any changes to the project schedule or implementation plan. This process will also assist in identifying and addressing any unforeseen or emerging Project-related socio-economic and socio-community issues or concerns of Kelly Lake communities.

Kelly Lake Communities Interests and Use

This section presents and evaluates readily available baseline information regarding Kelly Lake Communities interests and use in relation to the proposed Project. For the purposes of this Section, the VEC is Kelly Lake Communities Interests and Use, and the term "Kelly Lake Communities" refers collectively to the KLMSS and the KLCN as identified in the Section 11 order issued the BC EAO. Consistent with the Project Terms of Reference, PRC undertook a collaborative approach to supporting community directed Traditional Knowledge and Traditional Use Studies (TK and TUS), including baseline collection and analysis on Kelly Lake Communities interests and use. Both KLMSS and KLCN received support and completed studies for inclusion in the assessment. Baseline for understanding the Kelly Lake Communities Interests and Use in relation to the Project draws primarily on the *KLMSS Traditional Use Overview Study* (Golder 2009), the *Traditional Land Use Impact Report: Kelly Lake Cree Nation*, and key ethnographic and archival sources.

The study area for this section includes:

- LSA: the maximum footprint of the Project
- RSA: based largely on watershed features and is a broader area around the Project where there is potential for Project related environmental effects such as noise, dust, effects on water, and community perceived disturbance

Baseline is considered for site specific and non-site specific traditional use values associates with Kelly Lake Community's areas of past, present, and prospective future use and associated interest. Baseline conditions are provided for the following seven traditional use categories: subsistence values, trapping/commercial values, habitation values, cultural/spiritual values, wildlife/ecological values, transportation values, and indigenous landscape values. Important subsistence and trapping/commercial values associated with several key historic village locations, as well as other related values, are reported within the RSA, but are not reported for the LSA.

The residual Project effects on Kelly Lake Communities interests and use, after mitigation measures, are considered to be important, but are likely not significant, as defined in Section 24.2.9. A site visit with Kelly Lake Communities, and additional consultation with Kelly Lake Communities, post-application, should provide an opportunity to confirm or refine this determination of significance.

Section 24.4.4 summarizes Project environmental effects on Kelly Lake Communities traditional land use values and proposed mitigation measures. There are overlaps between some of these mitigation measures where in some instances a single mitigation measure will work to mitigate more than one type of traditional use value.

The follow-up and monitoring for Kelly Lake interests and use includes involvement of the Kelly Lake Communities in monitoring measures. Follow-up and monitoring are summarized below:

- PRC will involve Kelly Lake Communities in reclamation planning or in establishing reclamation plan objectives to support long-term future viability of the area for future traditional use practices.
- PRC will work with the Kelly Lake Communities to identify and communicate opportunities for Kelly Lake involvement in environmental monitoring during construction and operation. This involvement may include baseline monitoring in the Five Cabin Creek drainage, employment of Kelly Lake member(s) in ongoing environmental monitoring programs and/or annual opportunities to report the results of ongoing monitoring programs to the Kelly Lake Communities.

Conclusions

The environmental assessment undertaken by the Roman Project team has concluded that the Project is unlikely to cause significant adverse environmental effects to the terrestrial environment, socio-economic conditions in the region or to First Nations or Kelly Lake Communities. Some water quality parameters are predicted to exceed regulatory thresholds (selenium, sulphate and cobalt) and as a result some residual project and cumulative effects to water and sediment quality and aquatic resources within the upper portions of the Babcock and Gordon Creek drainages are predicted to be significant during low flow periods. There is considerable uncertainty regarding these predicted effects and additional work is underway to more clearly define appropriate thresholds for protection of aquatic life.

These conclusions are based on PRC commitments to construct the Project as proposed and implement the mitigation measures and environmental management plans, as well as commitments to work with First Nations and Kelly Lake communities defined in the associated sections of the Application. All conclusions are developed within the context of the sub-regional land use plan which has zoned the Project area as Enhanced Resource Use, with coal mining identified as a key resource for development.

Other Authorizations Required

PRC has identified the following additional authorizations that will be required for the project development:

Table 2 Authorizations Required

Regulation or Act	Approval/ Permit Required	Lead Agency	Facility or Activity	Purpose of Approval/Permit
BC *Environmental Assessment Act*	Environmental Assessment Certificate	BC Environmental Assessment Office	Entire Project	Constitutes primary environmental approval. Issuance of an environmental assessment certificate signifies that key issues (regarding the environmental, socio-economic, cultural, and health concerns) relevant to whether the project should or should not proceed have been resolved, or can be resolved by technically feasible means as project development proceeds
Coal Act	Coal Lease	Ministry of Energy, Mines, and Petroleum Resources	Mine site	Confers rights to occupy lands for the purpose of mining and commercial coal production
Land Act	License of Occupation	Integrated Land Management Bureau	RP2 and associated ditches	Confers the rights to occupy Crown land to construct support facilities
-	Land Use Agreement	Elk Valley Coal Corporation/ Teck Coal	RP2 and associated ditches	Agreement to occupy and construct support facilities on EVCC/Teck tenure
-	Road Use Agreement	Canadian Natural Resources Ltd.	Coal haul route, PDR-46	Agreement with primary road user (CNRL) for use and maintenance of the PDR-46
BC *Mines Act*	Permit Approving Mine Plan and Reclamation Program (Mine Permit)	Ministry of Energy, Mines, and Petroleum Resources	Mine site	Authorizes construction, operation and closure of the mine. Additionally approves the Reclamation plan. Requires compliance with the Health, Safety and Reclamation Code for Mines in British Columbia
BC *Forest and Range Practices Act*	License to Cut	Ministry of Forests and Range	Mine site and rail load-out	Authorizes the clearing of merchantable timber
BC *Water Act*	Water Licenses	Ministry of Environment, Water Stewardship Division	Water management structures including RP1, RP2, RP3, and associated collector and diversion ditches	Authorizes diversion and use surface water and approves water retaining structures (such as sedimentation ponds)
BC *Environmental Management Act*	Effluent and Air Permits	Ministry of Environment, Environmental Protection Division	Mine site	Authorize the discharge of effluent, including discharges from sedimentation pond, and emissions of fugitive dust respectively

Table 2 Authorizations Required (cont'd)

Regulation or Act	Approval/ Permit Required	Lead Agency	Facility or Activity	Purpose of Approval/Permit
BC *Environmental Management Act*	Municipal Sewage Regulation Authorization	Ministry of Environment, Environmental Protection Division	Mine site	Authorizes the discharge of sewage effluent from mine site facilities
Drinking Water Protection Act	Application for Waterworks Construction Permit	Northern Health Authority	Domestic water system	Authorizes the construction of a domestic water system for mine facilities
Drinking Water Protection Act	Operating Permit	Northern Health Authority	Domestic water system	Authorizes the operation of a domestic water system for mine facilities
Explosives Act	Base Factory Permit	Natural Resources Canada	Mine site, Explosives Facility	Authorizes the production of bulk explosives. Third party responsibility. Existing permit for Trend with sufficient capacity to accommodate Project. No permit amendment required
Explosives Act	Mechanical ANFO Certificate	Natural Resources Canada	Mine site, Explosives Facility	Authorizes the production of ANFO with powered equipment to be discharged directly into a borehole. Third party responsibility. Existing permit for Trend with sufficient capacity to accommodate Project. No permit amendment required

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List of Abbreviations and Symbols

ABA	acid base accounting
ACCI	Anglo Coal Canada Inc.
AP	acid potential
AQDCP	Air Quality and Dust Control Plan
ARD	acid rock drainage
BC EAO	British Columbia Environmental Assessment Office
BCEAA	British Columbia *Environmental Assessment Act*
BCM	bank cubic metre
BMP	Best Management Practice
BRIC	Brazil, Russia, India and China
CAC	Criteria Air Contaminants
CCR	coarse coal refuse
CDC	Conservation Data Centre
CEA Agency	Canadian Environmental Assessment Agency
CEAA	Canadian *Environmental Assessment Act*
CNRL	Canadian Natural Resources Limited
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPP	coal processing plant
DFO	Department of Fisheries and Oceans
DRFN	Doig River First Nation
EA	Environmental Assessment
EAO	Environmental Assessment Office
EEM	Environmental Effects Monitoring
EMP	environmental management plan
FOS	Factors of Safety
GHG	Greenhouse Gas
ha	hectares
HADD	Harmful Alterations, Disruption or Destruction
HCC	hard coking coal
HGI	Hardgrove Grindability Index
Hillsborough	Hillsborough Resources Limited
HRFN	Halfway River First Nation
ICP	inductively coupled plasma
ILMB	Integrated Land Management Bureau
KI	Key Indicator
KLCN	Kelly Lake Cree Nation
KLFN	Kelly Lake First Nation
KLMSS	Kelly Lake Métis Settlement Society
km	kilometre
kV	kilovolt
L	litre
LRMP	Land and Resource Management Plan
LSA	Local Study Area
m	metre
MAP	mean annual precipitation
MAR	mean annual runoff
masl	metres above sea level

MDL ..... maximum disturbance limit
MEMPR ..... Ministry of Energy, Mining and Petroleum Resources
mg/L ..... milligrams per litre
ML ..... metal leaching
ML/ARD ..... metal leaching/acid rock drainage
MLIB ..... McLeod Lake Indian Band
mm ..... millimetres
MOA ..... Agreement
MOE ..... Ministry of Environment
MOU ..... Memorandum of Understanding
Mt ..... million tonnes
mtpa ..... million tonnes per annum
NAG ..... non-acid generating
NECC ..... North East Coal Coalition
NEIPC ..... North East Invasive Plant Council
NEMDRC ..... North East Mine Development Review Committee
NEMI ..... NEMI Northern Energy & Mining Inc.
NOW ..... Notice of Work
NP ..... neutralization potential
NRCAN ..... Natural Resources Canada
OCP ..... Official Community Plan
PAG ..... potentially acid generating
pH ..... measure of the relative acidity or alkalinity of a substance
PRC ..... Peace River Coal Inc.
QCL ..... Quintette Coal Limited
ROM ..... run-of-mine
ROPC ..... Receptors of Potential Concern
ROW ..... Right-of-way
RR ..... rural resource
RSA ..... Regional Study Area
Se ..... Selenium
SEAT ..... Socio-Economic Assessment Toolkit
SeMP ..... Selenium Management Plan
SEPSCP ..... Surface Erosion Prevention and Sediment Control Plan
SESC ..... Surface Erosion and Sediment Control
SFN ..... Saulteau First Nations
SIBEC ..... Site Index—Biogeoclimatic Ecosystem Classification
T8TA ..... Treaty 8 Tribal Association
TAEG ..... The Adhoc Environmental Group or The Aboriginal Environmental Group
TEK ..... traditional ecological knowledge
TEM ..... terrestrial ecosystem mapping
the Coal Assets ..... northeast British Columbia metallurgical coal assets
the Partnership ..... Peace River Coal Limited Partnership
the Project ..... Roman Coal Mine Project
TIC ..... total inorganic carbon
TLUS ..... traditional land use study
TMF ..... tailings management facility
TOR ..... Terms of Reference
TSA ..... Timber Supply Area
TSS ..... total suspended solids

TUS ..... traditional use study/studies
VEC ..... Valued Environmental Component
WCC ..... Western Coal Corp.
WMFN ..... West Moberly First Nations
WPMP ..... Wildlife Protection and Monitoring Plan
WSC ..... Water Survey of Canada

Roman Coal Mine Project

ENVIRONMENTAL ASSESSMENT REPORT

VOLUME 1, SECTION 1: INTRODUCTION

Prepared for:
BC Environmental Assessment Office
Victoria, British Columbia

Prepared by:
Peace River Coal Inc.
Vancouver, British Columbia

March 2010

1 Introduction

1.1 Proponent Identification

The Peace River Coal Limited Partnership (the Partnership) was formed on November 29, 2006. The Partnership comprises:

- Peace River Coal Inc. (PRC) currently with 75 percent ownership. PRC is wholly owned by Anglo Coal Canada Inc. (ACCI)
- Hillsborough Resources Limited (Hillsborough) currently with 13 percent ownership
- Northern Energy and Mining Inc. (NEMI) currently with 12 percent ownership

The parties transferred their northeast British Columbia metallurgical coal assets (the Coal Assets) into the Partnership. The Coal Assets are managed by PRC, as general partner of the Partnership. PRC is the Proponent of the proposed Roman Coal Mine Project (the Project).

Hillsborough and NEMI are Vancouver-based mining companies traded on the Toronto Stock Exchange under the stock symbols HLB and NNE, respectively. Hillsborough owns and operates the Quinsam Mine, an underground thermal coal mine on Vancouver Island, which has been operating since 1987.

Anglo American plc's coal interests are held through its wholly owned Anglo Coal business, one of the world's largest private sector coal producers and exporters with mining operations in South Africa, Australia, Colombia, Venezuela and Canada. Anglo Coal produces thermal and metallurgical coals for international customers in the Med-Atlantic and Indo-Pacific markets as well as South African and Australian based local customers. Anglo Coal operates in Canada through Anglo Coal Canada Inc.

PRC's Coal Assets include the Trend, Horizon, Reesor, Bickford, Mesa and Prospect properties and 50 percent of the Belcourt Saxon Limited Partnership (see Figure 1.2-1).

Glen Koropchuk is the Chief Executive Officer and General Manager of PRC, the Corporate Office is located at:

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1.2 Project Overview

The Roman Coal Mine Project is adjacent to the PRC's operating Trend Coal Mine in order to provide additional reserves, to extend the life of projects and capitalize on existing infrastructure.

The Project is an open-pit metallurgical coal mine with approximately 30.6 million tonnes (Mt) of run of mine (ROM) reserves located approximately 30 km south of Tumbler Ridge, British Columbia. The mine will produce high-quality metallurgical coal

for approximately 10 years at an average rate of 3 million tonnes per annum (mtpa) from second quarter of 2012 to third quarter 2022 assuming Project approval by the first quarter of 2010. The projected time frame for Project construction is approximately 18 months, beginning in late 2011 and will overlap with the construction phase. At the completion of mining, final decommissioning and reclamation is expected to take an additional two to three years.

The Project proposes to mine the Roman deposit through an open pit extending from the southern border of the South Block of the Trend Coal Mine, producing two to four million tonnes per annum of metallurgical coal. Coal mined from the Project will be transported on the Canadian National Rail Line to Ridley Island coal terminal near Prince Rupert to supply the international metallurgical export market.

The Roman deposit comprises two coal bearing formations (Gates and Gething) offering the potential to develop several blending options.

The Project involves construction, operation, and, following the 10-year operational mine life, eventual decommissioning and reclamation.

The Project areas will be cleared and grubbed and soils will be stockpiled in strategic locations to allow for soil replacement during reclamation.

Mine construction will include:

- clearing and grubbing for required infrastructure
- installation of initial erosion control measures
- construction of collector ditches to capture surface water flows from areas disturbed by the construction of North and East dump and by Phase 1 mining activities
- construction of two sediment ponds to treat effluent from mine disturbance and associated soil salvaging
- construction of the coal processing plant, coal storage areas, maintenance facilities and offices
- initiation of pre-strip activities and associated soil salvage
- construction of mine access and haul roads
- complete construction of the required infrastructure associated with the rail load-out including the coal conveyance system and over track silos

The maximum disturbance limit (MDL) is approximately 810 ha. Approximately 39 percent of this footprint overlaps previously disturbed areas of the Trend Coal Mine. The area of new disturbance associated with the Project is projected to be 498 ha.

The Project will use a conventional truck and shovel method of open pit mining. Mining will begin with the drilling and blasting of waste rock. The waste rock will then be loaded into haul trucks to be placed in external dumps or backfilled into previously mined out pits (the South Block of the Trend Coal Mine). The ROM coal will then loaded into haul trucks and transported to the Roman coal wash plant for processing. The Roman coal wash plant will also process coal from the Trend Coal Mine.

The Roman Coal Mine Plan (see Section 4.4) is divided into operational phases to maximize the potential for backfilling pits where the economic coal resources have been extracted. This minimizes the footprint of the external dumps, decreasing the total

disturbed area. Backfilling of open pits will also reduce the exposed footwall and hanging wall areas.

There are six economically viable seams in the Gates Formation (D, E, F, G, J and K) and four economically viable coal seams in the Gething Formation (Bird, GT1, GT2 and GT3). The average strip ratio is estimated to be 8.4:1 (bank cubic metres of waste rock per ROM coal tonne).

The Project will target reserves of approximately 30.6 Mt ROM coal, which is anticipated to produce approximately 21.5 Mt of product coal.

Reclamation will involve re-sloping waste dumps and fill roads, soil replacement and revegetation. Final closure will involve removal of all facilities and infrastructure, and decommissioning and reclamation of roads and water management structures.

1.2.1 Project History

Coal was discovered in the Peace River region in 1793, but commercial interest was limited and local until the 1970s when expansion of Japanese steel production stimulated coal development worldwide. This led to exploration of coal lands throughout northeastern British Columbia.

Denison Mines Ltd., Teck Corporation, the federal and provincial governments, and the Japanese steel mills worked in cooperation to construct rail facilities, port facilities and the Quintette and Bullmoose Coal Mines. Production began in 1983 and 1984 with both mines operating successfully until the closure of the Quintette Mine in 2000, followed by the Bullmoose Mine in 2003. These mining efforts did not exhaust the coal resource in the area and potentially mineable coal deposits remain, including the Roman Block held by PRC.

Most of the Quintette coal licenses were acquired by Denison Mines in 1969 to 1970, and were committed to a joint venture with Mitsui Mining to create Quintette Coal Limited (QCL), partly owned by various Japanese interests.

QCL, with their partner Mitsui Mining Company, explored the Trend Property during the period 1972 to 1975 and again in 1985, mapping the geology and completing 15 surface trenches and 17 drill holes. Denison managed QCL until 1990, when financial difficulties led to corporate reorganization resulting in the establishment of the Quintette Operating Company, operated and majority owned by Teck Corporation.

Subsequently, Teck Corporation merged with Cominco Ltd. to form Teck-Cominco, which later joined with partners to form the Fording Coal Partnership. During the period 1999 to 2000, most of the original Quintette Property coal licenses were forfeited and returned to the Crown.

In October 2000, NEMI acquired a block of the Quintette Property licenses on Roman and Quintette mountains, which are known as the Trend and Roman Blocks (see Figure 1.2-1). NEMI subsequently began field examination of the Trend property in 2002, building on the previous efforts of QCL. Successful results led to major exploration and environmental work programs in 2003 and 2004.

Figure 1.2-1 Peace River Coal—Coal Tenure

In March 2005, NEMI applied for approval for a Mine Permit and Reclamation Program pursuant to Section 10 of the *Mines Act*, for the Trend Coal Mine, and on May 18, 2005 NEMI was issued Permit C-224 approving a mining program of 240,000 tpa of clean coal production.

On January 25, 2007, Permit C-224 was amended to approve an expanded mining program of up to 2 Mt per year of clean coal production at the Trend Coal Mine.

During the period from 2005 through 2007, NEMI, and later PRC, undertook intensive exploration programs on the Roman property to gather sufficient geological data to support a development decision regarding development of the coal resources on the property. Structural and quality data from the coal seams of the Gates and Gething Formations were collected according to the guidelines and criteria of Geological Survey of Canada Paper 88-21: A Standardized Coal Resource/Reserve Reporting System for Canada (Hughes et al. 1989).

In August 2007, PRC submitted a Project description to the British Columbia Environmental Assessment Office (EAO). On September 11, 2007 an order was issued to the Proponent pursuant to Section 10 (1)(c) of the British Columbia *Environmental Assessment Act* (BCEAA), SBC 2002, c.43, confirming that an Environmental Assessment Certificate is required for the Project. On October 2, 2008, the EAO issued an order pursuant to Section 11 of the BCEAA to PRC outlining the scope of the assessment and the procedures and methods for assessing the Project.

In November 2008, PRC completed a Pre-feasibility Study on the Project. The purpose of the Pre-feasibility Study was to determine how to deliver optimal value to the business by evaluating a range of options for the development of the Project. The Roman Project Pre-feasibility Study has explored numerous development options which included the assessment of a variety of production rates, mining methods, and infrastructure options.

Based on information collected during this study, PRC made several refinements to the mine plan presented in the August 2007 Project Description submitted to the EAO (see Section 4.2.6).

1.2.2 Project Location

The Project located in the Murray River drainage of northeast British Columbia, approximately 30 km south of Tumbler Ridge (see Figure 1.2-2). The Project, which is located on Crown land, is directly south of the PRC's operating Trend Coal Mine and is bound to the west by Babcock Creek and to the east by Gordon Creek. The centre of the Project is in UTM Zone 10, NAD 83 at coordinates 6083500 Northing, 630000 Easting (54° 52' 53.832",-120° 58' 24.816").

Primary access to the Project is via a non-status road known locally as the Talisman Road (see Figure 1.2-3). Access from Tumbler Ridge is via the Heritage Highway and the Canadian Natural Resources Limited's (CNRL) Petroleum Development Road 46 (PDR-46).

The Project is located in the southern part of historical Treaty No. 8 lands. Saulteau First Nations and the West Moberly First Nations are located 115 km to the north-northwest and the McLeod Lake First Nations are located 125 km to the west.

The Kelly Lake Communities, which include the Kelly Lake Cree First Nation and the Kelly Lake Métis Settlement Society, are located 70 km to the northeast.

Figure 4.1–2 shows the locations of the administrative offices of the interested First Nations (Section 21) and the location of the Kelly Lake Communities (Section 24) in relation to the Project. Figure 17.3–1 shows the location of archaeological sites identified in and around the Project. Additionally, Figure 24.3–1 identifies culturally sensitive areas identified through the Traditional Interest and Use Assessment undertaken with the Kelly Lake communities.

Lastly, Figures 9.5–1 and 9.5–2 show the Project's proximity to rare plant populations and rare ecosystem respectively, while Figures 10.5–1 and 12.2–3 show ungulate winter range and habitat areas and watercourses and sampling stations located near the proposed Project.

Figure 1.2-2 British Columbia Provincial Map

Figure 1.2-3 Northeastern British Columbia Regional Map

1.2.3 Project Land Use Context

The Dawson Creek Land and Resource Management Plan (LRMP) and the Dawson Creek Timber Supply Area (TSA) Strategic Land Use Plan (draft) provide guidance regarding resource management decision making in the Project area.

Dawson Creek Land and Resource Management Plan

The Project is in the Dawson Creek LRMP area (Integrated Land Management Bureau 1999, Internet site). The LRMP area covers approximately 2.9 million ha in northeast British Columbia. It is bound to the north by the Fort St. John Forest District, to the west by the Mackenzie Forest District, to the south by the Prince George Forest District and to the east by the province of Alberta (see Figure 1.2-4).

Dawson Creek Timber Supply Area Strategic Land Use Plan (draft)

The Dawson Creek TSA Strategic Land Use Plan (draft) was created to establish landscape biodiversity objectives through old forest retention (Ministry of Agriculture and Lands n.d., Internet site). Within this order, reporting units are broken out, each with their own old growth retention targets.

The Project is within reporting unit BM2 (Integrated Land Management Bureau 2006, Internet site), which targets retention of forests greater than 140 years old over 33 percent of the reporting unit area (Ministry of Agriculture and Lands n.d., Internet site).

The western edge of the Project MDL overlaps the Babcock Trail scenic area (Integrated Land Management Bureau 2005, Internet site).

The Project area is zoned as rural resource (RR1) where mineral exploration is identified as a permitted land use.

District of Tumbler Ridge Official Community Plan

The Project is located within the District of Tumbler Ridge, which has an Official Community Plan (OCP) and related zoning bylaw to guide development (District of Tumbler Ridge 2005; 2006). The OCP specifies that:

- The District of Tumbler Ridge is a community that wants the ability to:
  - respond to and promote economic activity
  - promote an appreciation of wilderness
  - make a diversity of lifestyles possible
- The District of Tumbler Ridge's objectives concerning mining activity are that:
  - mining is supported and encouraged
  - the importance of recreation is considered in development
  - environmental stewardship is implemented

Figure 1.2-4 Dawson Creek Land and Resource Management Plan Boundary

Treaty No. 8 First Nations

First negotiated in late June 1899, Treaty No. 8 encompasses an area in northwestern Canada of some 840,000 km^2. At the time, it was not only the largest land settlement undertaken by the Canadian government with First Nations, but also the first to recognize that the "Aboriginal title" of Indians and Métis are co-existent. The proposed Project is located in the south part of the area covered by Treaty No. 8.

The closest communities to the Project, within Treaty No. 8, are:

- Saulteau First Nations and West Moberly First Nations—115 km north-northwest
- McLeod Lake First Nation—125 km west

For this environmental assessment, the following five Treaty No. 8 First Nations have been included in the Section 11 Order:

- Doig River First Nations (DRFN)
- Halfway River First Nation (HRFN)
- Saulteau First Nations (SFN)
- McLeod Lake Indian Band (MLIB)
- West Moberly First Nations (WMFN)

Kelly Lake Communities

The Project is located within the area of interest indicated by the Kelly Lake Métis Settlement Society (KLMSS), the Kelly Lake Cree Nation (KLCN) and the Kelly Lake First Nation (KLFN) (collectively referred to as Kelly Lake Communities). The Kelly Lake Communities are located 70 km to the northeast of the Project.

The Kelly Lake Communities understand themselves to be Aboriginal and assert Aboriginal rights protected under the Canadian Constitution (1982). None of the Kelly Lake Communities are recognized signatories of Treaty No. 8, nor have they established other forms of federal or provincial land claim agreements. The relationship among the Kelly Lake Communities, and between Kelly Lake Communities and the Crown, is dynamic and subject to ongoing discussion. Within this submission, Kelly Lake Communities are considered to be separate communities residing together and the KLCN, KLFN and KLMSS are referred to collectively as Kelly Lake Communities.

The following Kelly Lake Communities have expressed an interest in being involved in the BCEAA Project review and have also been listed in the Section 11 Order:

- Kelly Lake Cree Nation (KLCN)
- Kelly Lake Métis Settlement Society (KLMSS)

See Figure 1.2-5 for the locations of the administrative offices of the interested First Nations and the location of the Kelly Lake Communities in relation to the Project.

Figure 1.2-5 Interested First Nations and Interested Kelly Lake Communities in the Project Area

1.2.4 Project Details

The Project includes

- three linear open pits—one large central Gates pits flanked by two shallower Gething pits to be mined in three phases
- a network of mine access and haul roads
- waste rock dumps north and south of the pits (some waste rock will be disposed of in the Trend Coal Mine South block pits)
- in-pit tailings impoundment
- water management structures, including sedimentation ponds and associated collection ditches
- soil stockpiles
- a portable sewage treatment plant
- a new wash plant which will be constructed within the Trend Coal Mine disturbed area, with associated facilities, including drying plant, coal storage, and coarse coal reject pile and sedimentation ponds
- use of infrastructure from Trend Coal Mine:
  - a 21 km haul road from the wash plant to the load-out
  - a 25 kV power line extension
  - a bulk explosives facility
  - an office, mine dry and maintenance facility

Table 4.3–1 summarizes the existing Trend facilities and the proposed Roman upgrades and expansion. Figure 4.3–2 provides a map of the proposed locations of the on-site Project facilities.

1.2.4.1 Project Schedule

Construction activities associated with the Project including the construction of mining infrastructure and offsite facilities, development of mine access and development of the initial mining area in the Phase 1 pits are to be completed over a period of 18 months with construction slated to begin in late 2011. Seasonal fluctuations experienced at site, delays in the issuance of the Environmental Assessment (EA) Certificate or other key operational permitting could delay the start of construction until early 2012.

The operations phase is delineated into three sub-phases which outline the progression of the active faces of mining. Active mining is scheduled to begin in early of 2012 and continue until 2022.

Decommissioning and reclamation are anticipated to continue for a further two years following the completion all production.

A more detailed Project schedule will be developed during the Roman Final Feasibility Study.

1.2.5 Project Justification

Coking coal was in demand in 2008, supported by the global demand for steel as well supply constraints in Australia. Weakened economies in the United States and the European Union are likely to result in a reduced growth in steel demand in these markets for 2009; however, rapid industrialization and urbanization within Brazil, Russia, India and China (the BRIC countries) is expected to continue. In 2009, China alone will account for 37 percent of the global steel demand. Although growth rates for steel should moderate, the trend is upward and should support the price of coking coal going forward.

With its established position in the Canadian coal industry, PRC is recognized as a supplier of high-value metallurgical coal.

The Project aims to maximize the potential financial return from mining the Roman resource, taking into account the opportunities for synergies with the existing Trend open cut operation. Integration of the Roman Coal Mine with the Trend Coal Mine operation combined with lower operating costs will generate a long-term, sustainable business.

The Project will have a capital cost of $320 million and is anticipated to employ up to 285 people during construction and 375 permanent employees throughout the life of the mine. The total direct mining payroll will be in the order of $22 million per year. This equates to an additional 451 jobs created indirectly throughout British Columbia as a result of the Project. In addition over the life of the mine the Project is estimated to directly contribute $134 million in provincial and federal income and capital tax.

1.3 Regulatory Framework

1.3.1 British Columbia *Environmental Assessment Act*

The BCEAA S.B.C. 2002, c.43 is administered by the BC EAO, a provincial agency that coordinates the assessment of the effects of major projects in British Columbia. The environmental assessment process takes into account the potential for environmental, economic, social, heritage and health effects.

The BCEAA requires major projects (e.g., industrial, mining, energy, water management, waste disposal, food processing, transportation and tourist destination resort projects) to obtain an environmental assessment certificate before proceeding to permitting.

With respect to coal mines, as stated in Part 3 of the Reviewable Projects Regulation (BC Reg. 370/02), the construction of a new facility is reviewable if during operation, it will have a production capacity of more than 250,000 tpa of clean coal or raw coal or a combination of both clean coal and raw coal. Therefore, the Project is a reviewable project.

Key milestones in the BCEAA Project review, to date, include:

- The Proponent submitted the Project Description for the Project to the EAO in August 2007.
- EAO issued a Section 10 Order pursuant to Section 10(1)(c) of the BCEAA S.B.C. 2002, c.43 requiring the Proponent to apply for an environmental assessment certificate.

- A Roman Project Working Group meeting was held with government representatives, First Nation representatives and other integral parties identified by the EAO to review the Project in November 2007.
- EAO issued a Section 11 Order pursuant to Section 11 of the BCEAA for the Project on October 2, 2008 setting out the formal scope, procedures and methods for the environmental assessment of the Project.
- A Roman Working Group Meeting was held in Fort St. John with government representatives, First Nation representatives and other integral parties identified by the EAO to review the Project on November 14, 2008 to review the draft Terms of Reference and work plans.
- The Proponent issued a letter to the EAO outlining changes to the original mine plan on December 30, 2008.
- The draft Terms of Reference entered a public review period on February 16, 2009, which ended on March 18, 2009.
- The Terms of Reference for the Application were finalized on May 12, 2009.

1.3.2 Canadian *Environmental Assessment Act*

In conjunction with a BCEAA, a project can also require review under the Canadian *Environmental Assessment Act* (CEAA), SC 1992, c.37 if approvals are required in areas of federal jurisdiction (or if federal land or funding is involved). Under the Canada/British Columbia Agreement on Environmental Assessment signed March 2004, the EAO coordinates harmonized reviews of proposed projects where both the provincial and federal environmental assessment acts are triggered.

As part of the Trend Coal Mine regulatory process, the following conclusions were reached by Canadian Environmental Assessment Agency (CEA Agency):

- For the Trend Coal Mine, a Section 35 *Fisheries Act* authorization was not required by the Fisheries and Oceans Canada (DFO) as any harmful alteration, disruption and destruction of fish habitat was avoided. On April 15, 2009, after reviewing Project details, DFO determined that the Project would not cause as any harmful alteration, disruption and destruction of fish habitat and DFO did not exercise any powers or duties under Section 5(1) of the CEAA for the Project. This decision was confirmed on May 12, 2009.
- Babcock and Gordon Creeks were deemed non-navigable at the Trend Coal Mine site by Transport Canada Navigable Waters Division.
- A Base Factory License requires a federal environmental assessment by Natural Resources Canada (NRCAN). NRCAN conducted a screening assessment of the license application for the Trend Coal Mine explosives factory site submitted by the third party explosives supplier. A Base Factory License was issued to the Third Party Contractor for the Trend Coal Mine on August 31, 2008. The Project would use this same explosive supply source.

As part of the Roman Coal Mine Project, DFO and CEAA reviewed previous decisions to determine if there was a CEAA trigger for the Project and on May 12, 2009 confirmed that the Project did not trigger the CEAA.

1.3.3 Licenses and Permits

The Project will require operational permits for construction, operations and closure. Following the submission of the Environmental Assessment Application, the Proponent will begin preparation of applications for the necessary permits.

An application for an amendment to the Permit Approving a Roman Coal Mine Plan and Reclamation Program in place for the Trend Coal Mine Permit (C-224) will be submitted to the British Columbia Ministry of Energy, Mines, Petroleum Resources (MEMPR) within or immediately following the EA application review period with the objective of receiving approval for a *Mines Act* permit amendment in 2011.

Once approval is granted for the mine permit amendment, several additional permits and licenses will be required.

Water management at the mine will require the construction of water management structures including sedimentation ponds and ditches, which will require a water license pursuant to the *Water Act* and an effluent permit pursuant to the *Environmental Management Act*.

Project-related emissions of particulate matter and air contaminants will also require an air quality permit pursuant to the *Environmental Management Act*.

Application for the aforementioned operating permits and licenses will occur directly after the issuance of the amended *Mines Act* permit in order to receive approval before the end of the construction phase.

1.4 General Application Background

1.4.1 Structure of the Application

This document is structured to provide the Project description, environmental baseline data, results of analyses, effects assessments and environmental management plans needed for the issuance of an Environmental Assessment Certificate for the Project and to satisfy the Terms of Reference (TOR).

This Environmental Assessment Report is provided in four volumes as follows:

- Volume 1: Introduction
- Volume 2: Biophysical Environmental Assessment
- Volume 3: Human Environment Assessment
- Volume 4: Summary of Effects and Conclusion

1.4.2 Summary of Project Planning

In 2005, 2006 and 2007, PRC and NEMI carried out exploration programs comprising rotary percussion (open hole) drilling, HQ (63.5 mm diameter) core drilling, large diameter (150 mm diameter) coring, field mapping and trenching on Roman Mountain.

Between 2005 and 2007 29,107 m of drilling was carried out, including 24,154 m in 135 rotary percussion holes, 3094 m in 15 HQ core holes and 1398 m in 27 large diameter core holes. A total of 43 trenches were dug to expose the Gates Formation coal seams and nine trenches exposed the Gething Formation coal seams.

The intent of the 2005 exploration program was to confirm the location, structure and size of the deposit as reported by Quintette Coal Limited in 1976. Based on the results of the 2005 program, the 2006 program intended to confirm the known size of the deposit and to increase the data point density sufficient to define an Indicated Resource as defined by Hughes et al. (1989).

In 2007, further drilling was done on the Gates Formation seams to increase confidence for both quality and structure and to enable the definition of Measured Resources as defined by Hughes et al. (1989).

Drilling on the Gething Formation seams in 2007 intended to define an Indicated Resource. This information was used to compile a geological model and support the development of a preliminary Roman Coal Mine Plan, which was presented in Section 3 of the Roman Coal Mine Project Description, August 2007 (BC EAO 2009, Internet site).

In November 2008, a Pre-feasibility Study for the Project was completed to determine how to best mine the Roman Mountain coal resource. The Pre-feasibility Study report includes all data collected up to December 31, 2007. Resource modeling, estimates and interpretations are based on these data. Further drilling and trenching completed in 2008 improved structural interpretations and filled gaps in quality and structural data points for the Gates Formation to enable an increase in Measured Resources. Drilling and trenching on the Gething Formation seams increased the data point density to enable the definition of Indicated Resources for some portions of the seams. The 2008 data and interpretations will be included in the updated Roman model for the Feasibility Study Report, which will be initiated in 2009.

The Project plans presented in this application are based on the updated geological model and the results of the options analysis presented in the Pre-feasibility Study.

1.4.3 Legal Orders or Agreements Applying to the Review of the Project

Pursuant to an order under Section 10(1)(c) of the BCEAA issued by the EAO on September 11, 2007, the Project requires an Environmental Assessment Certificate and the Proponent may not proceed with the Project without an assessment.

The scope, procedures and methods for the environmental assessment of the Project are defined by an order under Section 11 of the BCEAA issued by the EAO on October 2, 2008

1.5 Table of Concordance

See Table 1.5-1 for the Table of Concordance that cross-references information presented in the Application with the information requirements specified in the Approved Terms of Reference for the Project.

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Table 1.5-1 Table of Concordance

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
Preface This section will include a general statement of context and purpose for the development of the Application, including: • an indication that the Project is subject to review under the BCEAA following from a request for Project review initiated by the Proponent and the subsequent issuance of an Order under Section 10 (1) (c) of the BCEAA • a statement that the proposed Project is/is not subject to a federal screening-level review or comprehensive study pursuant to the CEAA • a notation that the Application has been prepared in accordance with the approved TOR • a brief description of the TOR development process, including a listing of the parties involved in the review of the draft TOR	Preface			
Executive Summary This section will present a summary of the Application, including: • the identification of the Proponent • a concise description of key Project components • a description of information distribution and consultation activities involving First Nations, Kelly Lake communities, the public and government agencies, plus a summary of issues raised and Proponent responses • a summary of the effects assessment methods • a general overview of the key effects identified, proposed mitigation measures and any follow-up or monitoring programs • a summary of the Proponent's conclusions from the assessment	Executive Summary			
Table of Contents The Table of Contents will provide the organizational framework within which information is presented in the Application. The Table of Contents will include an outline of all volumes, sections, subsections, lists of references, appendices, tables and figures to be included in the Application	Table of Contents			
Abbreviations and Acronyms This section will provide definitions of Project-specific terms, acronyms and abbreviations used in the Application	Abbreviations and Acronyms			
1 Introduction				
1.1 Proponent Identification This section of the Application will provide information about the Proponent, including company name, history, incorporation, structure, management and reporting structure, address and phone/fax/email	Volume 1, Section 1.1 Proponent Identification			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
1.2 Project Overview This section of the Application will: • provide a description of the Project, its history, and its purpose • describe the project's location and setting, including regional and Treaty No. 8 area context, site-specific setting and proximity to environmentally sensitive areas or cultural sites (including maps depicting these areas and sites) • describe the land use context, including identification of regional or sub regional land use plans that are in place, as well as locating the Project in relation to the boundaries of regional or municipal areas of jurisdiction • describe existing site access • identify and list the Project elements included in the Project scope • indicate whether the Project components require the use of Crown land or are located on private land • describe the socio-economic benefits of the Project, including the direct labour force requirements during construction (in person years) and operation (total, permanent, temporary, full- and part-time jobs annually at full scale operations) and the estimated capital cost	Volume 1, Section 1.2 Project Overview			
• provide the timeframe for Project construction, operation, decommissioning and closure	Volume 1, Section 1.2.4.1 Project Schedule			
1.3 Regulatory Framework This section of the Application will: • provide a summary of the relevant provincial and federal regulatory and policy requirements governing the Project, and any applicable provincial plans or local government official community plan and zoning requirements • outline the permits, licenses, approvals and authorizations required for Project construction, operation, decommissioning and closure	Volume 1, Section 1.3 Regulatory Framework, local government community plans are discussed in Section 1.2.3			
1.4 General Application Background This section of the Application will include: • a description of the structural components of the Application • a summary of Project planning and Project review history to date • a summary of any legal orders or agreements that apply to the review of the Project	Volume 1, Section 1.4 General Application Background			
1.5 Table of Concordance The Application will include a Table of Concordance that cross-references information presented in the Application with the information requirements specified in the Terms of Reference	Volume 1, Section 1.5 Table of Concordance			
1.6 Roman Coal Mine Project Team This section of the Application will identify the roles and responsibilities of the environmental assessment team, including key Proponent personnel and consultants	Volume 1, Acknowledgements			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
2 Information Distribution and Consultation				
2.1 Consultation Overview This section of the Application will provide a brief description of the consultation efforts that PRC has undertaken with First Nations, Kelly Lake Communities, the public, stakeholders and government agencies during the pre-application period, and those that are planned during the Application review for the Roman Coal Mine Project. Any associated agreements or accommodation measures will be also be described	Volume 1, Section 2.3.1, 2.4.1, 2.6.1, 2.6.1 and 2.5.1 respectively			
2.2 Pre-application Consultation This part of the Application will be divided into sections that address pre-application consultation with First Nations, Kelly Lake communities, stakeholders, the public and government agencies. Each section will include: • an outline of meetings, consultation and information distribution before and after the issuance of the section 10 order for the Project • a description of any cooperation agreements reached	First Nations: Volume 1, Section 2.3.2.1, 2.3.3.1, 2.3.4.1, 2.3.5.1, and 2.3.6.1 KL Communities: Volume 1, Section 2.4.2.1 and 2.4.3.1 Government Agencies: Volume 1, Section 2.5.2 Public and Stakeholders: Volume 1, Section 2.6.2			
• a summary of issues raised during consultation and the Proponent's response to those issues • a discussion about the degree to which issues raised during the pre-application consultations are considered resolved or addressed by the Proponent or other parties	First Nations: Volume 1, Sections 2.3.2.2-2.3.2.3, 2.3.3.2-2.3.3.3, 2.3.4.2-2.3.4.3, 2.3.5.2-2.3.5.3, 2.3.6.2-2.3.6.3, and Sections 2.3.7-2.3.8 KL Communities: Volume 1, Sections 2.4.2.2-2.4.2.3, 2.4.3.2-2.4.3.3, and 2.4.4 Government Agencies: Volume 1, Section 2.5.3 and 2.5.4 Public and Stakeholders: Volume 1, Section 2.6.3			
2.3 Consultation Planned during Application Review This part of the Application will be divided into sections that address planned consultation with First Nations, Kelly Lake communities, stakeholders, the public and government agencies during the Application review period. Each section will include a description of: • the programs proposed for consultation with the public during the Application review stage	First Nations: Volume 1, Section 2.3.10 KL Communities: Volume 1, Section 2.4.6 Government Agencies: Volume 1, Section 2.5.6 Public and Stakeholders: Volume 1, Section 2.6.5			
• the proposed process for resolution of any outstanding issues during the review	First Nations: Volume 1, Section 2.3.9 KL Communities: Volume 1, Section 2.4.5 Government Agencies: Volume 1, Section 2.5.5 Public and Stakeholders: Volume 1, Section 2.6.4			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
3 Geology, Geochemistry and Coal Resources				
3.1 Regional Geology This section of the Application will describe the geology of the region in which the Project is located.	Volume 1, Section 3.1 Regional Geology			
3.2 Roman Property Geology This section of the Application will describe the geology of the Roman property	Volume 1, Section 3.2 Roman Property Geology			
3.3 Geochemical Characteristics This section of the Application will describe the geochemical characteristics of the Roman property, including characteristics of the coal and waste rock. Additionally it will discuss • results of a detailed assessment to characterize the selenium and metal leaching and acid rock drainage (ML/ARD) potential of each major lithologic unit and wastes that will be produced during mining and processing, including waste rock, pit walls, coal stockpiles, coarse coal rejects (CCR) and tailings • the geochemical testing program used to characterize each major lithological unit and waste materials likely to be produced during mining and processing, including acid base accounting tests, mineralogical assessment of the sulphide and carbonate minerals, and kinetic tests • test results and supplemental data used to compare the Roman Project to the Trend Coal Mine to determine whether the Trend Coal Mine is a good geochemical analog to Roman, and therefore whether the kinetic testing completed for the Trend Coal Mine could be used for Roman	Volume 1, ARD Potential Info located in Section 3.4.1 Overall Potential for ARD, Se and metal leaching potential located in Section 3.4.2 Source Water Quality Predictions			
• test data that will be used in conjunction with water quality data from coal mines with similar geochemical characteristics to predict discharge water quality from each mine component (open pits, waste rock, CCR, tailings and coal stockpiles), including estimates of sulphate, selenium and any metals identified as potential issues at other coal mining sites or in the test data • the findings of the characterization program that will be used to determine materials handling procedures, ultimate disposition of materials and proposed reclamation practices in order to mitigate any potential ML/ARD	Volume 1, Section 3.4 Assessment and Prediction of Geochemical Performance			
3.4 Project Coal Resources This section of the Application will describe the project's coal resources.	Volume 1, Section 3.5 Project Coal Resources			
4 Project Description and Scope of Project				
4.1 Location of Project and Mapping This section of the Application will provide: • the Project location described in terms of latitude and longitude as well as proximity to Tumbler Ridge • all required and appropriate mapping and plans needed to locate the Project, all of its components and its proximity to all environmentally or culturally sensitive areas	Volume 1, Section 4.1 Project Location			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
4.2 Roman Coal Mine Plan This section of the Application will present the detailed current mine plan, including: • open pit development plan including layout, design and production scheduling (coal extraction and release) • location of pits and sequence of mining • preliminary waste dump locations and sequencing	Volume 1, Section 4.4 Mine Design			
• water management structures, including sedimentation ponds, collector ditches and tailings facility	Volume 1, Section 4.4.3 Site Water Management			
• type of equipment that will be used	Volume 1, Section 4.4.4 Mining Fleet			
• proposed location for soil stockpiles	Volume 1, Section 4.4.2.8 Soil Storage and Dump Reclamation			
• the refinements and changes to the Roman Coal Mine Plan since the September 2007 Roman Coal Mine Project Description and the rationale for the changes	Volume 1, Section 4.3. Roman Coal Mine Planning Process			
• the sustainability guidelines that have guided the mine planning process	Volume 1, Section 4.2 Sustainability Principles			

4.3 Project Facilities
This section of the Application will include:
• a description of all on- and off-site components and infrastructure and other facilities to be developed for the Project, including:
  • pit design and sequencing
  • waste rock dumps (design and sequencing)
	Volume 1, Section 4.4.3.3 to 4.4.2.6			

• geotechnical design parameters	Volume 1, Section 4.4.2.7 Geotechnical Evaluation			
• road access structures	Volume 1, Section 4.5.2 to 4.5.3			
• process plant and facilities	Volume 1, Section 4.5.4 Coal Handling and Processing			
• site infrastructure	Volume 1, Section 4.5.5 to 4.5.13			
• a summary of the results of studies leading to the selection of sites for on- and off-site facilities • a summary of any consideration of alternative locations for the Project or Project components and identification of factors leading to the selection of the preferred option(s)	Volume 1, Section 4.4.2.1 and 4.4.2.2			
4.4 Construction Phase Activities This section of the Application will include a description of and a schedule for all construction activities, including: • clearing and grubbing • soil salvage and initial erosion control measures • water management facilities, including channels and sedimentation ponds • mine components, including coal handling, cleaning and load-out • mine infrastructure and facilities • development of the tailings structure • road construction and upgrades	Volume 1, Section 4.6 Construction Phase Activities			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
4.5 Operation Phase Activities This section of the Application will include a description of and a schedule for all operations activities, including: • open pit development, including waste rock disposal areas • erosion control measures and water management • dust control for mining, processing and coal transport activities	Volume 1, Section 4.7.1 Mining and 4.7.2 Coal Handling and Processing			
• coal processing, including raw and clean coal handling and tailings disposal	Volume 1, Section 4.7.2 Coal Handling and Processing			
• waste disposal plans, including domestic, industrial and hazardous waste and sewage disposal	Volume 1, Section 4.7.4 Waste Management			
• coal transport from the processing plant to the rail load-out • rail loading activities	Volume 1, Section 4.7.2 Coal Handling and Processing			
• maintenance facilities, including warehousing, fuel storage and handling • logistical support required for the Project, including: • electrical supply and distribution • propane supply for distribution • water supply for process and potable water • water balance for process plant and tailings storage facility • explosives supply and on-site storage	Volume 1, Section 4.7.3 Support Facilities			
• work force requirements and potential sourcing	Volume 1, Section 4.7.5 Personnel Requirements			
• worker transportation to the site	Volume 1, Section 4.5.2.3 Traffic			
• goods and services required and potential sourcing	Volume 3, Section 18.4.1.3 Subsection Procurement and Purchase of Goods and Services			
4.6 Decommissioning and Reclamation Activities This section of the Application will include: • an estimate of the expected life of the Project based on anticipated annual production and known reserves	Volume 1, Section 4.8 Decommissioning and Reclamation Activities			

• the proposed end land use objectives for all Project components based on current land uses and economically achievable reclamation programs and techniques
• a description of decommissioning activities, including a proposed schedule for:
  • removal of buildings
  • treatment plans for foundations
  • removal or *in situ* decommissioning of gas, power and water lines
  • remediation of waste storage facilities
  • a description of reclamation activities, including a proposed schedule for:
  • reclamation of waste rock disposal areas, open pits, roads and the tailings storage facility, including land forms and soil replacement
	Volume 1, Section 4.8 Decommissioning and Reclamation Activities and Section 4.12 Reclamation Plan			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
• reclamation of water management facilities • revegetation programs • post-closure monitoring programs • contingencies for temporary and /or pre-mature closure, including: • implications for ML/ARD from the site • a summary of reclamation activities and how they may differ from the conceptual final reclamation plan				
4.7 Mine Waste Management The section of the Application will present a conceptual waste rock management plan. The plan will describe materials handling procedures, deposition methods and reclamation practices required to minimize the potential for ML/ARD from the waste rock disposal areas	Volume 1, Section 4.9 Mine Waste Management, reclamation practices are discussed in Section 4.12			
4.8 Tailing Management This section of the Application will address tailings management, including effluent characterization and management, ML/ARD control and water quality compliance points	Volume 1, Section 4.10 Tailings Management, water quality implications are discussed in Section 12.4.1.2 while source terms are discussed in Section 3.4, and water quality compliance points are presented in Section 5.6			
4.9 Site Water Management This section of the Application will address the following elements: • site water balance	Volume 1, Section 4.11.8 and 4.11.12			
• general layout	Volume 1, Section 4.11.1 Overview of Site Water Management Plan			
• diversion channels and runoff collection ditches for the mine site, plant site and load-out site • settling ponds	Volume 1, Section 4.11.5 to 4.11.7			
• effluent characterization and management	Volume 1, Section 4.11.4, and 4.11.9 to 4.11.12			
4.10 Reclamation Plan The Reclamation Plan will include mitigations for Project effects the wildlife and vegetation key indicators identified in the vegetation and wildlife sections of the Application, including but not limited to: • identification and reclamation of post-mine ecosystem units appropriate to the biophysical parameters of the site • use of suitable forage species • placement of rock piles • control of invasive plants • and monitoring of reclaimed vegetation communities	Volume 1, Section 4.12.4.2 Capability/ Productivity Objectives			
This section of the Application will include: • construction phase and interim reclamation	Volume 1, Section 4.12.2 Environmental Monitoring and Surveillance			
• a review of information on baseline soil metal levels and trace element uptake in vegetation	Volume 1, Section 4.12.4.9 Trace Element Uptake in Vegetation			
• pre- and post-mine assessments of forest site indices for mine permit application	Volume 1, Section 4.12.4.2.2 Forestry			
• a soil salvage plan, salvage/stockpile methods and a five-year schedule showing sequence of salvage and soil replacement	Volume 1, Section 4.12.1.2 Material Salvage and Replacement Strategy			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
• a rationale for the selection of end land use objectives, including reference to input received from First Nations	Volume 1, Section 4.12.4.1 to 4.12.4.2.2			
• a conceptual Final Reclamation Plan based on the identified end land use objectives, including: • discussion and definition of post-mine capability objectives	Volume 1, Section 4.12.4.1 to 4.12.4.2.2			
• reclamation planning for various waste materials and access structures, and	Volume 1, Section 4.12.4.3 to 4.12.4.8			
• operational and post-closure monitoring requirements for geotechnical stability of waste dumps, assessing metal uptake in vegetation and meeting terrestrial ecology/reclamation objectives	Volume 1, Section 4.12.5 Operational and Post-closure Monitoring			
5 Environmental Management Plans				
This section of the Application will present the environmental management plans (EMPs), which describe the practices and procedures that will be systematically applied during all phases of the Project to manage potential environmental effects. EMPs will be developed based on the results of the assessment and will be discussed within relevant sections of the Application. The EMPs that may be developed for the Project include, but are not limited to:	Volume 1, Section 5 Environmental Management Plans			
• Surface Erosion and Sediment Control Plan	Volume 1, Section 5.5 Surface Erosion and Sediment Control plan			
• Mine Site Water Management Plan	Volume 1, Section 4.11 Water Management Plan			
• ML/ARD Prediction, Prevention, Management and Monitoring Plan	Volume 1, Section 5.8 Metal Leaching and Acid Rock Drainage Management Plan			
• Selenium Management Plan	Volume 1, Section 5.7 Selenium Management Plan			
• Fish Habitat Protection Plan	Volume 1, Section 5.9 Fish and Fish Habitat Protection Plan			
• Air Quality and Dust Control Plan	Volume 1, Section 5.2 Air Quality and Dust Control Plan			
• Wildlife Protection and Monitoring Plan	Volume 1, Section 5.3 Wildlife Protection and Monitoring Plan			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
6 Effects Assessment Approach				
6.1 Introduction This part of the Application will introduce the general framework and approach used for assessing Project effects by discipline involved in the assessment. The framework includes the following components: • Introduction • Scope of Assessment • Baseline Conditions • Effects Assessment Methods • Project Effects Assessment • Summary of Mitigation Measures • Monitoring Further details on the effects assessment approach will be provided within each discipline section	Volume 1, Section 6.1 Introduction			
6.2 Scope of Assessment This section of the Application will describe the general scope of the environmental effects assessment. It will include the timelines for each Project phase or scenario and the spatial extent of the study areas used for evaluating local or regional effects. It will also describe the potential causal linkages between the Project components and the biophysical, socio-economic and cultural environments, and the general procedure and rationale for focusing the effects assessment on valued environmental components (VECs) and key indicators (KIs). A discussion of the influence of consultations with the public, First Nations, Kelly Lake communities and government agencies on the scope of assessment will also be included, as applicable. Specifics on the scope of assessment for each VEC will be provided in the VEC-specific sections of the Application	Volume 1, Section 6.2 Scope of Assessment			
6.3 Baseline Conditions This section of the Application will provide a general description of the standards governing the collection, compilation and analysis of data used to describe baseline conditions. Reference will be made to the more detailed, VEC-specific baseline methods that will be included in subsequent sections of the Application	Volume 1, Section 6.3 Baseline Conditions			
6.4 Project Effects This section of the Application will describe the general methods used to identify, describe and evaluate the potential for Project-related effects, and to determine if any Project residual effects are possible. In general, the Project effects assessment methods include the following steps: • identifying and describing potential Project effects	Volume 1, Section 6.4.1.1 Description of Project Environmental Effects			
• determining appropriate technically and economically feasible mitigation measures and, where warranted, contingency measures to be implemented in the event of unexpected effects	Volume 1, Section 6.4.1.2 Mitigation of Project Environmental Effects			
• characterizing Project residual effects in terms of direction, magnitude, geographic extent, frequency, duration, reversibility and prediction confidence, assuming effective implementation of prescribed mitigation measures	Volume 1, Section 6.4.1.3 Characterization of Residual Project Environmental Effects			

Table 1.5-1 Table of Concordance (cont'd)

• determining the significance of Project residual effects according to a pre-determined set of criteria	Volume 1, Section 6.6.1 Determination of the Significance of Project Environmental Effects			
• identifying Project residual effects that could potentially contribute to cumulative effects	Volume 1, Section 6.5.2 Screening for Cumulative Environmental Effects			
6.5 Summary of Mitigation Measures This section of the Application will discuss the development of summaries of mitigation measures to avoid or reduce Project effects identified for each VEC	Volume 1, Section 6.4.1.2 and 6.5.3.2			
6.6 Monitoring This section of the Application will provide an overview of the approach used to determine requirements for monitoring programs based on the results of the assessment	Volume 1, Section 6.7 Monitoring			
Information Requirements in Terms of Reference	**Refer to EA Section**	**Info present**	**Info missing**	**Comments**
7 Air Quality				
7.1 Introduction This section of the Application will introduce the air quality assessment and identify linkages to other sections of the Application	Volume 2, Section 7.1 Introduction			
7.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the assessment of air quality, including: • the information sources used	Volume 2, Section 7.2.7 Information Sources for Air Quality			
• the identification of key indicators for detailed assessment	Volume 2, Section 7.2.2 to 7.2.3			
• the delineation of a study area	Volume 2, Section 7.2.5 Spatial Boundaries for Air Quality			
• the timeframes for Project scenarios	Volume 2, Section 7.2.4 Temporal Boundaries for Air Quality			
• the influence of consultation on issues scoping and the assessment The air quality assessment will focus on the primary emissions sources associated with the Project (i.e., mine site, plant site and rail load-out).	Volume 2, Section 7.2.10 Influence of Consultation on the Assessment for Air Quality			
7.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline air quality and climate data required to support the assessment. It will characterize baseline conditions, and will include information on: • wind climate	Volume 2, Section 7.3.1 and 7.3.3			
• ambient air quality	Volume 2, Section 7.3.4 Air Quality, and 7.5.1.3, 7.5.2.3, and 7.5.3.3			
• emissions sources in the region	Volume 2, Section 7.3.5 Surrounding Environment			
• sensitive receptors and their distance from the mine, plant site and rail load-out	Volume 2, Section 7.2.2 Key Issues for Air Quality			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
7.4 Effects Assessment Methods This section of the Application will describe the specific approach and methods used to determine the Project effects on air quality, including the identification of relevant quantitative ambient air quality criteria and qualitative criteria used for characterizing Project effects and determining effect significance	Volume 2, Section 7.4 Environmental Effects Assessment Methods for Air Quality			
7.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on air quality during all phases of Project development. This will include assessments of fugitive coal dust, criteria air contaminants and greenhouse gases Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 7.5 Project Effects			
7.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed to reduce or avoid effects on air quality during each phase of the Project	Volume 2, Section 7.6 Summary for Air Quality			
7.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the air quality assessment	Volume 2, Sections 7.5.1.5, 7.5.2.8, 7.5.3.8, and 7.5.4.8			
8 Terrain and Soils				
8.1 Introduction This section of the Application will introduce the terrain and soils assessment and identify linkages to other sections of the Application (reclamation, vegetation, wildlife)	Volume 2, Section 8.1 Terrain and 8.2 Soils			
8.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the assessment of terrain and soils, including: • the information sources used	Volume 2, Section 8.1.1.7 and 8.2.1.7			
• the identification of key indicators for detailed assessment	Volume 2, Section 8.1.1.2 to 8.1.1.4 and 8.2.1.2 to 8.2.1.4			
• the delineation of a study area	Volume 2, Section 8.1.1.6 and 8.2.1.6			
• the timeframes for Project scenarios	Volume 2, Section 8.1.1.4, 8.1.1.5 and 8.2.1.5			
• the influence of consultation on issues scoping and the assessment The terrain and soils assessment will focus on the planned areas of disturbance associated with the mine site and coal haul route.	Volume 2, Section 8.1.1.9 and 8.2.1.10			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
8.3 Baseline Conditions This section of the Application will describe the approach and methods used to complete terrain and soils mapping and to collect baseline terrain and soils information required to support the assessment. It will characterize baseline conditions, and will include the following information: • a description of key terrain features, including mountains, rivers, lakes • terrain, surficial geology and soils information from all available sources, including terrain mapping, soil survey data, • geotechnical test pit data and exploration drill logs • a description of areas that are sensitive to erosion and mass wasting due to terrain conditions and surficial materials • soil characterization for reclamation planning and erosion potential mapping • reconnaissance level identification of unstable terrain features	Volume 2, Section 8.1.2 and 8.2.2			
8.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on terrain and soils, including criteria for effects characterization and determining effects significance	Volume 2, Section 8.1.3.1 and 8.2.3.1			
8.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on terrain and soils during representative phases of Project development. A maximum footprint scenario will be used to represent the most extensive disturbance occurring during the construction, operation and decommissioning phases of the Project. A post-closure scenario will represent conditions after decommissioning, assuming that application of the reclamation plan is successful Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 8.1.3.2 to 8.1.3.9 and Section 8.3.1 to 8.3.2			
8.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on terrain and soils during each phase of the Project	Volume 2, Section 8.1.3.4 and 8.3.3.1			
8.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the terrain and soils assessment	Volume 2, Section 8.1.3.9 and 8.3.3.3			
9 Vegetation				
9.1 Introduction This section of the Application will introduce the vegetation assessment and identify linkages to other sections of the Application (wildlife, soils and terrain, First Nations and Kelly Lake Communities interests and use)	Volume 2, Section 9.1 Introduction			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
9.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the assessment of vegetation, including: • the information sources used	Volume 2, Section 9.2.7 Information Sources for Vegetation			
• the identification of key indicators for detailed assessment	Volume 2, Section 9.2.2 and 9.2.3			
• the delineation of a study area	Volume 2, Section 9.2.5 Spatial Boundaries for Vegetation			
• the timeframes for Project scenarios	Volume 2, Section 9.2.4 Temporal Boundaries for Vegetation			
• the influence of consultation on issues scoping and the assessment The vegetation assessment will focus on the planned areas of disturbance associated with the mine site and coal haul route	Volume 2, Section 9.2.10 Influence of Consultation on the Vegetation Assessment			
9.3 Baseline Conditions This section of the Application will describe the approach and methods used to complete terrestrial ecosystem mapping and to collect baseline vegetation information required to support the assessment. It will characterize baseline conditions, and will include the following information: • a summary of vegetation data collected for the Trend Coal Mine Project and the Horizon Mine Project	Volume 2, Section 9.3 Baseline Conditions for Vegetation			
• descriptions of ecosystem units from Project terrestrial ecosystem mapping	Volume 2, Section 9.3.2 Ecosystem Units within the Regional Study Area			
• a summary of plant species at risk that are known to or could potentially occur in the Project area, including COSEWIC-listed, provincially-listed (red-listed and blue-listed) and federally-listed (under the *Species at Risk Act*) species and their habitats	Volume 2, Section 9.5.1.3 Baseline Conditions for Rare Plants			
• species identified by First Nations or Kelly Lake communities as being of cultural, spiritual, or traditional use importance	Volume 2, Section 9.2.10 Influence of Consultation on the Vegetation Assessment			
• a summary of baseline contaminant levels in vegetation samples	Volume 2, Section 9.3.5 Trace Metals Concentration in Vegetation			
• results of rare plant surveys	Volume 2, Section 9.5.1.3 Baseline Conditions for Rare Plants			
• descriptions of wetland, riparian and alpine/parkland ecosystem units	Volume 2, Section 9.5.3.3 and 9.5.5.3			
• description of mature and old forest communities	Volume 2, Section 9.5.6 Old Forest			
• a summary of Conservation Data Centre (CDC) element occurrence records	Volume 2, Section 9.5.1.3 Baseline Conditions for Rare Plants			
9.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on vegetation, including criteria for effects characterization and determining effects significance	Volume 2, Section 9.4, 9.5.1.2, 9.5.2.2, 9.5.3.2, 9.5.4.2, 9.5.5.2, and 9.5.7.2			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
9.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on vegetation during representative phases of Project development. A maximum footprint scenario will be used to represent the most extensive disturbance occurring during the construction, operation and decommissioning phases of the Project. A post-closure scenario will represent conditions after decommissioning; assuming application of the reclamation plan is successful. The evaluation of Project effects will include consideration of the possibility of early closure Mitigation measures designed to reduce or avoid predicted Project effects (including the effects of early closure) will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 9.5.1.4, 9.5.2.4, 9.5.3.4, 9.5.4.4 to 9.5.4.6, 9.5.5.4 to 9.5.5.6, and 9.5.7.4			
9.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on vegetation during each phase of the Project	Volume 2, Section 9.6.1 Summary of Mitigation for Vegetation			
9.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the vegetation assessment	Volume 2, Section 9.6.3 Summary of Monitoring and Follow-Up for Vegetation			
10 Wildlife				
10.1 Introduction This section of the Application will introduce the wildlife assessment and identify linkages to other sections of the Application (e.g., vegetation surface water quality, First Nations and Kelly Lake Communities Interests and Use)	Volume 2, Section 10.1 Introduction			
10.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the wildlife assessment, including: • the information sources used	Volume 2, Section 10.2.7 Information Sources for Wildlife			
• the identification of key indicators for detailed assessment • the rationale for selection of key indicators	Volume 2, Section 10.2.2 and 10.2.3			
• the identification of study areas for the key indicators • the rationale for the delineation of a study areas	Volume 2, Section 10.2.5 Spatial Boundaries for Wildlife			
• the timeframes for Project scenarios	Volume 2, Section 10.2.4 Temporal Boundaries for Wildlife			
• the influence of consultation on issues scoping and the assessment The wildlife assessment will focus on the planned areas of disturbance associated with the mine site and coal haul route	Volume 2, Section 10.2.10 Influence of Consultation on Assessment for Wildlife			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
10.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline information on wildlife. It will characterize baseline conditions and will include the following: • a summary of existing wildlife inventory and habitat use information for the Project area including information on: occurrence, distribution, and population status of key wildlife, as well as information on movement patterns, travel corridors and potential breeding areas • a summary of important wildlife habitats and features such as nesting habitats, identified Ungulate Winter Ranges, Wildlife Habitat Areas, potential bear denning areas, and wetland and riparian habitat for aquatic birds • a summary of the results of the breeding bird survey and wildlife habitat evaluation conducted in 2007 • a discussion of the on-going caribou research program and summary of information relevant to the Project area	Volume 2, Section 10.3 Baseline Conditions for Wildlife and Section 10.5.1.3, 10.5.2.3, 10.5.3.3, 10.5.4.3, 10.5.5.3, 10.5.6.3, 10.5.7.3, 10.5.8.3, 10.5.9.3, 10.5.10.3, 10.5.11.3, 10.5.12.3, 10.5.13.3, 10.5.14.3			
• incidental observations of wildlife or wildlife sign • habitat availability maps for caribou, moose, elk, mountain goat, grizzly bear, wolverine, fisher, marten, northern goshawk and songbirds • a description of habitat availability within the Project area for ptarmigan, northern myotis, hoary marmot and harlequin duck • CDC element occurrence records • information (e.g., incidental observations) that suggests or confirms the existence of COSEWIC-listed wildlife, provincially listed (red-listed and blue-listed) and federally listed (under the *Species at Risk Act*) species or their habitat within the study area~~s~~ • a summary of wildlife species identified as being of cultural, spiritual, or traditional use importance by the First Nations or Kelly Lake Communities				
10.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on wildlife, including criteria for effects characterization and determining effects significance	Volume 2, Section 10.4 Environmental Effects Assessment Methods for Wildlife and Section 10.5.1.2, 10.5.2.2, 10.5.3.2, 10.5.4.2, 10.5.5.2, 10.5.6.2, 10.5.7.2, 10.5.8.2, 10.5.9.2, 10.5.10.2, 10.5.11.2, 10.5.12.2, 10.5.13.2, 10.5.14.2			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
10.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on wildlife during representative phases of Project development. A maximum footprint scenario will be used to represent the most extensive disturbance occurring during the construction, operation and decommissioning phases of the Project. A post-closure scenario, based on the post-mine ecosystem unites identified in the Reclamation Plan (Section 4.10) will represent conditions after decommissioning, assuming application of the reclamation plan is successful Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 10.5.1.4, 10.5.1.5, 10.5.2.4, 10.5.3.4, 10.5.3.5, 10.5.4.4, 10.5.5.4, 10.5.5.5, 10.5.6.4, 10.5.7.4, 10.5.8.4, 10.5.8.5, 10.5.9.4, 10.5.10.4, 10.5.11.4, 10.5.12.4, 10.5.13.4, 10.5.13.4, 10.5.14.4, 10.5.14.5			
10.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on wildlife during each phase of the Project This section will also briefly summarize PRC's role in the ongoing caribou research program in the South Peace region in collaboration with government agencies, stakeholder groups, and other industrial proponents	Volume 2, Section 10.6.1 Summary of Mitigations for Wildlife			
10.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the wildlife assessment	Volume 2, Section 10.6.3 Summary of Follow-up and Monitoring for Wildlife			
11 Climate and Surface Water Hydrology				
11.1 Introduction This section of the Application will introduce the surface water hydrology assessment and identify linkages to other sections of the Application (e.g., groundwater, surface water quality, fish and fish habitat)	Volume 2, Section 11.1 Introduction			
11.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the surface water hydrology assessment, including: • the information sources used	Volume 2, Section 11.2.7 Information Sources for Surface Water Hydrology			
• the identification of key indicators for detailed assessment	Volume 2, Section 11.2.3 Selection of Measurable Parameters for Surface Water Hydrology			
• the delineation of a study area	Volume 2, Section 11.2.5 Spatial Boundaries for Surface Water Hydrology			
• the timeframes for Project scenarios	Volume 2, Section 11.2.4 Temporal Boundaries for Surface Water Hydrology			
• the influence of consultation on issues scoping and the assessment The surface water hydrology assessment will focus on the watersheds and sub-watersheds that could potentially be affected by the Project	Volume 2, Section 11.2.10 Influence of Consultation on the Assessment for Surface Water Hydrology			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
11.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline information on surface water hydrology. It will characterize baseline conditions, and will include the following information: • a description of climate conditions in the Project area, including temperature, precipitation and evaporation patterns	Volume 2, Section 11.3.1 Climate			
• a description of ponds/streams/lakes/rivers/wetlands within the local and regional study areas	Volume 2, Section 11.3.2 Hydrology			
• an evaluation of site baseline climatic characteristics, including annual, seasonal, monthly and short duration rainfall, snowfall and total precipitation, snow depths and water equivalents based on snow survey data, evaporation rates and temperatures	Volume 2, Section 11.3.1 Climate			
• an evaluation of site baseline hydrological regimes using on-site field data and regional streamflow data reported by Environment Canada • an evaluation of average monthly and seasonal flows, peak flows and low flows at key locations on streams within the local and regional study areas based on all available regional and site data	Volume 2, Section 11.3.2 Hydrology			
• a description of all data sources and data collection methods	Volume 2, Section 11.3.1.2 and 11.3.2.2			
11.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on surface water hydrology	Volume 2, Section 11.4 Environmental Effects Assessment Methods for Surface Water Hydrology			
11.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on surface water hydrology during representative phases of Project development. Annual and wet and dry season flow volumes will be estimated for all Project component areas and for key locations downstream of the Project. Predicted flows from the Project area will be used to design water management facilities and calculate mass loadings of Project-related contaminants to receiving waters Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized and will be used in other assessment sections where the significance of residual Project effects on environmental receptors (e.g., fish habitat or water quality) will be determined	Volume 2, Section 11.5 Environmental Effects Assessment for Surface Water Hydrology			
11.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on surface water hydrology during each phase of the Project	Volume 2, Section 11.6.1 Summary of Mitigation for Surface Water Hydrology			
11.7 Monitoring This section of the Application will describe any monitoring that is recommended based on the surface water hydrology assessment	Volume 2, Section 11.6.3 Summary of Follow-Up and Monitoring for Surface Water Hydrology			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
12 Surface Water and Sediment Quality				
12.1 Introduction This section of the Application will introduce the surface water and sediment quality assessment and identify linkages to other sections of the Application (groundwater, fish and fish habitat, periphyton and benthos, wildlife)	Volume 2, Section 12.1 Introduction			
12.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the surface water and sediment quality assessment, including: • the information sources used	Volume 2, Section 12.2.7 Information Sources for Surface Water and Sediment Quality			
• the identification of key indicators for detailed assessment	Volume 2, Section 12.2.2 and12.2.3			
• the delineation of a study area	Volume 2, Section 12.2.5 Spatial Boundaries for Surface Water and Sediment Quality			
• the timeframes for Project scenarios	Volume 2, Section 12.2.4 Temporal Boundaries for Surface Water and Sediment Quality			
• the influence of consultation on issues scoping and the assessment The surface water and sediment quality assessment will focus on all tributaries that will receive mine-influenced discharge (Babcock and Gordon Creeks), including downstream lotic systems (Flatbed Creek and Murray River)	Volume 2, Section 12.2.10 Influence of Consultation on the Assessment for Surface Water and Sediment Quality			
12.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline surface water and sediment quality information required to support the assessment. It will characterize baseline conditions, and will include the following information: • baseline water quality data for waterbodies potentially affected by development of all phases of the Project • all laboratory and field batch-specific quality assurance data (lab precision, accuracy, blank data, field precision and certified reference data) • baseline sediment composition data, including grain size, elemental abundance, total organic carbon and polycyclic aromatic hydrocarbons, for all potentially affected drainages	Volume 2, Section 12.3 Baseline Conditions for Surface Water and Sediment Quality			
12.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on surface water and sediment quality, including criteria for effects characterization and determining effects significance	Volume 2, Section 12.4 Environmental Effects Assessment Methods for Surface Water and Sediment Quality			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
12.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on surface water and sediment quality during representative phases of Project development. Water quality effects on all potentially affected watercourses will be predicted, and a risk-based assessment will be made to predict the potential effects on various receptors (e.g., fish, waterfowl, wildlife, periphyton and benthos) Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 12.5 and 12.6; Residual project effects on periphyton and benthos and fish are found in Sections 14.5 and 15.5 respectively			
12.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on surface water and sediment quality during each phase of the Project	Volume 2, Section 12.5.3 and Section 5 Environmental Management Plans			
12.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the surface water and sediment quality assessment	Volume 2, Section 12.7.3 Summary of Follow-Up and Monitoring for Surface Water and Sediment Quality			
13 Groundwater Quality and Quantity				
13.1 Introduction This section of the Application will introduce the groundwater quality and quantity assessment and identify linkages to other sections of the Application (surface water hydrology, surface water and sediment quality, terrain and soils)	Volume 2, Section 13.1 Introduction			
13.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the groundwater quality and quantity assessment, including: • the information sources used	Volume 2, Section 13.2.6 Information Sources for Groundwater Quality and Quantity			
• the identification of key indicators for detailed assessment	Volume 2, Section 13.2.2 and 13.2.3			
• the delineation of a study area	Volume 2, Section 13.2.5 Spatial Boundaries for Groundwater Quality and Quantity			
• the timeframes for Project scenarios	Volume 2, Section 13.2.4 Temporal Boundaries for Groundwater Quality and Quantity			
• the influence of consultation on issues scoping and the assessment The groundwater assessment will focus on potential effects on the site groundwater system due to mine dumps, tailings facilities and sedimentation ponds, and the effects on groundwater–surface water interaction resulting from the Project. The assessment will specifically address effects on groundwater contributions to Babcock and Gordon Creeks	Volume 2, Section 13.2.9 Influence of Consultation on the Assessment for Groundwater Quality and Quantity			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
13.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline groundwater quality and quantity information required to support the assessment. It will characterize baseline conditions, and will include the following information: • methods for monitoring well installation, groundwater quality sample collection, and hydraulic testing and analysis (methods will concur with BC Ministry of Environment requirements) • a definition of a site conceptual model for the groundwater flow system, including groundwater flow directions and gradients, recharge and discharge zones, aquifers and aquitards • site-specific groundwater quality data (including available data from the Trend Small Mine) and a comparison with available regional data. Specific focus will be placed on selenium and nitrates • estimates of baseline groundwater contributions to surface water (made in conjunction with the surface water hydrology assessment)	Volume 2, Section 13.3 Baseline Conditions for Groundwater Quantity and Quality and Section 4.11.8 Water Demands and Supply			
13.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on groundwater quality and quantity, including criteria for effects characterization and determining effects significance	Volume 2, Section 13.4 Environmental Effects Assessment Methods for Groundwater Quantity and Quality			
13.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on groundwater quality and quantity during representative phases of Project development. All potential effects will be discussed in an integrated manner with proposed water management plans, including the effects of pit dewatering and water management facilities on both the groundwater system and groundwater contributions to surface water, as well as any other identified effects resulting from modification of the groundwater system. Specific sections will address potential effects on acutely sensitive areas Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 13.5 Environmental Effects Assessment for Groundwater Quantity and Quality, discussion of water management plans is deferred to Section 12 Surface Water and Sediment Quality. The water quality management plans are laid out in Section 4.11 and 5.			
13.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on groundwater quality and quantity during each phase of the Project	Volume 2, Section 13.6.1 Summary of Mitigation for Groundwater Quantity and Quality			
13.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the groundwater quality and quantity assessment	Volume 2, Section 13.5.1.8 Follow-up and Monitoring for Changes in Groundwater Quantity and Quality			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
14 Periphyton and Benthos				
14.1 Introduction This section of the Application will introduce the periphyton and benthos assessment and identify linkages to other sections of the Application (surface water and sediment quality, fish and fish habitat, wildlife)	Volume 2, Section 14.1 Introduction			
14.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the periphyton and benthos assessment, including: • the information sources used	Volume 2, Section 14.2.8 Information Sources for Periphyton and Benthos			
• the identification of key indicators for detailed assessment	Volume 2, Section 14.2.2 to 14.2.4			
• the delineation of a study area	Volume 2, Section 14.2.6 Spatial Boundaries for Periphyton and Benthos			
• the timeframes for Project scenarios	Volume 2, Section 14.2.5 Temporal Boundaries for Periphyton and Benthos			
• the influence of consultation on issues scoping and the assessment The periphyton and benthos assessment will focus on Project effects on the abundance and diversity of periphyton and benthic invertebrate communities in Babcock and Gordon Creeks and will use this as an indicator of the health of these streams. The assessment will also identify the presence of stressors and the potential for food chain transfer of compounds of potential concern, such as selenium	Volume 2, Section 14.2.11 Influence of Consultation on Assessment			
14.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline periphyton and benthos information required to support the assessment. It will characterize baseline conditions, and will include the following information: • baseline benthic invertebrate and benthic periphyton community data, including, taxonomy, periphyton biomass and selenium tissue concentrations for reference and affected areas of Babcock and Gordon Creeks • analytical results compared with available historical data and applicable environmental quality guidelines • summary statistics and a description of field and laboratory quality assurance/quality control procedures, as appropriate	Volume 2, Section 14.3 Baseline Conditions for Periphyton and Benthos			
14.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on periphyton and benthos, including criteria for effects characterization and determining effects significance	Volume 2, Section 14.4 Effects Assessment Methods for Periphyton and Benthos			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
14.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on periphyton and benthos during representative phases of Project development. The potential for mine-related development and operational activities to affect periphyton and benthic invertebrate community structure or selenium accumulation will be determined based on the findings of the water quality and groundwater assessments, site-specific habitat conditions, and literature pertaining to similar effects in other Project areas Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 14.5 Environmental Effects Assessment for Periphyton and Benthos			
14.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on periphyton and benthos during each phase of the Project	Volume 2, Section 14.6 Follow-up and Monitoring for Periphyton and Benthos			
14.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the periphyton and benthos assessment	Volume 2, Section 14.6 Follow-up and Monitoring for Periphyton and Benthos			
15 Fish and Fish Habitat				
15.1 Introduction This section of the Application will introduce the fish and fish habitat assessment and identify linkages to other sections of the Application (surface water hydrology, surface water and sediment quality)	Volume 2, Section 15.1 Introduction			
15.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the fish and fish habitat assessment, including: • the information sources used	Volume 2, Section 15.2.7 Information Sources for Fish and Fish Habitat			
• the identification of key indicators for detailed assessment	Volume 2, Section 15.2.2 and 15.2.3			
• the delineation of a study area	Volume 2, Section 15.2.5 Spatial Boundaries for Fish and Fish Habitat			
• the timeframes for Project scenarios	Volume 2, Section 15.2.4 Temporal Boundaries for Fish and Fish Habitat			
• the influence of consultation on issues scoping and the assessment The fish and fish habitat assessment will focus on fish species composition, distribution, relative abundance and fish habitat characteristics in Gordon and Babcock Creeks (both systems are within or immediately downstream of the Project footprint). This section will also discuss baseline data for whole body selenium concentrations for resident slimy sculpin and bull trout in Gordon and Babcock Creeks, including populations isolated by natural barriers.	Volume 2, Section 15.2.9 Influence of Consultation on the Assessment			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
15.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline fish and fish habitat information required to support the assessment. It will characterize baseline conditions, and will include the following information: • a description of fish distribution and habitat use in waters affected by the disturbance footprint and in potentially affected waters both upstream and downstream. Baseline data collected from Gordon and Babcock Creeks in 2003 and 2004 will be used for this description • the identification of fish distribution limits within stream systems potentially affected by the proposed development • documentation of the location and passability of all permanent barriers to fish movement • the identification of resident sub-populations • an assessment of habitat suitability • a description of bull trout life history and seasonal habitat use (i.e., spawning, rearing and overwintering) based on the analysis of length, age and maturity data collected at fish sample sites in potentially affected drainages • fish distribution and habitat use information for nearby drainage to provide a regional context for environmental and contingency planning • documentation of whole body concentrations of selenium and other metals/metalloids in bull trout and sculpin from both near-field and far-field locations	Volume 2, Section 15.3 Baseline Conditions			
15.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on fish and fish habitat, including criteria for effects characterization and determining effects significance	Volume 2, Section 15.4 Environmental Effects Assessment Methods for Fish and Fish Habitat			
15.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on fish and fish habitat during representative phases of Project development. Potential Project-related effects will be assessed for each phase of the Project based on fish distribution, projected effects on surface and groundwater flows and quality, and potential Project-related changes to aquatic habitat in downstream reaches of Gordon and Babcock Creeks Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 2, Section 15.5 Environmental Effects Assessment for Fish and Fish Habitat			
15.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on fish and fish habitat during each phase of the Project	Volume 2, Section 15.6. Follow-up and Monitoring for Fish and Fish Habitat			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
15.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the fish and fish habitat assessment	Volume 2, Section 15.6 Follow-up and Monitoring for Fish and Fish Habitat			
16 Land Use and Tenure				
16.1 Introduction This section of the Application will introduce the land use and tenure assessment and identify linkages to other sections of the Application (socio-economic, First Nations and Kelly Lake Communities Interests and Use)	Volume 3, Section 16.1 and 16.2			
16.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the land use and tenure assessment, including: • the information sources used	Volume 3, Section 16.2.8 Information Sources for Land Use and Tenure			
• the identification of key indicators for detailed assessment	Volume 3, Section 16.2.2 to 16.2.4			
• the delineation of a study area	Volume 3, Section 16.2.6 Spatial Boundaries for Land Use and Tenure			
• the timeframes for Project scenarios • the influence of consultation on issues scoping and the assessment	Volume 3, Section 16.2.5 Temporal Boundaries for Land Use and Tenure			
The land use and tenure assessment will focus on areas of overlap and interaction between Project activities and those associated with other tenures (e.g., forestry, oil and gas), land designations (e.g., parks and protected areas) and users (e.g., recreation) in the Project area. Current land use activities will be identified, and any relevant land use plans or designations will be referenced to provide context for the assessment	Volume 3, Section 16.2.11 Influence of Consultation on Land Use and Tenure			
16.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline land use and tenure information required to support the assessment. It will characterize baseline conditions, and will include the following information: • a description of Crown land requirements for the Project and any private land acquisition needs, noting if any Crown land is to be converted to fee simple • a description of current land use tenures and activity levels within the Project lease area and footprint • a description of any activities elsewhere in the region that are potentially affected by Project activities • a description of viewscapes that are potentially affected by the Project	Volume 3, Section 16.3 Baseline Conditions for Land Use and Tenure			
16.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on land use and tenure, including criteria for effects characterization and determining effects significance	Volume 3, Section 16.4 and 16.2.10			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
16.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on land use and tenure during representative phases of Project development. Potential direct or indirect effects on each land use activity will be described for each phase of Project development, as relevant, including changes in the capacity of a resource to support land use, in access to a resource, in quality of user experience or in visual quality Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 3, Section 16.4.1 Assessment of Change in Access to Quantity or Quality of a Resource of Importance to Land Users and Tenure Holders			
16.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on land use and tenure during each phase of the Project	Volume 3, Section 16.5.1 Summary of Effects Management for Land Use and Tenure			
16.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the land use and tenure assessment	Volume 3, Section 16.5.3 Summary of Follow-Up and Monitoring for Land Use and Tenure			
17 Archaeology				
17.1 Introduction This section of the Application will introduce the archaeology assessment and identify linkages to other sections of the Application	Volume 3, Section 17.1 Introduction			
17.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the archaeology assessment, including: • the information sources used	Volume 3, Section 17.2.7 Information Sources for Archaeology			
• the identification of key indicators for detailed assessment	Volume 3, Section 17.2.2 and 17.2.3			
• the delineation of a study area	Volume 3, Section 17.2.5 Spatial Boundaries for Archaeology			
• the timeframes for Project scenarios	Volume 3, Section 17.2.4 Temporal Boundaries for Archaeology			
• the influence of consultation on issues scoping and the assessment A site-specific archaeological impact assessment will determine whether archaeological sites protected under the *Heritage Conservation Act* are present and may be adversely affected. This will include an evaluation of the significance of such sites and an assessment of the potential effects on them	Volume 3, Section 17.2.10 Influence of Consultation on the Assessment of Archaeology			
17.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline archaeology information required to support the assessment. It will characterize baseline conditions, and will describe the results of an archaeological survey of the subject area	Volume 3, Section 17.3 Baseline Conditions for Archaeology			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
17.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on archaeological resources, including criteria for effects characterization and determining effects significance	Volume 3, Section 17.4 Environmental Effects Assessment Methods for Archaeology VEC			
17.5 Project Effects This section of the Application will present an assessment of potential effects of the Project on archaeological resources during representative phases of Project development. Potential adverse effects on archaeological sites protected under the *Heritage Conservation Act* will be identified, and the heritage significance of identified archaeological sites will be assessed Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 3, Section 17.5 Environmental Effects Assessment for Archaeological Remains			
17.6 Summary of Mitigation Measures This section of the Application will present a summary of mitigation measures proposed in the assessment to reduce or avoid effects on archaeological resources during each phase of the Project. Mitigation measures will be developed in consultation with the Ministry of Tourism, Culture and the Arts (Archaeology Branch) and local First Nation and Kelly Lake communities	Volume 3, Section 17.6.1 Summary of Mitigation for Archaeology			
17.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the archaeological assessment	Volume 3, Section of 17.6.3 Summary of Follow-Up and Monitoring for Archaeology			
18 Regional and Local Socio-economic and Health Conditions				
18.1 Introduction This section of the Application will introduce the socio-economic assessment and identify linkages to other sections of the Application	Volume 3, Section 18.1 Introduction			
18.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the socio-economic assessment, including: • the information sources used	Volume 3, Section 18.2.6 Information Sources			
• the identification of key indicators for detailed assessment	Volume 3, Section 18.2.2 to18.2.4			
• the delineation of a study area	Volume 3, Section 18.2.5.2 Spatial Boundaries			
• the timeframes for Project scenarios	Volume 3, Section 18.2.5.1 Temporal Boundaries			
• the influence of consultation on issues scoping and the assessment Key indicators may include housing, local participation in employment, contract and business opportunities, community health, or local population changes due to workers relocating to the area	Volume 3, Section 18.2.10 Influence of Consultation on the Assessment			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments

18.3 Baseline Conditions
This section of the Application will describe the approach and methods used to collect baseline socio-economic information required to support the assessment. It will characterize baseline conditions, and will include the following information:
• local and regional economy:
  • an overview of main industries in the region
  • a list of the major employers in Tumbler Ridge, Chetwynd and other centres (as relevant)
• community demographics
• infrastructure and services
• employment and income information
• skills profile
• public health and safety
	Volume 3, Section 18.3 Baseline Conditions			

18.4 Effects Assessment Methods This section of the Application will describe the specific methods used to determine the Project effects on socio-economic and health receptors, including criteria for effects characterization and determining effects significance	Volume 3, Section 18.4.1.2 Economic Effects Assessment Methods			
18.5 Project Effects This section of the Application will present an assessment of potential effects and benefits of the Project on socio-economic conditions during representative phases of Project development. The assessment may include consideration of the following effects: • local population changes due to workers relocating to the area • effects on housing due to an influx of workers	Volume 3, Section 18.4.2 Assessment of Socio-Community Effects			
• government revenues • local construction and operations employment	Volume 3, Section 18.4.1 Assessment of Local and Regional Economic Effects			
• local contract and business opportunities • effects on local emergency and health infrastructure and services due to an influx of workers • public health and safety issues due to an influx of workers • effects on recreational attraction and infrastructure Mitigation measures designed to reduce or avoid predicted Project effects will be described, and any relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 3, Section 18.4.2 Assessment of Socio-Community Effects			
18.6 Summary of Mitigation Measures This section of the Application will provide a summary of any measures, identified in collaboration with communities, to avoid, minimize, or mitigate potential adverse effects on socio-economic conditions, plus measures to enhance benefits of Project activities	Volume 3, Section 18.5.1 Summary of Mitigation for Local and Region Socio-Economic Conditions			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
18.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the socio-economic and health assessment	Volume 3, Section 18.5.3 Follow-Up and Monitoring for Local and Regional Socio-Economic Conditions			
19 First Nations Setting				
This section will provide contextual background information on First Nations with expressed interests in the Project area. It will include general ethnographic and historical information; community profiles, including population numbers and a description of the community's proximity to the Project area; and general information on political and treaty affiliations	Volume 3, Section 19 First Nations Setting			
20 Kelly Lake Communities Setting				
This section will provide contextual background information on Kelly Lake communities with expressed interests in the Project area. It will include general ethnographic and historical information; community profiles, including population numbers and a description of the community's proximity to the Project area; and general information on political affiliations	Volume 3, Section 22 Kelly Lake Communities Setting			
21 First Nations Socio-Economic Considerations				
21.1 Introduction This section of the Application will introduce the First Nations socio-economic assessment and identify linkages to other sections of the Application	Volume 3, Section 20.1 Introduction			
21.2 Scope of Assessment This section will describe the Project components to be assessed, and the approach used in the First Nations socio-economic assessment, including: • information sources used	Volume 3, Section 20.2.7 Information Sources for First Nations Socio-Economic Considerations			
• identification of key indicators for detailed assessment (e.g., livelihoods and economic vitality, education and training)	Volume 3, Section 20.2.2 and 20.2.3			
• delineation of a study area	Volume 3, Section 20.2.5 Spatial Boundaries for First Nations Socio-Economic Considerations			
• timeframes for Project scenarios	Volume 3, Section 20.2.4 Temporal Boundaries for First Nations Socio-Economic Considerations			
• influence of consultation on issues scoping and the assessment The First Nations who may be involved will be defined by the section 11 order. They may include: • West Moberly First Nations • Saulteau First Nations • Halfway River First Nation • McLeod Lake Indian Band • Doig River First Nations Detailed scope and methods will be defined in collaboration with the groups involved	Volume 3, Section 20.2.10 Influence of Consultation on the Assessment for First Nations Socio Economic Assessment			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
21.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline information on First Nations socio-economic conditions to support the assessment. It will also characterize baseline conditions by providing community profiles that describe past and present social, economic and community conditions of potentially affected First Nations. The baseline conditions will be described in collaboration with the First Nation groups and will focus on key indicators identified in collaboration with those groups. To the extent that information and data are available, community profiles may include the following: • an overview of main industries and businesses in the communities • a review of mixed economies in the community	Volume 3, Section 20.3 Baseline Conditions For First Nation Socio-Economic Consideration			
• community demographics • infrastructure and services • employment and income information • skills profile and training needs • educational attainment • community health To supplement the baseline summary, qualitative information from primary and secondary sources may be developed in collaboration with the First Nations				
21.4 Effects Assessment Methods This section will describe the methods used to determine the Project effects on First Nations socio-economic conditions, including criteria for effects characterization and determining effects significance.	Volume 3, Section 20.4 Socio-Economic Effects Assessment Methods for First Nations Socio- economic Considerations			
21.5 Project Effects This section of the Application will be developed in collaboration with the First Nations. It will present an assessment of potential effects and benefits of the Project on First Nations socio-economic conditions during representative phases of Project development. The assessment may include consideration of the following effects: • livelihoods and economic vitality • social stability and community well-being • population structure and health • education and training Other potential effects or benefits may be identified in collaboration with the First Nations. Particular emphasis will be placed on identifying the Project's potential future effects and benefits on the socio-economic conditions of First Nations Mitigation measures designed to reduce or avoid predicted Project effects will be described, and relevant management plans will be referenced. Project residual effects will be characterized, and the significance of those effects will be determined	Volume 3, Section 20.5 Socio-Economic Effects Assessment for First Nations Socio-Economic Considerations			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
21.6 Summary of Mitigation Measures This section of the Application will provide a summary of any measures, identified in collaboration with the involved groups, to avoid, minimize, or mitigate potential adverse effects upon First Nations socio-economic conditions, plus measures to enhance the socio-economic benefits of Project activities for First Nations	Volume 3, Section 20.6.1 Summary of Mitigation Socio-Economic Considerations			
21.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the First Nations socio-economic assessment	Volume 3, Section 20.6.3 Summary of Follow-Up and Monitoring for First Nations Socio-Economic Considerations			
22 Kelly Lake Communities Socio-Economic Considerations				
22.1 Introduction This section of the Application will introduce the Kelly Lake communities' socio-economic assessment and identify linkages to other sections of the Application	Volume 3, Section 23.1 Introduction			
22.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used in the Kelly Lake communities socio-economic assessment, including: • the information sources used	Volume 3, Section 23.2.7 Information Sources for Kelly Lake Socio-Economic Considerations			
• the identification of key indicators for detailed assessment (e.g., livelihoods and economic vitality, education and training)	Volume 3, Section 23.2.2 and 23.2.3			
• the delineation of a study area	Volume 3, Section 23.2.5 Spatial Boundaries for Kelly Lake Socio-Economic Consideration			
• the timeframes for Project scenarios	Volume 3, Section 23.2.4 Temporal Boundaries for Kelly Lake Socio-Economic Considerations			
• the influence of consultation on issues scoping and the assessment The Kelly Lake communities who may be involved will be defined by the section 11 order and include: • Kelly Lake Métis Settlement Society • Kelly Lake Cree Nation • Detailed scope and methods will be defined in collaboration with the groups involved.	Volume 3, Section 23.2.10 Influence of Consultation on the Assessment of Kelly Lake Socio-Economic Considerations			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
22.3 Baseline Conditions This section of the Application will describe the approach and methods used to collect baseline Kelly Lake communities' socio-economic information to support the assessment. It will also characterize baseline conditions by providing community profiles that describe past and present social, economic and community conditions of potentially affected Kelly Lake communities. The baseline conditions will be described in collaboration with the Kelly Lake Community groups and will focus on key indicators identified in collaboration with those groups. To the extent that information and data are available, community profiles may include the following: • an overview of main industries and businesses in the communities • a review of mixed economies in the community • community demographics • infrastructure and services • employment and income information • skills profile and training needs • educational attainment • community health To supplement the baseline summary, qualitative information from primary and secondary sources may be developed in collaboration with the Kelly Lake communities	Volume 3, Section 23.3 Baseline Conditions for Kelly Lake Socio-Economic Considerations			
22.4 Effects Assessment Methods This section of the Application will describe the methods used to determine the Project effects on Kelly Lake communities socio-economic conditions, including criteria for effects characterization and determining effects significance	Volume 3, Section 23.4 Socio-Economic Effects Assessment Methods			
22.5 Project Effects This section of the Application will be developed in collaboration with the Kelly Lake communities. It will present an assessment of potential effects and benefits of the Project on Kelly Lake communities' socio-economic conditions during representative phases of Project development. The assessment may include consideration of the following effects: • livelihoods and economic vitality • social stability and community well-being • population structure and health • education and training Other potential effects or benefits may be identified in collaboration with the Kelly Lake communities. Particular emphasis will be placed on identifying the Project's potential future effects and benefits on the socio-economic conditions of Kelly Lake communities Mitigation measures designed to reduce or avoid predicted Project effects will be described, and relevant management plans will be referenced. Project residual effects will be characterized, and the significance of these effects will be determined	Volume 3, Section 23.5 Socio-Economic Effects Assessment for Kelly Lake Socio-Economic Considerations			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
22.6 Summary of Mitigation Measures This section of the Application will provide a summary of any measures, identified in collaboration with the involved groups, to avoid, minimize, or mitigate potential adverse effects upon Kelly Lake communities' socio-economic conditions, plus measures to enhance the socio-economic benefits of Project activities for Kelly Lake communities	Volume 3, Section 23.6.1 Summary of Mitigation for Kelly Lake Socio-Economic Considerations			
22.7 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the Kelly Lake communities' socio-economic assessment	Volume 3, Section 23.6.3 Summary of Follow-Up and Monitoring for Kelly Lake Socio-Economic Considerations			
23 First Nations Interest and Use				
23.1 Introduction This section will introduce the First Nations interests and use, and will identify linkages to other sections of the Application (socio-economic, vegetation, fish and wildlife)	Volume 3, Section 21.1 Introduction			
23.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used to identify First Nations interests and use, including: • information sources used	Volume 3, Section 21.2.7 Information Sources for First Nations Interests and Use			
• identification of key indicators for detailed assessment	Volume 3, Section 21.2.2 and 21.2.3			
• delineation of a study area	Volume 3, Section 21.2.5 Spatial Boundaries for First Nations Interests and Use			
• timeframes for Project scenarios	Volume 3, Section 21.2.4 Temporal Boundaries for First Nations Interests and Use			
• influence of consultation on issues scoping and the assessment Key issues addressed will include the past and current use of lands and resources for traditional purposes by the First Nations, and potential effects that may result in changes in the ability of First Nations to exercise their rights and respective interests The First Nations involved will be defined by the section 11 order, and will include: • West Moberly First Nations • Saulteau First Nations • Halfway River First Nation • McLeod Lake Indian Band • Doig River First Nations Detailed scope and methods will be defined in collaboration with the First Nations	Volume 3, Section 21.2.10 Influence of Consultation on the Assessment for First Nations Interest and Use			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments

23.3 Baseline Conditions
This section of the Application will describe the approach and methods used to identify the ethno-historic and cultural contexts of the Project. PRC will undertake a traditional use study, in collaboration with First Nations, to document non-confidential past and current use of lands and resources including site-specific values in the Project area
This section will be developed in collaboration with the involved communities and may include:
• a brief description of the First Nations potentially affected by the proposed Project, including:
  • a summary of areas covered by Treaty No. 8
  • the location of all Indian Reserves in the regional study area
  • a description of basic governance systems
  • a basic description of how First Nations perceive the environment, lands and resources and related perceptions regarding interests and use that may be conveyed through traditional knowledge or other means
• a qualitative description of mixed economies
• a review of relevant maps, databases and published literature on historic and current traditional land use and ecological knowledge in the Project area, including First Nations land use agreements and land use plans
• a summary of past and current land uses associated with the Project area, including site-specific values, the purposes for which they are important, and their relative importance within the context of wider land use, as indicated by First Nations
	Volume 3, Section 21.3 Baseline Conditions for First Nations Interest and Use			

23.4 Project Effects This section of the Application will be developed in collaboration with the involved communities. It will identify and evaluate potential interactions, effects and benefits of the Project on First Nations interests and define mitigation measures and characterize residual Project effects. The effects assessment will focus on VECs, and will use methods identified in collaboration with the involved communities. The assessment will evaluate potential residual effects on First Nations interests and use as reflected in the baseline. Analysis of potential residual effects and methods of assessment will be discussed in the Application	Volume 3, Section 21.4.2 Environmental Effects Assessment Methods for First Nations Interests and Use			
23.5 Summary of Mitigation Measures This section of the Application will provide a summary of mitigation measures described in the assessment to avoid, minimize, or mitigate potential adverse effects on First Nations communities' interests and use, plus measures to enhance the benefits of Project activities	Volume 3, Section 21.5.1 Summary of Mitigation for First Nations Interests and Use			
23.6 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the First Nations Interests and Use section of the Application	Volume 3, Section 21.5.3 Summary of Follow-Up and Monitoring for First Nations Interests and Use			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
24 Kelly Lake Communities Interest and Use				
24.1 Introduction This section of the Application will introduce the Kelly Lake Communities Interests and Use section of the Application and will identify linkages to other sections of the Application (socio-economic, vegetation, fish and wildlife)	Volume 3, Section 24.1 Introduction			
24.2 Scope of Assessment This section of the Application will describe the Project components to be assessed, and the approach used to Kelly Lake Communities interests and use, including: • the information sources used	Volume 3, Section 24.2.7 Information Source for Kelly Lake Communities Interests and Use			
• the identification of key indicators for detailed assessment	Volume 3, Section 24.2.2 and 24.2.3			
• the delineation of a study area	Volume 3, Section 24.2.5 Spatial Boundaries for Kelly Lake Communities Interests and Use			
• the timeframes for Project scenarios	Volume 3, Section 24.2.4 Temporal Boundaries for Kelly Lake Interests and Use			
• the influence of consultation on issues scoping and the assessment Key issues addressed will include the past and current use of lands and resources for traditional purposes by the Kelly Lake communities, and potential effects that may result in changes in the ability of the Kelly Lake communities to exercise their interests The Kelly Lake communities involved will be defined by the section 11 order and include: • Kelly Lake Métis Settlement Society • Kelly Lake Cree Nation Detailed scope and methods will be defined in collaboration with the Kelly Lake communities	Volume 3, Section 24.2.10 Influence of Consultation on the Assessment for Kelly Lake Interests and Use			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments

24.3 Baseline Conditions
This section of the Application will describe the approach and methods used to identify the ethno-historic and cultural contexts of the Project. PRC will undertake a traditional use study, in collaboration with the Kelly Lake communities, to document non-confidential past and current use of lands and resources including site-specific values in the Project area. This section will be developed in collaboration with the involved communities and may include:
• a brief description of the Kelly Lake communities potentially affected by the proposed Project, including:
  • a summary of areas of interest
  • a description of basic governance systems
  • a basic description of how Kelly Lake peoples perceive the environment, lands and resources and related perceptions regarding interests and use that may be conveyed through traditional knowledge or other means
  • a qualitative description of mixed economies
• a review of relevant maps, databases and published literature on historic and current traditional land use and ecological knowledge in the Project area
• a summary of past and current land uses associated with the Project area, including site-specific values, the purposes for which they are important, and their relative importance within the context of wider land use, as indicated by knowledgeable Kelly Lake community members
	Volume 3, Section 24.3 Baseline Conditions for Kelly Lake Communities Interests and Use			

24.4 Project Effects This section of the Application will be developed in collaboration with the involved communities. It will identify and evaluate potential interactions, effects and benefits of the Project on Kelly Lake communities' interests and use, define mitigation measures and characterize residual Project effects. The effects assessment will focus on VECs, and will use methods identified in collaboration with the involved communities. The assessment will evaluate potential residual effects on Kelly Lake communities' interests and use as reflected in the baseline. Analysis of potential residual effects and methods of assessment will be discussed in the Application	Volume 3, Section 24.4.4 Project Environmental Effects on Kelly Lake Communities Interests and Use			
24.5 Summary of Mitigation Measures This section of the Application will provide a summary of the mitigation measures to avoid, minimize, or mitigate potential adverse effects on Kelly Lake communities' interests and use, plus measures to enhance the benefits of Project activities	Volume 3, Section 24.5.1 Summary of Mitigation for Kelly Lake Interests and Use			
24.6 Monitoring This section of the Application will describe any monitoring measures that are recommended based on the Kelly Lake Communities Interests and Use section of the Application	Volume 3, Section 24.5.3 Summary for Follow-Up and Monitoring for Kelly Lake Interests and Use			

Table 1.5-1 Table of Concordance (cont'd)

Information Requirements in Terms of Reference	Refer to EA Section	Info present	Info missing	Comments
25 Summary of Project Residual Effects and Mitigation Measures				
This section of the Application will provide a tabular summary of Project residual effects identified in the effects assessments for each VEC. The summary will reference mitigation measures that were considered in identifying the Project residual effects	Volume 4, Section 25 Summary of Project Residual Effects and Mitigation Measures			
26 Summary of Commitments				
This section of the Application will list commitments presented in the Application, including mitigation measures and any monitoring and follow up programs	Volume 4, Section 26 Summary of Commitments			
27 Conclusion				
This section of the Application will summarize the effects assessment findings and will provide concluding statements regarding the significance of any Project residual or cumulative effects predicted to occur as a result of the Project	Volume 4, Section 27 Conclusion			
28 Other Authorizations Required				
This section of the Application will include a list of Authorizations, Permits, Licenses and approvals for the construction, operation and decommissioning of the Project	Volume 4, Section 28 Other Authorizations Required			
29 References and Supporting Documentation				
This section of the Application will list the references and supporting documents used in preparing the Application	References and Supporting Documentation appear at the end of each section respectively			
30 Appendices				
This section of the Application will include all appendices referenced in the Application	Appendices appear at the end of each section respectively			

1.6 References

1.6.1 Literature Cited

District of Tumbler Ridge. 2005. Official Community Plan. Tumbler Ridge, BC.

District of Tumbler Ridge. 2006. Zoning Bylaw: Bylaw No. 517. Tumbler Ridge, BC.

Hughes, J.D., L. Klatzel-Maudry, and D.J. Nikols. 1989. A Standardized Coal Resource/Reserve Reporting System for Canada. Geological Survey of Canada Paper 88-21.

1.6.2 Internet Sites

British Columbia Environmental Assessment Office (EAO). 2009. Roman Coal Mine Project Description dated Aug 23/07 from Peace River Coal Inc. Available at: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_308_24704.html

Canadian *Environmental Assessment Act*. 2007. Operational Policy Statement: Addressing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act.* Available at: http://www.ceaa-acee.gc.ca/013/0002/cea_ops_e.htm

Integrated Land Management Bureau. 1999. Dawson Creek Land and Resource Management Plan. Victoria, BC. Available at: http://ilmbwww.gov.bc.ca/slrp/lrmp/fortstjohn/dawson_creek/docs/dawson_creek_lrmp_march_1999.pdf [accessed October 2008]

Integrated Land Management Bureau. 2005. Peace Forest District (Dawson Creek Timber Supply Area – excluding TFL#48). Scenic Areas. Available at: http://www.ilmb.gov.bc.ca/slrp/lrmp/fortstjohn/dawson_creek/docs/scenic_area_map.pdf [accessed October 2008]

Integrated Land Management Bureau. 2006. Map 1. Reporting units (old forest retention order). Available at: http://www.ilmb.gov.bc.ca/slrp/lrmp/fortstjohn/dawson_creek/docs/Map1Order_Report_Units.pdf [accessed October 2008]

Ministry of Agriculture and Lands. N.d. Draft Ministerial Order. Available at: http://www.ilmb.gov.bc.ca/slrp/lrmp/fortstjohn/dawson_creek/docs/Order_for_public_review.pdf [accessed October 2008]

Ministry of Agriculture and Lands. 2005. Peace Forest District (Dawson Creek Timber Supply Area – excluding TFL#48). Scenic Areas. Available at: http://www.ilmb.gov.bc.ca/slrp/lrmp/fortstjohn/dawson_creek/docs/scenic_area_map.pdf [accessed October 2008]

Roman Coal Mine Project

ENVIRONMENTAL ASSESSMENT REPORT

VOLUME 1, SECTION 2: INFORMATION DISTRIBUTION AND CONSULTATION

Prepared for:
BC Environmental Assessment Office
Victoria, British Columbia

Prepared by:
Peace River Coal Inc.
Vancouver, British Columbia

March 2010

2 Information Distribution and Consultation

2.1 Introduction

Before the Partnership between NEMI Northern Energy and Mining Incorporated (NEMI), Hillsborough Resources Limited and Anglo Coal Canada Inc. was formed to create Peace River Coal Limited Partnership (PRC LP) in November 2006, NEMI introduced the Roman Coal Mine Project (the Project) to government agencies, Aboriginal groups and the public annually between 2004 and 2007 as part of a discussion about future development of its Trend property. More detailed discussions with key agencies and the community began in early 2007.

This section includes information related to consultation efforts to date, during the pre-Application period, and identifies planned future PRC initiatives to engage First Nations, Kelly Lake Communities, government agencies, the public and stakeholders during the Application-review period.

2.2 Consultation Overview

2.2.1 Methodology

Since 2004, general information sessions and consultation efforts conducted by PRC in relation to its activities in the area have included the Trend Coal Mine, the Project and the Horizon Mine Coal Project. While development of the Project may not have been the principal focus in meetings between 2004 and 2007, the company chose to present the Project conceptually each time in an effort for early engagement with government and the community. The Project was presented at meetings with government agencies and Aboriginal communities as well as at public open houses.

There was a substantial effort to communicate information about the establishment of PRC to First Nations, Kelly Lake Communities, government agencies and the public, including information about the company's tenure areas, exploration and mining activities. In the spectrum of consultation, it was felt that clear informative communication and information sharing about this new company was critical to establishing understanding and longer term relationships. The topic of the Project was raised for information sharing and discussion very early-on when the proponent was also providing information and consulting about the company's Trend and Horizon projects.

The initial Project Description was submitted to the EAO in August 2007. PRC prepared Draft Proposed Terms of Reference (TOR) for an Application for an EA Certificate and submitted them to the EAO in September 2008. In conjunction with the Draft Proposed TOR, PRC also prepared and submitted a number of work plans detailing the work proposed in each of the following areas:

- Air Quality
- Terrain and Soils
- Vegetation
- Wildlife

- Hydrology
- Water and Sediment Quality
- Groundwater
- Fish and Fish Habitat
- Benthos and Periphyton
- Land Use and Tenure
- Archaeology
- Socio-economic Conditions
- First Nations Interests and Use
- Kelly Lake Communities Interests and Use

The Section 11 Order issued for the Project pursuant to the British Columbia *Environmental Assessment Act* (BCEAA) S.B.C. 2002, c43 dated October 2, 2008 sets out the scope of the Project and the assessment as well as the assessment procedures through the pre-application and application review stages. The Order identifies groups that must be consulted: First Nations, Kelly Lake Communities, the public, and federal, provincial and local government agencies. By definition of the Section 11 Order, First Nations means the Saulteau, West Moberly, Halfway River and Doig River First Nations (DRFN) and the McLeod Lake Indian Band (MLIB). Also by definition of the Section 11 Order, Kelly Lake Communities means the Kelly Lake Cree Nation and the Kelly Lake Métis Settlement Society (KLMSS). As discussed in 2.4.1 below, PRC has also sought to engage the Kelly Lake First Nation as a third organization within the Kelly Lake Communities, though with limited success. PRC has followed the direction of the Section 11 Order and this Section 2 of the EA Application reflects the consultation requirements of that Order.

PRC's Community and Social Policy Statement (Appendix 2A) informs and guides the company's communication, consultation and engagement efforts. Key areas of focus include community and social development and recognition of the interests of Aboriginal groups in the areas of PRC operations.

PRC employs a range of communications and engagement methods to share information about its projects and related activities (e.g., telephone calls and conference calls; faxes; emails and letters; one-on-one meetings; public meetings; open houses; government sponsored meetings; attendance at and sponsorship of attendance at conferences). All of these points of contact, communication, information sharing, meetings and consultation are well documented and taken together contribute to a body of knowledge within PRC and support the development of positive working relationship with communities, government agencies and public stakeholders.

In the sections that follow, there is discussion of the consultation efforts undertaken by PRC during the Pre-Application period with First Nations, Kelly Lake Communities, the public, stakeholders and government agencies. Within each section are sub-sections that provide:

- outlines of meetings, consultation and information distribution prior to submission of the Application

- summaries of issues raised during consultation and the Proponent's response to those issues
- discussion about the degree to which issues raised during the pre-application consultations are considered resolved or addressed by the Proponent or other parties

Only selected communications or meetings from PRC's contacts communications database are highlighted in the discussion of Pre-application Consultation within this document; this is not an exhaustive listing of all of its contacts and communications.

The selected communications or meetings organized into categories reflecting activities that occurred before and after the date of issuance of the Section 11 Order for the Project on October 2, 2008 and are summarized in Sections 2.3 and 2.4 and in Tables 2.3–1 through 2.4–4. Please note that not all communications listed in the tables are in the text of Sections 2.3 and 2.4; please also note that communications mentioned in the text of Sections 2.3 and 2.4 may not contain all the detail (e.g., names; key topics; materials) listed in the tables.

2.3 First Nations

2.3.1 Overview

The Project is within the area covered by Treaty No. 8. In the Project area, there are eight Treaty No. 8 signatory First Nations of which six are members of the Treaty 8 Tribal Association (T8TA): DRFN; Fort Nelson First Nation (FNFN); Halfway River First Nation (HRFN); Prophet River First Nation (PRFN); SFN; and West Moberly First Nations (WMFN). The other two Treaty No. 8 signatory communities are: Blueberry River First Nations (BRFN) and MLIB. The BC EAO invited all eight communities to participate in the Project review and to participate in the Working Group. The T8TA received funding from the BC EAO in support of a coordinator role to facilitate participation in the EA process by member Nations. Eventually, this mechanism was not utilized as some of its member decided to focus more efforts on direct discussion with PRC.

From 2004 to 2007, PRC engaged the WMFN, the SFN, the HRFN and the MLIB directly. Then in 2008, as requested by WMFN, SFN, DRFN and HRFN, PRC also worked through the T8TA to facilitate Project consultation with member First Nations, largely coordinated by the T8TA EA Coordinator, but continued to engage with the WMFN, SFN, and HRFN directly on the Project. In the course of this engagement process, three First Nations participated on a regular basis and expressed interest in participating in the review process: SFN; WMFN; and, MLIB. DRFN and HRFN have also expressed some interest in participating in the review of the Project.

Following guidance from the BC EAO and the Treaty No. 8 First Nations, PRC also put a great deal of effort into consultation and engagement with The Aboriginal Environmental Group (TAEG); an ad hoc group including representatives from T8TA First Nations supported by the T8TA EA Coordinator. This process involved several meetings with representatives from one or more of the six Treaty No. 8 First Nations at the T8TA offices to work to develop and advance a proposal for a collective community-led traditional use study (TUS)**,** which would include both the timing and cost of activities and deliverables**,** in support of the Project EA Application. Eventually, the TAEG mechanism was not utilized as some of its members decided to focus more efforts on

direct discussion with PRC. In addition to discussions with the TAEG, PRC continued to consult with and engage directly with each FN.

MLIB did not participate with TAEG and engaged directly with PRC to develop and implement a TUS program for the Project.

PRC has established ongoing communication and consultation processes with the three First Nations that have expressed the longest-standing and most consistent interest and participation (SFN; WMFN; and, MLIB) as well as maintaining open communication with DRFN and HRFN.

2.3.2 Saulteau First Nations

2.3.2.1 Pre-application Consultation

Pre-section 11 Order—Saulteau First Nations

From May 19, 2004 through October 2, 2008 there were more than 366 documented communications between PRC and SFN. While the company presented the Project conceptually in power point presentations between 2004 and 2006, one of the early detailed communications on the Project occurred on June 20, 2007 at a Trend, Horizon and Roman North East Mine Development Review Committee (NEMDRC) project update meeting. The SFN Coal Coordinator participated in this meeting. The 266 or more communications before that date were primarily related to PRC's Trend Coal Mine, but often included updates on Roman, for example, on the exploration status.

Consultation on the Project increased in mid 2007 with a July 11, 2007 meeting with the SFN to discuss TUS, socio-economic, cumulative effects and archeological work on PRC projects including Roman. At this meeting, and as one way to address FN capacity building, PRC invited SFN and offered to pay for hotel, travel and meal expenses for one member to attend the Reclamation Symposium in Squamish. At the meeting, there was a discussion about available TUS information in the area. There was also a discussion regarding the potential for harmonization of data collection. For example, there was discussion about exploring the efficiency of interviewing elders for multiple coal projects in a similar geographic area at the same time. A SFN elder and another community member participated at this meeting. These discussions are reflected in EAO minutes for that meeting.

On July 17, 2007, SFN faxed a request to PRC for a donation to facilitate helicopter funding to transport elders for the Twin Sisters hike. PRC provided a monetary donation.

Between August 8 and 13, 2007, a SFN community member participated in the Project soils field program. On August 30, 2007, PRC sent an email asking SFN for input to the potential approach for a review of existing TUS data and data collection for TUS. Also, in August, there were numerous discussions regarding air quality, dust generated from coal transport trucks and how the dust may settle on berry bushes. PRC responded to SFN by communicating to the trucking company and with the operations team, the importance of utilizing the truck covers with transporting both to and from the mine site and keeping the covers in good condition for the current operations and any future operations.

On September 7, 2007, SFN had a number of community members, including youth and the coal coordinator, attend a tour of Roman. On September 19, 2007, PRC had a discussion with SFN representative to advance discussions on Roman TUS. This

discussion occurred at the Reclamation Symposium. PRC sponsored one SFN attendance at this conference.

The first project EAO Working Group meeting was held in Fort St. John on November 14, 2007 at which time regional study area (RSA) maps, mine plan project maps and a project presentation was delivered. There was a discussion to review the existing TUS and socio-economic dataset and archaeology information. Archaeology field work took place in September 2007 with participation from SFN. The draft Archaeological Impact Assessment was presented to the First Nations for their review and comment. A SFN representative asked a question regarding the method utilized to determine duration of field work. An explanation was provided regarding the standard techniques. A presentation to provide an overview of the socio-economic and traditional land use and interests work was prepared. The first slide generated much comment on TUS between the First Nations representatives, the EAO and PRC. These November 2007 discussions are documented in EAO minutes for the meeting.

A Project traditional use study working group meeting with PRC and some First Nations, coordinated by the EAO, was held on February 21, 2008 as a follow up to the discussions of the November 2007 working group meeting. There was an overview and discussion on existing TUS information. In correspondence before the meeting (February 15 and 19) PRC proposed the attendance of SFN elders at the meeting in an effort to include elder comments in the TUS planning process and offered to pay the cost for elders to attend. An elder and Coal Coordinator attended on behalf of SFN. The SFN elder made a number of comments with respect to traditional use in the Project area including identifying summer as the best time of year for collecting field information. The elder also discussed the importance of native plants for medicinal purposes, Aboriginal sites, protecting the watershed and aquatic life and the terrestrial animals that drink the water. PRC addressed these concerns in its environmental management plans for the Project including the reclamation, wildlife protection, invasive plants control, and water management plans in the Application. PRC provided funding to SFN for the elder's honoraria as well as travel expenses for the coal coordinator to attend this EAO meeting. PRC also reiterated its offer to fund TUS capacity both verbally and by hand-delivered letter at this meeting. SFN, WMFN, HRFN and KLMSS had a meeting outside the EAO-led meeting and stated that by March 20, 2008, they would provide input to the EAO on a proposed third party TUS process that could be applied to the Project. These WG discussions are documented in EAO minutes for the meeting.

PRC had an introductory meeting with the new SFN Chief and Council on April 17, 2008. At that meeting, SFN stated they would require a working relationship protocol agreement to be negotiated between SFN and PRC. Shortly thereafter, SFN requested capacity funding and said that consultation would cease until capacity funding was received; the request was communicated via phone, fax and email on April 28, 2008. Also, during the month, PRC provided SFN with a list of current job vacancies at the Mine.

On May 22, 2008 PRC mailed and emailed a letter to SFN reaffirming the company's willingness to provide TUS capacity funding, restating a specific proposal and also to advance a potential 2008 TUS field program.

PRC's CEO and General Manager, as well as the Commercial Manager met with Chief, Councilors and staff at SFN on June 18, 2008 to discuss relationship building and negotiation of a memorandum or protocol agreement.

A TUS proposal was received from T8TA dated June 17, 2008. On July 3, 2008, PRC's consultant provided TUS data on other PRC projects to SFN's Land Manager in an effort to advance discussions on Roman TUS and to suggest a review of existing data prior to finalizing any TUS scoping proposal. PRC then met with SFN's Land Manager on August 1, 2008 to discuss and exchange comments on a draft memorandum agreement.

On August 13, 2008 SFN advised PRC, other coal companies and government that they were discontinuing the position of Coal Coordinator due to the lack of financial resources to support the position; this termination significantly affected the communication and consultation process. The timing was also very unfortunate as PRC along with other coal companies, under the auspices of the Northeast Coal Coalition (NECC), had garnered provincial government agreement to enter into a co-funding arrangement on a Coal Coordinator position.

On or about September 19, 2008 the SFN Land Manager left the position. On September 30, 2008 PRC visited SFN to be introduced to the SFN staff member newly assigned to the PRC file. Subsequently, other staff members have been involved on the PRC file along with the Chief and Council.

On September 22, 2008, PRC met with SFN Chief at the T8TA office to discuss a Project update as well as a joint TAEG-TUS program (The Adhoc Environmental Group later known as The Aboriginal Environmental Group). There was significant discussion regarding EA process.

See Table 2.3-1 for selected pre-section 11 Order contact records for SFN.

Post-section 11 Order—Saulteau First Nations

Between October 2, 2008 and December 29, 2009 there have been about 150 or more documented communications between PRC and SFN.

PRC representatives met with SFN Councilor at the NE Coal Forum in Chetwynd, October 10, 2008, to discuss SFN's participation in the T8TA TAEG Project traditional land use study (TLUS).

On October 27, 2008 PRC CEO and General Manager, wrote to SFN Chief and Council to reiterate the offer of additional capacity funding to facilitate the review of the Project EA Application. On the same date, the first draft of the TOR was provided to SFN for comment.

On October 28, 2008, a meeting was held at the T8TA office in which the TAEG tabled a TUS Capacity Funding proposal for the Project. SFN Chief attended this meeting. Then on October 31, 2008, PRC and T8TA EA representative corresponded by email and in person regarding Roman EA and community led studies. PRC provided a reply to TAEG's TUS capacity funding proposal.

Table 2.3-1 Selected Pre-section 11 Order Contact Records—Saulteau First Nations

Date	PRC rep	SFN rep	Location	Key Topics	Materials
20 June 2007	Angela Waterman Pat Wong	Fernie Garbitt	George Dawson Inn, Dawson Creek	NEMDRC meeting–powerpoint re Trend, Roman and Horizon projects	Information package with maps + powerpoint re Trend, Roman and Horizon projects
10 July 2007	Angela Waterman Trevor Hulme	A. Apasassin, B. Courteille, C. Gauthier, Linda Watson, Clayton Davis, Patrick Jarvis	SFN Band Office	Trend, Horizon and Roman project presentations, TUS, cooperation agreement, contracting	Maps and draft agreement
10 July 2007	Angela Waterman Golder/Craig Candler Archer/Remi Farvacque	Naomi Owens Della Owens	MLIB Office	Roman, Trend, Horizon projects, TUS and Socio-economics	Maps and power point presentations
30 Aug 2007	Angela Waterman	Fernie Garbitt Clayton Davis	Telephone and email	Request confirmation re joint PRC-WCC socio-ec study + Joint Roman-Horizon TUS study utilizing Trend TUS information	
17 Sep 2007 19 Sep 2007	Angela Waterman	Darryl Garbitt Fernie Garbitt	Symposium	Roman TUS and archeology	Project Description
14 Nov 2007	Angela Waterman, Steve Amor, Trevor Leary, Craig Candler, Scott Trusler, Justin Stockwell, Remi Farvacque	Fernie Garbitt	FSJ Northern Grande Quality Inn Hotel	First Project EAO Working Group Meeting	RSA maps, Mine project maps, Power-Point presentation

Table 2.3-1 Selected Pre-section 11 Order Contact Records—Saulteau First Nations (cont'd)

Date	PRC rep	SFN rep	Location	Key Topics	Materials
15 Feb 2008	Angela Waterman	Fernie Garbitt	PRC sent email	PRC invite a couple of elders to attend mtg on Feb 21; offer to reimburse expenses	
19 Feb 2008	Angela Waterman	Fernie Garbitt	PRC received email	Agreed–Elder Ron Letendre will attend	
21 Feb 2008	Angela Waterman	Ron Letendre Fernie Garbitt	FSJ Northern Grande Quality Inn Hotel	Roman EAO TUS Working Group meeting	PRC cheque for SFN attendance, Letter offer funding for TUS, Golder TUS overview presentation
17 Apr 2008	Angela Waterman	Harley Davis, Norman Napoleon, Fernie Garbitt, Glenda Gover	SFN Band Office	Working relationship protocol agreement	
28 Apr 2008	Angela Waterman	Harley Davis Fernie Garbitt	Telephone Fax	Capacity Funding required for consultation to continue	
22 May 2008	Angela Waterman	Harley Davis Councilors Fernie Garbitt	Letter sent via post and email	Reaffirmation of previous offer of capacity funding	letter
18 June 2008	Trevor Hulme Hugh Kendrick Michael Cunningham	Harley Davis, Norman Napoleon, Caleb Behn, Fernie Garbitt	SFN Band Office	PRC–SFN relationship building and memorandum or protocol agreement	
3 July 2008	Golder/Craig Candler	Caleb Behn Fernie Garbitt	email	Archaeology and TUS overview for PRC projects to advance Roman TUS discussions	
01 Aug 2008	Michael Cunningham	Caleb Behn	SFN Band Office	Re: draft MOU agreement	
19 Sep 2008	Michael Cunningham	Caleb Behn		Caleb Behn leaves Land Mgr position	

Table 2.3-1 Selected Pre-section 11 Order Contact Records—Saulteau First Nations (cont'd)

Date	PRC rep	SFN rep	Location	Key Topics	Materials
22 Sep 2009	Scott Trusler John Errington Golder/Craig Candler Michael Cunningham	Chief Harley Davis	T8TA office	Roman project update/TAEG joint-TUS/EA process discussions	Minutes
30 Sep 2008	Michael Cunningham	Naomi Owens	SFN Band Office	Introductory meeting as NO new to PRC file	
NOTE: October 2, 2008—Section 11 Order issued for the Project					

On November 3, 2008, PRC confirmed to T8TA EA representative that PRC is willing provide funding support for TAEG to participate in meetings relating to scoping and review of community-led TUS studies and indicating that PRC is waiting for more information from TAEG before proceeding.

Another EAO Working Group meeting was held in Fort St. John on November 14, 2008. This meeting was primarily to review the draft TOR and baseline work plans. SFN did not send a representative to this meeting. These WG discussions are documented in EAO minutes for the meeting. This meeting was followed by a WG meeting on December 2, 2008 also in Fort. St. John. The purpose of this meeting was to provide the Aboriginal groups, who were unable to attend the November 14, 2008 meeting, another opportunity to obtain information from EAO and PRC and to review the draft TOR and baseline work plans. SFN did not send a representative to this meeting.

A SFN staff member emailed PRC on December 3, 2008 asking if PRC had received comments from SFN regarding the draft Project EA Terms of Reference. PRC advised SFN that no comments had been received by PRC but suggested SFN contact the BC Environmental Assessment Office. On December 16, 2008, PRC received a telephone call from T8TA EA representative to confirm that T8TA is preparing a response to PRC's capacity funding proposal on behalf of five communities. The T8TA representative asked whether PRC would like to see separate agreements for EA process and community-led TUS studies, which PRC confirmed.

PRC met SFN Chief at a holiday social event in Chetwynd on December 19, 2008 to raise the Roman EA capacity funding as a topic for discussion at the next meeting with and a brief discussion regarding a potential meeting date in early 2009.

The meeting was held on January 8, 2009 at the SFN band office with Chief and two Councilors, an elder and a staff member. Topics of discussion included: the draft MOU agreement; the Project EA process including TUS and capacity funding and timelines; and, the terms of reference and funding timelines for a new Coal Coordinator position.

On January 19, 2009, the T8TA EA Coordinator contacted PRC to update PRC on progress of revised TUS proposal; they were anticipating completion on January 21, 2009 and apologized for the delay. The T8TA EA Coordinator requested PRC to save January 28, 2009 as meeting date with TAEG and indicated that TAEG had a positive view of PRC and was interested in moving forward. She then contacted PRC on January 22, 2009 to say that the proposal would be delayed until the next day. The proposal was received by PRC on January 23, 2009. A number of emails were exchanged to finalize the arrangements for a TUS meeting, but the meeting did not materialize and funding for the T8TA EA Coordinator position was not renewed by the province and the position was terminated on March 31, 2009. On March 27 and again on March 30, 2009, PRC contacted the T8TA Lands and Resources Director to indicate that PRC was interested in the continuation of T8TA, Tamara Dokkie as EA coordinator for the Roman Coal Mine Project. Despite the termination, PRC continued to engage with T8TA in efforts to retain the capacity of the EA Coordinator for T8TA in relation to the Project. Separate from the T8TA process, PRC continued to discuss the Project EA and TUS directly with SFN.

On January 26, 2009 PRC sent SFN Chief and Council a letter via post, fax and email following up on the October 27, 2008 letter again offering to discuss additional capacity funding support for the Project EA; this letter was sent as there had been no response the earlier letter of offer. PRC followed-up on the letter during a phone call with a SFN staff

member on February 3, 2009; that call also included discussion of the Coal Coordinator terms of reference and critical timing for accessing funding for the position.

On February 16, 2009 the second draft of the TOR reflecting comments received from the WG was provided to SFN for comment.

PRC followed up on the capacity funding question with an email on February 18, 2009 and meeting with three Councilors on February 26, 2009 while meeting regarding the Trend Coal Mine effluent permit amendment application, a sediment pond water license and design, and presented a revised technical assessment report (TAR).

In April 15, 21, 22 and 29 2009, PRC contacted SFN again with respect to advancing the Roman EA and TUS capacity funding discussion. On April 29, 2009 PRC sent the draft Roman EA Consultation Report to SFN Chief by email and mail for comments.

PRC contacted SFN again by email on May 22, 2009 to determine if SFN had yet reviewed PRC's proposal for Roman EA Capacity Funding and then on June 9, 2009, met with the Chief and one Councilor to discuss the Roman EA and capacity funding again. In August 2009, PRC again attempted to advance discussions on Roman EA and TUS with emails and telephone calls to the Chief and Councilors on August 20 and 27.

PRC then hosted a tour of the Trend and Roman Coal Mine project area with the SFN Oil and Gas representative, a community member and three elders on September 9, 2009. One elder commented on the medicinal value of an alpine plant. There were questions on exploration and geology. Answers were provided at the time of the tour. PRC met with one Councilor on September 30, 2009 to discuss components of an MOU including future capacity funding.

On December 17, 2009, PRC received an email from SFN advising that they intend to send comments regarding the draft Consultation Report by January 7, 2010. As of January 11, 2010, no comments had been received from SFN. Should comments be received after January 11, 2010, PRC will provide them to the BC EAO for consideration during the application review period.

From the period 2007 to 2009 alone, PRC has documented 300 interactions with SFN. In addition to the general consultation on the Roman EA, PRC has documented over thirty (30) TUS related communications with SFN in the form of emails, letters, telephone calls, field program participation or tours and meetings. PRC provided various funding offers to support SFN in capacity building, particularly in the areas of EA participation and TUS work. In PRC's opinion, a substantive level of effort has been made to consult with the SFN on the Project, particularly in respect to advancing a program of study for traditional land use.

See Table 2.3-2 for selected post-section 11 Order contact records for SFN.

Table 2.3-2 Selected Post-section 11 Order Contact Records—Saulteau First Nations

Date	PRC rep	SFN rep	Location	Key Topics	Materials
10 Oct 2008	Scott Trusler Michael Cunningham	Norman Napoleon	NE Coal Forum in Chetwynd	SFN participation in T8TA–TAEG joint TUS	
27 Oct 2008	Trevor Hulme Scott Trusler	Chief Harley Davis Council	Via letter and email	Offer of capacity funding for review of application	Letter
27 Oct 2008	Scott Trusler	Chief Harley Davis	Via letter and email	Roman TOR	Project draft Terms of Reference
28 Oct 2008	Scott Trusler Michael Cunningham	Chief Harley Davis,, T8TA/Tamara Dokkie, WMFN/Bruce Muir	Meeting T8TA office Fort. St. John	Discussion of Roman EA and consultation; TAEG tabled TUS capacity funding agreement	TAEG Capacity Funding Proposal
31 Oct 2008	Scott Trusler Michael Cunningham	T8TA/Tamara Dokkie	email	PRC reply to TAEG's proposal Roman EA and community led studies	PRC TUS Capacity Funding Proposal
3 Nov 2008	Scott Trusler	T8TA/Tamara Dokkie	email	PRC confirms willing to provide funding support for TAEG to participate in scoping and review and community-led TUS studies	
03 Dec 2008	Scott Trusler	Monica Rice	Email	SFN comments on Project TOR	
16 Dec 2008	Scott Trusler	T8TA/Tamara Dokkie	Telephone call	T8TA confirms they are preparing a response to PRC's capacity funding proposal.	
08 Jan 2009	Michael Cunningham	Harley Davis, N. Napoleon, D. Ronnenberg, Jack Davis, Monica Rice	SFN Band Office	Draft agreement, Roman EA process and timelines, Coal Coordinator TOR and funds	

Table 2.3-2 Selected Post-section 11 Order Contact Records—Saulteau First Nations (cont'd)

Date	PRC rep	SFN rep	Location	Key Topics	Materials
19 Jan 2009	Scott Trusler	T8TA/Tamara Dokkie	Telephone call	T8TA called to update on progress of revised TUS proposal with anticipation of completion January 21, 2009. Apologized for the delay and indicated that TAEG has a favourable view of PRC and is interested in moving forward. Also asked PRC to save January 28 and TAEG meeting date	
26 Jan 2009	Scott Trusler	Harley Davis	Via post, fax and email	Follow-up to Oct 27, 2008 letter offering capacity funding for Project review	Letter sent via post, fax and email
03 Feb 2009	Michael Cunningham	Monica Rice	Via phone	PRC capacity funding offer; Coal Coordinator TOR and funds	
16 Feb 2009	Adriana MacLeod	Chief Harley Davis	mail	Roman TOR	second draft TOR
26 Feb 2009	Scott Trusler Adriana MacLeod	Norman Napoleon		Trend Coal Mine - effluent permit amendment application, the SP4 water license and design, and presented the revised TAR	Revised technical assessment report (TAR)
22 Apr 2009	Michael Cunningham	Glenda Glover	Telephone calls and emails	Copies of Roman EA capacity funding letters	Letters
29 Apr 2009	Scott Trusler	Chief Harley Davis	Email and mail	Draft Roman EA Consultation Report sent for comments	Draft Roman EA Consultation Report
07 Sept 2009	Angela Waterman Adriana MacLeod Michael Cunningham Kevin Sharman Bert Schalekamp	Barry Davis, Naomi Owens, George Davis, Matilda Hebiert and Raymond Napolean	Site Tour	Three presentations and fact sheet	

2.3.2.2 Saulteau First Nations Summary of Issues and Concerns

- PRC has had numerous discussions, meetings and exchange of emails with representatives of SFN in an open dialogue on issues regarding the Project as well as the Trend Coal Mine and Horizon project both prior to and after issuance of the Section 11 Order for the Project (October 2, 2008).
- PRC and SFN have a mutual commitment to negotiate a relationship agreement or Memorandum of Understanding (MOU) and are working on a draft document.
- SFN has participated in a consultation process both directly with PRC as well as under the auspices of the BC EAO and the T8TA TAEG.
- In general, issues raised by SFN have largely focused on the government consultation processes or on regional cumulative environmental effects within SFN traditional lands as well as cultural effects on their members and their community.
- Project specific concerns expressed by SFN include: the potential effects of the development on wildlife, especially caribou, air quality (dust from coal trucks on berry bushes), protection of native plants and on water systems, specifically the possibility of contamination and the effects on fish.
- An ongoing issue expressed by SFN is the lack of capacity to address both the routine regulatory reviews and correspondence (referrals) related to industry operations and activity as well as capacity to review major new development proposals that require substantial time commitments on the part of staff and leadership.

2.3.2.3 PRC Summary of Measures to Address SFN Concerns

- PRC along with a number of other interested coal mining companies in the area agreed to co-fund, with the provincial government, a Coal Coordinator position for SFN, to provide capacity to respond to regulatory applications, for a one-year term and to work together to identify long-term funding for the position.
- PRC discussed with SFN and offered, on a number of occasions, a capacity funding agreement containing a mutually agreed scope-of-work that would include both the timing and cost of activities and deliverables, in support of SFN participation in both traditional use studies (TUS) and the Project EA review process.
- PRC followed the request of those T8TA First Nations defined in Schedule A of the Order under Section 11 in its efforts to work collectively, and to provide TUS and EA capacity funding collectively, through a mutually agreed scope-of-work agreement with TAEG of the T8TA, that would specify both the timing and cost of activities and deliverables. PRC has repeatedly offered to work with and provide capacity funding to those TAEG member First Nations as defined in Schedule A of the Order under Section 11, either collectively or individually, to document those First Nations' interests and use in the Project area. Besides this collective approach, PRC has also offered to provide capacity funding through negotiation of agreements with the individual First Nations. At the time of publication, a Project specific SFN TUS was not available for consideration in this Application. PRC looks forward to the possible provision of additional information from each FN, and will continue to offer reasonable capacity support for SFN TUS or other related studies to document and propose strategies to avoid or mitigate First Nations Interests and Use in relation

to the Project. If received prior to construction, recommendations from such studies will be considered by PRCI for inclusion in ongoing construction and operational management plans.

- In concert with preparation of the Wildlife section of the Project EA, PRC has developed a Wildlife Mitigation and Monitoring Plan including a specific Caribou Management Plan.
- Heritage resources are addressed in the archaeology and Traditional Land Use Site Protection Plan
- Air quality issues are addressed in the Air Quality and Dust Control Plan in the Application.
- The Reclamation Plan in the EA is largely driven by the high priority placed on caribou habitat end land-use objectives. There is also the Invasive Plant Management plan to address native plant protection.
- Water quality issues are addressed in the Water Management Plan and the Surface Water and Sediment Quality sections of the Application.

2.3.3 West Moberly First Nations

2.3.3.1 Pre-application Consultation

Pre-section 11 Order—West Moberly First Nations

In the period May 19, 2004 through October 2, 2008 there were more than 463 documented communications between PRC and WMFN. While the company presented the Project conceptually in power point presentations between 2004 and 2006, one of the first mentions of the Project in the tracking record was on February 4, 2005 when PRC spoke to a WMFN representative regarding Project exploration activities.

The next reference is December 13, 2006 as PRC emailed a WMFN Councilor regarding plans to discuss Trend-Roman, Horizon-Southridge and perhaps another PRC project early in 2007.

On March 14, 2007 the PRC President and another representative met with WMFN Chief and Councilors at the WMFN council chambers to discuss a range of topics that included the Project EA schedule.

On April 25, 2007, there was a conference call between PRC, the EAO and WMFN regarding traditional use studies and socio-economic planning.

On June 14, 2007, PRC was in communication with WMFN directly and under the auspices of the T8TA in regards to the provision of information and maps plus arranging a meeting to discuss capacity, consultation, timelines, and community-led studies (traditional use analysis and socio-economic impact assessment).

WMFN attended the June 20, 2007 North East Mines Development Review Committee (NEMDRC) update meeting on PRC's Trend, Horizon and Roman projects. PRC delivered a Power-Point presentation and provided attendees with an information package containing copies of the PowerPoint presentation on the Trend, Horizon and Roman projects as well as a map of the properties.

On July 6, 2007 a meeting was held in the West Moberly Dunne-za Lodge to discuss the Roman and Horizon project descriptions as well as to begin drafting a cooperation agreement. The Chief and four Councilors attended this meeting. PRC followed up on July 9, 2007 via email confirming the points of the discussion and provided the most recent version of the draft cooperation agreement for comment. The agreement included details regarding the costs PRC committed to provide capacity funding for WMFN representatives to meet with regulators (travel, hotel, time) including NEMDRC meetings; and, willingness to make the funding retroactive to date of last NEMDRC meeting of June 20, 2007. On July 10, 2007 a dinner meeting was held in Chetwynd with the WMFN Land Use Manager and the discussion was about contracting and on traditional use and socio-economic studies and identification of a consultant for WMFN to use on Roman and Horizon project studies. Please see Table 2.3-3 for participants. On July 11, 2007, a meeting was held with EAO to discuss TUS for PRC projects, but WMFN did not send a representative to this meeting.

A meeting tentatively set for July 23, 2007 was postponed twice into August and then effectively cancelled as the next time PRC and WMFN met was at the NEMDRC September 2007 meeting in Fort St. John. In the interim there was email and phone communication back and forth, with BC EAO and T8TA representatives being copied, regarding the Project's traditional use and socio-economic studies including views on TUS approach. The exchange of emails on August 30, 2007 outlines the discussion between PRC and WMFN regarding the proposed process for moving forward on the Roman traditional use and socio-economic studies.

WMFN was at the NEMDRC September 26, 2007 meeting in Fort St. John where PRC provided updates on the Project and the environmental baseline studies.

The first Project EAO Working Group meeting was held in Fort St. John on November 14, 2007 at which time regional study area (RSA) maps, mine plan Project maps and a Project presentation was delivered. There was a discussion to review the existing TUS and socio-economic dataset and archaeology information. Archaeology field work began in September 2007 with participation from WMFN. The draft Archaeological Impact Assessment was presented to the First Nations for their review and comment. The WMFN representative asked a question regarding the number of field days completed for the archaeology study and an answer was provided by the archaeologist. A presentation to provide an overview of the socio-economic and traditional land use and interests work was prepared. The first slide generated much comment on TUS between the First Nations representatives, the EAO and PRC. The WMFN stated that FN have little capacity to participate in the studies. EAO noted that both the Proponent and EAO are having separate capacity funding discussions with FN. These November 2007 discussions are documented in EAO minutes for the meeting.

A Project traditional use study working group meeting with PRC and some First Nations, coordinated by the EAO, was held on February 21, 2008 as a follow up to the discussions of the November 2007 working group meeting. There was an overview and discussion on existing TUS information. In correspondence before the meeting (February 15 and 19) PRC proposed the attendance of WMFN elders at the meeting in an effort to include elder's input to the TUS planning process and offered to pay the cost for elders to attend. Although SFN and MLIB sent elders, WMFN did not send elders to this meeting. WMFN Land Manager stated that the TAEG is open to reviewing existing TUS datasets to determine information application to Roman and that the TAEG is an adhoc group. WMFN also suggested that the hiring of a summer student would be helpful in assisting

the community members with documenting and gathering existing TUS information into a database. PRC provided a cheque to WMFN to cover the representative's travel expenses and a per diem for attending this meeting. SFN, WMFN, HRFN and KLMSS had a meeting outside the EAO-led meeting and stated that by March 20, 2008, they would provide input to the EAO on a proposed third party TUS process that could be applied to the Project. These WG discussions are documented in EAO minutes for the meeting.

In early March 2008 WMFN suggested a meeting be held with PRC, in Moberly Lake, to discuss socio-economic matters. Correspondence was exchanged through March resulting in an April 16, 2008 meeting date and an agenda. At the mid-April meeting PRC had an Anglo American representative from London, UK provide a background on the company (Anglo) and make a presentation on Anglo's Socio-economic Assessment Toolkit (SEAT) with case studies; copies of a PRC brochure and Anglo's 'Good Citizenship Principles' were distributed. Also at this meeting, PRC introduced two new PRC resource people who are providing general support to PRC in the areas of community engagement and Aboriginal affairs.

On May 22, 2008 PRC mailed and emailed a letter to WMFN reaffirming the company's willingness to provide TUS capacity funding, restating a specific proposal and also to advance a potential 2008 TUS field program.

Through the latter part of April and in early June 2008, PRC and WMFN exchanged emails regarding how community members can apply for jobs at the mine with resumes be sent directly to the Vancouver, British Columbia office who will then forward them to the PRC Human Resources department; two candidates were identified for interviews.

On July 9, 2008 PRC circulated copies of Community, Social and Aboriginal Policy to First Nations. On July 24 WMFN provided a response and on August 28, 2008 WMFN requested clarification of the Policy when it comes to the negotiation of agreements. This led to an exchange of emails resulting in a meeting on September 3, 2008 to discuss a range of matters—including the introduction a new PRC staff member who will be working on Aboriginal affairs issues over the coming 12-15 months.

The September 3, 2008 meeting was held at the WMFN band office and other items on the agenda were West Moberly's concerns about the lack of benefit (employment and contracting opportunities) coming to them from the coal mines but also a mutual commitment to work on negotiation of an agreement between PRC and WMFN.

See Table 2.3-3 for selected pre-section 11 Order contact records for WMFN.

Table 2.3-3 Selected Pre-section 11 Order Contact Records—West Moberly First Nations

Date	PRC rep	WMFN rep	Location	Key Topics	Materials
14 Dec 2006	Angela Waterman	Clarence Willson	Email	Plans to discuss Trend, Roman, Horizon, Southridge and Belsax early in 2007	
14 Mar 2007	Trevor Hulme Angela Waterman	Roland Willson Clarence Willson Betty Brown Brandi Scott	WMFN Council Chambers	Roman EA schedule plus Horizon, Trend Mine, By-Pass Road, Anglo	Maps
25 Apr 2007	Angela Waterman + EAO– J. Truscott N. Vinette J. Errington	Bruce Muir and T8TA-Jason Lee	Conference call	Traditional use study and socio-economic planning	
14 June 2007	Angela Waterman	Clarence Willson Bruce Muir + Kori Dokkie Brandi Scott Betty Brown Roland Willson	Emails	WMFN request digital copies of Roman maps prior to meeting	
14 June 2007	Angela Waterman, Craig Candler + EAO–Joe Truscott Nicole Vinette	Clarence Willson Bruce Muir + K. Broderick J. Lee V. Solonas L. Letendre L. Willson T. Gillanders	Email	Request for group meeting to discuss capacity, consultation, timelines, cumulative impacts, status of studies and TUA/SIA	
20 June 2007	Angela Waterman Pat Wong	Bruce Muir	George Dawson Inn, Dawson Creek	NEMDRC meeting–ppt re Trend, Roman and Horizon projects	ppt presentation re Trend, Horizon and Roman + map

Table 2.3-3 Selected Pre-section 11 Order Contact Records—West Moberly First Nations (cont'd)

Date	PRC rep	WMFN rep	Location	Key Topics	Materials
06 July 2007	Angela Waterman + Ed Beswick	Clarence Willson Roland Willson Betty Brown Brandi Scott Bruce Muir	WMFN lodge	PRC–Roman and Horizon project descriptions; draft cooperation agreement–incl. capacity funding; WMFN raised issues of government/ proponent capacity funding, cumulative effects and contracting competition	PRC tenure and regional study area maps
09 July 2007	Angela Waterman	Clarence Willson + Roland Willson Kori Dokkie Brandi Scott Betty Brown Bruce Muir	Email exchange	PRC confirms capacity funding for WMFN reps to attend regulatory meetings (travel, hotel, time)	Digital PRC tenure map to ftp site as requested
10 July 2007	Angela Waterman Neale Quan + Consultants (Golder and Archer) and contractors (Blackwater)	Bruce Muir + Dunne-za	Trend site and Red Lion Inn Restaurant	Traditional use study and socio-economic study; W. Assan as consultant; truck contracting–re Blackwater and Dunne-za	
30 Aug 2007	Angela Waterman + Golder–Craig Candler and Pascale Mera	Bruce Muir	Email exchange–3x in/out	PRC to focus on the Project, not Horizon; follow-up to recent discussion on Roman TUS and Socio-ec; questions and 'joint' PRC-WCC studies; use of Trend TUS info; accusations PRC doing it wrong; WMFN question if PRC still funding FN to attend reclamation conference	
26 Sep 2007	Angela Waterman + Archer–Remi Farvacque	Bruce Muir	Quality Inn Northern Grande–FSJ	NEMDRC –Project update; status of environmental baseline field program	NEMDRC minutes of meeting

Table 2.3-3 Selected Pre-section 11 Order Contact Records—West Moberly First Nations (cont'd)

Date	PRC rep	WMFN rep	Location	Key Topics	Materials
14 Nov 2007	Angela Waterman Steve Amor + T. Leary C. Candler S. Trusler J. Stockwell R. Farvacque	Bruce Muir	Quality Inn Northern Grande–FSJ	First Project EAO Working Group Meeting	Regional study area maps; mine/project maps; power-point presentation
15 Feb 2008	Angela Waterman	Bruce Muir	PRC sent email	PRC invited, and offered to pay for, elders to attend Feb.21 Roman EAO TUS meeting	
18 Feb 2008	Angela Waterman	Bruce Muir	PRC received email	WMFN declined offer for elders to attend, expenses paid, the Feb 21 mtg	
21 Feb 2008	Angela Waterman	Bruce Muir	FSJ Northern Grande Quality Inn Hotel	Second Project EAO Traditional Use Study Working Group meeting	PRC cheque in the amount of $450 for WMFN attendance, Letter offer funding for TUS, Golder TUS overview presentation
13 Mar 2008 14 Mar 2008 16 Mar 2008	Angela Waterman	Clarence Willson Roland Willson Kori Dokkie Brandi Scott Betty Brown Bruce Muir	Email exchange	Planning and confirming April 17 meeting; discussions regarding draft agreement; Anglo's policies and principles	
17 April 2008	Angela Waterman + Jon Samuels–AA Michael Cunningham + Jonathan Fowler–De Beers	Clarence Willson Betty Brown	West Moberly Lodge	Jon Samuel–Anglo company background and introduction to SEAT process; AW did projects update; discussion of TUS and socio-economic studies	Agenda; Anglo Good Citizenship Principles doc.; PRC brochure

Table 2.3-3 Selected Pre-section 11 Order Contact Records—West Moberly First Nations (cont'd)

Date	PRC rep	WMFN rep	Location	Key Topics	Materials
18, 22, 23, 24, 30 April 2008 + 02, 03, 06 June 2008	Angela Waterman	Clarence Willson	Email exchange and fax	Resumes of individual members to AW and HR re job applications; status of applications; two to be interviewed	resumes
09 July 2008	Angela Waterman	Roland Willson Clarence Willson Kori Dokkie Brown Family Bruce Muir	Email	PRC circulated to First Nations copy of Community, Social and Aboriginal Policies	Copies of Policies
24 July 2008	Angela Waterman	Clarence Willson	Email	WMFN says–Policies not very encouraging	
30 July 2008 26 Aug 2008	Michael Cunningham–MPC	Bruce Muir	Email	MPC sent introductory email requesting meeting in early August; MPC sent second email requesting meeting in early September	
28 Aug 2008	Angela Waterman Scott Trusler Michael Cunningham	Clarence Willson	Email exchange 3x in/out	WMFN request clarification on company Policy position regarding negotiation of agreements? PRC-WMFN set meeting for Sep. 3	
03 Sep 2008	Michael Cunningham	Clarence Willson Kori Dokkie Laura Webb	Meeting at WMFN band office	MPC introduction and background; WMFN concerns about jobs and contracting; draft cooperation agreement	
NOTE: October 2, 2008—Section 11 Order issued for the Project					

Post-section 11 Order—West Moberly First Nations

Between October 2, 2008 and December 3, 2009 there have been about 107 or more documented communications and meetings between PRC and WMFN.

On October 27, 2008 PRC CEO and General Manager wrote to WMFN Chief and Council to reiterate the offer of additional capacity funding to facilitate the review of the Project EA Application. On the same date, the first draft of the Project TOR was provided to WMFN for comment.

On October 28, 2008, a meeting was held at the T8TA office in which the TAEG tabled a TUS Capacity Funding proposal for the Project. WMFN Land Use Manager attended this meeting. Then on October 31, 2008, PRC and T8TA EA representative corresponded by email and in person regarding Roman EA and community led studies. PRC provided a reply to TAEG's TUS capacity funding proposal.

On November 3, 2008, PRC confirmed to T8TA EA representative that PRC is willing provide funding support for TAEG to participate in meetings relating to scoping and review of community-led TUS studies and indicating that PRC is waiting for more information from TAEG before proceeding.

Another EAO Working Group meeting was held in Fort St. John on November 14, 2008. This WG was primarily to review the draft TOR and baseline work plans. WMFN did not send a representative to this meeting. These WG discussions are documented in EAO minutes for the meeting. This meeting was followed by a WG meeting on December 2, 2008 also in Fort. St. John. The purpose of this meeting was to provide the Aboriginal groups who were unable to attend the November 14, 2008 meeting, another opportunity to obtain information from EAO and PRC and to review the draft TOR and baseline work plans. WMFN did not send a representative to this meeting.

During the middle part of December 2008, PRC and WMFN exchanged emails to schedule another meeting—January 8, 2009 was agreed. That meeting actually happened on January 9, 2009 with three main items of interest being discussed: overall relations between First Nations, the coal industry and government; the relationship between WMFN and PRC; and, outlining the goals and objectives of WMFN in coming to an agreement with PRC.

On January 19, 2009, the T8TA EA Coordinator contacted PRC to update PRC on progress of revised TUS proposal; they were anticipating completion on January 21, 2009 and apologized for the delay. The T8TA EA Coordinator requested PRC to save January 28, 2009 as meeting date with TAEG and indicated that TAEG had a positive view of PRC and was interested in moving forward. She then contacted PRC on January 22, 2009 to say that the proposal would be delayed until the next day. The proposal was received by PRC on January 23, 2009. A number of emails were exchanged to finalize arrangements for a TUS meeting, but the meeting did not materialize and funding for the T8TA EA Coordinator position was not renewed by the province and the position was terminated on March 31, 2009. On March 27 and again on March 30, 2009, PRC contacted the T8TA Lands and Resources Director to indicate that PRC was interested in the continuation of T8TA, Tamara Dokkie as EA coordinator for the Roman Project. Despite the termination, PRC continued to engage with T8TA to retain the capacity of the EA Coordinator for T8TA in relation to the Project. Separate from the T8TA process, PRC continued to discuss Roman EA and TUS directly with WMFN.

On January 26, 2009 PRC sent the WMFN Chief and Council a letter via post, fax and email following up on the October 27, 2008 letter again offering to discuss additional capacity funding support for the Project EA; this letter was sent as there had been no response the earlier letter of offer.

On February 16, 2009 a second draft of the TOR reflecting the WG comments was provided to WMFN for comment.

WMFN requested a meeting with BC EAO and PRC that was held on February 23, 2009. The purpose of the meeting was principally to discuss the EA process, how the Project EA was unfolding, and WMFN's participation in the Project EA, including capacity funding issues.

PRC representatives went to WMFN on February 27, 2009 to meet with Band Councilors about the Project, the Project EA, the EA process and how the loss of funding for the EA Coordinator at the T8TA will affect the community-led TUS work.

On March 27, 2009, PRC met with a WMFN Councilor and the Land Use Manager to discuss the Project and EA plus EA process, capacity funding, loss of government funding for T8TA EA Coordinator and how that affects the Roman EA community-led TUS work.

On April 29, 2009 PRC sent the draft Roman EA Consultation Report to WMFN Chief and Land Use Manager by email and mail for comments. At the time of submission of this EA Application, PRC had received no comments regarding the draft consultation report from WMFN. Should comments be received after submission of the application, PRC will provide them to the BC EAO for consideration during the application review period.

Additional discussions held during meetings or telephone calls regarding FN community-based TUS and capacity funding for Roman EA occurred on May 19, July 6, August 20, and September 14, 2009 between PRC and WMFN Chief, Councilors and the Land Use Manager.

From the period 2007 to 2009 alone, PRC has documented 258 interactions with WMFN. In addition to the general consultation on the Roman EA, PRC has documented over twenty (20) TUS related communications with WMFN in the form of emails, letters, telephone calls and meetings. In PRC's opinion, a substantive level of effort has been made to consult with the WMFN on the Project, particularly in respect to advancing a program of study for traditional land use.

See Table 2.3-4 for selected post-section 11 Order contact records for WMFN.

Table 2.3-4 Selected Post-section 11 Order Contact Records—West Moberly First Nations

Date	PRC rep	WMFN rep	Location	Key Topics	Materials
27 Oct 2008	Trevor Hulme Scott Trusler	Roland Willson	Email and mail	PRC letter offer of capacity funding for Roman EA process	Offer letter
27 Oct 2008	Scott Trusler	Roland Willson	Email and mail	TOR	Roman draft Terms of Reference
11 Dec 2008 + 15, 16, 18 Dec 2008 19 Dec 2008	Michael Cunningham	Roland Willson Clarence Willson	Email exchange	PRC request meeting before or just after break for the holidays WMFN- PRC agree on Jan. 8 meeting	
09 Jan 2009	Michael Cunningham	Clarence Willson Elizabeth (Betty) Brown	Meeting at WMFN band office	FNs-industry-government relations; WMFN- PRC relations; and goals/ objectives of WMFN in having agreement with PRC	
26 Jan 2009	Scott Trusler	Chief Roland Willson	Via post, fax and email	Follow-up to 27 Oct 2008 letter offering capacity funding for Project review	Letter sent via post, fax and email
10 Feb 2009	Scott Trusler Michael Cunningham	Bruce Muir	Meeting at T8TA office in FSJ	Trend Coal Mine–effluent permit amendment application PE-17762 and SP4	
16 Feb 2009	Adriana MacLeod	Chief Roland Willson	Email and mail	TOR	Second draft TOR
23 Feb 2009	Scott Trusler Adriana MacLeod	Bruce Muir	Meeting at WMFN with EAO and PRC	BC EA process, the Project EA, WMFN participation and capacity funding	
27 Mar 2009	Scott Trusler Michael Cunningham	Clarence Willson Bruce Muir	Meeting at WMFN band office	Project update and EA, the EA process, and loss of funding for EA Coordinator at T8TA + effect on Roman community-let TUS work	
29 Apr 2009	Scott Trusler	Chief Roland Willson Bruce Muir	Email and mail	Draft Roman EA Consultation Report sent for comments	Draft Roman EA Consultation Report

2.3.3.2 West Moberly First Nations Summary of Issues and Concerns

- PRC has had numerous discussions, meetings and exchange of emails with representatives of WMFN in an open dialogue on issues regarding the Project as well as the Trend and Horizon Coal Mine projects both prior to and after issuance of the Section 11 Order (October 2, 2008).
- PRC and WMFN have a mutual commitment to negotiate a relationship agreement or Memorandum of Understanding (MOU) and are working on a draft.
- WMFN has participated in a consultation process both directly with PRC as well as under the auspices of the BC EAO and the T8TA TAEG.
- In general, issues raised by WMFN have been largely focused on the government-mandated consultation process from exploration through closure and remediation as well as regional cumulative environmental and cultural effects on their members and their community.
- Concerns specific to the Project expressed by WMFN have included: the potential effects of the proposed development on caribou, water, and fish.

2.3.3.3 PRC Summary of Measures to Address WMFN Concerns

- PRC along with a number of other interested coal mining companies in the area agreed to co-fund, with the provincial government, a Coal Coordinator position for WMFN, to provide capacity to respond to regulatory applications, for a one-year term and to work together to identify long-term funding for the position.
- PRC discussed with WMFN and offered, on a number of occasions, a capacity funding agreement containing a mutually agreed scope-of-work that would include both the timing and cost of activities and deliverables, in support of WMFN participation in both TUS and the Project EA review process
- PRC followed the request of those T8TA First Nations defined in Schedule A of the Order under Section 11 in its efforts to work collectively, and to provide TUS and EA capacity funding collectively, through a mutually agreed scope-of-work agreement with TAEG of the T8TA, that would specify both the timing and cost of activities and deliverables. PRC has repeatedly offered to work with and provide capacity funding to those TAEG member First Nations as defined in Schedule A of the Order under Section 11, either collectively or individually, to document those First Nations' interests and use in the Project area. Besides this collective approach, PRC has also offered to provide capacity funding through negotiation of agreements with the individual First Nations. At the time of publication, a Project specific WMFN TUS was not available for consideration in this Application. PRC looks forward to the possible provision of additional information from each First Nation, and will continue to offer reasonable capacity support for WMFN TUS or other related studies to document and propose strategies to avoid or mitigate First Nations Interests and Use in relation to the Project. If received prior to construction, recommendations from such studies will be considered by PRC for inclusion in ongoing construction and operational management plans.

- In concert with preparation of the Wildlife section of the Project EA, PRC has developed a Wildlife Mitigation and Monitoring Plan including a specific Caribou Management Plan.
- Heritage resources are addressed in the archaeology and Traditional Land Use Site Protection Plan
- Air quality issues are addressed in the Air Quality and Dust Control Plan in the Application.
- The Reclamation Plan in the EA is largely driven by the high priority placed on caribou habitat end land-use objectives. There is also the Invasive Plant Management plan to address native plant protection.
- Water quality issues are addressed in the Water Management Plan and the Surface Water and Sediment Quality sections of the Application.

2.3.4 McLeod Lake Indian Band

2.3.4.1 Pre-application Consultation

Pre-section 11 Order—McLeod Lake Indian Band

From May 20, 2004 through October 2, 2008 there were more than 329 documented communications between PRC and MLIB. While the company presented the Project conceptually in power point presentations between 2004 and 2006, one of the first mention of the Project in the PRC MLIB contacts tracking record is March 14, 2007 at a PRC meeting with MLIB Chief at the Chetwynd Duz Cho Office. The approximately 212 or more communications from May 20, 2004 were primarily related to the Trend Coal Mine development, corporate issues and discussions regarding long-term employment and contracting opportunities for MLIB community and members.

At the March 14, 2007 meeting, there was discussion of discussion of MLIB traditional territory and land-use activities in general while PRC provided background information about Anglo American plc, the Trend Coal Mine and updates on both the Horizon Mine Coal Project and the Project environmental assessment (EA) schedules. PRC tenure maps including a general outline of the MLIB traditional territory were distributed.

On June 15, 2007 PRC met with MLIB at the BC Ministry of Environment office in Prince George. PRC provided an update about the Trend Coal Mine, the power line extension right-of-way (ROW) ILMB referral, and the Horizon and Roman project proposals. Materials distributed include Power-Point presentations on Trend, Horizon and Roman projects; maps of coal tenures and Trend Coal Mine power line alignment and revision of ROW; and, map of Trend, Horizon and Roman Coal Mine project areas.

The MLIB was represented at the June 20, 2007 meeting of the Northeast Mine Development Review Committee (NEMDRC) where PRC provided updates for the Trend, Horizon and Roman projects. Copies of maps and Power-Point presentations for these three PRC properties were distributed.

Consultation on the Project increased in mid 2007 with a July 11, 2007 meeting to discuss the Roman TUS and archeological work and other PRC projects with the MLIB. At this meeting, and as one way to address FN capacity building, PRC invited MLIB and offered to pay for hotel, travel and meal expenses for one member to attend the

Reclamation Symposium in Squamish. There was a discussion about available TUS information in the area. There was also a discussion regarding the potential for harmonization of data collection. For example, there might be efficiency in interviewing elders for multiple coal projects in a similar geographic area at the same time. Two MLIB elders and the Land Use Manager participated at this meeting. In addition to traditional land use, socio-economic studies and cumulative effects were also discussed. These discussions are reflected in EAO minutes for that meeting.

On August 30, 2007, PRC sent an email asking MLIB for input to the potential approach for a review of existing TUS data and data collection for TUS.

On August 14, 2007 PRC telephoned and emailed MLIB inviting Band representatives for a tour of Trend Coal Mine plus Horizon and Roman Coal Mine projects. On August 30, 2007, PRC sent an email asking MLIB for input to the potential approach for a review of existing TUS data and data collection for TUS.

A site visit was held on September 7, 2007 and lasted about four hours with three community representatives participating in the tour. Later in the month, MLIB participated in the Roman archaeology field assessment.

PRC and MLIB representatives attended a Reclamation Symposium in Squamish, British Columbia on September 19 and 20, 2007. During the symposium, PRC and MLIB had a couple of general discussions about the Project. Later on September 26, 2007, PRC's archaeology consultant firm Archer and MLIB participated in a NEMDRC meeting at the Quality Inn Northern Grande in Fort St. John. At the meeting, PRC provided an update on the Project and the status of the environmental baseline field program. The MLIB representatives asked about any tools or materials found; specifically if there was anything unique or exceptional. The answer was no, nothing unique or exceptional; findings were of lithic one-time use sites. PRC provided MLIB with copies of the NEMDRC Power-Point presentation material via letter on October 26, 2007.

The first Project EAO Working Group meeting was held in Fort St. John on November 14, 2007 at which time regional study area (RSA) maps, mine plan Project maps and a Project presentation was delivered. There was a discussion to review the existing TUS and socio-economic dataset and archaeology information. Due to confusion regarding venue, MLIB land representative did not attend the meeting in Fort St. John.

Early in January 2008, PRC asked MLIB if they would like to have a presentation on Anglo's SEAT program (Socio-Economic Assessment Toolbox) by an Anglo American representative from the London, UK office; they said yes. Two MLIB representatives met with PRC for that presentation on March 3, 2008. Along with the actual SEAT presentation, MLIB was provided copies of the SEAT Power Point and PRC projects area maps.

A Project traditional use study working group meeting with PRC and some First Nations, coordinated by the EAO, was held on February 21, 2008 as a follow up to the discussions of the November 2007 working group meeting. There was an overview and discussion on existing TUS information. In correspondence before the meeting (February 15 and 19) PRC proposed the attendance of MLIB elders at the meeting in an effort to include input from elders in the TUS planning process and offered to pay the cost for elders to attend. MLIB sent six representatives to this meeting; four elders and two land use staff. One MLIB elder provided a prayer to open the meeting. A MLIB elder made a suggestion around marking of cultural sites. PRC provided a cheque to MLIB to cover the elder's

honoraria for attending this meeting. These WG discussions are documented in EAO minutes for the meeting.

On March 6, 2008, MLIB said they would like to set up meetings with PRC's consultants to discuss the traditional use and socio-economic studies; PRC agreed to have Archer and Golder contact McLeod Lake. A meeting with Golder was held on March 11, 2008 in Vancouver and then on March 28, 2008 PRC, Golder and Archer met with MLIB at their Land Referral Office in Chetwynd. The March 11, 2008 meeting focused on the socio-economic effects assessment process and primary data collection methods, particularly those that could be used in the context of the Project and any future SEAT-type study. McLeod Lake indicated it was open to working with PRC on the socio-economic studies but needed more information. It was agreed that Golder would prepare a draft work plan to present and discuss with MLIB. The March 28, 2008 meeting focused on the Roman traditional use study in the context of a review of the Trend Coal Mine and Horizon project traditional use study work. It was decided that there would be no further traditional use studies but that McLeod Lake would provide traditional ecological knowledge (TEK) for the baseline and mitigation sections of the Application.

On April 16, 2008 MLIB confirmed in a telephone call with Golder Associates (consultants to PRC) that MLIB was interested in discussing with PRC how jobs and economic opportunities will be created for their community rather than participating in further socioeconomic studies as they felt the relevant data had been collected previously.

In a meeting in PRC's Vancouver office on May 1, 2008 MLIB representatives requested that the company contribute 25 percent of the cost of their coal coordinator position, in lieu of the government not providing any funding; a proposed budget was provided. PRC took the request under consideration. Subsequently, PRC worked with other coal mining companies to come to an agreement with government on providing funding for a coal coordinator position on a 50:50 (government: industry) basis.

From May 21 to 23, 2008 PRC telephoned and exchanged emails with MLIB representatives to try to arrange a meeting to introduce new PRC staff member who will be working on Aboriginal affairs issues over the coming 12–15 months. A meeting date of June 19, 2008 was agreed and the new PRC representative met with the new MLIB coal coordinator at the Land Referral (Duz Cho) office in Chetwynd.

In July, August and September 2008, there were a number of communications in regards to a possible McLeod Lake Elders-Youth field camp to the Project area. On September 4, 2008 it was decided that the proposed Elders-Youth TEK field camp could not be held due to the elders not being available and the lack of a community Youth Coordinator. There was a brief discussion on September 5, 2008 about McLeod Lake possibly doing a short community berry-picking field trip instead of the TEK camp; however, that did not come to fruition due to logistical issues both in the community and at site and other priorities for the community.

On September 25, 2008 PRC participated in a career fair in McLeod Lake with a display booth and hand-out information material about the company, the Trend Coal Mine, the Roman Coal Mine and employment opportunities; numerous resumes were received. The next day, September 26, PRC had an introductory meeting with the Chief at the MLIB office to discuss the company's operations and activities in the area, the Project, the existing community-company relationship, ways to improve the relationship and the idea of formalizing a relationship agreement in the near future.

Towards the end of September and early October 2008 there were a number of communications to arrange a conference call for early October to decide how to move forward with a community led traditional use study.

See Table 2.3-5 for selected pre-section 11 Order contact records for MLIB.

Post-section 11 Order—McLeod Lake Indian Band

Between October 2, 2008 and November 20, 2009 there have been about 123 or more documented communications between PRC and MLIB.

On October 3, 2008 PRC and MLIB held a conference call to talk about the traditional use studies. During the call it was recognized that the earlier concept of doing a community-led TUS had morphed into a community Elders' TEK exercise. It was decided that a site visit to the Trend and Roman Coal Mine projects by elders of the community was a good idea. This would be followed-up with an elders meeting in the community the next day. In addition, it was recognized that McLeod Lake community owned business might be looking for opportunities to work with or for PRC. As a follow-up to that meeting, on October 7, 2008 the MLIB Coal Coordinator emailed PRC a list of McLeod Lake businesses along with their business profiles.

PRC met with MLIB Coal Coordinator on October 9, 2008 at the Coal Forum in Chetwynd. The discussion was around planning for an elders' visit to the Trend and Roman Coal Mine project area as well as McLeod Lake's interest in caribou studies and site reclamation plans. On October 10, 2008 MLIB Coal Coordinator emailed to confirm the elders' site visit for October 16, 2008 with a follow-up session in the community on October 17, 2008.

The elders' site visit to the Trend and Roman Coal Mine project area went ahead as planned with five McLeod Lake elders plus Coal Coordinator participating. The site tour was in the morning of October 16, 2008 and in the afternoon PRC did a presentation on the Project with numerous photos followed by the elders talking about species, habitat and areas of concern to them; the session was videotaped. Then, on October 17, 2008 the elders met in the community for discussion and interviews about traditional ecological knowledge related to the site visit and the Project. In general, the concerns expressed were in regards to caribou, lichens, marmots and site reclamation plans; as before, the session was videotaped. It must be acknowledged that while consultants for PRC have a copy of the tapes, for confirming accuracy of information to be incorporated in the Project EA, the tapes and knowledge reflected in the tapes are the property of MLIB.

On October 27, 2008 PRC CEO and General Manager, wrote to the Chief and Council of MLIB offering to discuss additional capacity funding to facilitate the review of the Project EA Application. On the same date, PRC sent the first draft of the TOR to MLIB for comments.

PRC met with the Chief and two Councilors on November 5, 2008 at the MLIB office. The discussion was of the Project EA process, PRC's letter offering to discuss additional capacity funding for the Project EA application review and how to move forward on a possible PRC–MLIB framework relationship agreement.

Table 2.3-5 Selected Pre-section 11 Order Contact Records—McLeod Lake Indian Band

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
14 Mar 2007	Angela Waterman	Alec Chingee Bob Inkpen	Duz Cho Office, Chetwynd	MLIB traditional territory and activities; Anglo background; Trend operations; Horizon and Roman Coal Mine Project EA schedules	PRC property maps with outline of MLIB traditional territory
15 June 2007	Angela Waterman + Govt–Joe Truscott, Del Reinhiemer, Gabi Matscha, Dennis Fudge, John DeGrace	Verne Solonas	MOE–Prince George office	Trend Coal Mine, powerline extension ROW, ILMB referral, Horizon and Roman Coal Mine Project proposals	Power-Point presentations on Trend, Horizon and Roman plus powerline and ROW revision; project maps
20 June 2007	Angela Waterman Pat Wong	Verne Solonas	George Dawson Inn, Dawson Creek	NEMDRC meeting–updates on Horizon and Roman projects	Power-Point presentations and maps on Trend, Horizon and Roman
11 July 2007	Angela Waterman	Verne Solonas Arlene Solonas Geraldine Solonas	McLeod Lake Land Office	Roman and Horizon EAO sub-working group mtg.–traditional land use, socio-ec and cumulative impacts	
14 Aug 2007	Angela Waterman	Cheryl Chingee	Telephone and email	Invite MLIB representatives for site visit	
07 Sep 2007	Angela Waterman	Cheryl Chingee Jenine Solonas Margie Alec	Trend Coal Mine + site visit	Tour–Trend Coal Mine + Roman and Horizon projects	
19 Sep 2007 20 Sep 2007	Angela Waterman	Geraldine Solonas Cheryl Chingee	Meeting and Lunch Squamish	Reclamation Symposium General discussions on the Project	
26 Sep 2007	Angela Waterman Archer–Remi Farvacque	Cheryl Chingee	Quality Inn Northern Grande, FSJ	NEMDRC mtg–Roman proj. update; environmental field program; lithic one-time use sites	

Table 2.3-5 Selected Pre-section 11 Order Contact Records—McLeod Lake Indian Band (cont'd)

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
11 Oct 2007	Angela Waterman	Cheryl Chingee Margie Alec	Tumbler Ridge community center	Coal Forum–social encounter	
15 Oct 2007	Angela Waterman	Cheryl Chingee	Sent letter		NEMDRC ppt slide presentation
18 Jan 2008	Angela Waterman	Cheryl Chingee	Sent email	Asked if MLIB would like a meeting and presentation by Jon Samuel of Anglo (Ldn) re SEAT–Mar 3	
14 Feb 2008 15 Feb 2008	Angela Waterman	Cheryl Chingee	Email exchange Conference call	MLIB confirm attend Feb 21 mtg and Mar 3; agree 2 elders to attend Feb 21 Roman TUS meeting; reimbursement;	
21 Feb 2008	Angela Waterman	Cheryl Chingee Verne Solonas Michael Solonas Lawrence Solonas Albert Solonas Veronica Solonas	Fort St. John Northern Grande Quality Inn	EAO Roman Traditional Use Study working group meeting	PRC cheque for MLIB attendance, Golder TUS overview presentation
03 Mar 2008	Angela Waterman	Cheryl Chingee Verne Solonas	Fort St. John Peace Cultural Centre	Introduction to Anglo and SEAT by Jon Samuel; economic benefits	Distributed project area maps and power point presentation
06 Mar 2008	Angela Waterman	Cheryl Chingee Verne Solonas	Email exchange	MLIB request meeting to discuss TLU and socio-economic studies; Archer (RF) and Golder (PM) to contact	

Table 2.3-5 Selected Pre-section 11 Order Contact Records—McLeod Lake Indian Band (cont'd)

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
11 Mar 2008	Pascale Mera (Golder)	Cheryl Chingee Verne Solonas	Richmond Restaurant	Socio-ec effects assessment process and data collection; questions re amount of time–field seasons; MLIB open to participating but need more info; Golder to prepare draft workplan to review	
28 Mar 2008	Angela Waterman Craig Candler (Golder) and Remi Farvacque (Archer)	Cheryl Chingee Verne Solonas	MLIB Land Referral Office - Chetwynd	Review of Trend and Horizon TUS; Roman TUS scoping?; TEK for providing baseline and mitigation report for Roman EA	
10 Apr 2008	Angela Waterman	Verne Solonas	Email exchange	Letter re: TUS/TEK for PRC projects	
16 Apr 2008	Angela Waterman	Verne Solonas	Telephone call	MLIB confirms not interested in doing community-based data collection from the Project; focus efforts on jobs and procurement opportunities; decision in writing to follow	
01 May 2008	Angela Waterman	Joe Gosnell Verne Solonas	Meeting at PRC office	MLIB request 25% funding for 2008 coal coordinator position as government is not providing funds	MLIB tabled proposed budget
21 May 2008	Angela Waterman Michael Cunningham	Verne Solonas Cheryl Chingee	Telephone and email	Discuss PRC meeting June 12-20, 2008	
23 May 2008	Angela Waterman Michael Cunningham	Vern Solonas	Email exchange	Set meeting June 19 in Chetwynd; Jennifer Weightman is new MLIB coal coordinator	

Table 2.3-5 Selected Pre-section 11 Order Contact Records—McLeod Lake Indian Band (cont'd)

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
19 Jun 2008	Michael Cunningham	Jennifer Weightman Verne Solonas	MLIB Land Referral–Duz Cho office Chetwynd	Introductory meeting and general discussion	
02 July 2008 08 July 2008	Michael Cunningham Remi Farvacque (Archer)	Jennifer Weightman	Email exchange + telephone	MLIB request contact to arrange recon for Elders-Youth TEK field camp/trip; PRC facilitate	
21 Aug 2008	Michael Cunningham	Verne Solonas	Email	PRC request update on progress on Elders-Youth TEK field camp/trip	
30 Aug 2008	Angela Waterman	Cheryl Chingee Verne Solonas	Email sent and telephone message left	PRC to focus on Project; request confirmation of joint PRC-WCC socio-economic study and joint Roman-Horizon TUS study using Trend TLU information	
04 Sep 2008	Michael Cunningham	Jennifer Weightman	Email exchange	PRC request confirmation of Elders-Youth TEK field camp; MLIB said it is a NO-GO as no Youth Coordinator and elders unavailable	
05 Sep 2008	Michael Cunningham	Jennifer Weightman	Email exchange	may do short berry picking field trip	
19 Sep 2008	Michael Cunningham	Verne Solonas	Email	PRC request meeting with new Chief Derek Orr	
25 Sep 2008	Michael Cunningham Amber Harker	Verne Solonas	McLeod Lake community hall	Career Fair display booth; met community members to discuss job opportunities	
26 Sep 2008	Michael Cunningham	Chief Derek Orr Verne Solonas	McLeod Lake	Introductory meeting; PRC tabled idea of a formal relationship agreement: Chief to take to Council	

Table 2.3-5 Selected Pre-section 11 Order Contact Records—McLeod Lake Indian Band (cont'd)

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
26 Sep 2008	Michael Cunningham	Jennifer Weightman	Email	MLIB agree with proposal for conf call re TUS	
01 Oct 2008	Michael Cunningham	Jennifer Weightman	Email exchange	TUS conference call set for Oct 2nd	
NOTE: October 2, 2008—Section 11 Order issued for the Project					

Another EAO Working Group meeting was held in Fort St. John on November 14, 2008. This meeting was primarily to review the TOR and baseline work plans. MLIB sent a representative to this meeting. These WG discussions are documented in EAO minutes for the meeting. This meeting was followed by a WG meeting on December 2, 2008 also in Fort. St. John. The purpose of this meeting was to provide the Aboriginal groups, who were unable to attend the November 14, 2008 meeting, another opportunity to obtain information from EAO and PRC, review the TOR and baseline work plans. As MLIB already attended the November 14, 2008 meeting, MLIB did not send a representative to this meeting.

On January 26, 2009 PRC sent the MLIB Chief and Council a letter via post, fax and email following up on the October 27, 2008 letter again offering to discuss additional capacity funding support for the Project EA; this letter was sent as there had been no response the earlier letter of offer.

On February 16, 2009 PRC sent the second draft of the TOR reflecting comments from the WG to MLIB for comments.

On February 26, 2009 PRC met with Chief and Council the MLIB office. There was discussion of PRC's letter of offer for the Project EA capacity funding and it was decided that PRC would send a draft agreement for MLIB to review. There was a long discussion about a possible relationship agreement, it's possible goals and objectives, and what the community might like to see in such an agreement. It was agreed PRC would prepare a draft to send to Chief and Council for their consideration. A draft Project EA capacity funding agreement was sent by PRC to MLIB via email on March 16, 2009.

On April 29, 2009 PRC sent the draft Roman EA Consultation Report to MLIB Chief and Coal Coordinator by email and mail for comments. In response, MLIB sent a request for more information on caribou in order to participate in Roman EA review. On May 21, 2009, PRC provided a statement of commitment to working with MLIB on issues of concern and outline ongoing caribou research and caribou mitigation and monitoring plan to be submitted in the Roman EA.

On June 5, 2009, PRC communicated to MLIB Coal Coordinator by email to reiterate desire to discuss Roman EA review capacity funding and MLIB and PRC met on June 10, 2009 to discuss these items. On June 11 and 18, 2009, PRC outlined the potential funding mechanisms for providing capacity including MOU and coal coordinator funding. PRC sent an additional email to MLIB to request meeting to discuss capacity funding for Roman EA on July 8, 2009.

PRC hosted a tour of Project area and the Trend Coal Mine on July 29, 2009. Five MLIB community members attended including three elders, the Coal Coordinator and the Land Use Manager. There were discussions regarding reclamation, wildlife (marmots, caribou), vegetation (lichen, grasses) as well as questions around mining equipment specifications and water management structures. Questions were answered in the meeting and are addressed in the Application in the Project description section and the various Environmental Management Plans.

On September 2, 2009, PRC tabled the draft MOU which included EA capacity funding. The next day, PRC followed up with asking MLIB for comments on the MOU draft.

From the period 2007 to 2009 alone, PRC has documented 252 interactions with MLIB. In addition to the general consultation on the Roman EA, PRC has documented over 27 TUS related communications with MLIB in the form of emails, letters, telephone calls

and meetings which resulted in a MLIB TUS report submitted with this Application and comments to the draft EA Consultation Report. In PRC's opinion, a substantive level of effort has been made to consult with the MLIB on the Project, particularly in respect obtaining the traditional land use information.

See Table 2.3-6 for selected post-section 11 Order contact records for MLIB.

2.3.4.2 McLeod Lake Indian Band Summary of Issues and Concerns

- PRC has had numerous discussions, meetings and exchange of emails with representatives of MLIB in an open dialogue on issues regarding the Project as well as the Trend and the Horizon Coal Mine project both before and after issuance of the Section 11 Order (October 2, 2008).
- PRC and MLIB have a mutual commitment to negotiate a framework relationship agreement or Memorandum of Understanding (MOU) and are working on a draft.
- MLIB has participated in a consultation process directly with PRC and the BC EAO.
- Issues raised by MLIB have been primarily about the Project's potential effects on caribou, caribou habitat and the connectivity of caribou habitat as well as on remediation and water systems.

2.3.4.3 PRC Summary of Measures to Address MLIB Concerns

- PRC along with a number of other interested coal mining companies in the area agreed to co-fund, with the provincial government, a Coal Coordinator position for MLIB, to provide capacity to respond to regulatory applications, for a one-year term and to work together to identify long-term funding for the position.
- MLIB has submitted traditional use and knowledge information for the Roman EA Certificate Application with the financial, technical and logistical support of PRC including a site visit and multi-media documentation.
- After discussions regarding the Project and at the request of MLIB, PRC submitted for consideration a draft capacity funding agreement, with a scope-of-work that included both the timing and cost of activities and deliverables, in support of the community's participation in the Project EA review process.
- In concert with preparation of the Wildlife section of the Project EA, PRC has developed a Wildlife Mitigation and Monitoring Plan including a specific Caribou Management Plan.
- Heritage resources are addressed in the archaeology and Traditional Land Use Site Protection Plan
- Air quality issues are addressed in the Air Quality and Dust Control Plan in the Application.
- The Reclamation Plan in the EA is largely driven by the high priority placed on caribou habitat end land-use objectives. There is also the Invasive Plant Management plan to address native plant protection.
- Water quality issues are addressed in the Water Management Plan and the Surface Water and Sediment Quality sections of the Application.

Table 2.3-6 Selected Post-section 11 Order Contact Records—McLeod Lake Indian Band

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
03 Oct 2008	Michael Cunningham Scott Trusler Craig Candler (Golder)	Jennifer Weightman	Telephone conference call	Various–TUS, elders' Trend-Roman site visit, list of band-owned businesses	
07 Oct 2008	Michael Cunningham	Jennifer Weightman	Email	Company profiles of MLIB owned businesses	Company business profiles
09 Oct 2008	Michael Cunningham Scott Trusler	Jennifer Weightman	Meeting–NE Coal Forum in Chetwynd	Planning for elders' Roman site visit and community meeting; MLIB asked about caribou studies and site reclamation plans	
10 Oct 2008	Michael Cunningham	Jennifer Weightman	Email	Confirmation of elders' site visit Oct 16 and follow-up mtg in community on Oct 17	
16 Oct 2008	Adriana MacLeod Ian MacLeod Towagh Behr (Golder)	Jennifer Weightman + elders (5)	Meeting–Trend and Roman Coal Mine project site	Site tour in am; presentation in pm; elders talked about species, habitat and areas of concern	Video taped
17 Oct 2008	Adriana MacLeod	Jennifer Weightman Verne Solonas Alec Chingee + elders	Meeting–McLeod Lake	Elders from site tour participated in interviews for Roman TEK study; elders concerns related to caribou, lichens, marmots and reclamation	Video taped
27 Oct 2008	Scott Trusler Adriana MacLeod	Chief Derek Orr	Registered mail	PRC letter offer of capacity funding for Roman EA process	Offer letter and Roman draft Terms of Reference
05 Nov 2008	Michael Cunningham	Chief Derek Orr Councilors Josie Tylee and Destiny Bear	Meeting–McLeod Lake band office	Roman EA process and PRC capacity funding offer (letter); no position yet on PRC idea for a formal relationship agreement	

Table 2.3-6 Selected Post-section 11 Order Contact Records—McLeod Lake Indian Band (cont'd)

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
14 Nov 2008	Scott Trusler Adriana MacLeod Michael Cunningham Kevin Sharman Bill Murphy	Jennifer Weightman	EAO WG meeting Fort. St, John	EAO WG meeting Fort. St, John TOR baseline work plans	
28 Nov 2008	Scott Trusler	Jennifer Weightman	Telephone and Email	PRC sent map of properties as requested	
03 Dec 2008	Scott Trusler	Jennifer Weightman	Telephone call	PO/invoice for elders' Roman/Trend site visit and follow-up mtg;	
11 Dec 2008	Michael Cunningham	Chief Derek Orr	Email	PRC request meeting before holidays or early in New Year - 2009	
17 Dec 2008	Scott Trusler	Jennifer Weightman	Telephone call	PRC asked for meeting in Jan 2009	
22 Jan 2009	Michael Cunningham	Chief Derek Orr	Email	Follow-up to request for meeting	
26 Jan 2009	Scott Trusler Adriana MacLeod	Chief Derek Orr	Via post, fax and email	Follow-up to 27 Oct 2008 letter offering capacity funding for Project review	Letter sent via post, fax and email
05 Feb 2009 + 06 Feb 2009	Michael Cunningham	Chief Derek Orr	Email exchange	MLIB confirm Feb 11 mtg; request e-copy of draft; PRC–no draft to table–need to discuss items before draft; proposed agenda–Roman capacity funding letters + items for draft agreement	
09 Feb 2009	Michael Cunningham	Chief Derek Orr Jennifer Weightman	Phone call and emails	MLIB–death in the community requires Feb 11 mtg to be rescheduled; PRC–condolences and open to new mtg date	
16 Feb 2009	Adriana MacLeod	Chief Derek Orr	mail	TOR	second draft TOR

Table 2.3-6 Selected Post-section 11 Order Contact Records—McLeod Lake Indian Band (cont'd)

Date	PRC rep	MLIB rep	Location	Key Topics	Materials
26 Feb 2009	Michael Cunningham	Chief Derek Orr + Councilors Josephine Tylee, Destiny Bear, Jenine Solonas and Fred Ingallie	Meeting at McLeod Lake band office	PRC to draft and send Roman EA capacity agreement for review; discussion of issues and process for relationship agreement / MOU; terms of reference for coal coordinator position co-funded by government and NECC	
16 Mar 2009	Michael Cunningham	Chief Derek Orr + Councilors Josephine Tylee, Destiny Bear, Jenine Solonas and Fred Inyallie	Email	PRC sent draft capacity funding agreement re the Project for review	Draft Roman EA capacity funding agreement
29 Apr 2009	Scott Trusler	Derek Orr Jennifer Weightman	Email and mail	Draft Roman EA Consultation Report sent for comments	Draft Roman EA Consultation Report

2.3.5 Doig River First Nation

2.3.5.1 Pre-application Consultation

Pre-section 11 Order—Doig River First Nations

There is no record of direct contact or communication between PRC and DRFN from January 1, 2006 to just before issuance of the Project Section 11 Order by the EAO. DRFN is a member of T8TA and a participant in TAEG. The DRFN would have received notice of meetings between PRC and the T8TA-TAEG, from the T8TA EA Coordinator, and they participated in at least one such meeting on September 22, 2008.

See Table 2.3-7 for selected pre-section 11 Order contact records for DRFN.

Table 2.3-7 Selected Pre-section 11 Order Contact Records—Doig River First Nation

Date	PRC rep	FN rep	Location	Key Topics	Materials
22 Sep 2008	Scott Trusler Michael Cunningham + consultants John Errington and Craig Candler (Golder)	Jane Calvert (DRFN) Chief Harley Davis (SFN) Bruce Muir (WMFN) Tamara Dokkie (T8TA)	T8TA office in Fort St John	Project update; T8TA-TAEG joint TUS; FNs capacity issues; FNs concerns re EA process	
NOTE: October 2, 2008—Section 11 Order issued for the Project					

Post-section 11 Order—Doig River First Nations

Since issuance of the Project Section 11 Order, PRC has tried to engage DRFN twice with an offer to discuss additional capacity funding for community participation in the Roman EA process. The offer was sent via mail, fax and email on October 27, 2008 along with the Project draft Terms of Reference.

The offer was sent again on January 26, 2009.

On April 29, 2009 PRC sent the draft Roman EA Consultation Report to DRFN Chief and staff by email and mail for comments. At the time of submission of this EA Application, PRC had received no comments regarding the draft consultation report from DRFN. Should comments be received after submission of the application, PRC will provide them to the BC EAO for consideration during the application review period.

See Table 2.3-8 for selected post-section 11 Order contact records for DRFN.

Table 2.3-8 Selected Post-section 11 Order Contact Records—Doig River First Nation

Date	PRC rep	FN rep	Location	Key Topics	Materials
27 Oct 2008	Scott Trusler	Chief Norman Davis	Email and mail	Offer of EA capacity funding re the Project	Letter and email + Project draft terms of reference
26 Jan 2009	Scott Trusler Adriana MacLeod	Chief Norman Davis	Email, mail and fax	Follow-up re capacity funding offer	Letter and emails sent
29 Apr 2009	Scott Trusler	Chief Norman Davis / Jane Calvert	Email and mail	Draft Roman EA Consultation Report sent for comments	Draft Roman EA Consultation Report

2.3.5.2 Doig River First Nation Summary of Issues and Concerns

PRC has tried to directly engage in consultation with DRFN and has been available for meetings arranged through the T8TA, under the auspices of TAEG, of which DRFN is a member.

PRC has received no information or communications from DRFN regarding the Project.

2.3.5.3 PRC Summary of Measures to Address DRFN Concerns

DRFN has not identified issues or concerns regarding the Project therefore there is nothing specific to address beyond what is covered elsewhere in this section.

2.3.6 Halfway River First Nation

2.3.6.1 Pre-application Consultation

Pre-section 11 Order—Halfway River First Nation

From May 24, 2007 through October 2, 2008 there were about 30 or more documented communications between PRC and HRFN. The first record in the PRC HRFN contacts database is from May 24, 2007 when PRC consultant ARCAS contacted the community in regards to a heritage permit application.

PRC met with HRFN representatives on July 11, September 19 and 26, 2007.

The July 11, 2007 meeting involved discussions on the Roman TUS and archeological work and other PRC projects with the HRFN. At this meeting, and as one way to address FN capacity building, PRC invited HRFN and offered to pay for hotel, travel and meal expenses for one member to attend the Reclamation Symposium in Squamish. There was a discussion about available TUS information in the area. There was also a discussion regarding the potential for harmonization of data collection. For example, there might be efficiency in interviewing elders for multiple coal projects in a similar geographic area at the same time. The HRFN Lands Manager participated at this meeting. HRFN had questions around operations (waste production and coal extraction) and identification of

wildlife use in an area. PRC and its consultant provided responses at this meeting. In addition to traditional land use, socio-economic studies and cumulative effects were also discussed. These discussions are reflected in EAO minutes for that meeting.

On August 30, 2007, PRC sent an email asking HRFN for input to the potential approach for a review of existing TUS data and data collection for TUS.

The September 19, 2007 meeting was at a Reclamation Symposium and the discussion was of the Project TUS and archeology work while the meeting on September 26, 2007 was a North East Mine Development Review Committee (NEMDRC) meeting where PRC provided a Project update, schedule and summary of baseline data.

PRC visited the HRFN band office on October 22, 2007 to meet with the Chief and other community representatives. PRC gave them an overview of the company and Anglo American plc as well as the Trend Coal Mine and the Roman and Horizon projects. HRFN was given copies of PRC's tenure maps as well as RSA maps.

The first Project EAO Working Group meeting was held in Fort St. John on November 14, 2007 at which time RSA maps, mine plan Project maps and a Project presentation was delivered. There was a discussion to review the existing TUS and socio-economic dataset and archaeology information. The draft Archaeological Impact Assessment was presented to the First Nations for their review and comment. The HRFN Land Manager commented that traditional use, archaeology and socio-economics studies are complementary and important to the EA process. A presentation to provide an overview of the socio-economic and traditional land use and interests work was prepared. The first slide generated much comment on TUS between the First Nations representatives, the EAO and PRC. These November 2007 discussions are documented in EAO minutes for the meeting.

A Project traditional use study working group meeting with PRC and some First Nations, coordinated by the EAO, was held on February 21, 2008 as a follow up to the discussions of the November 2007 working group meeting. There was an overview and discussion on existing TUS information. In correspondence before the meeting (February 15 and 19) PRC proposed the attendance of HRFN elders at the meeting in an effort to include elder's input to the TUS planning process and offered to pay the cost for elders to attend. Although SFN and MLIB sent elders, HRFN did not send elders to this meeting. HRFN stated that elders consider effects on the land first before they consider the Project itself. They are more concerned with how the land can be effected. PRC provided a cheque to HRFN to cover the representative's travel expenses and a per diem for attending this meeting. SFN, WMFN, HRFN and KLMSS had a meeting outside the EAO-led meeting and stated that by March 20, 2008, they would provide input to the EAO on a proposed third party TUS process that could be applied to the Project. These WG discussions are documented in EAO minutes for the meeting.

On May 22, 2008 PRC mailed and emailed a letter to HRFN reaffirming the company's willingness to provide TUS capacity funding, restating a specific proposal and also to advance a potential 2008 TUS field program.

See Table 2.3-9 for selected pre-section 11 Order contact records for HRFN.

Table 2.3-9 Selected Pre-section 11 Order Contact Records—Halfway River First Nation

Date	PRC rep	HRFN rep	Location	Key Topics	Materials
24 May 2007	Rizwaan Abbas (ARCAS)	Bernice Lilly	Email and telephone	ARCAS heritage permit application	
11 July 2007	Angela Waterman	Tina Gillanders	EAO sub-working group meeting in McLeod Lake	TUS, SIA and cumulative effects re Roman and Horizon	Maps
15 Aug 2007	Angela Waterman	Tina Gillanders	Email exchange	Reclamation Symposium, PRC sponsor and meeting	
19 Sep 2007	Angela Waterman	Tina Gillanders	Meeting at Reclamation Symposium in Squamish	Roman TUS and archeology	Project description
26 Sep 2007	Angela Waterman	Tina Gillanders	NEMDMC meeting in Fort St. John	Project update, schedule and baseline data	
22 Oct 2007	Angela Waterman	Chief Gerry Hunter Tina Gillanders Francis Field	Meeting at HRFN Band Office	Overview of PRC, Anglo, Trend Coal Mine, Roman and Horizon projects	Tenure and RSA maps
14 Nov 2007	Angela Waterman Steve Amor Trevor Learey + ST, CC, JT, RF	Tina Gillanders	Meeting in Fort St. John–Quality Inn Northern Grande	First EAO–Roman Working Group meeting	RSA and mine maps; ppt presentation
15 Feb 2008	Angela Waterman	Tina Gillanders	Emails	PRC invited, and offered to pay for elders to attend Feb.21 Roman EAO TUS meeting	
21 Feb 2008	Angela Waterman	Tina Gillanders	Meeting in Fort St. John–Quality Inn	Roman TUS Working Group - EAO	PRC cheque for HWFN attendance, Letter offer funding for TUS, Golder TUS overview presentation
22 May 2008	Angela Waterman Michael Cunningham	Tina Gillanders	Email and mail	Confirm PRC capacity funding for Roman TUS	
NOTE: October 2, 2008—Section 11 Order issued for the Project					

Post-section 11 Order—Halfway River First Nation

Between October 2, 2008 and April 29, 2009 there have been approximately thirteen documented communications between PRC and HRFN.

On October 27, 2008 PRC offered capacity funding for Roman EA and provided the first draft Terms of Reference.

Another EAO Working Group meeting was held in Fort St. John on November 14, 2008. This meeting was primarily to review the TOR and baseline work plans. HRFN did not send a representative to this meeting. These WG discussions are documented in EAO minutes for the meeting. This meeting was followed by a WG meeting on December 2, 2008 also in Fort. St. John. The purpose of this meeting was to provide the Aboriginal groups, who were unable to attend the November 14, 2008 meeting, another opportunity to obtain information from EAO and PRC and to review the draft TOR and baseline work plans. HRFN did not send a representative to this meeting.

On January 26, 2009 PRC sent the Chief of HRFN a letter via post, fax and email following up on the October 27, 2008 letter again offering to discuss additional capacity funding support for the Project EA; this letter was sent as there had been no response the earlier letter of offer.

There were a number of discussions between HRFN and PRC in February 2009 around Roman EA capacity funding.

PRC met with HRFN representatives at their Lands Office on March 26, 2009. PRC provided a Power-Point presentation overview of the Project and the EA process. It was agreed that PRC should send the community a draft capacity funding agreement for community participation in the Project EA process; this was done via email on April 15, 2009. At the March 26 meeting, HRFN outlined the strengths and expertise of its community businesses for consideration by PRC.

On April 29, 2009 PRC sent the draft Roman EA Consultation Report to HRFN Chief and staff by email and mail for comments. At the time of submission of this EA Application, PRC had received no comments regarding the draft consultation report from HRFN. Should comments be received after submission of the application, PRC will provide them to the BC EAO for consideration during the application review period.

See Table 2.3-10 for selected post-section 11 Order contact records for HRFN.

2.3.6.2 Halfway River First Nation Summary of Issues and Concerns

- PRC has tried to directly engage in consultation with HRFN and has been available for meetings arranged through the T8TA, under the auspices of TAEG, of which HRFN is a member.
- HRFN has expressed a desire to participate in the Project EA process but say they do not have the capacity to do so.
- HRFN has expressed interest in knowing about employment and contracting opportunities that may be available from the Project and have provided information about their companies and expertise.

- Issues raised by HRFN about the Project are focused on water, in particular, the potential for mine contaminants to leach into the local water system and the need for water quality monitoring.

Table 2.3-10 Selected Post-section 11 Order Contact Records—Halfway River First Nation

Date	PRC rep	HRFN rep	Location	Key Topics	Materials
27 Oct 2008	Scott Trusler Adriana MacLeod	Chief Ed Whitford	Email and mail	PRC letter offer of capacity funding for Roman EA process	Offer letter and Roman draft Terms of Reference
26 Jan 2009	Scott Trusler Adriana MacLeod	Chief Ed Whitford	Email and mail	Follow-up to PRC 27 Oct 2008 letter offering capacity funding for Project review	Letter sent via post, fax and email
26 Mar 2009	Scott Trusler Michael Cunningham	Roslyn Pokiak Frances Field Jim Burks	Meeting at HRFN band office	Project update, ppt and EA process; PRC to send draft capacity funding agreement; economic opportunities and HRFN companies	
15 April 2009	Michael Cunningham	Roslyn Pokiak Frances Field	Email	PRC sent HRFN a draft Roman EA capacity funding agreement	
29 Apr 2009	Scott Trusler	Chief Ed Whitford / Roslyn Pokiak	Email and mail	Draft Roman EA Consultation Report sent for comments	Draft Roman EA Consultation Report

2.3.6.3 PRC Summary of Measures to Address HRFN Concerns

- PRC has offered, on a number of occasions, to discuss with HRFN, negotiation of a capacity funding agreement containing a mutually agreed scope-of-work that would specify both the timing and cost of activities and deliverables, in support of HRFN participation in both TUS and the Project EA review process.
- After discussion and at the request of HRFN, PRC has submitted a draft capacity funding agreement for the Project EA review process, for consideration by the community.
- PRC followed the request of those T8TA First Nations defined in Schedule A of the Order under Section 11 in its efforts to work collectively, and to provide TUS and EA capacity funding collectively, through a mutually agreed scope-of-work agreement with TAEG of the T8TA, that would specify both the timing and cost of activities and deliverables. PRC has repeatedly offered to work with and provide capacity funding to those TAEG member First Nations as defined in Schedule A of the Order under Section 11, either collectively or individually, to document those First Nations' interests and use in the Project area. Besides this collective approach, PRC has also offered to provide capacity funding through negotiation of agreements with the individual First Nations. At the time of publication, a Project specific HRFN TUS was not available for consideration in this Application. PRC looks forward to

the possible provision of additional information from each First Nation, and will continue to offer reasonable capacity support for HRFN TUS or other studies to document and propose strategies to avoid or mitigate First Nations Interests and Use in relation to the Project. If received prior to construction, recommendations from such studies will be considered by PRC for inclusion in ongoing construction and operational management plans.

- In concert with preparation of the Wildlife section of the Project EA, PRC has developed a Wildlife Mitigation and Monitoring Plan including a specific Caribou Management Plan.
- Heritage resources are addressed in the archaeology and Traditional Land Use Site Protection Plan
- Air quality issues are addressed in the Air Quality and Dust Control Plan in the Application.
- The Reclamation Plan in the EA is largely driven by the high priority placed on caribou habitat end land-use objectives. There is also the Invasive Plant Management plan to address native plant protection.
- Water quality issues are addressed in the Water Management Plan and the Surface Water and Sediment Quality sections of the Application.

2.3.7 Summary of Issues and Concerns Identified during the Pre-application Period—First Nations

Based upon communications, consultations and engagement with First Nations, the following issues have been identified as of common concern and are addressed in the Project EA Application:

- Water quality
- Fish and fish habitat
- Potential for acid generation (PAG) and leaching
- Coal dust management
- Soil erosion
- Caribou and caribou habitat
- Five Cabin drainage
- Progressive reclamation
- Cultural and traditional use sites

In addition to the above summary of issues of common concern, First Nations that engaged with PRC raised a number of additional issues of concern to their communities and their members that are not specific to PRC or to the Project and Terms of Reference:

- Cumulative effects assessment
- Cultural effects assessment or cultural integrity analysis
- Community capacity building and long-term projects EA capacity funding

PRC has offered to discuss, negotiate and provide, and has provided where possible, additional capacity funding for Project-related community-based TUS and TEK work as well as for participation in the Project EA Review process. However, PRC understands that the First Nations feel that their fundamental concerns on the larger, broader-scope issues identified above have not been fully addressed or satisfied at this time, and requires separate discussions with EAO outside the review of this Project EA.

2.3.8 Summary of Measures to Address Issues or Concerns Identified during the Pre-application Period—First Nations

In order to address key issues of common concern, the Project has been refined and a process of mitigation by design has been put in place. To that end, amongst others, the following mine design changes have been incorporated:

- reduce total mine footprint (890 to 811 ha)
- maximize dumping on existing Trend disturbance (39 percent overlap)
- remove rock drain dump from Babcock Creek
- move to in-pit tailings storage
- avoid Five Cabin Creek drainage
- minimize loss of high value caribou habitat wherever possible
- maximize Reclamation Plan for caribou habitat end-use objectives
- select covered coal stockpiles or silos at plant and load-out
- build new higher efficiency plant for increased coal recovery
- increase process water recovery from tailings ponds up to 90 percent
- use Trend-bypass road to haul coal from plant to rail load-out

These and other mitigative measures are explained within Section 5 of this Application (Environmental Management Plans). In regard to the identified issues of concern listed above, the following topics are included in Section 5 (amongst others):,Wildlife Monitoring and Protection Plan, Air Quality and Dust Control Plan, Surface Erosion and Sediment Control Plan. The Reclamation Plan is presented in Section 4.12.

With respect to additional issues of concern identified by First Nations (Section 2.3.7 above), PRC has taken direction from the Project Section 11 Order, the Project Terms of Reference and the EAO in regards to obligations under the BCEAA to consider heritage, social, economic, environmental and health effects. The Project Terms of Reference directs PRC to describe information about First Nations customs and practices for the purpose of better understanding First Nations Treaty rights and interests. This then facilitates determination of the project's potential effects on those rights and interests. PRC is addressing this requirement in the EA Application.

PRC respects the concerns of the First Nations regarding issues of core community capacity building, long-term capacity funding deficiencies, cultural effects and cumulative effects assessment. However, PRC views these as outside the Project scope and that the company has done what it can as a single proponent working under legislated processes on one Project environmental assessment application. PRC suggests these

larger, broader-scope issues identified by First Nations can only to be resolved in discussion between First Nations and federal and provincial government agencies.

2.3.9 Issues Resolution Process—First Nations

Based upon the level of pre-Application consultation, the early identification of issues of concern by interested parties and the work undertaken by PRC and its consultants to address them, PRC believes that the issues identified during the pre-Application stage have been satisfactorily addressed in the Project EA Application.

Nonetheless, there may be some issues that some parties feel may require clarification or further consideration. It is also possible that new issues may arise during the EA Application Review stage. PRC will work diligently to address these issues promptly through direct consultations with the concerned parties will commit to provide written responses as required by BC EAO.

PRC will use the Application Review period consultation to engage, listen and respond to First Nations regarding issues the First Nations identify as unresolved.

2.3.10 Application Review Period Consultation Plan—First Nations

The purpose of the First Nations consultation plan is to provide First Nations with the information they need, about the Project and the Application, to participate in the Application Review. The purpose is also to provide First Nations with an opportunity to identify their treaty rights and interests and provide meaningful input to the review, including the ability to discuss how their issues and concerns are being addressed and integrated into the design, construction and operation of the Project, where appropriate.

The EAO's Section 11 Order states that at least one formal public comment period of 45 days will be established by the Project Assessment Manager. The BC EAO will also advise how many public Open House sessions it will hold during the public comment period and where they are to be located. PRC will cooperate with the EAO in arranging the Open House sessions and First Nations will be invited to attend. These Open House sessions will be advertised in local newspapers and radio within adequate time period as directed by EAO. In addition, PRC will provide notification of the Open House sessions to First Nations via fax and email. At these sessions, PRC will describe the Project and the EA Certificate Application. The company will also identify issues that were raised during the pre-Application phase and show how they have been addressed in the EA Certificate Application. Open House participants, First Nations, Kelly Lake Communities, the Public and Stakeholders will be encouraged to provide comments with respect to Project plans and designs during the review.

PRC will record and track comments, issues and concerns raised at these sessions, working group meetings and meetings with First Nations as well as the proponent's position or response to that item, in an issues tracking management log that will be summarized in a report to be provided to the EAO within the time limits set by the EAO Project Assessment Manager. This summary report will contain a listing of meetings and presentations made to First Nations, Kelly Lake Communities, the Public and Stakeholders, and Tribal Associations; copies of meeting sign-up sheets from Open House sessions and in-community meetings with First Nations and Kelly Lake Communities; the issues tracking management log; and, copies of written comments, questions and responses.

As members of the Project EA Working Group, First Nations have the opportunity to participate in the technical presentations on the Project, and will be able to discuss the Project and the EA Application with government agencies and PRC representatives. Each First Nation community identified in the Section 11 Order will be provided with one community hard copy of the EAC Application for community review, and one hard copy of the EAC Application for a First Nations working group representative for review (estimated to be about 2500 pages in four large binders). Digital copies (DVD) of the Project EA Certificate Application will be available to all First Nations, to Open House participants and upon request to PRC.

PRC will place hard-copies of the Project EA Certificate Application in the public libraries in Tumbler Ridge and Chetwynd.

In addition to the Open House and Working Group sessions (above), PRC will continue to work with the EAO and First Nations, as per Section 11 Order, to facilitate participation in the EA Application review process by arranging to meet with each First Nations in their respective communities at a mutually agreeable time to describe the Project and the EA Certificate Application, identify issues that were raised during the pre-Application phase and show how they have been addressed in the EA Certificate Application, and to receive, discuss and document (issues tracking management log) any additional comments, issues and concerns of participating First Nations members. The issues tracking management log and the proponent's position or response to each item will be provided to the EAO and the respective First Nations within the time limits set by the EAO Project Assessment Manager. In addition to meetings, PRC will also communicate with the First Nations utilizing telephone, facsimile, and letters to Chief and Council, land office staff as well as community members.

PRC will also:

1. Request input from Chiefs and Councils and Land Use Manager on the Application
2. Meet with FN and, if requested, with T8TA
3. Reiterate PRC's previous offer to FN for Roman EA review capacity funding for the Roman EA review period. For example, for the regulatory reviews of previous PRC projects, PRC provided funding to FN for a joint-FN Independent Reviewer. PRC will also continue general Capacity Funding discussions as part of the ongoing discussions within the MOU framework
4. Attend EAO open houses in communities, as required
5. Deliver presentations on the proposed Project at community open houses, if requested
6. Provide summary Project information on the PRC website

As part of PRC's ongoing consultation process with First Nations, and specifically in the context of the Roman EA Application Review Period, PRC will offer to meet at a mutually agreeable time with the First Nations identified in the Section 11 Order that desire to meet with PRC. PRC will describe the Project and the EA Certificate Application, identify issues that were raised during the pre-Application phase and show how they have been addressed in the EA Certificate Application, and to receive, discuss and document (issues tracking management log) any additional comments, issues or concerns of participating First Nations members. The issues tracking management log and the proponent's position or response to each item will be provided to the EAO and

the respective First Nations within time limits set by the EAO Project Assessment Manager.

2.4 Kelly Lake Communities

2.4.1 Overview

Kelly Lake located approximately 75 km northeast of the Project, about 2 km west of the Alberta border and 55 km south of Dawson Creek, British Columbia. Many present-day Kelly Lake families trace their ancestry to family names at Kelly Lake in archival records as far back as the early to mid 1800s. The people have self-identified into three Kelly Lake communities: the Kelly Lake Cree Nation; the Kelly Lake First Nation; and, the KLMSS.

PRC recognizes that the Project is within territory wherein the people of Kelly Lake assert Aboriginal rights. From experience, PRC also recognizes and values the knowledge of the land held by the people of Kelly Lake.

The company has made efforts to contact all three of the Kelly Lake communities and have established ongoing engagement with two of these Communities: Kelly Lake Cree Nation and KLMSS. The Kelly Lake First Nation has not responded to efforts to communicate nor indicated any interest in participating in the BC EAO review process for the Project. Schedule A of the EAO Order under Section 11, defines Kelly Lake Communities as meaning the Kelly Lake Cree Nation and the KLMSS.

2.4.2 Kelly Lake Cree Nation

2.4.2.1 Pre-application Consultation

Pre-section 11 Order—Kelly Lake Cree Nation

From May 26, 2004 through October 2, 2008 there were 55 documented communications between PRC and Kelly Lake Cree Nation. While the company presented the Project conceptually in power point presentations between 2004 and 2006, these contacts were principally related to the Trend Coal Mine and were mostly by mail or fax and included notification of permit applications and communicating the availability of summer student positions at the Trend Coal Mine.

See Table 2.4-1 for selected pre-section 11 Order contact records for Kelly Lake Cree Nation.

Post-section 11 Order—Kelly Lake Cree Nation

Between October 2, 2008 and December 31, 2009 there have been about 52 or more documented communications between PRC and Kelly Lake Cree Nation.

On November 3, 2008, PRC provided an offer to KLCN for Roman EA Capacity funding. On the same date, PRC provided the first draft TOR for KLCN comment.

Kelly Lake Cree Nation officially participated in the Project EA process for the first time, via conference call, at the EAO Project Working Group Meeting held in Fort St. John on December 2, 2008. Four KLCN community members participated. The draft TOR was reviewed along with baseline work plans. There were general questions about the Project.

KLCN inquired about the consultant hired to conduct the TUS and TK work. KLCN expressed a desire to do their own TUS due to the sensitive nature of the work. KLCN requested environmental baseline information especially with response to fish and wildlife. These WG discussions are documented in EAO minutes for the meeting.

Table 2.4-1 Selected Pre-section 11 Order Contact Records—Kelly Lake Cree Nation

Date	PRC rep	KLCN rep	Location	Key Topics	Materials
24 May 2006	Angela Waterman	Cliff Calliou	Mail	Trend Coal Mine expansion permit amendment application	Trend Coal Mine expansion permit amendment application
15 Jan 2007	Angela Waterman	Cliff Calliou	Fax	PRC seeking applications from high school students for summer jobs at the mine	Notice of summer job criteria
19 Feb 2007	Angela Waterman	Cliff Calliou	Fax	PRC effluent permit application referral	Environmental protection notice
NOTE: October 2, 2008—Section 11 Order issued for the Project					

The following day, December 3, a PRC representative traveled to Kelly Lake to participate in a follow-up conference call between KLCN, PRC and EAO representatives regarding a traditional use study (TUS) for the Project. On December 4 and 5, 2008 the PRC representative attended the aforementioned Kelly Lake Cree Nation gathering in Dawson Creek and met with the Chief.

On January 23, 2009, the KLCN sent three pdf files pertaining to working with PRC on Roman and TLU. The proposal was discussed at a February 12, 2009 meeting and was followed by PRC's submission of a KLCN capacity agreement to support the community-led Roman TLUS and indicating that PRC wanted to commit to desktop work with requirements for further field investigation to be confirmed following completion of these studies.

On February 16, 2009, PRC provided the second draft of the TOR reflecting WG comments for KLCN comment.

In March and April 2009, there were additional discussions around finalization of the TUS scope. On April 20, 2009, PRC forwarded a copy of the Roman TOR to KLCN, the tracking table as well as the work plan.

On April 29, 2009 PRC sent the draft Roman EA Consultation Report to KLCN by email and mail for comments. PRC received comments on December 31, 2009 through the EAO and advised KLCN that PRC would be happy to meet to discuss to arrange a face to face meeting early in the application review period and prior to a final decision regarding the environmental certificate. PRC looks forward to the meeting as an opportunity to review the Roman application with KLCN, including anticipated effects, and to refine the currently proposed mitigations, especially as these may be relevant to the interests of the KLCN. PRC has been pleased to support KLCN involvement in the EA process to date, including consideration of KLCN interests through the KLCN TLU report.

Between May and July 2009, there were various discussions regarding various topics including the KLCN TLU Impact Report and its mitigation and planning table, payment status to KLCN for completion of their TLU report and planning for the PRC site tour.

On August 11, 2009, KLCN sent three community members, all of whom had taken environmental monitoring courses, to tour the Project and Trend Coal Mine areas. There were discussions around wildlife (caribou, wolves and elk), reclamation (seed mix), and environmental management plans. The mine operations were also discussed along with business opportunities and employment.

On October 6, 2009 PRC sent a list of job vacancies at the mine to KLCN.

In November 2009, PRC attended the KLCN Winter Gathering and provided a presentation to the community.

See Table 2.4-2 for selected post-section 11 Order contact records for Kelly Lake Cree Nation.

2.4.2.2 Kelly Lake Cree Nation Summary of Issues and Concerns

- PRC had limited engagement or interaction with Kelly Lake Cree Nation up until early December 2008 when the community began participating in the Project EA process.
- Beginning in December 2008, there has been regular, clear communication; the company and the community are working effectively together.
- PRC and Kelly Lake Cree Nation entered into a Project EA TUS Capacity Funding Agreement.
- Kelly Lake Cree Nation submitted a draft "Traditional Land Use Impact Report" for the Project, as committed to under that capacity funding agreement, which identifies issues and concerns.
- The primary areas of interest and concern identified in the TUS report included: incorporation of TUS and TEK into the EA process; potential disruption to wildlife, potential effects to traplines and gathering areas and other traditional use sites; potential effects on air, water and soil, as well as increased traffic due to the Project; and, employment and business opportunities.

Table 2.4-2 Selected Post-section 11 Order Contact Records—Kelly Lake Cree Nation

Date	PRC rep	KLCN rep	Location	Key Topics	Materials
03 Nov 2008	Scott Trusler	Chief Cliff Calliou	mail	TOR and capacity funding for Roman EA	Letter and TOR
02 Dec 2008	Scott Trusler Michael Cunningham Adriana MacLeod	Linette Hodges	EAO Project meeting in FSJ–KLCN on conf call		
03 Dec 2008	Michael Cunningham Scott Trusler Adriana MacLeod	Linette Hodges	Meeting + Conf call–LH + MPC in Kelly Lake and ST+AM and EAO rep in Van/Victoria	Project TUS / Roman TOR	
04 Dec 2008 05 Dec 2008	Michael Cunningham	Chief Cliff Calliou Linette Hodges	Gathering and meeting in Dawson Creek; MPC introductory meeting with Chief Calliou	Updates on various projects; building KLCN capacity and governance	
12 Dec 2008	Adriana MacLeod Scott Trusler Michael Cunningham	Linette Hodges	Emails	PRC sent update re Roman AIA, spatial data progress, baseline studies with pdf of caribou population census	Population Census of Threatened Caribou Herds in South Peace 2008
23 Jan 2009	Michael Cunningham	Chief Calliou Linette Hodges	Email	KLCN Chief sent pdf cover letter, work program and budget proposal for Roman TUS	
12 Feb 2009	Scott Trusler Michael Cunningham	Linette Hodges George Jennings	Conference call	Discussion of revised KLCN work program and budget for Roman TUS	
13 Feb 2009	Scott Trusler Michael Cunningham	Linette Hodges George Jennings	Email exchange	PRC uploaded information to ftp site and KLCN downloaded it	Trend Coal Mine permit application; Horizon TUS;
16 Feb 2009	Adriana MacLeod	Chief Calliou	Email	PRC sent second draft of Roman TOR	Draft Roman TOR
27 Feb 2009	Adriana MacLeod	Linette Hodges	Email and mail	PRC sent Roman AIA	Roman AIA

Table 2.4-2 Selected Post-section 11 Order Contact Records—Kelly Lake Cree Nation (cont'd)

Date	PRC rep	KLCN rep	Location	Key Topics	Materials
17 Mar 2009	Michael Cunningham	Chief Calliou	Courier	PRC sent Roman EA capacity funding agreement for signing	Capacity funding agreement
01 Apr 2009	Michael Cunningham	Chief Calliou George Jennings Linette Hodges	Courier	PRC received Roman EA signed capacity funding agreement	
02 April 2009	Michael Cunningham	Linette Hodges George Jennings Gretchen Fox	Email	PRC received first draft of KLCN Traditional Land Use Impact Report re Roman as per Agreement	Draft report
03 Apr 2009	Scott Trusler Michael Cunningham	Linette Hodges George Jennings Gretchen Fox	Conference call	Initial review and PRC feedback on draft Roman TUS impact report	
29 Apr 2009	Scott Trusler	Chief Cliff Calliou Linette Hodges and George Jennings	Email and mail	Draft Roman EA Consultation Report sent for comments	Draft Roman EA Consultation Report

2.4.2.3 PRC Summary of Measures to Address KLCN Concerns

- PRC committed to discuss and if possible negotiate to provide additional capacity funding to Kelly Lake Cree Nation in support of participation in both traditional use studies and the Roman EA review process.
- A capacity funding agreement was put in place and a report has been submitted by Kelly Lake Cree Nation under that agreement.
- PRC and its consultants worked with Kelly Lake Cree Nation to incorporate information from the report into the Project EA Application.
- In concert with preparation of the Wildlife section of the Project EA, PRC has developed a Wildlife Mitigation and Monitoring Plan including a specific Caribou Management Plan.
- Heritage resources are addressed in the archaeology and Traditional Land Use Site Protection Plan
- Air quality issues are addressed in the Air Quality and Dust Control Plan in the Application.
- The Reclamation Plan in the EA is largely driven by the high priority placed on caribou habitat end land-use objectives. There is also the Invasive Plant Management plan to address native plant protection.
- Water quality issues are addressed in the Water Management Plan and the Surface Water and Sediment Quality sections of the Application.

2.4.3 Kelly Lake Métis Settlement Society

2.4.3.1 Pre-application Consultation

Pre-section 11 Order—Kelly Lake Métis Settlement Society

In the period from May 26, 2004 through October 2, 2008 there were 285 documented communications between PRC and KLMSS. While the company presented the Project conceptually in power point presentations between 2004 and 2006, the principal focus of the consultation at that time was Trend.

One of the first mentions of the Project in the PRC KLMSS contacts tracking record database is in reference to an April 19, 2007 meeting in Kelly Lake. At that meeting, the community talked about their history, traditional territory and activities, recognition by Métis Nation of British Columbia and benefits from development. PRC talked about the Anglo American plc background, Trend Coal Mine operations, and the planned EA schedules for both the Horizon and Roman projects. The communications between January 1, 2006 and the first mention of the Project in the database were concerning a range of topics—the Trend Coal Mine operations, employment and contracting opportunities, requests for sponsorship, archaeology and wildlife studies.

Following this meeting and into the early summer of 2007 there were a number of email exchanges and telephone conversations as PRC consultants (AXYS and ARCAS) arranged to undertake wildlife and archeology field work related to the Project and sought to engage and employ local community residents in the field work.

The July 11, 2007 meeting involved discussions on the Roman TUS and archeological work and other PRC projects with the KLMSS. At this meeting, and as one way to address Aboriginal capacity building, PRC invited KLMSS and offered to pay for hotel, travel and meal expenses for one member to attend the Reclamation Symposium in Squamish. There was a discussion about available TUS information in the area. There was also a discussion regarding the potential for harmonization of data collection. For example, there might be efficiency in interviewing elders for multiple coal projects in a similar geographic area at the same time. KLMSS had questions regarding permitting process which were addressed by the EAO. In addition to traditional land use, socio-economic studies and cumulative effects were also discussed. These discussions are reflected in EAO minutes for that meeting.

On August 30, 2007, PRC sent an email asking KLMSS for input to the potential approach for a review of existing TUS data and data collection for TUS.

PRC sponsored a representative of KLMSS to attend a Reclamation Symposium on September 19, 2007. PRC met with the representative to discuss the elder's concerns around reclamation and the reclamation process. The two parties met again on September 26 at the NEMDRC meeting in Fort St. John where PRC provided updates on the Project and the status of the environmental baseline data field program.

PRC and KLMSS met on November 22, 2007 to discuss funding issues and contracting opportunities. There were a dozen or so follow-up emails and phone calls in regards to contracts and economic business opportunities during the rest of November and December 2007 and January 2008. Another contracts and business opportunity meeting was held on January 29, 2008 in Vancouver.

A Project traditional use study working group meeting with PRC and the KLMSS, coordinated by the EAO, was held on February 21, 2008 as a follow up to the discussions of the November 2007 working group meeting. There was an overview and discussion on existing TUS information. In correspondence before the meeting (February 15 and 19) PRC proposed the attendance of KLMSS elders at the meeting in an effort to include elder's input to the TUS planning process and offered to pay the cost for elders to attend. Although SFN and MLIB sent elders, KLMSS did not send elders to this meeting. KLMSS indicated elder's concern regarding moose in the area that are ill and non one knows why. SFN, WMFN, HRFN and KLMSS had a meeting outside the EAO-led meeting and stated that by March 20, 2008, they would provide input to the EAO on a proposed third party TUS process that could be applied to the Project. PRC provided a per diem for KLMSS to attend this meeting. These WG discussions are documented in EAO minutes for the meeting.

On March 25, 2008 KLMSS made a presentation at the PRC Vancouver office regarding a planned expansion of their camp services joint venture company, Ma-M-Way Camp Services Ltd.

On May 22, 2008 PRC mailed and emailed a letter to KLMSS reaffirming the company's willingness to provide TUS capacity funding, restating a specific proposal and also to advance a potential 2008 TUS field program.

On June 17, 2008 PRC and consultants met with KLMSS representatives in their community office to provide an update and to discuss the Project TUS and archeology work.

On August 20, 2008 a KLMSS representative visited the PRC office in Vancouver to discuss the Project and to describe efforts towards developing economic opportunities from non-coal and non-oil and gas sources.

See Table 2.4-3 for selected pre-section 11 Order contact records for KLMSS.

Post-section 11 Order—Kelly Lake Métis Settlement Society

Between October 2, 2008 and October 23, 2009 there have been about 52 or more documented communications between PRC and KLMSS.

PRC provided KLMSS with a commitment of capacity funding for participation in the Project EA via letter and email on November 3, 2008, telephone call on November 18, 2008 and in a meeting on December 12, 2008. During a number of emails and phone calls in November, it was agreed that KLMSS would participate in the Project EA Application process and contribute to completion of a KLMSS TUS and TEK study for the Project area. It was also agreed the parties would enter into a formal capacity funding agreement and KLMSS identified a consultant to assist them with this process.

The first draft of the TOR was sent to KLMSS for comment on November 3, 2008.

Another EAO Working Group meeting was held in Fort St. John on November 14, 2008. This meeting was primarily to review the TOR and baseline work plans. KLMSS did not send a representative to this meeting. These WG discussions are documented in EAO minutes for the meeting. This meeting was followed by a WG meeting on December 2, 2008 also in Fort. St. John. The purpose of this meeting was to provide the Aboriginal groups, who were unable to attend the November 14, 2008 meeting, another opportunity to obtain information from EAO and PRC and to review the TOR and baseline work plans. KLMSS sent a representative to this meeting.

Via emails, phone calls and a meeting, PRC and KLMSS came to agreement by December 31, 2008 and formalized at a meeting in the PRC Vancouver office on January 6, 2009. Later in January 2009, PRC consultants were in the community working with KLMSS on the TUS and TEK study for the Project.

Table 2.4-3 Selected Pre-section 11 Order Contact Records—Kelly Lake Métis Settlement Society

Date	PRC rep	KL Métis rep	Location	Key Topics	Materials
19 Apr 2007	Trevor Hulme Angela Waterman Paul Townsend	Caroline Campbell (Kookum), Len Wilson, Lyle Letendre, Grant Savard, Kathleen Letendre	KLMSS office trailer and via telephone	Community history, trad lands and activities, benefits; Anglo, Trend, Roman and Horizon EA	Maps of PRC property
11 July 2007	Angela Waterman	Lyle Letendre	EAO sub-working group meeting at McLeod Lake lands office	Roman and Horizon project updates and Trend ppt; TUS–SIA–cumulative effects	Trend, Horizon and Roman ppt presentation materials
30 Aug 2007	Angela Waterman	Len Wilson	Email	PRC to focus on Project; request confirmation of joint PRC-WCC socio-economic study and joint Roman-Horizon TUS study utilizing Trend TLU info	
19 Sep 2007	Angela Waterman	Lyle Letendre	Meeting at Reclamation Symposium in Squamish	Discussion of elders' concerns re Roman; reclamation work; PRC sponsored attendance at Symposium	
26 Sep 2007	Angela Waterman + Remi Farvacque (Archer)	Lyle Letendre	NEMDMC meeting in Fort St. John	Project update, schedule and baseline data; PRC-KLMSS discussion re participation in archeology field assessment	
22 Nov 2007	Angela Waterman	Lyle Letendre	Telephone calls and meeting	Discussion re KLMSS community centre and transition Project funding; contracting opportunities	
29 Jan 2008	Angela Waterman Brian Thompson Jim Cardno Steve Amor	Len Wilson	Meeting at PRC office in Vancouver	Discussion: contracts and business opportunities re Trend and Roman Coal Mine projects	

Table 2.4-3 Selected Pre-section 11 Order Contact Records—Kelly Lake Métis Settlement Society (cont'd)

Date	PRC rep	KL Métis rep	Location	Key Topics	Materials
15 Feb 2008	Angela Waterman	Lyle Letendre	Emails	PRC invited, and offered to pay for elders to attend Feb. 21 Project TUS Working Group meeting; offer declined	
21 Feb 2008	Angela Waterman	Lyle Letendre	Meeting in Fort St. John–Quality Inn Northern Grande	Project TUS Working Group meeting	PRC cheque for KLM attendance, Letter offer funding for TUS, Golder TUS overview presentation
25 Mar 2008	Angela Waterman Dan Farmer Jim Cardno Brian Thompson	Lyle Letendre Tina Letendre Zane Pickering	Meeting at PRC office in Vancouver	KLMSS is expanding business arm–Ma-M Way; seek contracting opportunities and use of camp	
22 May 2008	Angela Waterman Michael Cunningham	Len Wilson Lyle Letendre Tina Letendre	Email and mail	PRC confirms commitment to Project TUS capacity funding	
17 Jun 2008	Michael Cunningham + Pascale Mera (Golder) and Remi Farvacque (Archer)	Lyle Letendre Tina Letendre	Meeting in Kelly Lake–work site and office trailer	Update and discussion re Roman TUS and archeology work	
20 Aug 2008	Scott Trusler Michael Cunningham	Lyle Letendre	Meeting at PRC office in Vancouver	Discussion on the Project and KLMSS efforts to develop economic opportunities outside of coal and oil and gas	
NOTE: October 2, 2008—Section 11 Order issued for the Project					

The second draft of the TOR reflecting WG comments was sent to KLMSS for comment on February 16, 2009.

On April 29, 2009 PRC sent the draft Roman EA Consultation Report to KLMSS by email and mail for comments. PRC received comments on May 6, 2009 from KLMSS outlining their concerns around the Roman TOR.

From July to September 2009, there were discussions and planning with respects to a site tour of Trend and Roman Coal Mine project areas. This tour occurred on October 1, 2009 with two KLMSS members in attendance. There were discussions around KLMSS business ventures, old KLMSS settlements, environmental management and regulatory inspections as well as questions regarding wildlife, water management, air quality monitoring stations and reclamation plans.

On October 6, 2009 PRC outlined to KLMSS the current job postings at PRC.

See Table 2.4-4 for selected post-section 11 Order contact records for KLMSS.

2.4.3.2 Kelly Lake Métis Settlement Society Summary of Issues and Concerns

- KLMSS has contributed to the Project traditional use study and their contributions have been incorporated into the Project EA Application.
- Through this process, KLMSS has identified their primary issues of concern as being potential effects on wildlife and water as well as on disturbance of traditional use areas.

2.4.3.3 PRC Summary of Measures to Address KLMSS Concerns

- PRC provided capacity funding for KLMSS to work with PRC and its consultants to complete a TUS and TEK study for incorporation in the Roman EA application.
- PRC and KLMSS entered into a capacity funding agreement for participation in the Roman EA Application review process.
- In concert with preparation of the Wildlife section of the Project EA, PRC has developed a Wildlife Mitigation and Monitoring Plan including a specific Caribou Management Plan.
- Heritage resources are addressed in the archaeology and Traditional Land Use Site Protection Plan
- Air quality issues are addressed in the Air Quality and Dust Control Plan in the Application.
- The Reclamation Plan in the EA is largely driven by the high priority placed on caribou habitat end land-use objectives. There is also the Invasive Plant Management plan to address native plant protection.
- Water quality issues are addressed in the Water Management Plan and the Surface Water and Sediment Quality sections of the Application.

Table 2.4-4 Selected Post-section 11 Order Contact Records—Kelly Lake Métis Settlement Society

Date	PRC rep	KL Métis rep	Location	Key Topics	Materials
03 Nov 2008	Scott Trusler	Lyle Letendre	Letter and email	Capacity funding for Roman EA	Letter of offer and Roman draft Terms of Reference
18 Nov 2008	Scott Trusler Michael Cunningham	Lyle Letendre	Telephone call	PRC asked if KLMSS participating in T8TA-TAEG for Roman; LL indicated yes	
21 Nov 2008	Scott Trusler Michael Cunningham	Lyle Letendre	Telephone call	Roman TUS–KLMSS has sites want documented and include Trend; want to move ahead; has consultant to assist	
2 Dec 2008	Scott Trusler Michael Cunningham Adriana MacLeod	Lyle Letendre	Meeting in Fort. St. John	EAO WG meeting, TOR, TUS/TK	
12 Dec 2008	Scott Trusler Michael Cunningham	Keith Henry (KCD Consulting)	Meeting in West Vancouver	Contribution funding agreements for Roman EA and TUS/TEK	
15 Dec 2008	Scott Trusler	Keith Henry (KCD Consulting)	Email received by PRC	PRC received draft agreement	
17 Dec 2008	Scott Trusler	Keith Henry (KCD Consulting)	Email sent by PRC	PRC sent revised draft	
18 Dec 2008	Michael Cunningham	Lyle Letendre Tina Letendre Keith Henry (KCD Consult)	Email and meeting in West Vancouver	PRC-KLMSS relations, Roman proj EA/TUS agreements	
31 Dec 2008	Scott Trusler Michael Cunningham	Keith Henry (KCD Consult) and Lyle Letendre	Email exchange	KLMSS-LL and PRC agree on final Agreement; PRC emailed pdf copy	
06 Jan 2009	Hugh Kendrick Michael Cunningham	Lyle Letendre Keith Henry (KCD Consult)	Meeting at PRC Vancouver office	Finalization of agreement; general discussion: KLMSS, PRC, Project; EA process	

Table 2.4-4 Selected Post-section 11 Order Contact Records—Kelly Lake Métis Settlement Society (cont'd)

Date	PRC rep	KL Métis rep	Location	Key Topics	Materials
16 Feb 2009	Adriana MacLeod	Lyle Letendre	Mail	PRC sent second draft of Roman TOR	Hardcopy draft two of Roman TOR
29 Apr 2009	Scott Trusler	Lyle Letendre	Email and mail	Draft Roman EA Consultation Report sent for comments	Draft Roman EA Consultation Report

2.4.4 Summary of Issues and Concerns Identified during the Pre-application Period—Kelly Lake Communities

Two of the Kelly Lake Communities have engaged with PRC in separate consultation processes, as described above. In summary, their collective stated issues or concerns related to the Project include: potential disruption or effects on wildlife, wildlife travel corridors and on traplines used by community members; potential effects on the air, water and soil from the development itself and increased traffic related to the Project; potential disturbance, effects or destruction of traditional use areas. The Kelly Lake Communities expressed interest in employment and business opportunities related to the Project.

2.4.5 Issues Resolution Process—Kelly Lake Communities

Based upon the level of pre-Application consultation, the early identification of issues of concern by interested parties and the work undertaken by PRC and its consultants to address them, PRC believes that the issues identified during the Pre-application stage have been satisfactorily addressed in the Project EA Application.

PRC understands that there may be some issues that some parties feel may require clarification or further consideration and that there is a possibility that new issues may arise during the EA Application Review stage. PRC will work diligently to address these issues promptly through direct consultations with the concerned parties and with written responses as required by the BC EAO.

2.4.6 Application Review Period Consultation Plan—Kelly Lake Communities

The purpose of the Kelly Lake Communities consultation plan is to provide Kelly Lake Communities with the information they need, about the Project and the Application, to participate in the Application Review. The purpose is also to provide Kelly Lake Communities with an opportunity to identify their asserted rights and interests and provide meaningful input to the review, including the ability to discuss how their issues and concerns are being addressed and integrated into the design, construction and operation of the Project, where appropriate.

The EAO's Section 11 Order states that at least one formal public comment period of 45 days will be established by the Project Assessment Manager. The BC EAO will also advise how many public Open House sessions it will hold during the public comment period and where they are to be located. PRC will cooperate with the EAO in arranging the Open House sessions and Kelly Lake Communities will be invited to attend. These Open House sessions will be advertised in local papers and radio within adequate period as directed by EAO prior to the date on which they are to be held. In addition, PRC will provide notification of the Open House sessions to Kelly Lake Communities via fax and email. At these sessions, PRC will describe the Project and the EA Certificate Application. The company will also identify issues that were raised at these sessions, working group meetings and meetings with the Kelly Lake communities and show how they have been addressed in the EA Certificate Application. Open House participants, First Nations, Kelly Lake Communities and the public will be encouraged to provide comments with respect to Project plans and designs during the review.

PRC will record and track comments, issues and concerns raised at these sessions as well as the proponent's position or response to that item, in an issues tracking management log

that will be summarized in a report to be provided to the EAO within the time limits set by the EAO Project Assessment Manager. This summary report will contain a listing of meetings and presentations made to First Nations, Kelly Lake Communities, the Public and Stakeholders, and Tribal Associations; copies of meeting sign-up sheets from Open House sessions and in-community meetings with First Nations and Kelly Lake Communities; the issues tracking management log; and, copies of written comments, questions and responses.

As members of the Project EA Working Group, Kelly Lake Communities have the opportunity to participate in the technical presentations on the Project, and will be able to discuss the Project and the EA Application with government agencies and PRC representatives. Each Kelly Lake Communities identified in the Section 11 Order will be provided with one community hard copy of the EAC Application for community member review, and one hard copy of the EAC Application for a First Nations working group representative review (estimated to be about 2500 pages in four large binders). Digital copies (DVD) of the Project EA Certificate Application will be available to Kelly Lake Communities, to Open House participants and upon request to PRC.

PRC will place hard-copies of the Project EA Certificate Application in the public libraries in Tumbler Ridge and Chetwynd.

In addition to the Open House and Working Group sessions (above), PRC will continue to work with the EAO and Kelly Lake Communities, as per Section 11 Order, to facilitate participation in the EA Application review process by offering to meet with Kelly Lake Communities at a mutually agreeable time to describe the Project and the EA Certificate Application, identify issues that were raised during the pre-Application phase and show how they have been addressed in the EA Certificate Application, and to receive, discuss and document (issues tracking management log) any additional comments, issues or concerns of participating Kelly Lake Communities members. The issues tracking management log and the proponent's position or response to each item will be provided to the EAO and the respective First Nations within the time limits set by the EAO Project Assessment Manager.

In 2006-2007, PRC made offers of capacity funding support. In the fall of 2008, the CEO of PRC sent a registered letter directly to Kelly Lake Communities with an offer for capacity funding to support their participation in the EA Review process, subject to mutually agreed scope of work, activities, timeline, deliverables and cost. Since that letter, PRC has restated that offer on numerous occasions during meetings, in emails and over the telephone. This funding may be used in part for an external technical reviewer on behalf of the First Nations.

2.4.6.1 Kelly Lake Cree Nation (KLCN)

PRC entered into a Capacity Funding Agreement with Kelly Lake Cree Nation (KLCN) to undertake and complete a community-led desktop TUS study for the Project area. A report has been submitted by KLCN and they worked with PRC's consultants to incorporate it into the Project EA Application.

During the EA Application review stage (as above, Section 2.4.6), PRC will offer to meet with KLCN at least once to provide a Project update and to discuss any remaining concerns that they may have in relation to the Project EA Application, including discussion of possible employment and economic opportunities for their community members.

2.4.6.2 Kelly Lake Métis Settlement Society

PRC funded a TUS work program with the KLMSS that was done in January 2009 and the outputs were incorporated into the Project EA Application. PRC also entered into a capacity funding agreement with KLMSS in support of participation in the BC EAO process and meetings; review of and report on the draft Terms of Reference for the Application for an Environmental Assessment Certificate; and, for review of and report on the Project EA Application.

During the EA Application Review stage (as above, Section 2.4.6), PRC will offer to meet with KLMSS at least once to provide a Project update and to discuss any remaining concerns that they may have with the Project, including discussion of possible employment or economic opportunities for their community members.

2.5 Government Agencies

2.5.1 Overview

Federal Government

The following is a list of federal government agencies that PRC has contacted in relation to the Project:

- Canadian Environmental Assessment Agency (CEA Agency)—(on the Project Working Group)
- Department of Fisheries and Oceans (DFO)
- Transport Canada (TC)
- Natural Resources Canada (NRCAN)
- Canada Transportation Agency (CTA)
- Environment Canada (EC)

Provincial Government

PRC met with representatives of the CEA Agency and Department of Fisheries and Oceans in Vancouver in May 2004. At that time, the Proponent introduced the Trend Coal Mine Project to the agencies, including plans to develop the Roman block.

The following is a list of British Columbia provincial government agencies that PRC has contacted or provided information directly or indirectly through the EAO in relation to the Project; all are members of the Project EA Working Group:

- Environmental Assessment Office (EAO)
- Ministry of Agriculture and Lands (MAL), including specifically
    - Integrated Land Management Bureau (ILMB)
- Ministry of Community and Rural Development
- Ministry of Environment (MOE, formerly MWLAP)
    - Environmental Protection Division

  - Environmental Stewardship Division
  - Water Stewardship Division
- Ministry of Energy, Mines and Petroleum Resources
  - (MEMPR ex-MEM)
  - Mining and Minerals Division
  - Permitting and Reclamation Division
- Ministry of Forests and Range (MOFR)
- Ministry of Agriculture and Lands (MAL)
- Ministry of Tourism, Culture and the Arts
  - Archaeology Branch
  - Tourism Branch
  - Recreation Branch
- Ministry of Transportation (MOT)

PRC met with MEMPR and MOE (Environmental Protection Division) in Vancouver in May 2004. At that time, the Proponent introduced the Trend Coal Mine Project to the government agencies, including discussion of longer term plans to develop the Roman block within the same watershed as the Trend's South and Extension blocks.

Local Government

The following is a list of regional and local government agencies that PRC has contacted in relation to the Project:

- Northern Health Authority
- District of Tumbler Ridge (DTR)
- District of Chetwynd
- Peace River Regional District (PRRD)

2.5.2 Pre-application Consultation

PRC has consulted with federal, provincial, regional and local government agencies to discuss issues relevant to the Project including land tenure and scope of environmental baseline study and monitoring programs.

2.5.2.1 Pre-section 11 Order

Federal Government

The Proponent met with representatives of the CEA Agency and DFO in Vancouver during May 2004. At that time, the Proponent introduced the Trend property to the agencies, including the Roman block.

PRC met with the CEA Agency and DFO to present details of the Project on November 26, 2007.

On April 30, 2008 an email received from the EAO provided confirmation that there are no federal triggers for this Project.

Following submission of a letter from PRC to the EAO on December 30, 2008 outlining reductions in footprint and other changes to the mine plan for the Project, DFO once again reviewed their decision regarding a *Fisheries Act* trigger for the Project. On May 12, 2009 PRC received a letter from DFO confirming again that the Project would not cause a HADD and did not require a *Fisheries Act* authorization.

Provincial Government

PRC met with MEMPR and MOE, Environmental Protection Division in Vancouver in May 2004. At that time, the Proponent introduced the Trend property to the agencies. The company also explained that future exploration and mine development was planned for other coal license blocks, including the Roman block of the Trend property.

A meeting with a representative of the BC EAO was held in Victoria on January 16, 2007. The Proponent provided preliminary Project information and a proposed Project schedule to representatives from the MOE Environmental Protection Division on February 12, 2007 in Prince George. Project details were presented to MOE and MEMPR representatives on June 15, 2007 in Prince George, MEMPR in Dawson Creek on June 20, 2007 and MOE, Ecosystems Section on July 10, 2007 in Fort St. John. On July 11th, 2007 PRC participated in a BC EAO sub-working group meeting for Horizon and Roman Coal Mine projects held at the MLIB lands office.

PRC provided a Power Point presentation on the Trend, Horizon and Roman projects to the NEMDRC meetings in Fort St. John on June 20, 2007. PRC and consultants provided an update on the Project to the NEMDRC meeting in Fort St. John on September 26, 2007 focusing on its environmental baseline data field program and archaeological field assessment.

The first Project Working Group meeting was held November 14, 2007 in Fort St. John. At the meeting, PRC provided copies of the Project update PowerPoint presentation slides, regional study area maps and Trend Coal Mine maps.

On February 21, 2008 there was a Project TUS Working Group meeting held in Fort St. John, coordinated by the BC EAO.

2.5.2.2 Post-section 11 Order

Federal Government

On November 14, 2008 the BC EAO stated during a Project Technical Working Group meeting that no federal triggers had been identified for the Project. This comment was based upon the CEA Agency determination of “no federal triggers” conveyed to the BC EAO via email on April 30, 2008.

In early February 2009 PRC and consultants met with representatives of CEA Agency and DFO to re-visit the potential for a federal (*Fisheries Act*) trigger for the Project. To support DFO decision making, PRC provided a detailed description of the Project, its context in terms of fish habitat, and preliminary discussion of the potential for effects on

fish and fish habitat. On May 12, 2009 an email received from the EAO provided confirmation that there are no federal triggers for this Project.

Provincial Government

PRC provided a Project update report and PowerPoint presentation to the Project Working Group at a meeting on November 14, 2008 that included an Overview of PRC, an update on the Project Description, a consultation update and schedule, and work plans. The primary focus for the meeting was to review the Project draft TOR. At that meeting, the BC EAO confirmed that no federal CEAA triggers had been identified for the Project.

There was a Roman Working Group follow-up meeting on December 2, 2008 to provide an opportunity for First Nations and Kelly Lake Communities that could not participate in the earlier November meeting to provide their input. KLMSS participated in person at the Fort St. John meeting while KLCN participated via conference call.

Local Government

Representatives of local governments and agencies have participated in consultation on the Project:

- Northern Health Authority
    - Jimmy Yee, Drinking Water Leader at NE Health Services, is representative on the Project EA Working Group and provided comment on Project TOR
- District of Tumbler Ridge (DTR)
    - Lonny Miller, DTR-CEO, is representative on the Project EA Working Group
- District of Chetwynd
    - Chetwynd is not on Project EA Working Group; however Ellen Calliou, Economic Development Officer, provided input to the Project EA socio-economic assessment section
- Peace River Regional District (PRRD)
    - Tim Caton, Director of Electoral Area "E", is representative on the Project EA Working Group

2.5.3 Summary of Issues and Concerns Identified during the Pre-application Period

Based upon communications and engagement with government agencies, the following issues have been identified and are addressed in the EA Certificate Application:

- water quality
- fish and fish habitat
- potential for acid generation (PAG)
- coal dust management
- soil erosion
- caribou and caribou habitat
- progressive reclamation

2.5.4 Peace River Coal Inc. on How Issues and Concerns were Addressed

To address key issues of concern, the Project has been refined and a process of mitigation by design has been put in place. To that end, the following mine design changes have been incorporated:

- reduce total mine footprint (890 to 811 ha)
- maximize dumping on existing Trend disturbance (39 percent overlap)
- remove rock drain dump from Babcock Creek
- move to in-pit tailings storage
- avoid Five Cabin Creek drainage
- minimize loss of high value caribou habitat wherever possible
- maximize Reclamation Plan for caribou habitat end-use objectives
- select covered coal stockpiles or silos at plant and load-out
- build new higher efficiency plant for increased coal recovery
- increase process water recovery from tailings ponds up to 90 percent
- use Trend-bypass road to haul coal from plant to rail load-out

These and other mitigative measures are explained within the Project EA Application Section 5 (Environmental Management Plans). In regards to the identified issues of concern listed above, the following topics are included in Section 5 (amongst others): Reclamation Plan, Air Quality and Dust Control Plan, and Erosion Control and Sediment Control Plan.

2.5.5 Issues Resolution Process

Based upon the level of Pre-application consultation, the early identification of issues of concern by interested parties and the work undertaken by PRC and its consultants to address them, PRC believes that the issues identified during the pre-Application stage have been satisfactorily addressed in the Project EA Application.

Nonetheless, there may be some issues that some parties feel may require clarification or further consideration. It is also possible that new issues may arise during the EA Application Review stage. PRC will work diligently to address these issues promptly through direct consultations with the concerned parties and via the technical working group framework, with written responses being provided to the concerned party and to the BC EAO.

2.5.6 Application Review Period Consultation Plan

Shortly after PRC submits the Project EA Application to the BC EAO, the EAO will advise of the duration of the EA Application Review Period; 45 days. The BC EAO will also advise if any additional public Open House sessions are required during the EA application review period.

PRC will work with the BC EAO to facilitate public participation in the EA process by making representatives available upon request to provide information, answer questions or make presentations relating to the Project or the EA Application. PRC will also

maintain a tracking list of all comments, issues and concerns raised by government agencies, and will respond to these comments promptly during the EA application review period.

PRC will contact representatives of local, regional, provincial and federal government agencies as members of the Project EA Working Group and arrange to meet with them on an as-requested and mutually agreed basis to address agency-specific issues. It is anticipated that the BC EAO will arrange for a meeting of the Project Working Group within a few weeks after the Application has been accepted and circulated for review.

PRC and its consultants will prepare a presentation to describe the Project and the EA Application and will identify issues that have been raised in the pre-Application stage and indicate how they have been addressed in the Application.

2.6 Public and Stakeholders

2.6.1 Overview

PRC undertook a two-track approach to engagement and consultation with the public and stakeholders: 1) public consultation and engagement was undertaken through a series of EAO public Open Houses held in local communities during which PRC delivered presentations on the Project and was available to answer questions; and 2) stakeholder consultation and engagement undertaken through a more directed approach providing information to individual tenure holders through the mail or via email coordinated with information sharing in relation to operation of the Trend Coal Mine and other PRC activities.

Public

The EA process, under the BCEAA, is designed to be fair, transparent, inclusive, comprehensive and efficient. Consultations are an essential component of the EA process by ensuring decisions on a specific project take into account, and are responsive to, the interests of all potentially affected parties. This includes First Nations, the public, local governments, provincial and federal agencies and, where warranted, British Columbia's neighbouring jurisdictions. Public participation in the environmental assessment process helps to ensure that community values and public goals for community development are considered in Project planning and decision-making.

Through the EA process, the Public has opportunities for involvement both during the pre-application stage and the application review stage. For more information about the process and participation opportunities, readers are referred to the British Columbia "Environmental Assessment Office 2009 User Guide" that can be found online at http://www.eao.gov.bc.ca/pub/pdf/EAO_User_Guide_2009.pdf

Once the proponent submits a Project description, the Project enters the EA process and it is the BC EAO that manages or coordinates that process, under the BCEAA. In addition, the BC EAO manages an online public projects database which contains records about the Project such as the application and supporting documents, terms of reference, public and government comments and submissions, EAO generated documents, public notices and press releases, the detailed Project report, the EA certificate documentation. The website is referred to as the Projects Information Centre or e-PIC http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_home.html. The Project is at http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_home_308.html.

Stakeholders

PRC has identified a range of tenure holders and regular users of the land in the areas potentially affected by components of the Project. PRC interacts with many of these stakeholders on a regular basis where overlapping tenures, infrastructure and activities require collaboration and cooperation. A discussion of PRC's contact with stakeholders and their interests is presented in Section 2.6.2.3 (below).

Identified stakeholders include: Guide Outfitters; Trappers; Recreational Land User Organizations; Wind Tenure Holders; PNG; and Forestry.

2.6.2 Pre-application Consultation

2.6.2.1 Pre-section 11 Order—Public

PRC held a public Open House at the Community Center in Tumbler Ridge from 5:00 to 9:00 pm on November 14, 2007 that included information on the Project. There were 32 names on the sign-up attendance sheets and all were invited to fill-out a questionnaire and provide comments. One question received from the public was related to the potential for visual impacts. PRC addresses visual impacts in Section 16 of the Application. Three questionnaires were submitted; all said they received enough information and would support the Project if it could meet the requirements of the review process.

2.6.2.2 Post-section 11 Order—Public

In order to provide information about the Project draft TOR, and to receive comments from the public, the BC EAO invited the public to attend an Open House at two locations in February 2009:

- Chetwynd and District Recreational Centre, February 24, 2009
- Tumbler Ridge Community Centre, February 25, 2009

The BC EAO gave a presentation on the British Columbia environmental assessment process and provided opportunity for the public to ask questions about the process. PRC gave a presentation on the Project and was available to answer questions about the Project. Both sessions were sparsely attended, less than ten attendees at each, and questions focused primarily on employment opportunities and economic benefits to communities.

2.6.2.3 Pre-application Consultation—Stakeholders

Guide Outfitters

There have been numerous contacts (60 or more) with guide outfitters between May 6, 2004 and July 11, 2008. The most recent letter (May 19, 2009) provided an update on the Trend Coal Mine, PRC proposed projects, exploration activities and notifications and was sent to one identified individual Guide Outfitter and to the Guide Outfitters Association of British Columbia.

Trappers

There have been many contacts (57) with trappers between May 6, 2004 and January 9, 2009. Between December 6, 2006 and January 2, 2009 there have been four letters sent to

one identified individual Trapper on a range of issues including the Project area, the Talisman road closure, the Trend Coal Mine and PRC proposed projects, and exploration drilling. On March 5, 2008 two other identified individual Trappers were sent letters with a map concerning the Talisman road closure and open-pit blasting.

PRC sent update letters on July 11, 2008 and May 19, 2009 to all three previously identified individual Trappers.

Recreational Land User Organizations

PRC has ongoing communication with the Wolverine Nordic and Mountain Society (WNMS) and a positive working relationship with WNMS in sponsorship and support for the Emperor's Challenge marathon each August. Between January 14, 2008 and May 19, 2009 there have been nine emails and letters on a variety of matters: road use permits; Talisman Road closure; open-pit blasting; Trend Coal Mine and PRC Proposed Projects update; WNMS and applications for hiking trails.

PRC sent the Ridge Riders Snowmobile Club an update letter informing them of PRC activities and development plans on May 19, 2009.

Wind Power Interests

On May 19, 2009, PRC sent an update on the operation of the Trend Coal Mine and PRC proposed projects to three wind companies with Investigative Use Permits near PRC properties, including: Brookfield Power Wind Corporation, Chinook Power Corporation and Rengen Power Corporation. Previously, update letters were sent to these companies on July 11, 2008.

PRC only received a response from Chinook Power Corporation who suggested that PRC and Chinook enter into a data share agreement for spatial information in the areas of mutual interest. PRC has since entered into such an agreement with Chinook. .

Petroleum and Natural Gas Tenure Holders

The following petroleum and natural gas tenure holders have been identified and update letters have been sent most recently on or about May 19, 2009: Antelope Land Services; BP Canada Energy Resources Company (x2); Burlington Resources Canada Limited; Canadian Coastal Resources; Canadian Natural Resources Limited (x3); Devon Canada Corporation; Encana Corporation; Encana Oil and Gas Corporation (x3); Exxon Mobile Canada Energy; Imperial Oil Resources Ltd.; Kerr-McGee Canada Ltd. (x2); Meridian Land Services (90) Ltd.; Pacific Northern Gas Ltd.; Roland Resources (87) Inc.; Spectra Energy Corp; Suncor Energy (x3); Talisman Energy Inc. (x3); Thunder Creek Resources Ltd.; and W. J. Quinn Consulting Service.

Letters sent to multiple company representatives are identified by (x2), (x3). All companies were tenure holders of record in the area of the Project at the time of PRC's communications.

Forestry

On May 19, 2009, PRC sent an update on the operation of the Trend Coal Mine and PRC proposed projects to four forestry companies in regards to its activities in the area: British Columbia Timber Sales; Canadian Forest Products (Canfor); Chetwynd Forest Industries (West Fraser Mills); and, Louisiana Pacific Canada.

There were also communications with Chetwynd Forest Industries—West Fraser Mills via nine emails and phone calls between January 3, 2008 and June 4, 2008 on a range of topics to include: harvesting and road access to identified cutblocks in the vicinity of PRC's Horizon Mine Coal Project.

There was no contact with the other forest licensees in 2008. Previously, there had been an exchange of spatial data with British Columbia Timber Sales, Canfor and West Fraser Mills in July 2007. All companies were tenure holders of record in the area of the Project at the time of PRC's communications.

2.6.2.4 Public and Stakeholders Summary of Issues and Concerns

Only one comment was received during the 30-day public review for the draft Project TOR. The comment was not to be posted but was supportive of the Project.

2.6.2.5 Peace River Coal Inc. on How Issues and Concerns were Addressed

There were no issues or concerns to be addressed identified by the Public and Stakeholders.

2.6.3 Summary of Issues and Concerns Identified during the Pre-application Period

There have been no issues or concerns identified by the public or stakeholders regarding the Project. To date, PRC has not received any communications from the public in response to the open houses or during the public comment periods that have been organized to solicit input on the Project.

2.6.4 Issues Resolution Process

Based upon the level of pre-application consultation, the early identification of issues of concern by interested parties and the work undertaken by PRC and its consultants to address them, PRC believes that the issues identified during the pre-application stage have been satisfactorily addressed in the Project EA Application.

Nonetheless, there may be some issues that some parties feel may require clarification or further consideration. It is also possible that new issues may arise during the EA Application Review stage. PRC will work diligently to address these issues promptly through direct consultations with the concerned parties with written responses being provided to the concerned party and to the BC EAO.

2.6.5 Application Review Period Consultation Plan–Public and Stakeholders

The purpose of the Public and Stakeholders consultation plan is to provide the Public and Stakeholders with the information they need, about the Project and the Application, to participate in the Application Review. The purpose is also to provide the Public and Stakeholders with an opportunity to identify their interests, issues and concerns as well as to provide meaningful input to the review, including the ability to discuss how their issues and concerns are being addressed and integrated into the design, construction and operation of the Project, where appropriate.

The EAO's Section 11 Order states that at least one formal public comment period of 45 days will be established by the Project Assessment Manager. The BC EAO will also

advise how many public Open House sessions it will hold during the public comment period and where they are to be located. PRC will cooperate with the EAO in arranging the Open House sessions and the Public and Stakeholders will be encouraged to attend. These Open House sessions will be advertised in local papers and radio with adequate lead time, as directed by the EAO, prior to the date on which they are to be held. At these sessions, PRC will describe the Project and the EA Certificate Application. The company will also identify issues that were raised by members of the public during the public comment period and as identified by the EAO and show how they have been addressed in the EA Certificate Application. Open House participants, First Nations, Kelly Lake Communities, the Public and Stakeholders will be encouraged to provide comments with respect to Project plans and designs during the review.

PRC will record and track comments, issues and concerns raised at these sessions as well as the proponent's position or response to that item, in an issues tracking management log that will be summarized in a report to be provided to the EAO within the time limits set by the EAO Project Assessment Manager. This summary report will contain a listing of meetings and presentations made to First Nations, Kelly Lake Communities, the Public and Stakeholders, and Tribal Associations; copies of meeting sign-up sheets from Open House sessions and in-community meetings with First Nations and Kelly Lake Communities; the issues tracking management log; and, copies of written comments, questions and responses.

PRC will place hard-copies of the Project EA Certificate Application in the public libraries and town halls in Tumbler Ridge and Chetwynd.

Roman Coal Mine Project

ENVIRONMENTAL ASSESSMENT REPORT

VOLUME 1, SECTION 3: GEOLOGY, GEOCHEMISTRY AND COAL RESOURCES

Prepared for:
BC Environmental Assessment Office
Victoria, British Columbia

Prepared by:
Peace River Coal Inc.
Vancouver, British Columbia

March 2010

3 Geology, Geochemistry and Coal Resources

3.1 Regional Geology

The Project will target the Middle Gates Formation and Gething Formation coal seams in the Roman Mountain. Geochemical data from the nearby Quintette Mine, the Bullmoose Mine and the Wolverine Property indicate that the potential for acid rock drainage in the Gates Formation is generally very low (Mehling Environmental Management Inc. 1997; Western Coal Corp. [WCC] 2004). However, a small proportion of the waste rock (less than five percent), including some of the coal seams and conglomerates, are potentially acid generating. While this can lead to localized acidic seeps (Mehling 1997), neutralization potential in the surrounding rock is sufficient to maintain neutral pH conditions in the overall seepage and runoff from the waste rock dumps and pit walls. Data from proposed mines in the Gething Formation (e.g., the Dillon Mine application) also indicate a generally low potential for acid rock drainage.

The coal seams of economic interest are located in the Gates and Gething Formations and consist of a large syncline, the axis of which strikes northwest–southeast and plunges to the northwest. Typically, the limbs of the syncline drop at angles between 40 and 65°.

3.1.1 Regional Stratigraphy

Economic coal seams in the Peace River area are found in Jurassic and Lower Cretaceous strata, which were uplifted during the Laramide Orogeny to form the Rocky Mountains. Thrust faulting and intense folding strongly affected the strata during this mountain-building phase.

Thick coal seams are found in the Gates Formation and in the underlying Gething Formation, both of which are Lower Cretaceous age. These two phases of continental sedimentation are separated by marine deposits of the Moosebar Formation. See Figure 3.1-1 for the general stratigraphic relationship of Cretaceous strata which contains the northeast British Columbia coal measures within the study area. See Figure 3.1-2 for a regional coal geology map that indicates relationships between PRC's coal deposits and relevant coal geology features, namely the subcrops of the two coal measures formations, Gates and Gething, and the main structural geological features.

Figure 3.1-1 Regional Stratigraphic Section

Figure 3.1-2 Regional Cross Section

The Roman Mountain stratigraphy is confined mainly to the Lower Cretaceous (see Figure 3.1-3). Significant units, in ascending stratigraphic order are:

- Nikanassin Formation (Minnes Group)—mainly argillaceous with occasional siltstones, fine sandstones and minor coal seams. This unit straddles the Jurassic-Cretaceous boundary at the top of the Minnes Group.
- Cadomin Formation (Bullhead Group)—mainly coarse-grained, well-cemented conglomerates. Its thickness ranges from 15 to 45 m. The Cadomin is highly resistant to weathering and consequently forms a persistent and visible regional stratigraphic marker. This unit sits disconformably on the Minnes Group and forms the base of the Bullhead Group.
- Gething Formation (Bullhead Group)—alternating units of fine to coarse grained sandstone, carbonaceous shale, coal, siltstone and conglomerate. Three to four significant coal seams occur in the upper part of this formation and form part of the Project reserves. The Gething Formation coal seams have not been mined in this area. The upper contact of the Gething Formation is a thin pebble conglomerate overlain by distinctive glauconitic, marine sandstones that form the base of the overlying Moosebar Formation. Its thickness ranges from 120 to 200 m.
- Moosebar Formation (Fort St. John Group)—homogeneous dark grey shales and siltstones, often sideritic. This marine unit grades upward into similar, continental shales, forming the base of the overlying Gates Formation. The lower half of this unit is the most recessive-weathering rock in the area and commonly forms linear gullies and stream channels. Its thickness ranges from 120 to 215 m.
- Gates Formation (Fort St. John Group)—the major coal-bearing unit of the study area and comprises siltstone, shale, sandstone and conglomerate in several cycles of deposition, each culminating in a major coal seam. It is generally subdivided into the lower, middle and upper units.

  The Lower Gates comprises the Quintette Member, an 80 to 90 m thick sequence of primarily massive, fine-grained siltstones and sandstones. The Middle Gates, 90 to 100 m thick, consists of a series of fining-upward sequences that culminate in the economic coal seams of the Gates Formation. The Upper Gates comprises the Babcock Member which is a sequence of massive fluvial channel, conglomeratic sandstones and averages 20 to 30 m thick. Contained within the Upper Gates and overlying the Babcock Member is a 30 to 40 m sequence of shales and sandy shales with several thin, discontinuous coal seams. A thin bed of ferruginous chert pebbles marks the top of the unit.

  The overall thickness of the Gates Formation is 270 to 300 m.
- Hulcross Formation (Fort St. John Group)—marine unit consisting of medium-dark grey shales with thin interbeds of siltstone and very fine sandstone. Its thickness ranges from 75 to 105 m.
- Boulder Creek Formation (Fort St. John Group)—alternating sequence of shale and medium to fine-grained greywacke, overlain by conglomeratic sandstone; some thin, discontinuous coal seams exist. Its thickness averages about 130 m.

  Shaftesbury Formation (Fort St. John Group)—uppermost unit found in the area, consisting of dark grey-black marine shales with minor siltstone, with a thickness in excess of 80 m.

Figure 3.1-3 Roman Mountain Typical Stratigraphic Section

3.1.2 Coal Seam Development and Correlation

The Cadomin conglomerate and the Moosebar and Hulcross shales are particularly valuable for regional correlation, while the two main coal-bearing units, the Gates and Gething Formations, are easily distinguished (see Figure 3.1-4). The Babcock and Quintette Members are important for correlations within the Gates Formation. Correlations between the main Gates Formation coal seams are well established with those present on the Quintette Property to the north.

3.1.2.1 Gething Coal Seams

Up to four Gething coal zones and seams have been correlated regionally. In descending stratigraphic order they have been referred to as the Bird Seam, the Skeeter-Chamberlain Zone and the middle and lower coals. On the Roman Property, a single zone locally known as the Bird-GT zone is found near the top of the Gething Formation.

3.1.2.2 Gates Coal Seams

The coal seams of the Gates Formation are well established as the most prolific coal-bearing strata in northeast British Columbia. From northwest to southeast, significant thicknesses of Gates coal first occur in the Bullmoose Mountain area and continue to the provincial border, a distance of almost 140 km, and beyond. On Roman Mountain, aggregate coal seam thickness of mineable seams is approximately 16.5 m.

Both the Babcock and Quintette Members provide good marker horizons for correlation purposes. The main Gates Formation coal seams can reasonably be correlated throughout the area covered by the original Quintette Property and seam correlations within each of the drilled deposit areas are well established. From youngest to oldest, the coal seams have been labelled A to L. The main seams are D, E, F, G and J, although coal splits belonging to K Zone sometimes attain mineable thickness. Seams A, B and C within the Upper Gates Member are not sufficiently developed to present substantial economic potential.

3.1.3 Structure

The Peace River Coalfield structure is characterized by Upper Cretaceous regional thrusting and associated folding along a northwest to southeast trend, which formed the Rocky Mountain chain. The origin of the stress was from the southwest. The region is dominated by sequences of syncline and anticline pairs with southwest dipping axial planes, often truncated by high-angle thrust faults, which can splay, transecting the belt longitudinally. This has led to the repetition of coal-bearing sections several times across the 16-km wide zone. The structure within syncline and anticlines can vary from simple with gentle dips, to complex with steep dips. The fold axes vary in plunge from northwest to southeast.

Figure 3.1-4 Coal Seam Correlation

3.2 Roman Property Geology

3.2.1 Stratigraphy and Coal Seams

See Figure 3.1-3 for the principal stratigraphic and lithological units within the Gates Formation. See Table 3.2-1 for a detailed description of the Gates and Gething Formations and their associated coal seams.

Table 3.2-1 Roman Mountain Seam Data

Formation	Seam or Parting	True Thickness	
		Average (m)	Range (m)
Gates	D1	1.10	
	D1-D2 Parting	6.00	
	D2	2.40	0.80–4.70
	E1	1.80	0.30–6.70
	E1-E2 Parting	0.61	
	E2	0.73	
	E2-E3 Parting	1.50	
	E3	0.37	
	F	2.10	0.50–4.00
	G	3.73	0.70–12.00
	I	0.70	
	J	5.47	1.45–15.20
	K1	0.99	
	K2	0.83	
	K3	0.73	
Gething	Bird	3.35	
	GT Zone Total	10.70	
	GT Zone Coal	7.70	

Six major coal seams, from the D Seam at the top through the E, F, G, J and K Seams in descending stratigraphic order are present within the Gates Formation. Several subsidiary seams have been identified. Seam nomenclature is consistent with that of Trend Coal Mine and other mines in the area. See Table 3.2-1 for the average thicknesses of the Gates and Gething Seams.

The Upper Gates Formation comprises a 20-m thick zone of predominantly fine-grained sandstone containing occasional carbonaceous zones, thin claystone beds and at least four thin coal seams overlying the 10-m thick Babcock Member or D conglomerate. Its upper half is almost entirely sandstone and the lower half primarily well-sorted granule conglomerate and sandstone.

The characteristic D Seam package identified persists throughout the southeast half of the deposit. The D2 Seam average thickness remains constant at about 3 to 3.5 m across the deposit. The interburden between the D Seam and E Seam comprises predominantly fine-grained sandstone 20 to 25 m thick.

The E Seam package is found throughout the deposit. The E1 Seam varies in thickness from 2 to 2.5 m. Variations in partings and thickness sometimes makes identification of E2 Seam difficult. The E Seam is separated from the F Seam by approximately 20 m of siltstone.

The F Seam appears to thin slightly to the northwest but retains economic thickness of between 1.9 and 2.1 m throughout the southeast part of the area. The F and G Seam interburden is about 50 m thick and comprises siltstone, silty sandstone and fine-grained sandstone. The lower 10 m fines downward into a carbonaceous claystone.

The G Seam is developed over the entire deposit and varies in thickness between 0.7 and 12 m, with an average of 3.73 m. The upper part of the seam contains thin claystone laminae and the bottom metre grades into a carbonaceous siltstone that forms the base of the seam. The G Seam is separated from the I Seam by a 0.5 to 1 m thick carbonaceous claystone.

The I Seam is a shaly coal about 0.7 m in thickness. The interburden between the I and J Seam is a 2-m thick claystone.

The J Seam has a consistent thickness of about 6 m over Roman Mountain. The upper half of the seam might contain thin shaly partings, but the lower half is invariably clean. The interburden between the J and K Seams comprises a 12-m thick, fine-grained sandstone and sandy siltstone.

The J Seam normally forms the base of the economic coal zone.

The K Seam package comprises three seams (K1, K2 and K3), each separated by between 1 and 4 m of siltstone. The seam thicknesses are on average 1, 0.8 and 0.6 m, respectively. The sequence below the K Seam comprises a 20-m thick siltstone overlying persistent 1 m thick clay (unconsolidated ash fall). This clay has implications with respect to geotechnical design due to its mineralogical properties and was taken into consideration in the pit design. The clay overlies a 15-m thick, fine-grained sandstone.

The L Seam comprises a carbonaceous coal up to 2 m thick and overlies between 20 and 25 m of siltstone and claystone of the Lower Gates Formation.

The Lower Gates Formation grades downwards into the 100 to 140 m thick Moosebar Formation. The base of the Moosebar Formation is defined by the 1 to 2 m thick, glauconitic sandstone.

The top of the Gething Formation is defined by the Bird Seam. The Bird Seam varies in thickness from 4 to 5 m and only rarely does it contain thin, shaly partings. The parting between the Bird Seam and the GT Coal Zone comprises a 1- to 2-m thick claystone.

The GT Coal Zone comprises three well-defined coal seams (the GT1, GT2 and GT3 Seams). At this juncture of the investigation it has been considered prudent to refer to this as the GT coal Zone until the lateral continuity of coal seams is established. The coal zone occurs about 1 to 3 m below the Bird Seam and varies in thickness between 10 and 15 m. Individual coal seams vary in thickness between 1 and 2 m with about 60 to 70 percent of the coal zone comprising coal.

3.2.2 Roman Mountain Structure

Roman Mountain is located in the south-central region of the Peace River Coalfield and lies within the Quintette-Trend Fold Zone. The Quintette-Trend Fold Zone consists of the companion Murray Syncline, Waterfall Creek Anticline and Syncline, and Babcock

Anticline, with gently plunging northwest-southeast axial traces. The Babcock Anticline is nearly monoclinal, having a very gently dipping northeast limb. The Trend Coal Mine is located on the northeast limb of the Waterfall Creek anticline. Rock units of the Gates, Moosebar and Gething Formations are near surface and remain coherent, with faulting resulting in minimal stratigraphic displacement.

The Murray Syncline is the predominant structural feature on Roman Mountain and is a tight fold typical of the area. The syncline is asymmetrical with the northeast limb dipping fairly uniformly at 50 to 60° to the southwest. The southwest limb dips generally steeper, up to 80°. The fold axial trend is 310° T, with the hinge plunging at an average of 7.5° to the northwest.

Structural complexity varies on the property, with the northeast limb displaying moderate complexity in comparison to the more complex structure of the southwest limb. Overall, the stress from the southwest caused the strata to fold and as a mechanism for space accommodation, in-situ thrust faulting led to thickening of the coal seams in the hinge, with general thinning on the limbs. Some of the strata exhibits ductility which allowed folding, while more competent, brittle units have been faulted, leading to seam displacement, repetition and localized truncation. Thrust faulting has also resulted in minor drag folding along the thrust planes. This might explain some of the thickening of the seams in the fault zones.

At least three major steep thrust faults have been mapped on surface along the southwest limb, primarily exposed in trenches as repetitions of the J Seam in the Gates Formation and the Bird Seam in the Gething Formation. Further evidence of these faults is expressed in boreholes along the entire length of the southwest limb, where the G and J Seams show repetition and truncation.

Overall dimensions of the Roman Mountain coal deposit have been found to be close to earlier estimates but additional data has permitted a more refined the structural model.

3.3 Geochemical Assessment

Representative samples of waste rock, raw coal, coarse coal rejects (CCR) and tailings were tested to characterize the potential for acid rock drainage and metal leaching from the pit walls, waste dumps, CCR and tailings that will be produced during mining of the Project. For the locations of drill holes that were sampled for the acid rock drainage and metal leaching characterization program (see Figure 3.3-1). The geochemical testing program to characterize each major lithologic unit and possible wastes included acid base accounting, elemental analyses and kinetic testing. The details of the testing program were developed in accordance with *Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia* (Price 1997). The data were used to develop waste rock management plans to minimize the potential for acid rock drainage (ARD) and metal leaching (ML) (see Volume 1, Section 5), and to develop estimates of source concentrations (i.e., source-water quality estimates) for seepage and runoff from the waste rock dumps and pit walls for use in the predictions of discharge and receiving water quality (see Volume 2, Section 12).

Figure 3.3-1 Roman Geology Plan Showing Locations of ARD Drill Holes

Due to the close proximity and geological and geochemical similarities between Roman Mountain and the Trend Coal Mine, the objective of much of the geochemical testing program for the Project was to establish whether the Trend Coal Mine is a good geochemical analog for Roman Mountain, and therefore whether the mineralogical assessment and kinetic testing completed for the Trend Coal Mine could be used for geochemical characterization and estimates of source term concentrations for the Project. The geochemical assessment was prepared by SRK Consulting (Canada) Inc.

3.3.1 Coal, Waste Dumps, CCR and Tailings Description

As stated, the Project will target coal seams in both the Middle Gates and Gething Formations. Geochemical data from the neighbouring Trend Coal Mine (NEMI 2006), the nearby Quintette Mine, the Bullmoose Mine and the Wolverine Property indicate that the potential for acid rock drainage in the Gates Formation waste rock is generally very low (Mehling 1997; WCC 2004a). However, a small proportion of the waste rock (less than 5 percent at Quintette and Wolverine and up to 15 percent at Trend), including some of the coal seams and conglomerates, are potentially acid generating. While this can lead to localized acidic seeps (Mehling 1997), neutralization potential in the surrounding rock is sufficient to maintain neutral pH conditions in the overall seepage and runoff from the waste rock dumps and pit walls. Data from the Dillon Mine, which targets seams of the Gething Formation also indicate a generally low potential for acid rock drainage (WCC 2004b). Monitoring data from the Quintette and Bullmoose mines indicate consistently neutral pH and generally low metal concentrations in discharges from the sedimentation ponds (WCC 2004b). Monitoring of selenium at these sites, and field and laboratory testing from other coal mine properties in the area (see Section 3.4.4.2 and Appendix 3F), indicates selenium concentrations ranging from 5 to 50 times higher than the receiving water quality guideline of 0.002 mg/L. For this reason, selenium has been identified as one of the key water quality issues for all of the coal mining projects in the region.

During the Project there will be three elongated open pits, each approximately 3 km long: one main pit (Gates Pit) that will mine out the syncline east of Babcock Creek and two narrower shallow pits (Gething Pits) on either side of the Gates Pit that will follow the syncline's outcrop of the target Gething Seams. The Gates Pit will extend from the footwall of the K Seam through the hanging wall of the D Seam. The Gething Pits will extend from the footwall of the GT-3 Seam into the overlying Moosebar Formation (see Figures 3.3–2 to 3.3–5). Waste rock from the pits will be placed in waste rock dumps on the north and south sides of the pits, as well as pit backfill in the Trend Coal Mine-South Block pits. See Table 3.3-1 for estimated quantities of waste rock from each of the main interburden units.

Most of the overburden and interburden rock types associated with the Gates Pits, as well as several of the Gates coal seams will be exposed. The west wall of the pit will comprise material from immediately below the J Seam to the hanging wall of the F Seam with relative proportions roughly equivalent to the relative thicknesses of those units. The walls extending the length of Gates Pit will comprise material from the Moosebar Formation to the hanging wall of the K Seam. The void formed by the mined-out Gates Pit will be used as an in-pit tailings storage facility.

Figure 3.3-2 Typical Geological Cross-section

Figure 3.3-3 Section 12600E (Mine Grid) ARD Sampling, Pit Outlines and Stratigraphy

Figure 3.3-4 Section 13100E (Mine Grid) ARD Sampling, Pit Outlines and Stratigraphy

Figure 3.3-5 Section 11900E (Mine Grid) ARD Sampling, Pit Outlines and Stratigraphy

Table 3.3-1 Breakdown of Waste Rock Quantities by Rock Unit and Mining Phase (1000 x bcm)

	Above D-Seam	D- to K-Seam	Below K-Seam	Moosebar	Gething	Total
Gates Pit						
Phase I	4,587	26,683	13,810	0	0	45,079
Phase II	12,866	41,173	22,265	0	0	76,305
Phase III	4,373	47,645	38,719	0	0	90,737
Subtotal	21,826	115,502	74,793	–	–	212,121
Gething North Limb						
Phase I	0	0	0	503	291	794
Phase II	0	0	0	1,790	497	2,287
Phase III	0	0	0	1,322	266	1,588
Subtotal	–	–	–	3,616	1,054	4,669
Gates South Limb						
Phase I	0	0	0	1,334	167	1,501
Phase II	0	0	0	2,396	118	2,514
Phase III	0	0	0	5,081	1,444	6,525
Subtotal	–	–	–	8,812	1,728	10,540
Total	21,826	115,502	74,793	12,428	2,782	227,331
% Distribution	9.6%	50.8%	32.9%	5.5%	1.2%	100%

The Gething Pits will expose the Moosebar Formation on the south wall of the north Gething Pit and the north wall of the south Gething Pit. Gething materials from the footwall of the GT3 Seam will comprise the north wall of the north Gething Pit and south wall of the south Gething Pit. The Gething Bird and GT Seams (shown as the Gething Zone on Figures 3.3–2 to 3.3–5) and coal interburden sequence will be exposed along the bottom of each of the Gething Pits.

Run-of-mine (ROM) coal will be processed at a rate of approximately 550 tonnes/hour using conventional washing and heavy media separation techniques (see Section 4.3.4 for details). For a summary of ROM and product coal, CCR and tailings quantities see Table 3.3-2.

Both raw and clean coal will be stored in silos at the process plant. The CCR will consist of 0.15 to 31.5 mm size material. Initially, the fine tailings (-0.15 mm) will be filter pressed and along with CCR will be placed in waste dumps. Following the first two years of mine life, tailings will be discharged as slurry with approximately 25 to 30 percent solids into the Phase 1 Gates Pit void which will be used as an in-pit tailings management facility. Potentially acid-generating (PAG) CCR will also be placed in the in-pit management facility, while non-acid generating (NAG) CCR will be placed in the waste dumps.

The Project will use the existing access road to the Trend Coal Mine. Consequently there will be no new road cuts outside the maximum disturbance limit for the mine.

Table 3.3-2 Breakdown of Coal, CCR and Tailings Quantities by Seam and Mining Phase (1000x tonnes)

	Raw Coal				CCR				Tailings			
Seam	**Phase I**	**Phase II**	**Phase III**	**Total**	**Phase I**	**Phase II**	**Phase III**	**Total**	**Phase I**	**Phase II**	**Phase III**	**Total**
D2	296	784	866	1,946	98	260	287	645	10	27	30	67
E1	286	673	1,037	1,996	89	209	321	619	11	25	39	75
F	269	827	1,457	2,553	57	176	310	543	19	58	102	179
G	1,258	2,322	4,509	8,089	482	889	1,726	3,097	38	71	137	246
J	2,281	3,758	7,574	13,613	327	539	1,087	1,953	163	268	541	972
Bird	106	165	351	622	16	24	51	91	7	10	21	38
Gething	303	470	998	1,772	37	58	123	218	22	35	74	131
Total				30,591				7,165				1,707

3.3.2 Characterization Methods

3.3.2.1 Sample Selection

Two phases of sampling and static testing were completed. Phase I included two complete sections through the stratigraphic units that will be exposed during mining. The main objective of this first phase of testing was to determine whether the geochemical composition of the stratigraphic units at the Project are similar to the corresponding units at the Trend Coal Mine, and to confirm lateral continuity of the units within the Project property. Phase II was to obtain samples for additional testing of any materials found to be appreciably different than previously observed at the Trend Coal Mine.

Figure 3.3-1 shows the locations of drill holes that were sampled for the ML/ARD characterization program. Figures 3.3–3 to 3.3–5, show sections of each drill hole showing the samples relative to the coal seams. All of the samples were from HQ size drill core. Samples collected for the first phase of testing are described as follows:

- Section 12600E (see Figure 3.3-3):
  - DDHTR-2006-1, near the centre of the proposed Gates Pit included samples from the Upper Gates Formation above the D Seam through to the footwall of the J Seam
  - TRC07-004, near the centre of the proposed Gates Pit included samples from the hanging wall of the K Seam and through the Lower Gates Formation
  - TRC07-005 near the centre of the north Gething Pit included samples from the Moosebar and Gething Formations
- Section 13100E (see Figure 3.3-4):
  - DDHTR-2006-2 at the southeast end of the proposed Gates Pit included samples from the Upper Gates Formation to just above the G Seam

Samples from Phase 1 Section 12600E were analyzed for the full suite of acid base accounting (ABA) parameters and metals. Samples from DDHTR-2006-1 Section 13100E were analyzed for total sulphur and fizz rating only.

Results obtained from Phase I static testing indicated that lithologies above the D Seam generally have less sulphur than at the Trend property, but also have less neutralization potential. Phase II of static testing was to collect supplemental static data for these lithologies above the D Seam to evaluate the spatial variability of D Seam geochemical characteristics and confirm results from the first phase. Samples were selected from three additional diamond drill cores collected in the 2007 drilling program (TRC07-002, TRC07-004 and TRC07-007) (see Figure 3.1-1). These drill cores were obtained from the east end, centre and west end of the proposed Gates Pit.

In both phases of sampling, samples were selected based on the following criteria:

- Samples were selected to represent a continuous profile through the stratigraphy that will be exposed during mining. The only exceptions were the coal seams and the associated 10 cm hanging wall and footwall samples, which were required for coal quality testing.
- Intervals were selected to avoid crossing major lithological boundaries.

- Sample intervals were intended to be no longer than 12 m. Given the steep dip of the strata, this is the minimum thickness that would be possible to economically segregate in blasted waste rock in the pit.
- Intervals immediately above and below the coal seams, as well as partings between closely spaced coal seams were sampled separately as they might report to both waste rock and CCR during mining and processing. These samples were typically less than 1 m in length.

For summary logs and testing program information from each of the drill holes sampled for geochemical testing in both phases, see Appendix 3A: Sample Descriptions and Testing Program.

Representative coal, CCR, tailings, and hanging wall and footwall dilution samples from each of the coal seams were obtained from the coal quality testing programs of samples obtained from 2007 drill program. Two samples (representing median and 95th percentile sulphur concentrations) of each of these material types from each of the coal seams that will be mined or exposed were selected on the basis of coal quality data from raw coal, hanging wall and footwall samples available at the time of sample selection.

3.3.2.2 Testing Program

Samples for the first phase of testing were submitted for either acid base accounting or elemental analyses, or for analysis of total sulphur and fizz rating. Samples for the second phase of testing were submitted for acid base accounting and elemental analyses. Samples from both phases were available for the humidity column tests. See Table 3.3-3 for a summary of each phase of testing.

Table 3.3-3 Summary of Testing Program

Formation/Sample Type	Interval	Number of Samples Tested							
		ABA		S(T) and Fizz		Elemental Analyses		Humidity Column Tests	
		Ph I	Ph II	Ph I	Ph II	Ph I	Ph II	Ph I	Ph II
Upper Gates	Above D-Seam	13	26	5	-	13	26	-	2
Middle Gates	D-Seam to K-Seam	43	-	18	-	43	-	-	1
Lower Gates	Below K-Seam	7	-	-	-	7	-	-	-
Moosebar		16	-	-	-	16	-	-	-
Gething		14	-	-	-	14	-	-	-
Total Waste Rock Samples		119		23		119		3	
Hanging wall and Footwall Dilution Samples		2	41	1	-	2	41	-	-
Raw Coal Samples		2	14	1	-	2	14	-	-
CCR Samples		-	15	-	-	-	-	-	-
Tailings Samples		-	12	-	-	-	-	-	-
NOTE: Ph is abbreviation for Phase									

Static Testing

Static testing included the ABA analyses and an element scan. The majority of the ABA tests were completed using the Sobek et al. (1978) method, with sulphur speciation (total sulphur and sulphate sulphur), and total inorganic carbon (TIC). Sobek neutralization potential (NP) methods (Sobek et al. 1978) were used for consistency with other testing of coal in the region and general practices in the coal mining industry. However, it should be noted that this method might overestimate or underestimate the available neutralization potential because it is completed at boiling temperatures (enhancing reaction rates), and because the endpoint pH is not constrained in the method (which can lead to very aggressive pH conditions, or very mild conditions depending on a subjective fizz rating).

Due to a lab error, some of the ABA tests were completed using the modified Sobek method. Although this was not ideal for comparison purposes, the results are considered to be more conservative than the results from the standard Sobek tests. Therefore, the tests were not repeated.

In the interpretation of the Project test data, it appears that many of the stratigraphic intervals have lower NP in comparison to analogous units at Trend. Use of fizz ratings to determine the strength of acid added to the samples in the standard Sobek tests can lead to a systematic bias in the results from different batches of data, with lower fizz ratings often leading to lower NP results. In general, modified Sobek tests tend to result in lower NPs than standard Sobek tests, although this depends on the fizz ratings used in the standard tests. For these reasons, it might not be appropriate to attribute all of the differences in NP to differences in the rock.

Elemental analyses, including mercury and selenium, were completed using inductively coupled plasma (ICP) methods, following an aqua regia digestion.

Mineralogy

Results of the static testing program demonstrated that the geochemical characteristics of most rock types at Roman Mountain were sufficiently analogous to units at the nearby Trend Coal Mine that mineralogical data from the Trend Coal Mine (NEMI 2006) could be used to assess the ML/ARD potential of waste materials at the Roman property. Some supplemental work is currently in progress on the above D Seam sandstones and conglomerates from Roman Mountain, which tended to have much lower NP and sulphur content in comparison to the above D Seam sandstones and conglomerates at the Trend Coal Mine. However, as these units do not contain appreciable NP, the outcome of the mineralogy results are not expected to change the interpretation of results.

Mineralogical characterization for the Trend project included optical microscopy and XRD Rietveld analyses on 16 samples. Optical analyses were carried out by PetraScience Inc., Vancouver and XRD analyses were carried out by Elisabetta Pani, University of British Columbia, Vancouver.

Kinetic Testing

Results of the static testing program demonstrated that the geochemical characteristics of most rock types at Roman Mountain were sufficiently analogous to units at the nearby Trend Coal Mine that kinetic testing data from the Trend Coal Mine (NEMI 2006) could be used to estimate sulphate and metal leaching rates for the Project. The one major exception was the above D Seam sandstones and conglomerates from Roman Mountain,

which tended to have much lower NP and sulphur content in comparison to the above D Seam sandstones and conglomerates at the Trend Coal Mine.

The Trend program (NEMI 2006) included 7; 1-kg humidity cell tests, 13; 5-kg humidity column tests, and 1 anoxic column test representing a variety of rock types. The Roman program included two humidity column tests on the above D Seam material. One of these tests was configured as a layered column test to look at the interactions between more typical Middle Gates material and the above D Seam materials. See Table 3.3-4 for the types of samples and duration of testing for both the Project and Trend Coal Mine kinetic testing programs. The Roman humidity columns were terminated September 23, 2009, providing 56 weeks of leachate data for this report.

Table 3.3-4 Summary of Kinetic Testing Program

Program	Test ID	Description	Stratigraphic Position	Start Date	End Date	Duration (weeks)
Roman	Col 1-A	Siltstone/Claystone/Sandstone	Interburden between D and F-Seam	3-Sep-08	23-Sep-09	56
	Col 1-b	Sandstone and Conglomerate	Above D-Seam; high S; feed from Col 1-A	3-Sep-08	23-Sep-09	56
	Col 2	Sandstone	Above D-Seam sst; typical S	3-Sep-08	23-Sep-09	56
Trend	HC 1	Claystone/Siltstone	Hulcross Fm	3-Nov-04	6-Oct-05	44
	HC 2	Conglomerate	above D-Seam	3-Nov-04	12-May-05	27
	HC 3	Claystone	top of J-Seam	3-Nov-04	12-May-05	27
	HC 4	Claystone/Siltstone	above D-Seam	17-Nov-04	6-Oct-05	46
	HC 5	Claystone	base of G-Seam	17-Nov-04	12-May-05	25
	HC 6	CCR Composite	J and K Seam composite	17-Nov-04	12-May-05	25
	HC 7	Tailings Composite	South block composite	2-Feb-05	6-Oct-05	36
	Col 1	Sandstone/Siltstone	between D and E-Seam	3-Nov-04	12-May-05	27
	Col 2	Carbonaceous claystone and coal	between F and J-Seam	3-Nov-04	7-Jul-05	36
	Col 3	Claystone	between J and K Seam	3-Nov-04	12-May-05	27
	Col 4	Siltstone and sandstone	below K-Seam	3-Nov-04	12-May-05	27
	Col 5	Sandstone and conglomerate	below K-Seam	3-Nov-04	12-May-05	27
	Col 6	Sandstone with some conglomerate	Upper Gates	17-Nov-04	26-Apr-07	127
	Col 7	Claystone	between E and F-Seam	17-Nov-04	12-May-05	25
	Col 8	Siltstone/Claystone	between F and G-Seam	17-Nov-04	12-May-05	25
	Col 9	Sandstone	below K-Seam	17-Nov-04	12-May-05	25
	Col 10	Claystone	Moosebar	17-Nov-04	12-May-05	25
	Col 11	Sandstone	Gething footwall	17-Nov-04	12-May-05	25
	Col 12	Raw Coal Composite,	D through J Seams	19-Jan-05	6-Oct-05	38
	Col 13	CCR Composite	D through J Seams	19-Jan-05	2-Jun-05	20
	Anoxic Column	Tailings Composite (= HC 7)	South Block Composite	18-Feb-05	30-Jun-05	20

Further details on the two humidity column tests constructed to test the specific geochemical behaviour of the above D Seam sandstones and conglomerates at Roman are provided as follows. The first was configured as a layered test with leachate from a column of high NP Gates waste rock from between D and F Seams (Col 1-A) used as input to a column of above D Seam materials with higher than average total sulphur content (Col 1-B). The objective of the layered humidity column was to test the effectiveness of such layering at controlling the pH and release of oxidation products of above D Seam materials that appear to have already been significantly oxidized in-situ.

The second test (Col 2) contained a sample of the more typical, above D Seam sandstones and conglomerates with low sulphur and low NP contents. Samples were jaw crushed to half inch. Grain size analyses were completed in the representative sub-samples from each of the tests.

The layered humidity column tests were constructed such that the heights of each layer were the same (65 cm), and the surface area of the top column was two times greater than that of the bottom column. This ensured that twice as much water could be input in to the top column while still maintaining the same path length and water to rock contact ratio as the bottom column. This was necessary to produce enough leachate from the top column to have 500 mL for input to the bottom column, as well as enough for a subsample for geochemical analyses. The top column (Col 1-A) was filled with 8 kg of a high NP Gates composite sample and the bottom column (Col 1-B) was filled with 4 kg of low NP above D Seam materials with higher than average total sulphur content. Col 2 was constructed with the same dimensions as Col 1-B and was filled with 4 kg of a low NP above D Seam sandstone and conglomerate composite sample with typical total sulphur content.

Col 1-A of the layered column was initially flushed with 4 L of ultrapure deionized water. Two litres of leachate from Col 1-A was then used for the initial flush of Col 1-B. Col 2 was initially flushed with 2 L of ultrapure deionized water. Subsequent cycles for all columns were operated following the standard MEND (1991) procedure, with circulation of dry air for three days, humidified air for three days and then a flush applied as a trickle leach over a period of 16 hours. The weekly flushes were carried out with 1000 mL of ultrapure deionized water for Col 1-A, 500 mL of Col 1-A leachate for Col-1B and 500 mL of ultrapure deionized water for Col 2. Leachate from all cycles for the first 50 weeks and for every second week thereafter was collected and submitted for analysis of pH, conductivity, redox potential (Eh), sulphate, alkalinity and acidity. Analyses of dissolved elements for the duration of testing (56 weeks) were carried out according to the following analytical schedule:

- initial flush (cycle 1) and cycles 2, 4, 6, 10, and every fourth cycle thereafter were submitted for analysis of dissolved elements by ICP-MS (including Ca, Mg, Na, K and Fe)
- samples from cycles 3, 5, 8 and every fourth cycle thereafter up to cycle 48 were submitted for analysis of dissolved elements by ICP-OES. After cycle 48, the analytical frequency was reduced and analyses by ICP-OES were eliminated from the analytical schedule.

3.3.3 Geochemical Characterization Results and Discussion

3.3.3.1 Acid Base Accounting

Interpretation Criteria

For the purpose of interpretation, the following assumptions were made concerning sulphur form and calculation of acid potential (AP):

- For coal seams, CCR and tailings, the interpretation of sulphur form is complicated by the presence of sulphur as both sulphide and organic sulphur forms. Organic sulphur might be expected to oxidize but much less rapidly than sulphide minerals, therefore measurements of total sulphur will over-estimate the acid potential. To address this concern, sulphur content determined by aqua regia digestion with ICP analysis provides a better estimate of sulphur occurring as sulphide after adjustment for sulphate because the aqua regia digestion does not digest the organic sulphur forms (SRK 2006). In the interpretation of data for the Project, the acid potential for coal samples and coal waste materials (CCR and tailings) was calculated from sulphur concentrations indicated by ICP (after adjustment for sulphate content) if the ICP sulphur value was less than the total sulphur concentration. Otherwise, it was calculated from sulphide sulphur estimated by the difference between total sulphur and sulphur as sulphate.
- For non-coal units (i.e., overburden and interburden), the assumption is made that sulphur is present primarily as sulphide minerals, with insignificant proportions of organic sulphur. This is evident from the good agreement between total sulphur values and ICP sulphur values. AP for non-coal materials was calculated from sulphide sulphur estimated by the difference between total sulphur and sulphur as sulphate.

Waste Rock ABA Results

For ABA results for all waste rock samples, see Figures 3.3–6 to 3.3–9; for complete table of results, see Appendix 3B: ABA Results. For a statistical summary, see Table 3.3-5. Due to the variable length of the sample intervals, the percentiles shown in Table 3.3-5 are biased by samples that represent shorter intervals, typically those immediately adjacent to the coal seams or from coal partings. Since these intervals tend to have higher sulphur and lower NP, this bias is expected to result in a conservative indication of the overall characteristics of the unit. The length-weighted averages are not affected by this bias. Some sub-intervals, notably the partings between the D1 and D2 Seams, were over-represented because they were sampled in multiple drillholes. This type of bias was eliminated by averaging results from overlapping samples and using the averages in the overall statistics for the unit. The figures and tables do not include any of the coal seams or the 10-cm hanging wall and footwall dilution intervals immediately adjacent to the coal seams, because these materials are expected to report primarily to the coal, CCR or tailings. This enables a direct comparison between these results and the results presented in the Trend *Mines Act* Permit Application (NEMI 2006).

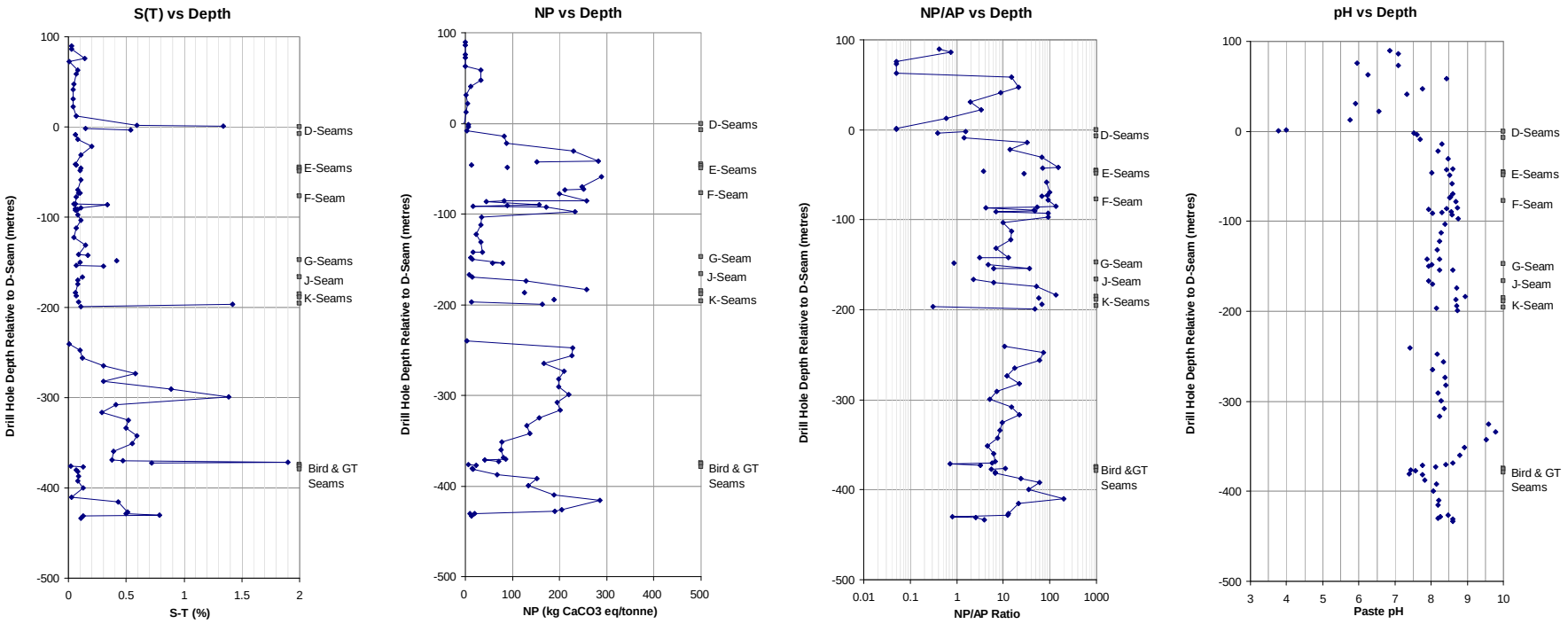

Figure 3.3-6 ABA Data with Depth—Representative Section

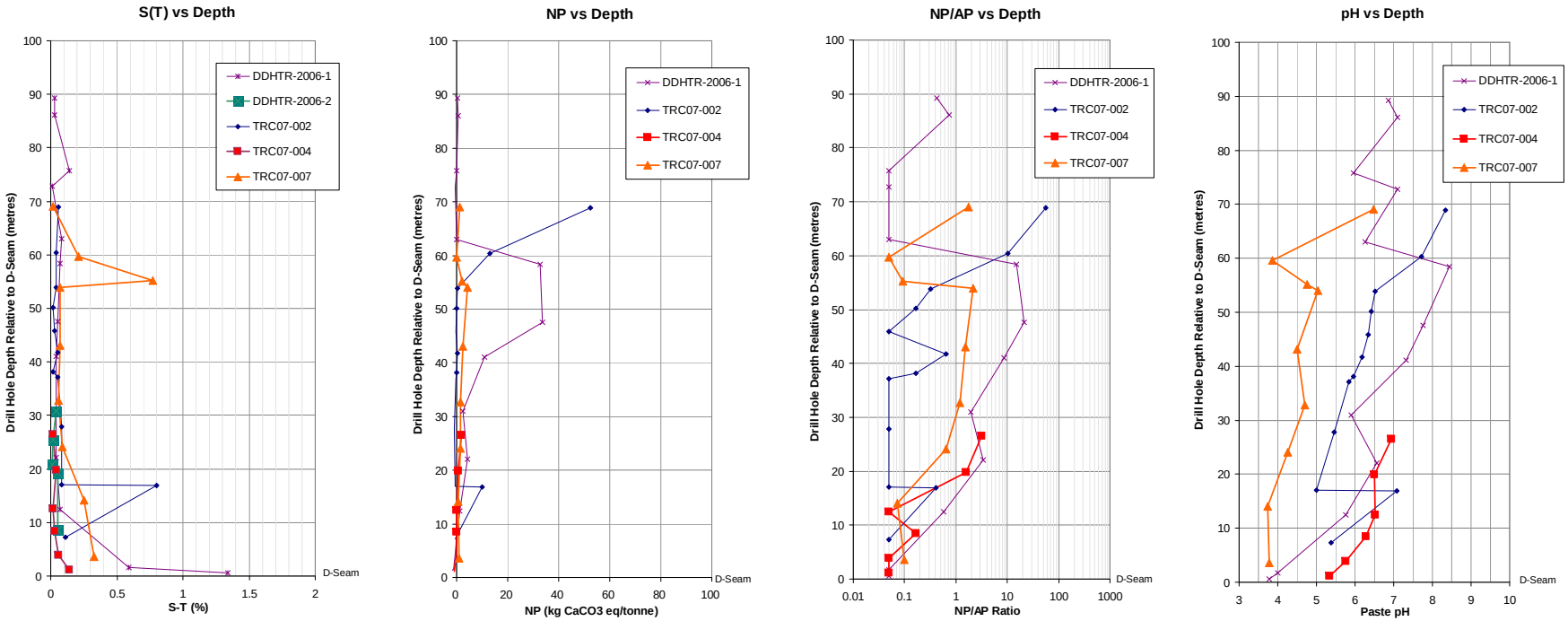

Figure 3.3-7 ABA Data with Depth—Additional Above D-Seam Drill Holes

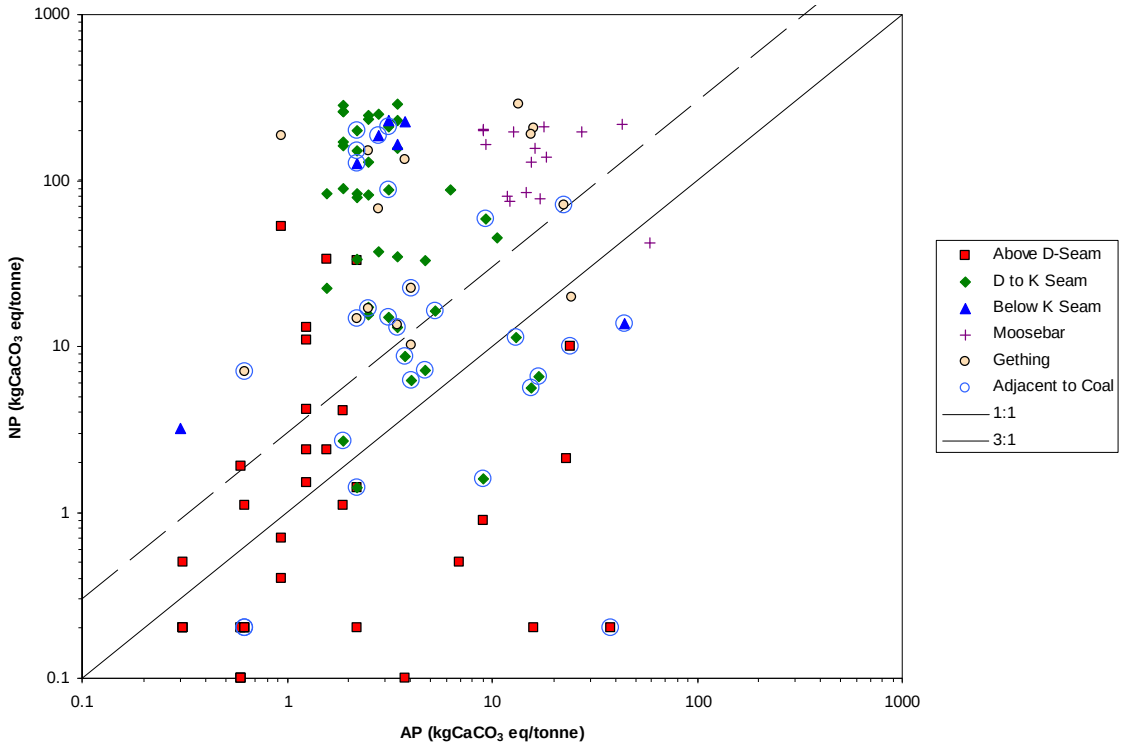

Figure 3.3-8 NP vs. AP—Waste Rock Samples

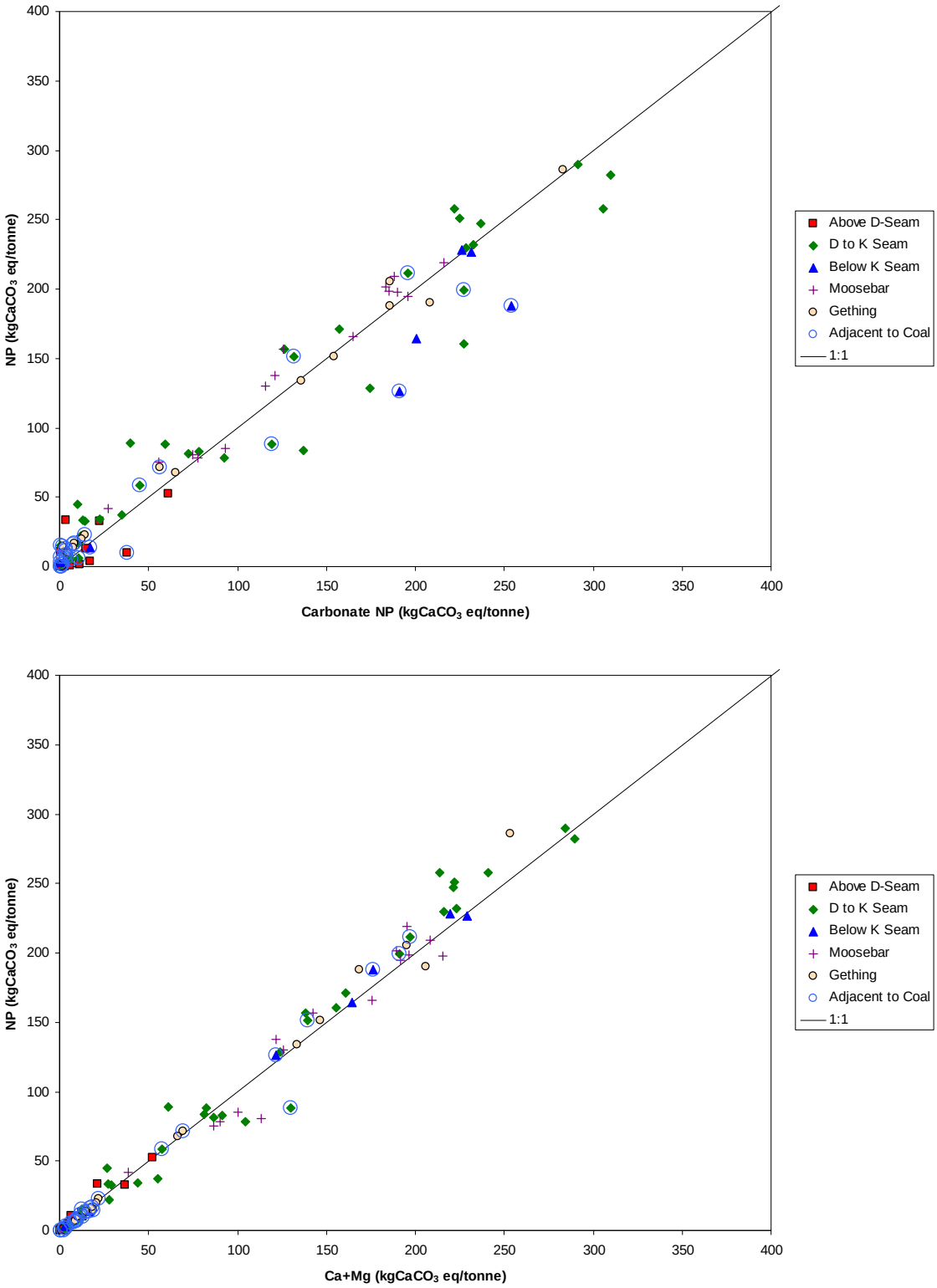

Figure 3.3-9 NP vs. TIC and Ca+Mg in Waste Rock Samples

Table 3.3-5 Summary of Acid Base Accounting Results for Waste Rock

Stratigraphy	Statistic	Paste pH	S(T) (%S)	$S(SO_4)$ (%S)	S (Sulphide)* (%S)	AP (kg $CaCO_3$/ tonne)	NP (kg $CaCO_3$/ tonne)	Net NP (kg $CaCO_3$/ tonne)	NP/ AP	$NP_{Carbonate}$ (kg $CaCO_3$/ tonne)	$NP_{carbonate}$/ AP
Above D-Seam	Min	3.74	0.01	0.01	0.01	0.3	-3.5	-41.6	-2.2	0.5	0.02
	10th Percentile	3.96	0.02	0.01	0.01	0.3	-0.7	-9.3	-1.2	0.7	0.2
	Median	6.17	0.05	0.02	0.04	1.3	0.5	-0.5	0.3	0.9	1.5
	Length Wt Average	6.12	0.10	0.02	0.09	2.7	5.9	3.2	2.2	7.2	2.7
	90th Percentile	7.40	0.31	0.08	0.33	10.4	11.3	10.1	9.0	15.1	5.9
	Max	8.43	1.34	0.12	1.22	38.1	52.5	51.6	56.0	60.9	65.0
	No. of Samples	39	44	39	39	39	39	39	39	39	39
D to K Seam	Min	6.21	0.05	0.01	0.05	1.6	2.7	-4.0	0.5	0.8	0.25
	10th Percentile	7.94	0.06	0.01	0.06	1.9	12.4	8.1	2.8	3.3	0.8
	Median	8.41	0.09	0.01	0.08	2.5	83.1	81.2	34.3	75.4	32.9
	Length Wt Average	8.41	0.10	0.01	0.10	3.0	139.0	136.0	45.9	140.5	46.4
	90th Percentile	8.71	0.26	0.01	0.22	7.0	252.7	250.1	94.6	233.8	108.3
	Max	8.95	0.68	0.02	0.42	13.1	289.5	286.1	150.4	310.0	165.3
	No. of Samples	38	56	38	38	38	38	38	38	38	38
Below K Seam	Min	7.41	0.01	0.01	0.01	0.3	3.2	-30.4	0.3	0.8	0.40
	10th Percentile	7.85	0.05	0.01	0.05	1.4	9.5	-10.4	6.5	10.8	1.8
	Median	8.34	0.10	0.01	0.10	3.1	164.0	160.6	57.6	200.7	61.8
	Length Wt Average	8.40	0.14	0.01	0.14	4.3	196.0	191.7	45.6	218.2	50.7
	90th Percentile	8.71	0.64	0.01	0.64	19.9	227.2	223.7	69.2	240.6	88.5
	Max	8.72	1.42	0.01	1.41	44.1	227.8	224.7	72.9	254.1	90.3
	No. of Samples	7	7	7	7	7	7	7	7	7	7
Moosebar	Min	7.77	0.29	0.01	0.29	9.1	41.8	-17.0	0.7	27.5	0.47
	10th Percentile	8.10	0.30	0.01	0.29	9.2	76.4	61.8	4.8	63.5	4.5
	Median	8.40	0.50	0.01	0.50	15.6	156.9	140.7	7.5	125.8	6.9
	Length Wt Average	8.68	0.56	0.01	0.56	17.4	154.8	137.4	8.9	143.5	8.3

Table 3.3-5 Summary of Acid Base Accounting Results for Waste Rock (cont'd)

Stratigraphy	Statistic	Paste pH	S(T) (%S)	$S(SO_4)$ (%S)	S (Sulphide)* (%S)	AP (kg $CaCO_3$/ tonne)	NP (kg $CaCO_3$/ tonne)	Net NP (kg $CaCO_3$/ tonne)	NP/ AP	$NP_{Carbonate}$ (kg $CaCO_3$/ tonne)	$NP_{carbonate}$/ AP
Moosebar (cont'd)	90th Percentile	9.56	1.19	0.01	1.18	36.9	206.2	190.7	20.2	193.5	19.2
	Max	9.78	1.90	0.02	1.88	58.8	219.3	192.5	22.2	215.8	20.4
	No. of Samples	15	15	15	15	15	15	15	15	15	15
Gething	Min	7.39	0.02	0.01	0.02	0.6	7.0	-4.7	0.8	0.8	0.51
	10th Percentile	7.49	0.05	0.01	0.05	1.4	11.5	6.2	2.8	3.0	0.9
	Median	8.15	0.13	0.01	0.12	3.8	67.6	49.1	11.2	56.7	3.5
	Length Wt Average	8.17	0.25	0.01	0.25	7.9	148.3	140.4	18.9	143.1	18.2
	90th Percentile	8.55	0.64	0.01	0.64	19.9	199.2	188.3	50.7	199.3	51.5
	Max	8.61	0.79	0.01	0.78	24.4	286.1	272.7	200.2	283.3	198.2
	No. of Samples	15	15	15	15	15	15	15	15	15	15
Adjacent to Coal Seams**	Min	3.77	0.02	0.01	0.02	0.6	-3.5	-41.6	-1.4	0.5	0.02
	10th Percentile	5.60	0.07	0.01	0.05	1.6	1.0	-11.0	0.1	0.8	0.2
	Median	7.75	0.12	0.01	0.11	3.4	12.9	6.4	3.1	6.6	1.3
	Length Wt Average	6.29	0.29	0.02	0.25	7.7	32.2	24.5	4.2	42.3	5.5
	90th Percentile	8.54	0.70	0.04	0.73	22.8	158.8	156.5	66.9	191.9	67.6
	Max	8.71	1.42	0.12	1.41	44.1	211.2	208.1	91.1	254.1	104.0
	No. of Samples	29	37	29	29	29	29	29	29	29	29

NOTES:
For below detection limit values, the value of the detection limit was used for statistical calculations.
* Sulphur as Sulphide was conservatively estimated as the difference between Total Sulphur and Sulphate Sulphur. For below detection $S(SO_4)$ results, a $S(SO_4)$ value was not subtracted from S(T).
** Adjacent to coal seam samples are samples within 1 m of a coal seam (excluding 10 cm dilution samples). These were included in summaries for the other stratigraphic sections.
AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from calculated sulphur as sulphide content.
NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
Net NP = Net neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
$NP_{Carbonate}$ = NP calculated from total inorganic carbon (TIC) assays as %C or CO_2. For below detection limit results, the detection limit values were used in calculation

See Figure 3.3-6 for changes in total sulphur, NP, NP/AP ratios and paste pH over depth for the representative section through all of the units that will be exposed during mining. See Figure 3.3-7 for the same set of results for the additional above D Seam sections, including the total sulphur results for the drill hole which was only analyzed for total sulphur and fizz rating (DDHTR-2006-2). The above D Seam results from the representative section are also plotted for comparison (see Figure 3.3-7). For a plot of NP versus AP for all waste rock samples, including additional above D Seam samples see Figure 3.3-8.

See Figure 3.3-9 for NP versus TIC and versus Ca+Mg for all waste rock samples, including additional above D Seam samples. The results are comparable to that of Trend Coal Mine and show that there is a good correlation between NP analyses and TIC and calcium and magnesium analyses, thus indicating that carbonates are the primary source of NP in these samples. However, a few samples had carbonate NPs higher than Sobek NPs, likely reflecting the presence of iron carbonates, which contribute to the TIC assay, but do not contribute to the NP. Several other samples had higher Sobek NPs than the carbonate NPs, potentially indicating overestimation of the NP due to reactions with silicate minerals.

In general, data for units in the Roman Property were geochemically similar to those at the Trend Coal Mine, indicating there is reasonable lateral continuity in the geochemical characteristics of these units between the two properties. The primary exception to this was for the above D Seam materials, which have lower sulphur than at the Trend Coal Mine but which also have lower NP.

Upper Gates (Above D Seam)

The upper Gates (above D Seam) materials at Roman Mountain will comprise approximately 10 percent of the waste rock produced from mining.

Rocks from the above D Seam unit include a variable sequence of conglomerates and sandstones, with minor siltstones. These are stratigraphically equivalent to the above D Seam sequence exposed at the Trend Coal Mine, and the Babcock member found in some of the open pits at the Quintette Mine. At the Trend Coal Mine, variations in sulphur and NP content of the above D Seam materials were distinct enough to enable division of the statigraphic unit into two zones: a 20 m zone of conglomerates immediately above the D Seam identified as potentially acid generating and material above 20 m identified as having relatively low potential for acid generation. A similar division of the above D Seam stratigraphy does not appear to be valid at the Project property. The above D Seam sections at Roman from five different drill holes showed that the lithology immediately above D Seam is not consistently conglomerate, but frequently sandstone, or an interbedded sequence of the two rock types. In addition, there was no consistent pattern of higher ARD potential in the rock immediately above D Seam.

Total sulphur concentrations in this stratigraphic section were variable, ranging from less than 0.01 to 1.34 percent total sulphur, with 90 percent of samples containing less than 0.31 percent sulphur. Median and length-weighted total sulphur concentrations were 0.05 and 0.10 percent, respectively. This is considerably less than the total sulphur contents observed at the Trend Coal Mine, which had overall combined (Extension and South blocks) length-weighted total sulphur values of 0.63 percent for less than 20 m above D Seam materials and 0.24 percent for more than 20 m above D Seam materials.

NP values of this stratigraphic section also tended to be low (typically less than 10 kg $CaCO_3$ eq/tonne), resulting in NP/AP ratios typically less than one. However, some intervals with higher NP values up to 50 kg $CaCO_3$ eq/tonne were present; therefore, the length-weighted average NP and APs resulted in an NP/AP ratio of 2.2 for the above D Seam materials. The overall length-weighted NP/AP ratio for this stratigraphic section classifies these materials as having uncertain acid generating potential. However, due to the small number of samples analyzed here and the fact that 67 percent of the above D Seam samples had NP/AP ratios of less than one, these materials should be considered to be potentially acid generating for waste management purposes. Paste pHs ranged from pH 3.7 to 8.43, indicating that some acid generation had already occurred in some samples.

Middle Gates (D to K Seam)

Samples from the D Seam to the top of the K Seam represent approximately 51 percent of the waste rock that would be exposed during mining. These samples generally had low sulphur, high NPs, NP to AP ratios substantially greater than three and neutral to slightly alkaline paste pHs, indicating a negligible potential for acid rock drainage. Total sulphur content was similar to the overlying Upper Gates (above D Seam) units both at Roman and at Trend, with 90 percent of samples having less than 0.26 percent sulphur, and a length-weighted average for all samples of 0.10 percent. The length-weighted average NP for Middle Gates samples at Roman was high (139 kg $CaCO_3$ eq/tonne), though less than the length-weighted average of 228 kg $CaCO_3$ eq/tonne for the same stratigraphic units observed at Trend. As discussed, some of the difference in NP between the two properties might be attributed to the subjective method used to determine acid strength in the Standard Sobek tests, and some might be attributed to differences in the standard and modified Sobek test methods. Therefore, it is not clear whether the differences in NP are due entirely to differences in the characteristics of the rock. In any case, NP to AP ratios in the Middle Gates interburden at Roman are generally much greater than three, indicating a negligible potential for acid generation.

The NP versus depth profile shows that a lower NP zone exists from about 20 m below the F Seam to just below the J Seam (see Figure 3.3-6). NP values of the siltstones and claystones in this zone are typically less than 30 kg $CaCO_3$ eq/tonne. However, due to the low sulphur content of these materials, NP ratios are generally still well over three, indicating negligible potential for acid generation.

There were some minor exceptions to the low sulphur and high NP characteristics typical of the overall Middle Gates stratigraphy. These were primarily restricted to the 1-m intervals that were immediately adjacent to each coal seam (see circles in Figure 3.3-8), which had higher sulphur, lower NP values and NP ratios of less than two. A 1-m claystone interval immediately below the D Seam and a 1 m claystone interval between the G and I seams both had NP to AP ratios of less than one due to low NP contents. Because these two claystone intervals represent only a very small proportion of the samples, and are relatively narrow (1 m), they represent only a small proportion of the total waste rock that will be produced during mining. In addition, they are surrounded by materials with relatively high NP, and are therefore expected to be well mixed with these materials during mining.

Lower Gates (Below K Seam)

Material from the Lower Gates, including the K Seam coal and interburden sequence, which is not expected to be processed, represents approximately 33 percent of the waste rock that would be exposed during mining. These samples generally appear to be geochemically similar to the upper half of the Middle Gates zone, with low total sulphur, high NPs, NP to AP ratios greater than 10 and neutral to slightly alkaline paste pH's indicating a negligible potential for ARD. As with the Middle Gates unit, the Lower Gates unit at Roman has similar total sulphur content and somewhat lower NP than observed at Trend Coal Mine. Again, this might be due in part to differences in the testing methodology.

The only exception to the generally low sulphur and high NP content of the Lower Gates zone was a relatively thin (0.74 cm) carbonaceous claystone interval immediately below K3 Seam, which had 1.42 percent total sulphur and an NP to AP ratio less than one. As with the exceptions in the Middle Gates units, the claystone interval of the Lower Gates stratigraphy is relatively narrow and represents only a small proportion of the total waste rock that will be produced. Since they are surrounded by materials with relatively high NP, it is expected that they will be well mixed with these materials during mining.

Moosebar Formation

Samples from the Moosebar Formation, which represents approximately 5.5 percent of the waste rock, tended to have elevated sulphur contents (typically 0.3 to 1.2 percent), and relatively high NPs (42 to 220 kg $CaCO_3$ eq/tonne). Most samples had NP/AP ratios greater than five. However, a 1.4-m interval of sandstone located immediately above the Gething contact had 1.9 percent total sulphur and an NP to AP ratio of 0.7. In general, the material represented by these samples is considered to be not PAG. However, due to the higher sulphur content, it is expected to contribute to release of sulphate and other contaminants from the waste rock dumps. Results for Moosebar Formation samples at Roman were within the range of values observed at Trend.

Gething Formation

Materials from the Gething Formation are expected to make up approximately 1.2 percent of the waste rock at Roman. Samples from the Gething Formation generally had low sulphur concentrations and high NP, with a length-weighted average of 0.25 percent sulphur and length weighted average neutralization potential of 148 kg $CaCO_3$ eq/tonne. While NP values were slightly lower than those observed at Trend, and total sulphur concentrations were generally slightly higher (Roman length-weighted average is 0.25 percent S; Trend is 0.18 percent S), the NP values at Roman are still high and result in NP to AP ratios typically greater than six, indicating that the Gething materials at Roman are not PAG.

A 1-m thick glauconitic claystone-sandstone zone was observed immediately above the Bird Seam and marks the Gething contact with the Moosebar formation. At the South Block at Trend, this unit had sulphur concentrations as high as 2.5 percent, negligible amounts of NP and was classified as PAG. At Roman, the one section intercepting this glauconite-rich unit had 0.72 percent total sulphur, 72 kg $CaCO_3$ eq/tonne and an NP to AP ratio of 3.2, suggesting it has a low potential for acid generation. Nonetheless, this unit should be monitored more closely to ensure that any variability in sulphur content is considered when determining where this material is placed in the waste rock dumps.

A third Gething coal zone was observed approximately 50 m below the GT Seam. The 2-m thick claystone layer directly above this seam had 0.79 percent total sulphur, 20 kg $CaCO_3$ eq/tonne and an NP to AP ratio of 0.8, indicating it has a strong potential for acid generation. Should the Gething pits intercept this unit, the sulphur content should be monitored to ensure proper placement of the material in the waste rock dumps.

For recommendations for operational monitoring of the waste rock, see Section 5.

Hanging Wall and Footwall Dilution Samples

Hanging wall and footwall dilution samples are the materials immediately above and below to the coal seams. During the mining process, this material may be recovered along with the coal, and eventually reports to the coarse coal rejects during processing. A small amount might end up in the waste rock dumps. However, due to the relatively small proportions of this material, it is expected to become well mixed with the surrounding rock during the mining and dumping process.

For ABA results for the 10 cm hanging wall and footwall dilution samples, see Figure 3.3-10. For a statistical summary, see Table 3.3-6 (for a complete table of results see Appendix 3B). As discussed, samples were selected to represent typical (median) and high sulphur concentrations (P95) on the basis of sulphur data from the coal quality testing program. The high sulphur (P95) results did show somewhat higher acid potentials for the D, K3, Bird and GT seams (as indicated by circles on the graph in Figure 3.3-10), but there was little difference between the more typical and high sulphur results for the E to J and the K1 and K2 seams.

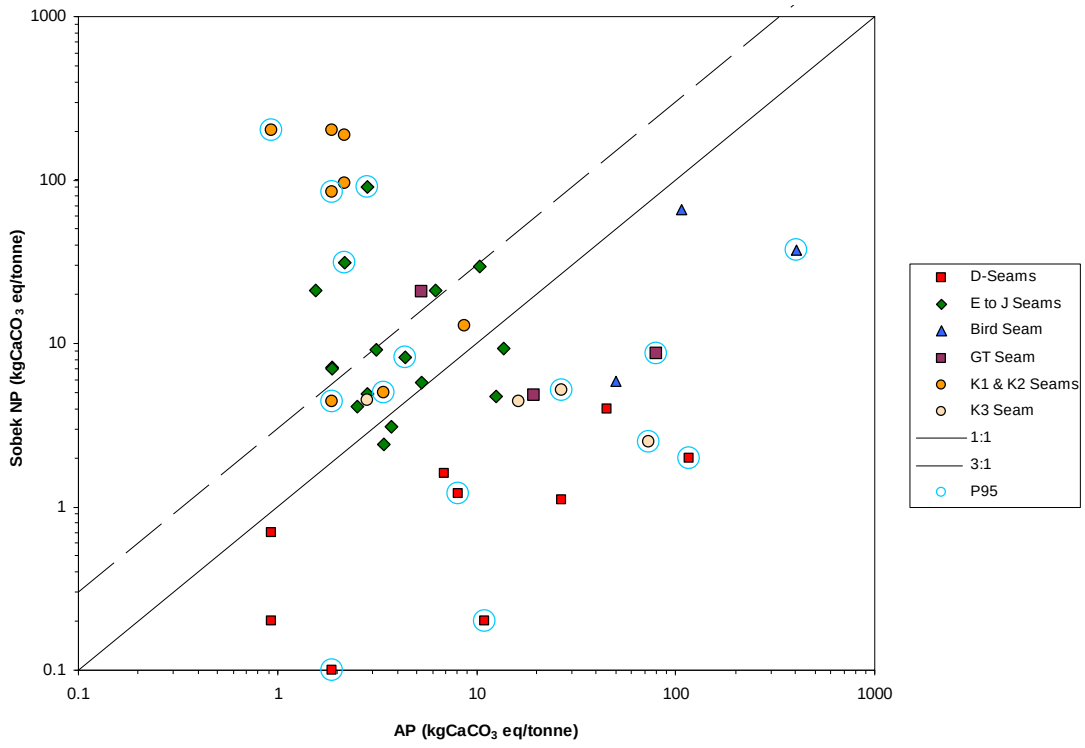

Figure 3.3-10 NP vs. AP—Hanging Wall and Footwall Dilution

Table 3.3-6 Summary of Acid Base Accounting Results for Hanging Wall and Footwall Dilution Samples

Major Zone	Interval	Paste pH	S(T) (%)	$S(SO_4)$ (%S)	S (Sulphide)* (%S)	AP (kg $CaCO_3$/ tonne)	NP (kg $CaCO_3$/ tonne)	Net NP (kg $CaCO_3$/ tonne)	NP/ AP	$NP_{Carbonate}$ (kg $CaCO_3$/ tonne)	$NP_{carbonate}$/ AP
D-Seams	D1 HW (Median)	6.43	0.11	0.08	0.03	0.9	0.7	-0.2	0.7	4.5	4.8
	D1 HW (P95)	4.84	0.28	0.02	0.26	8.1	1.2	-6.9	0.1	0.7	0.1
	D1R HW	4.99	0.08	0.05	0.03	0.9	-0.7	-1.6	-0.7	0.9	1.0
	D1 FW (Median)	6.13	0.24	0.02	0.22	6.9	1.6	-5.3	0.2	0.5	0.1
	D1 FW (P95)	6.08	0.51	0.16	0.35	10.9	-1.1	-12.0	-0.1	1.1	0.1
	D2 FW (Median)	6.12	0.89	0.03	0.86	26.9	1.1	-25.8	0.04	1.6	0.1
	D2 FW (P95)	5.80	0.08	0.02	0.06	1.9	0.1	-1.8	0.1	0.5	0.3
	D2 HW (Median)	6.20	1.49	0.03	1.46	45.6	4.0	-41.6	0.1	18.9	0.4
	D2 HW (P95)	4.26	3.84	0.07	3.77	117.8	2.0	-115.8	0.02	14.8	0.1
E-Seams	E1 FW (Median)	8.24	0.06	<0.01	0.06	1.9	7.1	5.2	3.8	12.7	6.8
	E1 HW (Median)	7.62	0.4	<0.01	0.4	12.5	4.7	-7.8	0.4	0.9	0.1
	E1 HW (P95)	8.47	0.09	<0.01	0.09	2.8	91.0	88.2	32.4	129.1	45.9
	E2 FW (Median)	7.92	0.09	<0.01	0.09	2.8	4.9	2.1	1.7	5.2	1.9
	E2 HW (Median)	8.15	0.1	<0.01	0.1	3.1	9.1	6.0	2.9	14.3	4.6
	E3 FW	8.24	0.44	<0.01	0.44	13.8	9.3	-4.5	0.7	5.0	0.4
	E3 FW		0.08								
F-Seam	F FW (Median)	7.70	0.12	<0.01	0.12	3.8	3.1	-0.7	0.8	1.6	0.4
	F HW (Median)	7.48	0.17	<0.01	0.17	5.3	5.8	0.5	1.1	3.6	0.7
G-Seam	G FW (Median)	8.38	0.2	<0.01	0.2	6.3	21.0	14.8	3.4	25.5	4.1
	G HW (Median)	8.18	0.11	<0.01	0.11	3.4	2.4	-1.0	0.7	5.0	1.5
	G HW (P95)	8.01	0.07	<0.01	0.07	2.2	31.3	29.1	14.3	106.6	48.7
I-Seam	I FW (Median)	8.01	0.08	<0.01	0.08	2.5	4.1	1.6	1.6	5.0	2.0
	I HW (Median)	7.97	0.33	<0.01	0.33	10.3	29.7	19.4	2.9	44.8	4.3
J-Seam	J FW (Median)	8.14	0.06	<0.01	0.06	1.9	7.0	5.1	3.7	11.8	6.3
	J HW (Median)	8.03	0.05	<0.01	0.05	1.6	21.0	19.4	13.4	35.5	22.7
	J HW (P95)	8.11	0.14	<0.01	0.14	4.4	8.2	3.8	1.9	14.3	3.3
K-Seams	K1 HW (Median)	8.74	0.07	<0.01	0.07	2.2	187.2	185.0	85.6	219.1	100.2
	K1 HW (P95)	8.80	0.03	<0.01	0.03	0.9	201.9	201.0	215.4	231.6	247.0

Table 3.3-6 Summary of Acid Base Accounting Results for Hanging Wall and Footwall Dilution Samples (cont'd)

Major Zone	Interval	Paste pH	S(T) (%)	$S(SO_4)$ (%S)	S (Sulphide)* (%S)	AP (kg $CaCO_3$/ tonne)	NP (kg $CaCO_3$/ tonne)	Net NP (kg $CaCO_3$/ tonne)	NP/ AP	$NP_{Carbonate}$ (kg $CaCO_3$/ tonne)	$NP_{carbonate}$/ AP
	K1 FW (Median)	7.90	0.28	<0.01	0.28	8.8	12.8	4.1	1.5	33.6	3.8
	K1 FW (P95)	8.28	0.06	<0.01	0.06	1.9	4.4	2.5	2.3	6.4	3.4
	K2 FW (Median)	8.33	0.06	<0.01	0.06	1.9	202.3	200.4	107.9	676.6	360.8
	K2 FW (P95)	8.09	0.11	<0.01	0.11	3.4	5.0	1.6	1.5	1.4	0.4
	K2 HW (Median)	8.42	0.07	<0.01	0.07	2.2	95.5	93.3	43.7	143.4	65.6
	K2 HW (P95)	8.35	0.06	<0.01	0.06	1.9	84.6	82.7	45.1	143.4	76.5
	K3 FW (Median)	8.12	0.52	<0.01	0.52	16.3	4.4	-11.9	0.3	5.5	0.3
	K3 FW (P95)	7.62	0.86	<0.01	0.86	26.9	5.2	-21.7	0.2	5.7	0.2
	K3 HW (Median)	8.15	0.09	<0.01	0.09	2.8	4.5	1.7	1.6	16.6	5.9
	K3 HW (P95)	5.54	2.35	0.02	2.33	72.8	2.5	-70.3	0.03	3.4	0.0
Bird Seam	Bird FW (Median)	5.70	1.66	0.06	1.6	50.0	5.9	-44.1	0.1	7.0	0.1
	Bird HW (Median)	7.80	3.44	0.02	3.42	106.9	65.7	-41.2	0.6	83.2	0.8
	Bird HW (P95)	5.80	13.01	0.11	12.9	403.1	37.6	-365.5	0.1	45.0	0.1
GT-Seam	GT Dilution - Combined	8.20	0.17	<0.01	0.17	5.3	20.8	15.5	3.9	22.0	4.1
	GT1 HW (Median)	4.94	0.67	0.05	0.62	19.4	4.8	-14.6	0.2	2.7	0.1
	GT1 HW (P95)	6.10	2.57	0.02	2.55	79.7	8.7	-71.0	0.1	9.3	0.1

NOTES:
Median or P95 designation indicates whether the coal seam that the sample was taken from was designated as having median or 95th percentile (P95) sulphur contents based on available coal quality data at time of sample selection.
For below detection limit values, the value of the detection limit was used for statistical calculations.
* Sulphur as Sulphide was conservatively estimated as the difference between Total Sulphur and Sulphate Sulphur. For below detection $S(SO_4)$ results, a $S(SO_4)$ value was not subtracted from S(T).
AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from calculated sulphur as sulphide content.
NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
Net NP = Net neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
$NP_{Carbonate}$ = NP calculated from total inorganic carbon (TIC) assays as %C or CO_2. For below detection limit results, the detection limit values were used in calculation.

Hanging wall and footwall samples from the D Seams had highly variable total sulphur concentrations ranging from 0.08 to 3.84 percent (median 1.1 kg $CaCO_3$ eq/tonne) and consistently low NP. As a result, all of the hanging wall and footwall material associated with these seams was considered to be potentially acid generating. Paste pHs ranged from 4.26 to 6.43, indicating that acidic conditions have already developed in some of the samples.

Samples from seams D to J had sulphur concentrations ranging from 0.05 to 0.44 percent, and variable NP, ranging from 2.4 to 91 kg $CaCO_3$ eq/tonne (median 7.7 kg $CaCO_3$ eq/tonne). The majority of these samples could be classified as not PAG to uncertain, although a few were considered to be PAG (see Figure 3.3-10).

Samples from the K1 and K2 seams had a similar range in sulphur content to the D to J seams, and higher NPs, ranging from 4.4 to 202 kg $CaCO_3$ eq/tonne (median 90 kg $CaCO_3$ eq/tonne). Three of the samples were classified as having an uncertain potential for ARD and five were classified as not PAG. In contrast, samples associated with the K3 Seam had higher sulphur concentrations and low NP, and were classified as uncertain to potentially acid generating.

Samples from the Bird Seam tended to have very high sulphur concentrations (1.7 to 13 percent), and low to moderate NP (5.9 to 59 kg $CaCO_3$ eq/tonne). All three samples were considered to be PAG.

Samples from the GT seam were more variable, with sulphur concentrations ranging from 0.17 to 2.57 percent and 4.8 to 21 kg $CaCO_3$ eq/tonne. Two of the three samples were classified as PAG, and one was considered not PAG.

These samples contained variable amounts of organic material and were expected to contain some organic sulphur. Correlations between total sulphur and ICP-S (which is the best indication of sulphide content) indicated that samples with lower amounts of total sulphur had proportionally less sulphide, suggesting that the current classifications of ARD potential are somewhat conservative for samples with low sulphur contents.

Coal, CCR and Tailings ABA Results

For results for the coal, CCR and tailings samples, see Figure 3.3-11 and Table 3.3-7.

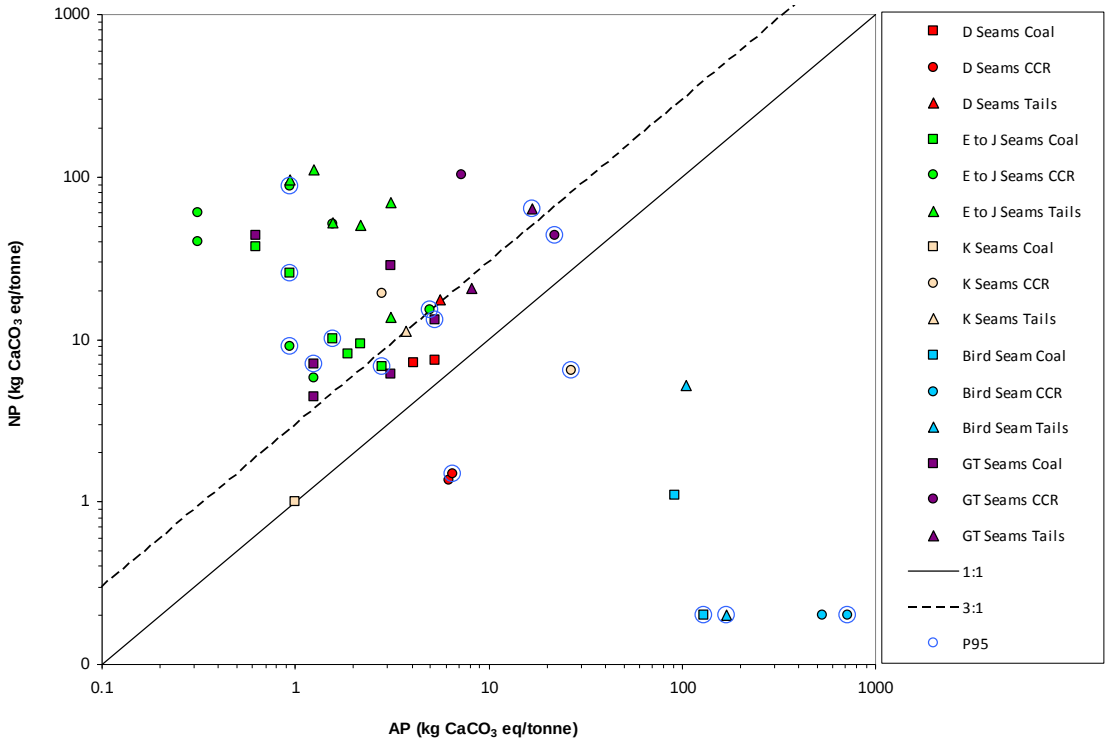

Figure 3.3-11 NP vs. AP—Coal, CCR, Tailings

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Table 3.3-7 Summary of Acid Base Accounting Results for Coal, CCR and Tailings Samples

Sample ID	Description	Drill Hole	Paste pH	S(T)	$S(SO_4)$	ICP S	S (Sulphide)*	AP	NP	Net NP	NP/AP	$NP_{Carbonate}$	$NP_{carbonate}/AP$
			(Std. Units)	(% S)	(% S)	(%S)	(%S)	(kg CaCO3/ tonne)	(kg CaCO3/ tonne)	(kg CaCO3/ tonne)		(kg CaCO3/ tonne)	
Waste Rock Program Samples													
13950	E3 Raw Coal	DDHTR-2006-2		0.61									
000375	I Raw Coal	DDHTR-2006-1	8.43	0.55	<0.01	0.06	0.06	1.88	8.2	6.3	4.4	2.5	1.3
TRC07005 000409	GT2 Seam Coal	TRC07-005	7.78	0.22	<0.01	0.02	0.02	0.6	43.8	43.2	70.1	45.0	72.0
Coal and CCR Program Samples													
TRC07-D1-7 (Pulv.)	D1 Raw Coal (Median)	TRC07-007	4.27	0.48	0.01	0.18	0.17	5.31	7.5	2.2	1.4	18.6	3.5
TRC07-D1-7 Raw Coal	D1 Raw Coal (Median)	TRC07-007	5.00	0.35	<0.01	0.13	0.13	4.06	7.2	3.1	1.8	25.9	6.4
TRC07-E1-7 (Pulv.)	E1 Raw Coal (Median)	TRC07-007	6.65	0.32	<0.01	0.07	0.07	2.19	9.4	7.2	4.3	13.4	6.1
TRC07-F9 (Pulv.)	F Raw Coal (P95)	TRC07-009	6.96	0.44	<0.01	0.05	0.05	1.56	10.1	8.5	6.5	11.8	7.6
TRC07009 F02-F10 (Pulv.) incl Fbone	F Raw Coal (P95)	TRC07-009	6.23	0.32	<0.01	0.09	0.09	2.81	6.8	4.0	2.4	3.0	1.1
TRC07007-G-7 (Pulv.)	G Raw Coal (Median)	TRC07-007	7.63	0.33	<0.01	0.02	0.02	0.63	36.9	36.3	59.0	44.3	70.9
TRC07-006 J02-J18 (Pulv.)	J Raw Coal (P95)	TRC07-006	7.93	0.28	<0.01	0.03	0.03	0.94	25.4	24.5	27.1	1.4	1.5
TRB07-Bird-8	Bird Raw Coal (Median)	TRB07-008	4.12	3.17	0.04	2.99	2.95	92.19	1.1	-91.1	0.0	47.5	0.5
TRB07-Bird-1	Bird Raw Coal (P95)	TRB07-001	4.33	4.18	0.04	4.41	4.14	129.38	0.0	-129.4	0.0	3.2	0.0
TRB07-GT1-1	GT1 Raw Coal (Median)	TRB07-001	7.97	0.35	<0.01	0.1	0.1	3.13	28.7	25.6	9.2	30.7	9.8
TRB07-GT1-7	GT1 Raw Coal (P95)	TRB07-007	8.07	0.38	<0.01	0.17	0.17	5.31	13.3	8.0	2.5	20.0	3.8
TRB07-GT2-1	GT2 Raw Coal (Median)	TRB07-001	7.46	0.29	<0.01	0.04	0.04	1.25	4.4	3.2	3.5	7.3	5.8
TRB07-GT2-7	GT2 Raw Coal (P95)	TRB07-007	7.84	0.28	<0.01	0.04	0.04	1.25	7.1	5.9	5.7	8.4	6.7
TRB07-GT3-1	GT3 Raw Coal (Median)	TRB07-001	7.42	0.52	<0.01	0.1	0.1	3.13	6.1	3.0	2.0	10.9	3.5
CCR TRC07-D2-9	D2 CCR (Median)	TRC07-009	5.68	0.29	0.01	0.21	0.2	6.3	1.4	-4.9	0.2	0.8	0.1
CCR TRC07-D2-4	D2 CCR (P95)	TRC07-004	5.40	0.39	0.02	0.23	0.21	6.6	1.5	-5.1	0.2	1.7	0.3
CCR TRC07-E2-3	E2 CCR (Median)	TRC07-003	7.78	0.28	<0.01	0.04	0.04	1.3	5.8	4.6	4.7	5.8	4.7
CCR TRC07-F-3	F CCR (Median)	TRC07-003	8.44	0.19	0.01	0.06	0.05	1.6	51.7	50.2	33.1	65.8	42.1
CCR TRC07-F-7	F CCR (P95)	TRC07-007	8.06	0.22	<0.01	0.03	0.03	0.9	9.0	8.1	9.6	11.7	12.4
CCR TRB07-G-5	G CCR (Median)	TRC07-005	8.45	0.1	0.02	0.01	0.01	0.3	39.9	39.5	127.5	45.8	146.7
CCR TRB07-G-4	G CCR (P95)	TRC07-004	7.75	0.35	0.01	0.17	0.16	5.0	15.1	10.1	3.0	12.5	2.5
CCR TRB07-J-4	J CCR (Median)	TRC07-004	8.30	0.08	0.02	0.03	0.01	0.3	60.1	59.8	192.5	70.0	224.0
Composite (CCR TRC07 J-6, J-7)	J CCR (P95)	Multiple	7.32	0.11	<0.01	0.03	0.03	0.9	87.6	86.7	93.4	105.0	112.0
Composite (CCR TRC07 K2-7 to K2-12)	K CCR (Median)	Multiple	7.05	0.24	<0.01	0.09	0.09	2.8	19.1	16.3	6.8	25.5	9.1
Composite (CCR TRC07 K3-1)	K CCR (P95)	TRC07-001	7.06	1.18	<0.01	0.86	0.86	26.9	6.5	-20.4	0.2	7.3	0.3
TRB07-Bird-1	Bird CCR (Median)	TRB07-001	4.19	17.14	0.07	>10.00	17.07	533.4	-2.8	-536.2	0.0	7.7	0.0
TRB07-Bird-8	Bird CCR (P95)	TRB07-008	4.10	23.1	0.12	>10.00	22.98	718.1	-3.7	-721.8	0.0	8.4	0.0
Comp of TRB07-001 GT CCR	GT CCR (Median)	TRB07-001	6.80	0.45	<0.01	0.23	0.23	7.2	103.7	96.5	14.4	128.2	17.8
Comp of TRB07-007 GT CCR	GT CCR (P95)	TRB07-007	7.90	0.87	<0.01	0.7	0.7	21.9	43.6	21.7	2.0	59.1	2.7
Tailings Program Samples													
Composite (Tail TRC07 D-2 to D-9)	D2 Tails (Median)	Multiple	7.24	0.57	0.03	0.21	0.18	5.6	17.6	12.0	3.1	31.8	5.7
Composite (Tail TRC07 F-1 to F-9)	F Tails (Median)	Multiple	7.41	0.4	<0.01	0.1	0.1	3.1	13.6	10.5	4.4	19.3	6.2
Tail TRB-07-G-3	G Tails (Median)	TRB07-003	8.13	0.05	<0.01	0.03	0.03	0.9	95.7	94.8	102.1	95.9	102.3
Composite (Tail TRC07 G-1, G-7)	G Tails (Median)	Multiple	7.45	0.25	<0.01	0.07	0.07	2.2	50.5	48.3	23.1	61.4	28.1
Composite (Tail TRC07 I-1)	I Tails (Median)	TRC07-001	7.66	0.18	<0.01	0.1	0.1	3.1	69.2	66.1	22.1	64.5	20.7

Table 3.3-7 Summary of Acid Base Accounting Results for Coal, CCR and Tailings Samples (cont'd)

Sample ID	Description	Drill Hole	Paste pH	S(T)	$S(SO_4)$	ICP S	S (Sulphide)*	AP	NP	Net NP	NP/AP	$NP_{Carbonate}$	$NP_{carbonate}/AP$
			(Std. Units)	(% S)	(% S)	(%S)	(%S)	(kg $CaCO_3$/ tonne)	(kg $CaCO_3$/ tonne)	(kg $CaCO_3$/ tonne)		(kg $CaCO_3$/ tonne)	
Tail TRB-07-J-3	J Tails (Median)	TRB07-003	8.17	<0.02	<0.01	0.04	0.04	1.3	110.2	109.0	88.2	110.9	88.7
Composite (Tail TRC07 J-1 to J-7)	J Tails (Median)	Multiple	7.45	0.23	<0.01	0.05	0.05	1.6	52.7	51.1	33.7	52.7	33.7
Composite (Tail TRC07 K1-2, K2-9)	K Tails (Median)	Multiple	7.53	0.49	<0.01	0.12	0.12	3.8	11.3	7.6	3.0	13.6	3.6
TRB07-Bird-8	Bird Tails (Median)	TRB07-008	5.66	4.31	0.07	3.43	3.36	105.0	5.2	-99.8	0.0	6.1	0.1
TRB07-Bird-1	Bird Tails (P95)	TRB07-001	4.70	6.58	0.17	5.62	5.45	170.3	-2.6	-172.9	0.0	2.3	0.0
Comp of TRB07-007 GT tails	GT Tails (Median)	TRB07-007	7.88	0.64	0.03	0.29	0.26	8.1	20.6	12.5	2.5	23.0	2.8
Comp of TRB07-001 GT tails	GT Tails (P95)	TRB07-001	7.70	0.87	0.03	0.57	0.54	16.9	63.7	46.8	3.8	72.7	4.3

NOTES:
Median or P95 designation indicates whether the coal seam that the sample was taken from was designated as having median or 95th percentile (P95) sulphur contents based on available coal quality data at time of sample selection.
ICP S = Sulphur concentrations determined from ICP-MS analyses. Organic S is resistant to digestion by aqua regia, therefore ICP S results can better represent inorganic S content than the S(T) analyses in organic materials such as coal.
S(Sulphide) = Sulphur as Sulphide. S(Sulphide) was estimated as the difference between Inorganic Sulphur and Sulphate Sulphur, where inorganic sulphur was assumed to be the lesser of S(T) and ICP S.
AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from calculated sulphur as sulphide content.
NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
Net NP = Net neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
$NP_{Carbonate}$ = NP calculated from total inorganic carbon (TIC) assays as %C or CO_2. For below detection limit results, the detection limit values were used in calculation.

In general, both the sulphur content and NP were low for coal, CCR and tailings from Gates Seams. In comparison to Trend, these materials generally had less total sulphur and higher NP, resulting in a relatively low potential for ARD. The only exceptions were coal and CCR associated with D Seam, which had NP to AP ratios of less than two. In contrast, all tailings samples and most CCR and coal samples from the Gates Seams had NP to AP ratios of greater than two, indicating that these materials had low potential for net acid generation.

Coal, CCR and tailings samples from the two Gething Seams showed that there are considerable geochemical differences between the Bird Seam and GT Seam samples at Roman. GT Seam coal, CCR and tailings appear to have similar total sulphur and NP as samples associated with the Gates Seams. Only one GT Seam coal sample and one GT Seam CCR sample had NP to AP ratios of 2, while all other GT Seam coal, CCR and tailings samples had NP to AP ratio between 2 and 15. In contrast, the Bird Seam coal, CCR and tailings samples had high total sulphur (3 to 23 percent) and negligible NP (less than 5 kg $CaCO_3$ eq/tonne), resulting in NP to AP ratios of less than 0.1 for all three coal materials for this seam. This indicates that Bird Seam coal, CCR and tailings have a high potential for acid generation. A comparison with Trend GT and Bird seam coal materials could not be made due to lack of data.

3.3.3.2 Elemental Analyses

Waste Rock

For a summary of elemental analyses for waste rock samples, see Table 3.3-8, along with global averages for shale and sandstone (Turekian and Wedpohl 1961, in Price 1997) and selenium data from the coal district in southeastern British Columbia (Lussier 2001). For complete results, see Appendix 3C: Elemental Analyses. As described, there is some bias towards samples representing shorter intervals in the stratigraphy, notably the 1-m intervals immediately above and below each of the coal seams. Other bias has been addressed by averaging samples that are over-represented in the dataset.

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Table 3.3-8 Summary of Elemental Analyses for Waste Rock

Stratigraphy	Statistic	As (mg/ kg)	Ba (mg/ kg)	Ca (%)	Cd (mg/ kg)	Co (mg/ kg)	Cr (mg/ kg)	Cu (mg/ kg)	Fe (%)	Mg (%)	Mn (mg/ kg)	Mo (mg/ kg)	Ni (mg/ kg)	Pb (mg/ kg)	Se*** (mg/ kg)	Zn (mg/ kg)
Above D-Seam	Min	1.7	37.9	0.01	0.01	0.4	46.5	3.05	0.21	0.01	10	1.64	4.1	2.50	0.1	1.2
	10th Percentile	2.8	56.5	0.01	0.03	0.5	183	3.83	0.28	0.01	12	3.98	5.3	3.43	0.2	2.3
	Median	4.5	74.6	0.05	0.06	1.5	215	7.04	0.44	0.01	22	4.66	10.2	5.02	0.3	17.0
	Length Wt Average	4.6	88.8	0.14	0.23	2.2	209	7.53	0.71	0.07	70	4.72	12.1	5.48	0.4	26.4
	90th Percentile	9.1	134	0.22	0.45	4.8	241	13.3	1.33	0.14	116	5.91	18.7	12.6	0.6	60.9
	Max	18.4	311	1.26	4.38	10.6	254	22.7	3.56	0.51	402	6.96	43.6	27.5	2.2	180
	No. of Samples	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
D to K Seam	Min	0.1	155	0.07	0.11	0.8	11.2	12.3	0.13	0.04	6	0.68	4.2	6.89	0.4	30.8
	10th Percentile	1.7	272	0.16	0.74	6.5	15.5	22.2	0.53	0.17	32	1.29	23.6	10.7	0.8	90.7
	Median	4.0	459	1.89	1.30	9.8	36.8	29.3	2.20	0.90	408	2.64	37.2	14.3	1.9	126
	Length Wt Average	5.1	434	3.56	1.54	9.4	57.8	27.0	2.36	1.10	437	2.85	37.3	12.9	1.7	128
	90th Percentile	9.2	567	6.22	2.34	14.1	72.5	44.9	3.37	1.78	653	3.36	52.7	20.3	3.0	179
	Max	18.4	733	8.77	3.74	17.5	123	48.5	3.74	2.25	846	4.68	60.0	22.1	3.9	202
	No. of Samples	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Below K Seam	Min	2.5	78.3	0.09	0.08	1.5	34.3	6.90	0.46	0.02	33	2.20	10.6	5.12	0.2	16.5
	10th Percentile	3.2	139	0.30	0.18	5.1	40.7	10.4	0.98	0.09	38	2.46	21.2	6.10	0.4	43.6
	Median	5.8	270	4.21	0.95	9.9	62.3	18.9	1.75	1.62	276	2.97	34.3	11.8	1.0	94.7
	Length Wt Average	6.7	336	4.95	0.72	9.3	67.7	21.9	2.22	1.66	399	2.75	35.4	11.2	1.3	91.1
	90th Percentile	23.1	518	5.95	1.87	13.0	152	41.5	3.52	1.82	698	4.73	54.2	18.4	4.5	165
	Max	46.6	598	6.08	2.18	13.5	213	45.7	3.61	1.87	782	4.93	64.6	20.1	8.0	192
	No. of Samples	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Moosebar	Min	3.9	79.2	0.86	0.10	8.0	12.4	12.7	1.81	0.42	106	0.48	23.9	9.72	0.7	79.7
	10th Percentile	5.5	158	1.89	0.14	8.1	14.3	23.4	2.21	0.99	208	0.96	25.9	12.4	0.8	81.8
	Median	7.8	346	3.19	0.28	9.4	34.4	29.7	2.39	1.53	251	2.16	36.5	13.8	1.3	102
	Length Wt Average	8.8	340	3.67	0.27	9.7	33.7	28.6	2.60	1.55	289	2.10	36.7	13.8	1.3	107
	90th Percentile	13.6	423	5.30	0.33	10.8	47.9	31.4	2.68	1.87	370	2.67	40.8	15.4	1.5	135
	Max	18.4	515	5.32	0.33	12.9	68.9	33.3	5.00	2.02	500	5.32	45.1	15.6	1.7	160
	No. of Samples	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Gething	Min	0.6	80.6	0.12	0.12	2.8	18.3	3.78	0.24	0.13	15	0.62	10.7	5.86	0.2	33.5
	10th Percentile	1.2	99.7	0.17	0.21	5.1	27.2	9.00	0.41	0.15	24	1.72	17.3	7.00	0.2	41.7
	Median	4.6	226	1.41	0.59	6.1	56.4	18.6	0.89	0.61	81	2.18	26.8	10.5	0.9	67.6
	Length Wt Average	4.8	225	3.67	0.68	5.7	89.8	14.1	1.15	1.17	137	2.52	23.5	9.79	0.6	74.7
	90th Percentile	7.6	582	5.70	3.39	10.5	124	35.5	1.69	1.48	176	3.23	40.2	17.3	2.0	189
	Max	8.6	1066	6.83	4.71	12.8	148	41.3	1.94	2.01	211	3.87	52.3	18.4	2.3	294
	No. of Samples	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Adjacent to Coal Seams**	Min	0.6	67.3	0.01	0.01	0.5	14.6	3.84	0.13	0.01	6	0.62	4.2	4.54	0.3	2.6
	10th Percentile	1.3	157	0.04	0.16	4.1	18.3	16.4	0.27	0.03	12	1.15	17.5	11.1	0.8	53.9
	Median	6.3	421	0.17	1.52	9.9	49.6	29.3	0.83	0.19	37	2.62	36.9	14.6	2.0	132
	Length Wt Average	5.9	307	0.74	1.60	7.7	66.1	23.4	1.17	0.36	167	2.56	30.4	11.3	1.5	120
	90th Percentile	14.1	632	3.89	3.59	12.9	125	47.7	2.59	1.49	508	5.10	53.4	20.4	3.5	196
	Max	46.6	1066	6.03	7.82	17.5	254	99.4	3.61	1.83	846	6.96	64.6	27.5	8.0	269
	No. of Samples	28	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 3.3-8 Summary of Elemental Analyses for Waste Rock (cont'd)

Stratigraphy	Statistic	As (mg/ kg)	Ba (mg/ kg)	Ca (%)	Cd (mg/ kg)	Co (mg/ kg)	Cr (mg/ kg)	Cu (mg/ kg)	Fe (%)	Mg (%)	Mn (mg/ kg)	Mo (mg/ kg)	Ni (mg/ kg)	Pb (mg/ kg)	Se*** (mg/ kg)	Zn (mg/ kg)
	Shale	13	580	2.21	0.3	19	90	45	4.72	1.5	850	2.60	68	20	0.6	95
	Sandstone	1	10	3.91	0.01	0.30	35	1	0.98	0.7	10	0.20	2	7	0.05	16
Global Averages			x		x			x	*	*	x					

NOTES:
X indicates that the global average for that parameter could only be estimated to the nearest order of magnitude (sandstone samples only).
* This element is present in a resistant mineral form, and may be underestimated in the ICP results due to incomplete digestion methods.
** Adjacent to coal seam samples are samples within 1 m of a coal seam (excluding 10 cm dilution samples). These were included in summaries for the other stratigraphic sections.
*** SE Coal Mines, Se concentrations of <0.5 to 8.4 ppm, median 3.8 ppm (Lussier 2001).
Shaded values indicate that the reported values are higher than the global averages for both sandstone and shale.
Bold indicates that the reported values are higher than the global averages for either sandstone or shale.
For below detection limit values, the value of the detection limit was used for statistical calculations.

Concentrations of most elements were generally in the range of the global averages for shale, and were similar to concentrations observed at the Trend Coal Mine. Selenium concentrations for all units except the Upper Gates (above D Seam) were slightly higher than global averages, but all units were slightly lower than concentrations measured at coal mines in southeast British Columbia (Lussier et al. 2001). The selenium concentrations found at Roman were generally similar to that for the Trend Coal Mine, with the exception that the above D Seam samples at Roman had slightly less selenium than at Trend. Plots showing selenium concentrations versus depth for the representative section as well as one for samples from the additional above D Seam drill holes shows that the Middle Gates interval (D to K seam) has slightly higher and more variable selenium concentrations than the other units and that most of the highest selenium concentrations are associated with samples adjacent to coal seams (see Figure 3.3-12). It can also be seen that selenium in the above D Seam material is consistently lower than the other stratigraphic units, and shows good spatial continuity throughout the property.

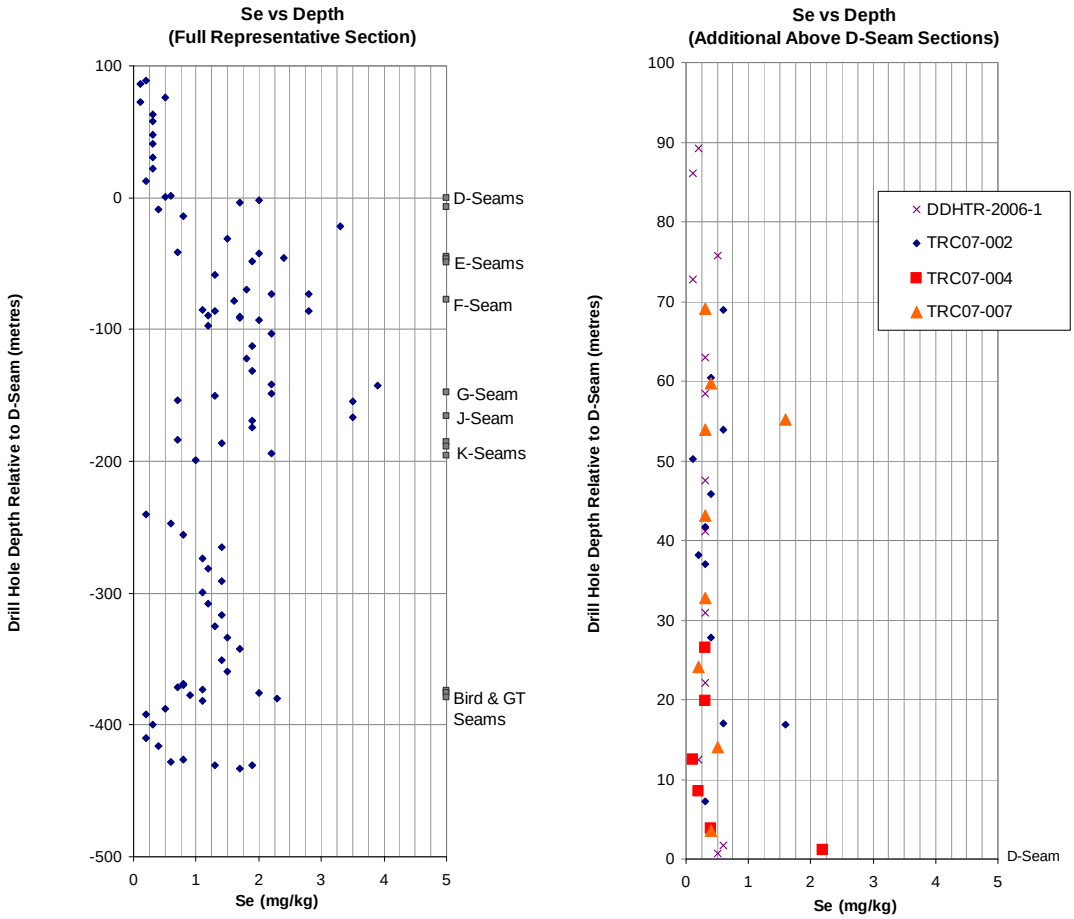

Figure 3.3-12 Selenium vs. Depth—Waste Rock Samples

In general, the coarse grained samples tended to have lower trace element concentrations than the claystones and samples adjacent to the coal seams. Samples from above D Seam

at Roman tended to have slightly lower barium, copper and nickel concentrations, and slightly higher molybdenum concentrations than samples from the stratigraphic units below D Seam. This observation was previously also noted at Trend. However, the above D Seam samples at Roman also have lower zinc concentrations than samples from the stratigraphic units below D Seam. These differences can be attributed to the relatively higher proportion of coarse grained samples in the above D Seam zone.

As was observed at Trend, concentrations of elements typically associated with sulphur-containing minerals or organic matter (e.g., selenium), were not correlated with sulphur, as has been observed at some other sites in the region.

Hanging Wall and Footwall Dilution

For a summary of elemental analyses for the hanging wall and footwall dilution samples, see Table 3.3-9, along with global averages for shale and sandstone (Turekian and Wedpohl 1961, in Price 1997) and selenium data from the coal district in southeastern British Columbia (Lussier 2001). For complete results, see Appendix 3C.

Table 3.3-9 Summary of Elemental Analyses for Hanging Wall and Footwall Dilution Samples

Major Zone	Interval	As (ppm)	Ba (ppm)	Ca (%)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mg (%)	Mn (ppm)	Mo (ppm)	Ni (ppm)	Pb (ppm)	Se (ppm)	Zn (ppm)
D-Seams	D1 HW (Median)	6	160	0.11	0.07	0.9	236.1	4.1	0.5	0.05	33	5.68	6.2	4.7	0.3	6.7
	D1 HW (P95)	9.4	196	0.06	0.17	4.6	146.7	11.1	0.37	0.01	34	0.77	20.4	8.3	0.4	55.6
	D1R HW	5.3	108	0.03	0.03	0.8	234.6	3.3	0.32	0.01	14	5.29	5.2	8.9	0.6	2.3
	D1 FW (Median)	0.2	831	0.06	4.42	4.9	14.4	28.5	0.28	0.09	19	1.49	18.9	15.6	2.6	337
	D1 FW (P95)	2	998	0.05	0.06	0.8	18.7	67.9	0.38	0.03	6	1.92	4.9	10.4	4.3	5.9
	D2 FW (Median)	8.1	94.8	0.08	0.85	8.5	12.9	21.4	0.45	0.03	5	6.85	23	11.6	3.6	168
	D2 FW (P95)	0.9	683	0.09	1.39	8.9	6.5	30.7	0.08	0.04	12	1.53	14.8	14.4	2.8	268
	D2 HW (Median)	28.8	30.4	0.13	5.28	14.9	28.4	70.5	2.48	0.18	234	2.53	73.4	18.1	2.4	289
	D2 HW (P95)	43.7	8.2	0.1	1.06	10.2	17.8	10.1	3.83	0.07	171	5.78	67.9	17.5	3.7	132
E-Seams	E1 FW (Median)	1	890	0.12	1.68	1.3	9.2	32.3	0.31	0.17	10	0.16	7.9	17.9	1.1	166
	E1 HW (Median)	8.9	355	0.17	1.79	8.7	8.1	38.9	0.29	0.05	3	2.7	46.3	18.2	5.2	136
	E1 HW (P95)	4.4	512	2.32	2.25	11.2	15.1	37.4	0.91	1.15	381	2.62	43.5	15.4	3.1	183
	E2 FW (Median)	11.8	486	0.15	1.07	1.9	65.4	34.4	0.14	0.06	9	1.32	13.9	16.0	1.8	78.6
	E2 HW (Median)	7.9	736	0.19	0.87	9.3	10.3	18.8	0.28	0.19	12	0.73	17.5	18.1	2	114
	E3 FW	2.9	325	0.2	0.68	3.7	10.2	27.3	0.08	0.09	11	1.85	7.7	12.8	2.3	140
	E3 FW															
F-Seam	F FW (Median)	4.3	371	0.18	1.15	3.6	9.4	47.8	0.12	0.06	6	0.61	15	25.7	2.4	107
	F HW (Median)	2.5	1521	0.24	0.73	5	19	19.2	0.1	0.03	8	2.44	7.1	24.3	3.6	26.7
G-Seam	G FW (Median)	6.3	807	0.5	0.44	6.7	18.4	23.2	0.24	0.27	13	2.11	16.3	13.7	1.3	32.9
	G HW (Median)	1.5	720	0.13	2.32	6.5	9	47.0	0.26	0.06	16	0.78	19.7	26.2	5.4	165
	G HW (P95)	10.7	641	0.62	1.41	17.6	16.7	49.4	3.69	0.45	1106	4.29	48.5	25.0	3.2	150
I-Seam	I FW (Median)	0.1	748	0.09	0.37	0.5	12.8	54.9	0.17	0.09	5	0.31	3.5	12.4	1.7	16.7
	I HW (Median)	8.3	706	0.56	1.63	10.3	10.5	45.2	0.96	0.38	39	3.22	31.4	23.1	4.3	142
J-Seam	J FW (Median)	1.1	904	0.15	1.56	7.1	12	45.8	0.22	0.11	7	1.13	29.1	19.7	2.6	74.4
	J HW (Median)	0.4	1148	0.44	0.69	2.4	8	37.4	0.63	0.34	38	0.89	11	19.1	3.5	103
	J HW (P95)	18.4	835	0.2	1.3	12.4	8.8	39.8	0.5	0.13	27	2.05	57.8	28.0	4.5	213
K-Seams	K1 HW (Median)	2.8	488	4.68	0.59	13.6	57.6	27.5	1	1.94	253	2.94	62	18.9	2	57
	K1 HW (P95)	2.1	371	4.25	0.61	7.3	66.8	23.8	1.07	2.02	250	1.86	18.9	9.3	1.3	52.1
	K1 FW (Median)	15.4	669	0.18	0.91	8.8	10.7	40.8	0.95	0.32	54	1.91	52.2	18.4	3	107
	K1 FW (P95)	0.1	954	0.17	0.09	0.7	13.3	32.5	0.12	0.1	13	0.73	2.9	13.9	2.1	6.3
	K2 FW (Median)	3.3	1059	1.78	0.19	2.4	13.5	9.0	30.8	0.9	6175	1.04	14	5.8	0.8	30.8
	K2 FW (P95)	3.5	948	0.25	1.83	14	12.9	47.6	0.07	0.05	3	1.65	49	21.1	3.5	149
	K2 HW (Median)	3.3	663	1.79	1.29	14.6	24.7	41.1	2.22	1.19	535	2.65	58.4	18.8	2.4	133
	K2 HW (P95)	1	630	1.88	1.62	14.1	31	41.4	1.94	1.27	536	2.72	49.1	19.4	2	177
	K3 FW (Median)	6.7	785	0.13	5.46	20	7.6	52.2	0.26	0.06	15	3.18	65.2	17.2	5.4	266
	K3 FW (P95)	8.1	130	0.13	8.94	23.7	8.3	57.1	0.38	0.06	5	4.42	59.3	17.0	6.8	350
	K3 HW (Median)	0.1	913	0.16	0.65	1.5	6.3	34.9	0.39	0.08	48	0.64	5.2	18.8	4.3	116
	K3 HW (P95)	72.7	15.7	0.09	3.85	22.7	13.6	59.6	1.76	0.06	4	6.67	149.6	32.7	9.5	137
Bird Seam	Bird FW (Median)	6.1	118	0.16	1.51	15.3	21.8	39.9	1.38	0.11	26	4.03	61.6	19.1	3.5	213
	Bird HW (Median)	30.9	75.6	1.69	0.14	13.6	134.5	16.5	3.63	0.6	331	8.29	34	18.7	0.9	60.8
	Bird HW (P95)	106	18.3	1.07	0.88	32.9	129.6	9.9	11.05	0.37	435	27.56	62.4	13.2	2.7	319

Table 3.3-9 Summary of Elemental Analyses for Hanging Wall and Footwall Dilution Samples (cont'd)

Major Zone	Interval	As (ppm)	Ba (ppm)	Ca (%)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mg (%)	Mn (ppm)	Mo (ppm)	Ni (ppm)	Pb (ppm)	Se (ppm)	Zn (ppm)
GT-Seam	GT Dilution-Combined	**2**	**452**	0.47	**0.69**	**11.6**	17.1	**39.1**	0.24	0.24	**18**	**2.06**	**37.1**	**19.7**	**3.2**	**42.9**
	GT1 HW (Median)	**2.1**	**180**	0.12	**0.33**	**1.4**	13	**13.5**	0.21	0.05	5	**0.61**	**5.7**	6.6	**1.3**	**114**
	GT1 HW (P95)	**35.1**	**109**	0.24	**0.8**	**7.9**	15.5	**26.6**	**1.64**	0.11	**14**	**2.72**	**34.6**	**19.9**	**4.5**	**110**
	Shale	13	580	2.21	0.3	19	90	45	4.72	1.5	850	2.6	68	20	0.6	95
	Sandstone	1	10	3.91	0.01	0.3	35	1	0.98	0.7	10	0.2	2	7	0.05	16
Global Averages			x		x			x	*	*	x					

NOTES:
Median or P95 designation indicates whether the coal seam that the sample was taken from was designated as having median or 95th percentile (P95) sulphur contents based on available coal quality data at time of sample selection.
X indicates that the global average for that parameter could only be estimated to the nearest order of magnitude (sandstone samples only).
* This element is present in a resistant mineral form, and may be underestimated in the ICP results due to incomplete digestion methods.
** SE Coal Mines, Se concentrations of <0.5 to 8.4 ppm, median 3.8 ppm, (Lussier 2001).
Shaded values indicate that the reported values are higher than the global averages for both sandstone and shale.
Bold indicates that the reported values are higher than the global averages for either sandstone or shale.

Concentrations of most elements were generally in the range of the global averages for shale. The only exceptions were barium, cadmium, selenium and zinc, which were somewhat higher than global averages. Concentrations of these elements were similar to results from Trend. As observed at Trend, selenium concentrations were slightly lower than concentrations measured at coal mines in southeast British Columbia (Lussier et al. 2002) and concentrations of elements typically associated with sulphur-containing minerals or organic matter (e.g., selenium), were not correlated with sulphur, as has been observed at some other sites in the region.

Coal, CCR and Tailings

For a summary of elemental analyses from the coal, CCR and tailings samples, see Table 3.3-10. Concentrations of most elements were in the same range as the global averages reported for sandstone and shale, and were similar to concentrations observed at Trend. However, selenium concentrations were somewhat higher than global averages for sandstone and shale, though they were within the range of values reported for coal mines in southeastern British Columbia (Lussier 2001), and most were within the range measured at Trend. The exceptions to this were CCR samples from the K3 and Bird Seams, which had selenium concentrations of approximately 7 mg/kg.

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Table 3.3-10 Elemental Analyses for Coal, CCR and Tailings Samples

Sample ID	Description	As (mg/kg)	Ba (mg/kg)	Ca (%)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (%)	Hg (µg/kg)	Mg (%)	Mn (mg/kg)	Mo (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Se** (mg/kg)	Zn (mg/kg)
Waste Rock Program Samples																	
13950	E3 Raw Coal																
000375	I Raw Coal	**10.7**	**300.9**	0.24	**0.97**	**4.3**	11.9	**28.91**	0.18	**45**	0.07	**40**	**2.88**	**18.3**	**12.6**	**1.6**	**55**
TRC07005 000409	GT2 Seam Coal	0.1	274.2	1.18	0.03	0.5	6.1	2.46	0.93	6	0.3	34	1.56	1.3	1.5	0.1	6.3
Coal and CCR Program Samples																	
TRC07-D1-7 (Pulv.)	D1 Raw Coal (Median)	0.6	**327**	0.33	**0.55**	**2.4**	4.1	**9.98**	0.9	23	0.04	**207**	**1.37**	**16.8**	**8.0**	**1.9**	**42.8**
TRC07-D1-7 Raw Coal	D1 Raw Coal (Median)	**<0.1**	**428**	0.35	**0.76**	**2.5**	10	**13.2**	**1.07**	13	0.06	**281**	**1.12**	**7.9**	**9.1**	**2.2**	**45.5**
TRC07-E1-7 (Pulv.)	E1 Raw Coal (Median)	1	**370**	0.27	**0.17**	**3.3**	2.3	**13.7**	0.13	**37**	0.11	7	**1.46**	**5.1**	**21.0**	**1.7**	**16.2**
TRC07-F9 (Pulv.)	F Raw Coal (P95)	**2.8**	**813**	0.31	**0.10**	**1.5**	2.5	**8.90**	0.09	**39**	0.09	6	**1.82**	**4.1**	5.3	**1**	6.0
TRC07009 F02-F10 (Pulv.) incl Fbone	F Raw Coal (P95)	1	**1227**	0.45	**0.61**	**2.9**	9.9	**26.8**	0.06	**159**	0.02	4	**3.79**	**6.4**	**22.8**	**4.5**	**40.1**
TRC07007-G-7 (Pulv.)	G Raw Coal (Median)	**1.3**	**1015**	1.19	**0.08**	**0.5**	0.7	**5.37**	0.26	17	0.22	10	**1.13**	0.9	4.5	**1**	7.7
TRC07-006 J02-J18 (Pulv.)	J Raw Coal (P95)	**1.9**	**324**	0.59	**0.05**	0.3	1.7	**8.12**	0.2	**39**	**<0.01**	**11**	**0.83**	1	5.4	**0.3**	5.6
TRB07-Bird-8	Bird Raw Coal (Median)	**10.8**	**17.8**	0.05	**0.16**	**2.9**	2.5	**8.41**	**2.43**	**406**	0.02	**20**	**1.29**	**10.6**	6.2	**1.2**	**37.2**
TRB07-Bird-1	Bird Raw Coal (P95)	**10**	7.2	0.05	**0.29**	**1.7**	4.9	**6.80**	**3.55**	**468**	0.02	**32**	**0.66**	**6.1**	2.3	**0.9**	**32.9**
TRB07-GT1-1	GT1 Raw Coal (Median)	**<0.1**	**404**	0.91	**0.03**	**0.5**	4.1	**6.51**	0.2	**<5**	0.15	**12**	**0.66**	1.4	3.0	**0.4**	11.5
TRB07-GT1-7	GT1 Raw Coal (P95)	**2.3**	**548**	0.4	**0.44**	**2.6**	3	**13.3**	0.26	18	0.12	9	**0.89**	**5.1**	5.1	**1.4**	**41.1**
TRB07-GT2-1	GT2 Raw Coal (Median)	0.1	**191**	0.11	**0.10**	**1**	1.8	**7.40**	0.06	**<5**	0.05	2	**0.99**	2	4.7	**0.5**	**34.7**
TRB07-GT2-7	GT2 Raw Coal (P95)	**<0.1**	**194**	0.2	**0.08**	**0.7**	2.5	**6.07**	0.1	**<5**	0.05	4	**1.12**	1.3	3.0	**0.5**	**25.6**
TRB07-GT3-1	GT3 Raw Coal (Median)	**<0.1**	**218**	0.14	**0.27**	**1.1**	3.8	**11.7**	0.19	13	0.06	9	**1.71**	**2.5**	6.4	**0.9**	**41.7**
CCR TRC07-D2-9	D2 CCR (Median)	**8.4**	**350**	0.07	**1.26**	**6.7**	6	**26.5**	0.21	**220**	0.03	**16**	**2.59**	**31.4**	**24.7**	**2.8**	**161**
CCR TRC07-D2-4	D2 CCR (P95)	**4.6**	**330**	0.06	**1.98**	**8.6**	5	**39.3**	0.23	**80**	0.04	**35**	**1.83**	**39.2**	**14.4**	**2.4**	**162**
CCR TRC07-E2-3	E2 CCR (Median)	**4.8**	**360**	0.14	**0.51**	**2.6**	5	**27.7**	0.11	**90**	0.06	8	**1.05**	**6.8**	**22.8**	**3.7**	**35.0**
CCR TRC07-F-3	F CCR (Median)	**6.5**	**1070**	1.18	**0.94**	**4.8**	7	**28.9**	**1.19**	**130**	0.57	**57**	**1.91**	**15.1**	**13.6**	**3.1**	**92.0**
CCR TRC07-F-7	F CCR (P95)	**3.9**	**460**	0.23	**1.23**	**5.5**	5	**34.4**	0.18	**130**	0.1	**25**	**1.56**	**21.3**	**14.3**	**2.3**	**104**
CCR TRB07-G-5	G CCR (Median)	**1.9**	**650**	1.12	**0.17**	**0.8**	3	**15.4**	0.43	**210**	0.38	**32**	**0.99**	**2.9**	**8.4**	**1.5**	**18.0**
CCR TRB07-G-4	G CCR (P95)	**5.6**	**1100**	0.43	**1.09**	**4.4**	8	**29.1**	0.24	**160**	0.16	**13**	**4.09**	**14.2**	**13.2**	**3.4**	**104**
CCR TRB07-J-4	J CCR (Median)	**2.9**	**1330**	1.71	**0.03**	**1.4**	7	**15.8**	0.55	**220**	0.49	**39**	**1.36**	**5.7**	**13.7**	**1.3**	**26.0**
Composite (CCR TRC07 J-6, J-7)	J CCR (P95)	**2.4**	**638.9**	**2.52**	**0.15**	**0.8**	8.5	**13.8**	0.78	**78**	**0.81**	**39**	**0.61**	**2.3**	**10.8**	**0.9**	9.4
Composite (CCR TRC07 K2-7 to K2-12)	K CCR (Median)	**2.1**	**550**	0.36	**0.48**	**3.4**	7.6	**19.7**	0.4	**116**	0.24	**30**	**0.87**	**11.3**	**12.7**	**2.1**	**84.1**
Composite (CCR TRC07 K3-1)	K CCR (P95)	**22.6**	**184**	0.16	**3.36**	**17.3**	7	**49.8**	0.66	**278**	0.08	7	**5.06**	**58**	**17.4**	**6.9**	**127**
TRB07-Bird-1	Bird CCR (Median)	**82.8**	**18.3**	0.18	**0.97**	**14.3**	25	**24.9**	**15.51**	**3209**	0.07	**108**	**8.82**	**48.9**	**39.5**	**7.2**	**102**
TRB07-Bird-8	Bird CCR (P95)	**70.3**	**15.6**	0.21	**0.61**	**5.6**	33.2	**6.94**	**23.7**	**3483**	0.09	**136**	**3.86**	**18.7**	2.7	**4.8**	**45.4**
Comp of TRB07-001 GT CCR	GT CCR (Median)	0.8	**620**	**3.2**	**0.66**	**1.7**	18.5	**14.1**	**1.06**	16	0.54	**43**	**1.01**	**5.8**	6.6	**1.4**	**72.5**
Comp of TRB07-007 GT CCR	GT CCR (P95)	**3.4**	**306**	1.13	**1.63**	**5.2**	22	**29.9**	**1.27**	**147**	0.35	**28**	**1.6**	**11.3**	**14.1**	**3**	**114**
Tailings Program Samples																	
Composite (Tail TRC07 D-2 to D-9)	D2 Tails (Median)	**4.4**	**494**	0.51	**0.39**	**10.1**	1.9	**24.4**	0.41	**37**	0.17	**30**	**2.69**	**32.5**	**9.4**	**1**	**102**
Composite (Tail TRC07 F-1 to F-9)	F Tails (Median)	**7.1**	**398**	0.32	**0.37**	**3.6**	1.7	**18.3**	0.3	**92**	0.18	**21**	**2.29**	**11.9**	**9.1**	**1.9**	**28.7**
Tail TRB-07-G-3	G Tails (Median)	**1.8**	**898**	**2.58**	**0.14**	**0.6**	2.3	**16.1**	0.59	**31**	0.56	**28**	**1.4**	**2.1**	**9.0**	**1.2**	**32.2**

Table 3.3-11 Elemental Analyses for Coal, CCR and Tailings Samples

Sample ID	Description	As (mg/kg)	Ba (mg/kg)	Ca (%)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (%)	Hg (ug/kg)	Mg (%)	Mn (mg/kg)	Mo (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Se** (mg/kg)	Zn (mg/kg)
Composite (Tail TRC07 G-1, G-7)	G Tails (Median)	**3.7**	**944**	1.73	**0.36**	**1.3**	3.7	**24.2**	0.39	**75**	0.45	**26**	**2.27**	**3.9**	**9.7**	**1.6**	**30.6**
Composite (Tail TRC07 I-1)	I Tails (Median)	**5.3**	**517**	1.8	**0.73**	**5.9**	20.1	**91.4**	**1.31**	**63**	0.62	**194**	**9.6**	**22.4**	**12.4**	**1.2**	**97.1**
Tail TRB-07-J-3	J Tails (Median)	**3.5**	**5644**	**3.32**	**0.12**	**0.5**	2.7	**25.0**	0.54	**154**	0.44	**29**	**1.58**	**2.5**	**12.6**	**0.8**	**32.7**
Composite (Tail TRC07 J-1 to J-7)	J Tails (Median)	**4**	**2748**	1.65	**0.13**	**0.9**	3.7	**44.4**	0.35	**54**	0.3	**27**	**2.1**	**3.8**	**8.2**	**0.7**	**19.8**
Composite (Tail TRC07 K1-2, K2-9)	K Tails (Median)	**5**	**264**	0.31	**0.38**	**5.2**	2.5	**26.6**	0.27	**99**	0.11	**38**	**2.45**	**14.7**	**9.5**	**1.8**	**60.4**
TRB07-Bird-8	Bird Tails (Median)	**11.4**	**34**	0.19	**0.25**	**6.8**	4.7	**24.4**	**2.77**	**609**	0.06	**33**	**3.07**	**29.7**	**14.0**	**1.5**	**68.1**
TRB07-Bird-1	Bird Tails (P95)	**14.1**	**18.2**	0.09	**0.38**	**1.9**	9.8	**15.9**	**5.61**	**581**	0.02	**114**	**1.34**	**8.2**	**11.4**	**1.3**	**52.4**
Comp of TRB07-007 GT tails	GT Tails (Median)	**1.6**	**818**	0.64	**0.27**	**2.4**	4.2	**20.6**	0.31	23	0.11	**19**	**1.19**	**5.4**	**8.3**	**1.5**	**53.9**
Comp of TRB07-001 GT tails	GT Tails (P95)	**2**	**189**	2.01	**0.30**	**1.4**	5.6	**29.2**	0.98	14	0.31	**42**	**1.89**	**8.7**	**11.3**	**1.9**	**86.0**
Global Averages	Shale	13	580	2.21	0.30	19	90	45	4.72	400	1.5	850	2.60	68	20	0.6	95
	Sandstone	1	10	3.91	0.01	0.30	35	1	0.98	30	0.7	10	0.20	2	7	0.05	16

NOTES:
Stat Rep = Indicates whether the coal seam from the drill core that the sample was taken from was designated as having median or 95th percentile (P95) sulphur contents based on available coal quality data at time of sample selection.
X indicates that the global average for that parameter could only be estimated to the nearest order of magnitude (sandstone samples only).
* This element is present in a resistant mineral form, and may be underestimated in the ICP results due to incomplete digestion methods
** SE Coal Mines, Se concentrations of <0.5 to 8.4 ppm, median 3.8 ppm, (Lussier 2001).
Shaded values indicate that the reported values are higher than the global averages for both sandstone and shale.
Bold indicates that the reported values are higher than the global averages for either sandstone or shale.

Bird Seam CCR and tailings samples had considerably higher arsenic, iron and mercury concentrations than the global averages for shale and the CCR and tailings samples from the other coal seams. Data for equivalent Trend samples was not available for comparison. The K3 Seam sample of CCR also had elevated arsenic; however, this seam is not expected to be mined. Samples of F Seam, G Seam and J Seam coal, CCR and tailings had higher concentrations of barium than measured at Trend. The J Seam tailings samples had up to 5644 mg/kg of barium.

3.3.3.3 Mineralogical Analyses

Results of the mineralogical analyses from the Trend project are provided in Appendix 3G and summarized in Table 3.3-12. These samples represent the same stratigraphy found at Roman, and are considered to be analogous to the rocks at Roman.

The samples were comprised primarily of quartz, carbonate, muscovite, kaolinite, and an extremely fine grained groundmass making up 5 to 80% of the matrix. Coal was present in several of the samples in quantities of 1 to 25%. Traces of feldspar, chlorite, rutile, Fe-oxides, and kerogen were also observed.

Table 3.3-12 Summary of Mineralogy Analysis

Sample #	Descriptions	Sulphides		Carbonates					
		Optical Petrology	Rietveld XRD	Optical Petrology	Rietveld XRD wt%				
		vol%	wt%	vol%	calcite	dolomite	ankerite	siderite	total
HC 01	Claystone/Siltstone - Hulcross Fm	4	2.5	2			1.4		1.4
Col 06	Sandstone with some conglomerate - Upper Gates	2	0.4	15				8.4	8.4
Col 01	Sandstone/Siltstone between D and E-seam	2		25	8.4	7.5	7.3	3.2	26.4
Col 07	Claystone between E and F-seam	tr		15				3.8	3.8
Col 08	Siltstone/Claystone between F and G-seam	tr		30	9	6.7	5.5	4.5	25.7
HC 05	Claystone at base of G-seam	2	1.4	2			0.6	0.6	1.2
HC 03	Claystone - Top J-seam	1	0.7	1			1.8	2.5	4.3
Col 03	Claystone between J and K-seam	tr		5		6.3		3.1	9.4
Col 04	Siltstone and sandstone below K-seam	1		15	2.9	5.1	2	6.1	16.1
Col 09	Sandstone below K-seam, high S	5	1.2	30	6	10.9	5.6	0.3	22.8
Col 05	Sandstone and conglomerate below K-seam, high S	1	0.4	25	3.7	8.2	3.6	0.4	15.9
Col 10	Claystone - Moosebar	4	0.9	2	2.5	14.5		0.4	17.4
Col 11	Sandstone - Gething footwall	2	0.2	35	5	8.8	5.2	0.2	19.2
Col 12	Raw Coal Composite, Seams D through J	1	1.1	0				0.3	0.3
HC 06	CCR - J and K-seam composite								
Col 13	CCR Composite, Seams D through J	1	0.2	0				0.3	0.3
HC 07	South Tailings Composite	4	2.7	3				0.7	0.7

NOTES:
tr = trace amounts observed

Several different carbonate minerals were observed based on differences in colour and association. Sulphide grains were very rare, typically less than 2%, and mostly consisted of fine rounded to framboidal pyrite and rarely traces of chalcopyrite. Exceptions were samples from Col 9 (Sandstone below K-seam), Col 10 (Claystone, Moosebar Fm), and the tailings composite which contained up to 4% by visual observation. In these samples, the pyrite occurred as framboids and masses of framboids, as well as fine to medium sized anhedral grains.

Reitveld XRD (Table 3.3-12) indicated that four types of carbonate minerals were present, namely calcite, dolomite ankerite and siderite. The analyses showed good correlation with analytical measurements of total inorganic carbon (Figure 3.3-13), indicating good quantification of the carbonates by this method. The proportion of calcium+magnesium carbonates versus iron carbonate is shown in Figure 3.3-13. The results indicated that there was substantial variability in the proportions of calcium+magnesium and iron within these rock types. Therefore it was not possible to make generalizations on the basis of rock type that could be used to quantitatively refine the interpretation of the static test results. However, in general, claystones and coaly samples contained higher proportions of iron carbonate, while the sandstones and siltstones contained higher proportions of calcium+magnesium carbonates. As a result, the reactive available portion of the carbonate NP in the claystone and coaly samples may be proportionally less than in the siltstone and sandstone samples.

The change from standard Sobek ABA used in the Trend project to modified Sobek ABA methods used in the Roman project is thought to provide a more accurate representation of the reactive NP present in these samples, making sample by sample corrections for mineralogy unnecessary.

Figure 3.3-13 Carbonate Mineralogy

3.3.3.4 Kinetic Testing

Leachate Chemistry and Contaminant Release Rates

For summaries of key results, see Figures 3.3–14 to 3.3–16 and Tables 3.3–10 to 3.3–11. For results from the humidity columns test, see Appendix 3D: Kinetic Test Results from Roman. As discussed, the only rock unit that had appreciable geochemical differences between Roman and Trend was the above D Seam material. Therefore, kinetic testing data from the Trend deposit was used to assess the geochemical performance of corresponding rock units at Roman. For this reason, data from Trend are included in the summary tables. A detailed discussion of results from the Trend program is presented in NEMI (2006); for specific excerpts and detailed results, see Appendix 3E: Kinetic Test Results from Trend.

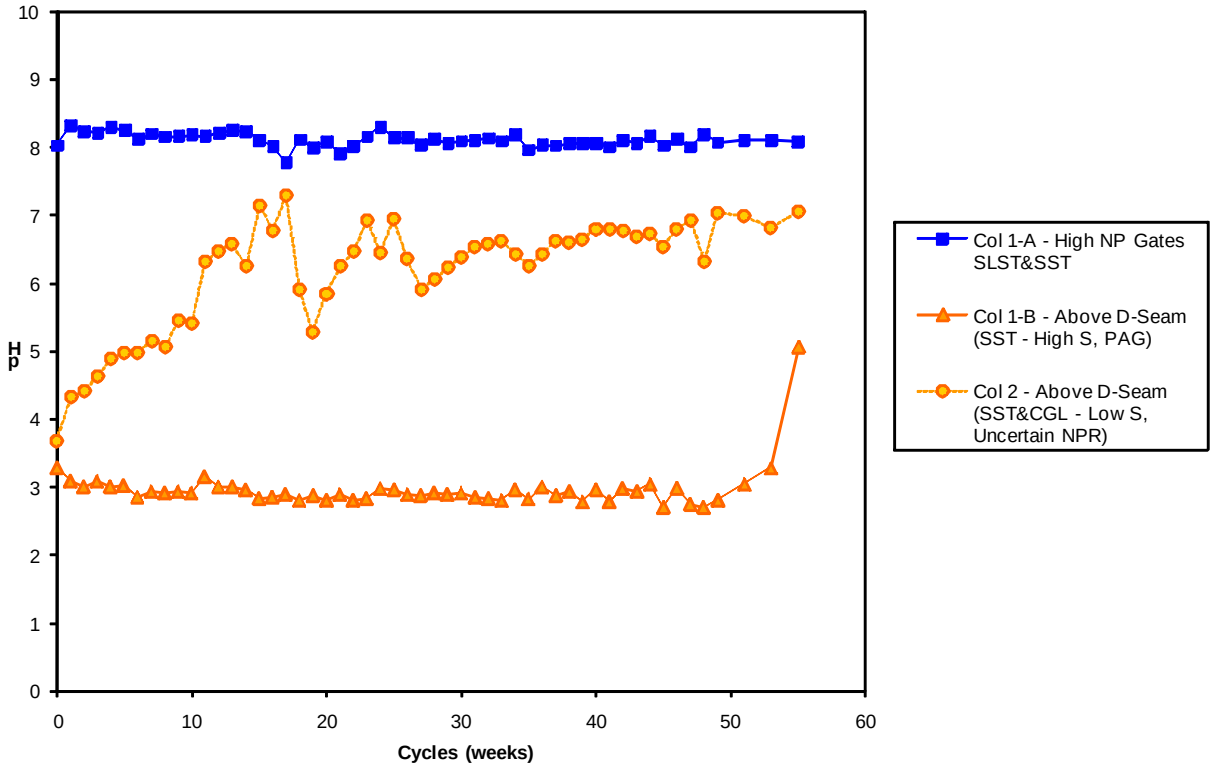

Figure 3.3-14 Kinetic Test Results—pH

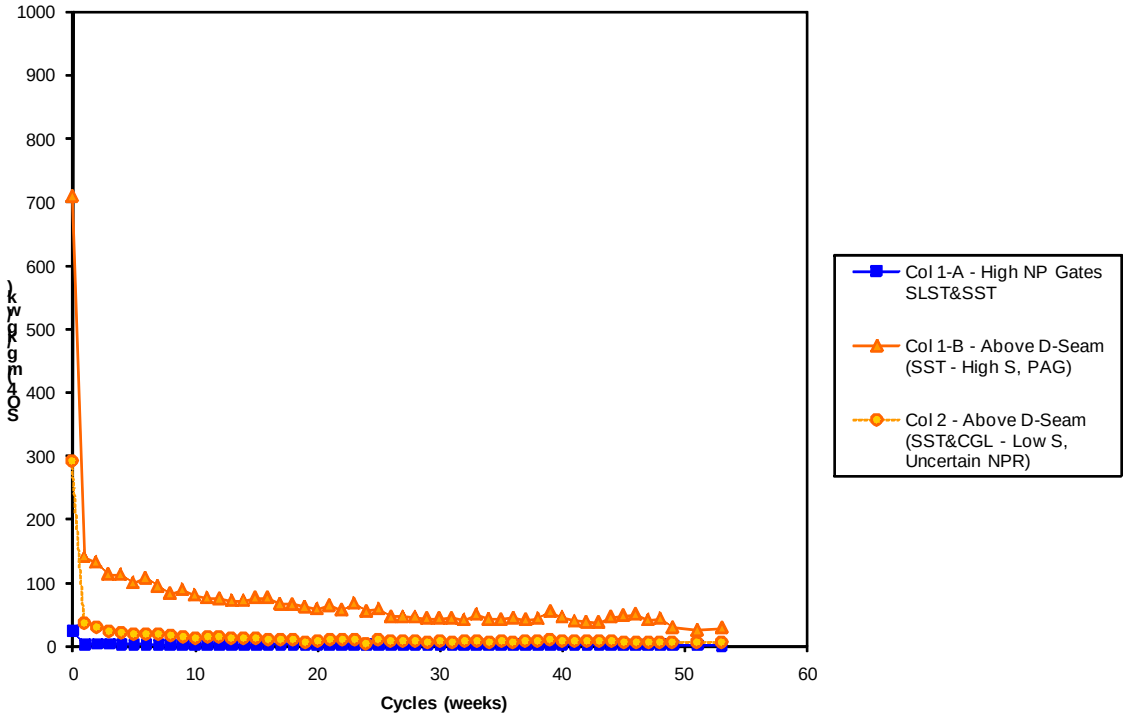

Figure 3.3-15 Kinetic Test Results—Sulphate

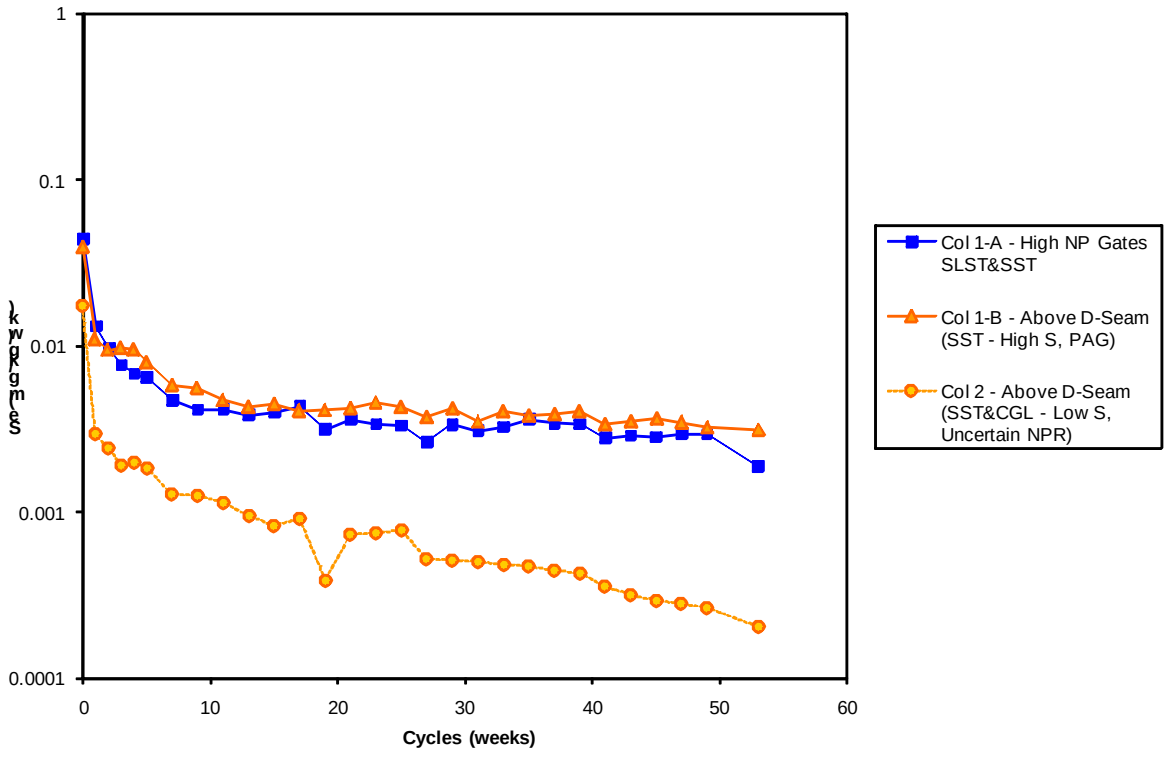

Figure 3.3-16 Kinetic Test Results—Selenium

Table 3.3-13 Summary of Kinetic Test Results

Program	Cell #	Drill Hole	Depths		Descriptions	Static Tests					Kinetic Tests							
			From	To		Paste pH	S	NP	NP/AP	Se	pH		Initial Loading		Overall Rate		Stable Rate	
													SO_4	Se	SO_4	Se	SO_4	Se
			m	m		s.u.	(%)	($kgCaCO_3/t$)		(ppm)	min	max	(mg/kg/week)					
Roman	Col 1-A	DDHTR-2006-1	104.6	169.55	D to F Seam IB slst/cly/sst	8.4	0.11	171	49	1.8	7.7	8.3	23.9	0.0441	3.0	0.0047	2.5	0.0033
	Col 1-B	TRC07-007	56	70	Above D-Seam sst and cgl; high S; feed from Col 1-A	3.7	0.27	0.60	0.08	0.48	2.7	5.1	709	0.0393	73.4	0.0053	50.7	0.0039
	Col 2	TRC07-007	16.13	56	Above D-Seam sst; typical S	4.6	0.07	2.4	1.4	0.27	3.7	7.3	292	0.0173	16.45	0.0011	8.5	0.0005
Trend	HC 01	DDH-TE-04-07	19.75	26.82	Claystone/Siltstone - Hulcross Fm	8.0	1.22	24.4	0.6		6.4	8.2	458	0.0134	41.0	0.0013	52.8	0.0011
	Col 06	DDH-TS-04-04	70.86	78.66	Sandstone with some conglomerate - Upper Gates	7.7	0.26	17.8	2.2	0.7	6.7	8.1	160	0.0063	18.9	0.0005	14.1	0.0003
	HC 02	DDH-TE-04-06	72.53	76.79	Conglomerate above D-seam	4.7	0.82	0.9	0.03	0.1	2.3	2.9	1800	0.0101	178.2	0.0013	182.3	0.0017
	HC 04	DDH-TS-04-01	60.26	63.23	Claystone/Siltstone above D-seam	7.3	0.56	5.8	0.3		3.4	6.8	135	0.0193	42.2	0.0077	66.7	0.0058
	Col 01	DDH-TE-04-06	97.39	108.43	Sandstone/Siltstone between D and E-seam	8.5	0.04	266.3	213.0	1.0	7.5	8.3	6.3	0.0077	0.8	0.0017	0.8	0.0017
	Col 07	DDH-TS-04-01	94.59	106.42	Claystone between E and F-seam	8.0	0.02	16.4	27.3	1.3	7.4	8.1	3.6	0.0110	0.5	0.0034	0.6	0.0034
	Col 08	DDH-TS-04-01	132.33	145.30	Siltstone/Claystone between F and G-seam	8.4	0.07	324.5	148.3		7.9	8.2	4.0	0.0104	0.5	0.0023	0.5	0.0018
	HC 05	DDH-TS-04-01	181.82	182.84	Claystone at base of G-seam	8.2	0.22	10.3	1.5		6.3	8.0	1.9	0.0081	2.0	0.0048	2.5	0.0041
	Col 02	DDH-TE-04-06	128.48	147.79	Carbonaceous claystone and coal between F and J-seam	8.4	0.06	70.7	37.7	2.1	7.7	8.2	6.2	0.0190	1.4	0.0043	2.1	0.0047
	HC 03	DDH-TE-04-06	193.83	194.83	Claystone - Top J-seam	8.3	0.20	16.3	2.6	1.9	6.5	8.1	16.9	0.0263	2.1	0.0040	2.4	0.0041
	Col 03	DDH-TE-04-01	72.62	77.59	Claystone between J and K-seam	8.5	0.07	115.0	52.6	2.2	7.7	8.3	3.4	0.0277	0.6	0.0046	0.8	0.0050
	Col 04	DDH-TE-04-01	94.15	110.08	Siltstone and sandstone below K-seam	8.9	0.06	78.7	45.8	0.8	7.9	8.7	5.5	0.0126	0.6	0.0019	0.5	0.0018
	Col 09	DDH-TS-04-03	92.64	111.80	Sandstone below K-seam, high S	9.0	0.91	232.2	8.2	0.3	7.7	8.2	112.8	0.0056	25.3	0.0011	21.2	0.0009
	Col 05	DDH-TE-04-01	114.49	132.94	Sandstone and conglomerate below K-seam, high S	8.7	0.14	109.5	25.6	0.1	7.7	8.3	64.5	0.0058	5.6	0.0006	3.7	0.0004
	Col 10	DDH-TS-04-07	15.21	45.45	Claystone - Moosebar	8.9	0.76	187.8	7.9	1.4	7.9	8.3	15.0	0.0197	4.6	0.0031	5.4	0.0027
	Col 11	DDH-TS-04-02	23.08	42.61	Sandstone - Gething footwall	9.0	0.08	188.2	75.3	0.6	7.8	8.3	54.9	0.0162	5.0	0.0012	3.6	0.0008
	HC 06	–	–	–	Raw Coal Composite, Seams D through J	8.4	0.09	38.8	13.8		5.2	8.0	1.9	0.0004	0.5	0.0001	0.5	0.0001
	Col 12				CCR - J and K-seam composite	7.2	0.06	2.0	1.1	0.8	3.3	7.3	2.3	0.0003	2.0	0.0001	2.0	0.0001
	Col 13				CCR Composite, Seams D through J	7.3	0.17	1.5	0.3	2.4	5.0	8.2	0.8	0.0007	0.3	0.0001	0.3	0.0001
	Anoxic Column				South Tailings Composite	6.7	0.14	4.8	1.1		7.1	8.0	45.1	0.0062	3.2	0.0003	1.5	0.0003
	HC 07				South Tailings Composite	6.7	0.14	4.8	1.1		3.6	6.8	1.9	0.0004	6.8	0.0002	15.4	0.0001

Table 3.3-14 Summary of Trace Element Concentrations in Kinetic Tests

Statistic	Program	Cell #	Drill Hole	Depths		Descriptions	Parameter																		
				from	to		pH	Alk	SO_4	Al	Sb	As	Ba	Cd	Ca	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	K	Se	Na	Zn
				(m)	(m)			(mg Ca CO_3/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Median	Roman	Col 1-A	DDHTR-2006-1	104.60	169.55	D to F Seam IB slst/cly/sst	8.1	224	21	0.004	0.003	0.0002	0.25	0.00003	40	0.003	0.0013	-0.001	0.00004	26.9	0.006	0.030	0.008	12.1	0.028	0.63	0.0006
		Col 1-B	TRC07-007	56.00	70.00	Above D-Seam sst and cgl; high S; feed from Col 1-A	2.9		440	17.4	0.0003	0.061	0.013	0.0018	42	0.066	0.19	77	0.00057	28.4	0.51	0.0003	0.30	7.1	0.033	0.95	0.50
		Col 2	TRC07-007	16.13	56.00	Above D-Seam sst; typical S	6.5	3.5	80	0.009	-0.00002	0.00006	0.028	0.0005	10	0.015	0.0027	0.015	0.00071	14.5	1.7	-0.00005	0.12	0.95	0.006	0.29	0.024
	Trend	HC 01	DDH-TE-04-07	19.75	26.82	Claystone/Siltstone - Hulcross Fm	7.5	20	89	0.009	0.0004	0.0002	0.02	-0.00004	29	-0.0002	-0.0002	-0.01	-0.0002	10.1	0.024	0.0036	0.0008	4.3	0.0028	0.30	0.001
		Col 06	DDH-TS-04-04	70.86	78.66	Sandstone with some conglomerate - Upper Gates	8.0	66	234	-0.005	-0.0010	-0.0010	0.03	-0.00020	57	0.001	-0.0010	-0.01	-0.0010	44.5	0.06	0.0004	0.0075	4.6	0.0051	0.40	0.007
		HC 02	DDH-TE-04-06	72.53	76.79	Conglomerate above D-seam	2.5		405	2.230	0.0004	0.0200	0.01	0.00003	9	0.023	0.16	163	0.0003	3.0	1.0	0.0005	0.16	0.04	0.0027	0.16	0.42
		HC 04	DDH-TS-04-01	60.26	63.23	Claystone/Siltstone above D-seam	4.1	1	73	0.094	-0.0002	0.0002	0.03	0.0023	15	0.11	0.0076	0.15	-0.0002	7.0	0.22	-0.0001	0.33	3.4	0.016	0.20	0.72
		Col 01	DDH-TE-04-06	97.39	108.43	Sandstone/Siltstone between D and E-seam	8.1	94	11	0.010	0.0010	0.0008	1.1	-0.00001	23	0.0010	-0.0002	-0.01	-0.0002	12.4	0.014	0.050	0.0031	9.7	0.025	1.5	-0.001
		Col 07	DDH-TS-04-01	94.59	106.42	Claystone between E and F-seam	7.9	54	6	0.008	0.0079	0.0058	1.9	-0.00001	24	0.0014	0.0004	-0.01	-0.0002	9.1	0.013	0.14	0.0065	6.9	0.043	1.9	-0.001
		Col 08	DDH-TS-04-01	132.33	145.30	Siltstone/Claystone between F and G-seam	8.1	91	7	0.008	0.0020	0.0010	1.8	-0.00001	22	0.0022	0.0005	-0.01	-0.0002	8.3	0.014	0.072	0.014	7.8	0.028	10.8	-0.001
		HC 05	DDH-TS-04-01	181.82	182.84	Claystone at base of G-seam	7.6	13	5	0.012	0.0009	0.0004	0.65	-0.00001	3	0.0001	-0.0002	-0.01	-0.0002	0.90	0.0003	0.0037	0.0007	1.5	0.0082	0.23	0.000
		Col 02	DDH-TE-04-06	128.48	147.79	Carbonaceous claystone and coal between F and J-seam	8.0	97	20	0.002	0.0046	0.0017	0.66	-0.00001	30	0.0018	-0.0002	-0.01	-0.0002	15.1	0.023	0.056	0.0051	9.8	0.067	2.7	0.001
		HC 03	DDH-TE-04-06	193.83	194.83	Claystone - Top J-seam	7.6	26	5	0.017	0.0030	0.0005	0.63	-0.00001	8	0.0007	-0.0002	0.03	-0.0002	2.1	0.0032	0.030	0.0025	3.4	0.0094	1.2	-0.001
		Col 03	DDH-TE-04-01	72.62	77.59	Claystone between J and K-seam	8.1	90	10	0.0070	0.0056	0.0021	2.4	-0.00001	23	0.0021	-0.0002	-0.01	-0.0002	10.6	0.010	0.11	0.0077	5.4	0.074	3.2	-0.001
		Col 04	DDH-TE-04-01	94.15	110.08	Siltstone and sandstone below K-seam	8.4	143	8	0.10	0.0048	0.0009	1.7	-0.00001	8	0.0007	0.0009	-0.01	-0.0002	3.9	0.0060	0.14	0.0014	4.4	0.029	84.8	-0.001
		Col 09	DDH-TS-04-03	92.64	111.80	Sandstone below K-seam, high S	8.0	73	324	0.0070	0.0015	0.0012	0.032	-0.00001	97	0.0024	0.0003	-0.01	-0.0002	48.8	0.060	0.023	0.020	6.0	0.014	1.3	0.001
		Col 05	DDH-TE-04-01	114.49	132.94	Sandstone and conglomerate below K-seam, high S	8.1	79	67	0.0070	0.0018	0.0010	0.091	-0.00001	29	0.0009	-0.0002	-0.01	-0.0002	18.5	0.013	0.035	0.0032	4.6	0.0085	5.0	-0.001
		Col 10	DDH-TS-04-07	15.21	45.45	Claystone - Moosebar	8.1	90	69	0.0080	0.0025	0.0014	0.12	-0.00001	33	-0.0002	0.0005	-0.01	-0.0002	19.0	0.0019	0.12	0.0009	6.4	0.039	5.0	-0.001
		Col 11	DDH-TS-04-02	23.08	42.61	Sandstone - Gething footwall	8.1	88	39	0.0085	0.0029	0.0014	0.15	-0.00001	33	0.0019	0.0004	-0.01	-0.0002	14.6	0.069	0.045	0.0077	1.4	0.010	0.75	0.001
		HC 06	-	-	-	Raw Coal Composite, Seams D through J	7.4	2	1	0.0010	-0.0002	-0.0002	0.014	-0.00001	0	-0.0002	0.0003	-0.01	-0.0002	0.095	0.0000	-0.0001	0.0004	0.08	-0.0002	0.13	0.002
		Col 12				CCR - J and K-seam composite	3.9	1	20	0.10	-0.0002	-0.0002	0.043	0.00016	3	0.0030	0.0017	0.24	-0.0002	1.0	0.0084	-0.0001	0.026	0.36	0.0011	0.09	0.083
		Col 13				CCR Composite, Seams D through J	6.9	2	2	0.0005	-0.0002	0.0000	0.015	-0.00001	1	0.0000	0.0001	0.03	-0.0002	0.24	0.0007	0.0004	0.0002	0.47	0.0013	0.05	0.004
		Anoxic Column				South Tailings Composite	7.4	79	16	0.0020	-0.0002	0.0031	0.30	-0.00001	34	0.0008	0.0001	0.01	-0.0002	9.9	0.11	0.013	0.0073	2.8	0.0018	0.29	0.006
		HC 07				South Tailings Composite	4.2	1	13	0.018	-0.0002	-0.0002	0.018	-0.00001	2	0.0005	0.0003	0.90	-0.0002	0.57	0.015	-0.0001	0.010	0.10	-0.0002	0.06	0.070

Table 3.3–12 Summary of Trace Element Concentrations in Kinetic Tests (cont'd)

Statistic	Program	Cell #	Drill Hole	Depths from (m)	Depths to (m)	Descriptions	Parameter pH	Alk (mg $CaCO_3$/L)	SO_4 (mg/L)	Al (mg/L)	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Cd (mg/L)	Ca (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Na (mg/L)	Zn (mg/L)
	Roman	Col 1-A	DDHTR-2006-1	104.60	169.55	D to F Seam IB slst/cly/sst	8.3	280	59	0.034	0.015	0.0043	0.38	0.00018	47	0.011	0.0038	0.015	0.014	3	0.026	0.43	0.039	18.1	0.11	14.7	0.0036
		Col 1-B	TRC07-007	56.00	70.00	Above D-Seam sst and cgl; high S; feed from Col 1-A	5.07	4.4	1807	110	0.0013	0.041	0.049	0.054	138	4.1	2.3	350	0.027	57.5	6.4	0.0037	11.2	10.0	0.10	12.5	34.1
		Col 2	TRC07-007	16.13	56.00	Above D-Seam sst; typical S	7.3	12	735	12.9	0.0004	0.0049	0.062	0.016	90	1.9	0.63	60.8	0.087	69.9	12.5	0.0006	5.2	2.6	0.044	1.7	7.7
Maximum (normally the initial cycle of the test)	**Trend**	HC 01	DDH-TE-04-07	19.75	26.82	Claystone/Siltstone - Hulcross Fm	6.4	45	236	0.021	0.0012	0.0010	0.087	0.050	87	0.0007	0.0010	0.05	-0.0002	17.5	0.052	0.015	0.0049	9.3	0.0069	2.8	0.008
		Col 06	DDH-TS-04-04	70.86	78.66	Sandstone with some conglomerate - Upper Gates	6.7	149	922	0.015	0.0023	0.030	0.099	0.003	194	0.38	0.0048	0.29	0.0090	116	2.2	0.014	0.89	14.4	0.038	1.7	0.12
		HC 02	DDH-TE-04-06	72.53	76.79	Conglomerate above D-seam	2.3		930	13.8	0.0009	0.33	0.044	0.0051	64	0.22	0.36	268	0.0020	24.9	5.9	0.0069	1.14	0.40	0.0052	0.50	5.5
		HC 04	DDH-TS-04-01	60.26	63.23	Claystone/Siltstone above D-seam	3.4	2	370	0.70	0.0005	0.0025	0.21	0.024	102	0.41	0.040	1.1	0.0010	26.4	0.99	0.0004	1.36	8.3	0.044	0.59	2.6
		Col 01	DDH-TE-04-06	97.39	108.43	Sandstone/Siltstone between D and E-seam	7.5	132	18	0.026	0.0063	0.0015	1.7	0.00008	34	0.0043	0.0015	0.02	-0.0002	28.9	0.023	0.15	0.020	14.6	0.029	2.7	0.004
		Col 07	DDH-TS-04-01	94.59	106.42	Claystone between E and F-seam	7.4	107	10	0.016	0.017	0.016	3.9	0.00008	41	0.0039	0.0009	0.05	-0.0002	15.0	0.023	0.26	0.013	10.8	0.054	3.0	0.002
		Col 08	DDH-TS-04-01	132.33	145.30	Siltstone/Claystone between F and G-seam	7.9	118	11	0.037	0.013	0.040	3.7	0.00006	52	0.0059	0.0012	0.03	-0.0002	19.7	0.046	0.20	0.030	12.1	0.056	19.8	0.009
		HC 05	DDH-TS-04-01	181.82	182.84	Claystone at base of G-seam	6.3	25	10	0.070	0.0036	0.0020	1.8	0.00005	7	0.0018	0.0012	0.03	-0.0002	2.6	0.0011	0.055	0.0050	2.5	0.037	1.2	0.002
		Col 02	DDH-TE-04-06	128.48	147.79	Carbonaceous claystone and coal between F and J-seam	7.7	186	36	0.023	0.018	0.0053	1.4	0.00022	92	0.0064	0.0013	0.04	-0.0002	38.3	0.089	0.28	0.030	14.9	0.10	3.5	0.006
		HC 03	DDH-TE-04-06	193.83	194.83	Claystone - Top J-seam	6.5	59	9	0.33	0.018	0.0033	1.5	0.00012	19	0.0031	0.0006	0.08	0.0004	5.7	0.024	0.12	0.0094	6.3	0.014	3.8	0.009
		Col 03	DDH-TE-04-01	72.62	77.59	Claystone between J and K-seam	7.7	154	13	0.066	0.015	0.0042	4.4	0.00019	50	0.0094	0.0012	0.01	0.0010	27.4	0.061	0.39	0.028	7.2	0.15	4.4	0.040
		Col 04	DDH-TE-04-01	94.15	110.08	Siltstone and sandstone below K-seam	7.9	316	19	0.36	0.035	0.0051	3.0	0.00011	19	0.0026	0.0017	0.07	-0.0002	12.5	0.039	0.71	0.0049	6.4	0.043	123	0.002
		Col 09	DDH-TS-04-03	92.64	111.80	Sandstone below K-seam, high S	7.7	91	542	0.070	0.0044	0.0020	0.065	0.00004	158	0.013	0.0012	0.07	0.0000	90.3	0.19	0.047	0.062	7.6	0.027	3.4	0.005
		Col 05	DDH-TE-04-01	114.49	132.94	Sandstone and conglomerate below K-seam, high S	7.7	116	240	0.014	0.0047	0.0046	0.11	0.00005	64	0.0077	0.0019	0.10	-0.0002	28.8	0.085	0.12	0.032	7.1	0.022	27.5	0.003
		Col 10	DDH-TS-04-07	15.21	45.45	Claystone - Moosebar	7.9	117	93	0.018	0.011	0.030	0.46	0.00004	45	0.0009	0.0014	0.04	-0.0002	25.2	0.020	0.21	0.0049	8.6	0.065	6.2	0.003
		Col 11	DDH-TS-04-02	23.08	42.61	Sandstone - Gething footwall	7.8	108	244	0.013	0.0069	0.0037	0.20	0.00008	72	0.017	0.0014	0.03	-0.0002	32.0	0.20	0.080	0.050	4.2	0.053	3.3	0.005
		HC 06	–	–	–	Raw Coal Composite, Seams D through J	5.2	3	2	0.0080	-0.0002	0.040	0.049	0.00010	0	0.0008	0.0010	0.17	-0.0002	0.15	0.0008	0.0006	0.0048	0.20	0.0007	0.33	0.008
		Col 12				CCR - J and K-seam composite	3.3	3	43	0.96	0.0002	0.0003	0.11	0.0021	10	0.019	0.030	2.4	0.0024	3.1	0.049	0.0010	0.058	0.60	0.0039	0.21	0.32
		Col 13				CCR Composite, Seams D through J	5.0	2	9	0.010	0.0003	0.0005	0.043	0.00015	2	0.0007	0.0006	0.06	-0.0002	0.71	0.0050	0.0013	0.0016	0.60	0.0044	0.13	0.011
		Anoxic Column				South Tailings Composite	7.1	131	460	0.039	0.0065	0.078	0.39	0.00010	177	0.031	0.0010	0.06	-0.0002	62.4	0.40	0.023	0.10	6.2	0.063	18.3	0.034
		HC 07				South Tailings Composite	3.6	2	46	1.59	-0.0002	0.0005	0.070	0.71	3	0.015	0.0086	9.9	0.0005	1.9	0.080	-0.0001	0.060	0.28	0.0017	0.22	0.27

NOTE:
Negative values indicate concentrations below detection limit (absolute value is the detection limit).

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Layered Column (Col 1-A and Col 1-B)

The layered humidity column was constructed to test the ability of high NP, low sulphur Middle Gates waste rock at controlling the pH and release of oxidation products of above D Seam materials that appear to have already been substantially oxidized in-situ.

Top Column (Col 1-A)—Middle Gates with High NP

A composite sample representing high NP Middle Gates waste rock was tested in humidity Col 1-A (the upper column). The composite consists of siltstones, claystones and minor sandstone from the interburden between D and F seams, and has a length-weighted average total sulphur content of 0.11 percent, NP of 171 kg $CaCO_3$ eq/tonne, paste pH of 8.4, and NP to AP ratio of 49. As expected, the leachate from the top column remained slightly alkaline (pH of about 8.1) throughout the 56 weeks of testing and had relatively high alkalinity release rates (about 28 mg/kg/week) and very low sulphate release rates (about 2.5 mg/kg/week).

Concentrations of most trace metals were generally low. However, median concentrations of antimony (0.003 mg/L), barium (0.25 mg/L), and molybdenum (0.030 mg/L) were slightly elevated relative to the columns containing above D Seam samples. These leaching rates were however comparable to those measured in Trend humidity column tests of Middle Gates samples with similar sulphur and NP contents.

Bottom Column (Col 1-B)—Above D-Seam with Elevated S and Low NP

An Upper Gates coarse to medium grained sandstone composite sample taken from a continuous 14 m interval directly above D Seam was tested in the bottom column of the layered humidity column test. The composite sample had a slightly elevated total sulphur with a length-weighted average total sulphur content of 0.27 percent (average for typical above D Seam samples is 0.10 percent), negligible NP (0.6 kg $CaCO_3$ eq/tonne) and an NP to AP ratio of 0.08, classifying it as potentially acid generating. It also had detectable sulphate sulphur (0.03 percent) and paste pH of 3.75, and was noted as having iron staining on fracture surfaces, indicating some degree of in-situ oxidation had occurred.

The alkaline leachate from Col-1A was used for the weekly flush of Col 1-B. Despite the high alkalinity content of the input leachate from Col 1-A, the leachate in Col 1-B was acidic from the outset and the pH remained relatively stable at approximately pH 3 throughout the duration of testing, with the exception of the last sample which had a pH of 5.1. However this result from the last sample is believed to be suspect, and could not be confirmed due to the short shelf life of leachate samples for this parameter. Sulphate release rates were high, with stable release rates of 51 mg/kg/week, and iron, rather than calcium and magnesium, was the dominant cation.

Trace element concentrations of most parameters were elevated in Col 1-B relative to the leachate from the low sulphur above D Seam sample in Col 2. These included aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, selenium, silver, thalium and zinc. Of these, aluminum, cadmium, copper, nickel and selenium were higher than concentrations measured in Trend Coal Mine kinetic tests of above D Seam materials. However, the elevated selenium concentrations in Col 1-B leachate are primarily an artefact of Middle Gates leaching from the top column, as the selenium concentrations from Col 1-B are not substantially different than the starting concentration of the input leachate from Col 1-A (see Figure 3.3-16).

Concentrations of antimony, barium and molybdenum were much less in Col 1-B leachate relative to concentrations in the input leachate from the upper column. This is likely due to increased sorption of these elements in the presence of secondary iron minerals or low pH conditions.

Overall, the results of the layered column test indicate that the alkalinity from the upper column was insufficient to buffer the pH and control metal concentrations at their source. For more discussion of the implications of the layered column results, see Section 3.4.

Above D-Seam Column with Uncertain NP/AP (Col 2)

The composite sample of Upper Gates sandstone and conglomerate tested in Col 2 represents typical above D Seam waste rock with low total sulphur and low NP, and was taken from a continuous 40 m interval directly overlying the sample interval used for the composite sample tested in Col 1-B. This sample has a length-weighted total sulphur content of 0.07 percent and NP of 2.42 kg $CaCO_3$ eq/tonne, resulting in an NP to AP ratio of 1.39, indicating that this material has uncertain potential for acid generation. As with the sample tested in Col 1-B, this sample also had indications of some degree of in-situ oxidation, with detectable sulphate sulphur (0.02 percent), paste pH of 4.63 and noted iron staining on fracture surfaces.

Leachate from Col 2 started acidic, with leachate from the initial flush having pH 3.7 and sulphate release of 292 mg/kg/week. Sulphate release decreased rapidly in the first couple weeks of testing and stabilized at 8.5 mg/kg/week. pH increased continuously to a pH of 7.29 over the first 17 weeks of testing. This was followed by a short-term drop in pH to 5.8, followed by a gradually increasing trend to the final pH of 7.06. This trend reflects flushing of acidic secondary minerals already present in the sample from prior in-situ oxidation. The increase to more neutral pH and a low stable sulphate leaching rate reflects ongoing oxidation of sulphides.

Calcium and magnesium are the dominant cations, with magnesium release typically slightly higher than calcium. Concentrations of copper, nickel, selenium and zinc are slightly elevated; however, they are lower than the high sulphur above D Seam leachate from the layered column test and within the range of concentration from Trend kinetic test results of above D Seam samples. These results confirm that the above D Seam materials are acid generating despite the relatively low sulphur content. They also indicate that the sulphides might oxidize and become depleted quite rapidly.

Long-term Projections of ARD

The humidity column tests were used to develop long-term projections of potential for acid generation from above D Seam materials and to further test the effectiveness of layering these materials with acid consuming rock from the Middle Gates Formation. Kinetic testing data from the Trend Coal Mine amendment application (NEMI 2006) was used to assess the long-term potential for acid generation from all of the other rock units at Roman. In general, long-term projections of acid generation in these types of samples are subject to several limitations. The most important of these are the relatively short duration of the available testing methods and the effects of rapid flushing. Testing with larger test columns, as was done here, can underestimate rates of sulphate removal, but might over-estimate rates of NP removal compared to field conditions. These limitations must be considered when making long-term projections of ARD.

Two calculation methods were used in this evaluation. The first method compared the projected depletion times of sulphide and carbonates. To do this, the rate of sulphide oxidation (mg SO_4/kg sample/week) was estimated using the steady state rate of sulphate released from the humidity column. This value was used to estimate the time to sulphide depletion, calculated by dividing the total amount of sulphide (mg/kg) by the rate of oxidation (mg/kg/wk). The rate of NP removal was estimated from the rate of calcium, magnesium and strontium released from the column (these elements are in solid solutions with carbonate minerals). The total NP was divided by this value to give a time to NP depletion. If the projected time to sulphide depletion was shorter than the time to NP depletion, the sample is likely to stay at a neutral pH.

The second method compared the molar ratio of the sum of calcium, magnesium and strontium release over sulphate release to the acid base accounting data. If this ratio is less than the NP to AP ratio of the sample, the sample is likely to stay at a neutral pH.

These calculations tend to give very conservative projections because of the relatively aggressive flushing conditions leading to high NP release rates. In samples with very low sulphide oxidation rates (less than 10 mg/kg/week), the results are not considered suitable for predicting the relative rates of NP and AP depletion, or critical NP to AP ratios below which acid generation could occur.

For the results of the above calculations for both Roman and Trend samples, see Table 3.3-15. The Roman kinetic testing results are interpreted below.

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Table 3.3-15 Kinetic Test Outcomes

Program	Kinetic Test Cell #	Drill Hole	Depths From (m)	Depths To (m)	Descriptions	NP/AP	SO_4 Release Rate (mg/kg/week)	Ca+Mg+Sr/ SO_4	NP Depl. (years)	AP Depl. (years)	NP Depletion >AP depletion	Ca+Mg+Sr/ SO_4 <NP/AP	Prediction Neutral	Prediction Acidic
Roman	Col 1-A	DDHTR-2006-1	104.60	169.55	D to F Seam IB slst/cly/sst	49.4	2.5	7.98	123	25	Yes	Yes	yes	
	Col 1-B	TRC07-007	56.00	70.00	Above D-Seam sst and cgl; high S; feed from Col 1-A	0.1	50.7	0.50	-0.2	1.2	No	No		yes
	Col 2	TRC07-007	16.13	56.00	Above D-Seam sst; typical S	1.4	8.5	1.01	3.5	1.8	Yes	Yes		Yes
Trend	HC 01	DDH-TE-04-07	19.75	26.82	Claystone/Siltstone - Hulcross Fm	0.6	52.8	1.3	6	12	No	No		Likely
	Col 06	DDH-TS-04-04	70.86	78.66	Sandstone with some conglomerate - Upper Gates	2.2	14.1	1.6	12.3	7.2	Yes	Yes	likely	
	HC 02	DDH-TE-04-06	72.53	76.79	Conglomerate above D-seam	0.03	182.3	0.1	0	1.9	No	No		Yes
	HC 04	DDH-TS-04-01	60.26	63.23	Claystone/Siltstone above D-seam	0.3	66.7	0.8	1.3	4.2	No	No		Yes
	Col 01	DDH-TE-04-06	97.39	108.43	Sandstone/Siltstone between D and E-seam	213.0	0.8	14.4	427	27	Yes	Yes	likely	
	Col 07	DDH-TS-04-01	94.59	106.42	Claystone between E and F-seam	27.3	0.6	16.5	34	19	Yes	Yes	likely	
	Col 08	DDH-TS-04-01	132.33	145.30	Siltstone/Claystone between F and G-seam	148.3	0.5	21.9	534	75	Yes	Yes	likely	
	HC 05	DDH-TS-04-01	181.82	182.84	Claystone at base of G-seam	1.5	2.5	2.4	32	50	No	No		possible
	Col 02	DDH-TE-04-06	128.48	147.79	Carbonaceous claystone and coal between F and J-seam	37.7	2.1	5.9	109	16	Yes	Yes	likely	
	HC 03	DDH-TE-04-06	193.83	194.83	Claystone - Top J-seam	2.6	2.4	8.6	14	47	No	No		possible
	Col 03	DDH-TE-04-01	72.62	77.59	Claystone between J and K-seam	52.6	0.8	13.1	207	49	Yes	Yes	likely	
	Col 04	DDH-TE-04-01	94.15	110.08	Siltstone and sandstone below K-seam	45.8	0.5	11.6	270	65	Yes	Yes	likely	
	Col 09	DDH-TS-04-03	92.64	111.80	Sandstone below K-seam, high S	8.2	21.2	1.4	152	24	Yes	Yes	likely	
	Col 05	DDH-TE-04-01	114.49	132.94	Sandstone and conglomerate below K-seam, high S	25.6	3.7	2.6	220	20	Yes	Yes	likely	
	Col 10	DDH-TS-04-07	15.21	45.45	Claystone – Moosebar	7.9	5.4	2.7	248	81	Yes	Yes	likely	
	Col 11	DDH-TS-04-02	23.08	42.61	Sandstone - Gething footwall	75.3	3.6	3.6	280	12	Yes	Yes	likely	
	HC 06	-	-	-	Raw Coal Composite, Seams D through J	13.8	0.5	1.1	1337	99	Yes	Yes	likely	
	Col 12				CCR - J and K-seam composite	1.1	2.0	0.6	30	16	Yes	Yes		yes
	Col 13				CCR Composite, Seams D through J	0.3	0.3	1.1	87	319	No	No		yes
	Anoxic Column				South Tailings Composite	1.1	1.5	6.2	9	51	No	No		possible
	HC 07				South Tailings Composite	1.1	15.4	0.4	16	5	Yes	Yes	predicted*	yes

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Calculations for Col 1-A of the layered column (high NP Middle Gates composite sample with NP to AP ratio of 49.4) indicated that acidic conditions are unlikely to develop in such samples.

The depletion calculations are not suitable for Col 1-B (elevated sulphur, low NP above D Seam composite sample with NP to AP ratio of 0.1), as leaching results for this test do not solely reflect the leaching characteristic of the sample in Col 1-B. They are instead the combined results of leaching through both Col 1-A and Col 1-B. In addition, the calculations are not suitable for predicting NP depletion of samples with such a low NP content (2.4 kg $CaCO_3$ eq/tonne). However, as was the objective of the layered test, the testing did show that the sample immediately generated acidic conditions and that the alkalinity generated from the high NP Middle Gates sample in Col 1-A was not enough to neutralize the acidity generated by the above D Seam sample tested in Col 1-B, and is possibly not enough to neutralize the acidity generated in above D Seam materials with lower sulphur contents.

Acidic conditions developed immediately in the sample representing typical low sulphur, low NP above D Seam materials (Col 2), and then continuously increased in pH to neutral to slightly acidic leachate. This composite waste rock sample had a length-weighted average NP to AP ratio of 1.4. Depletion calculations for this column test indicated that the little sulphide contained in the samples would be depleted slightly before the NP. In fact, the acidic conditions measured at the start of this test confirmed that this material is acid generating.

Testing of both above D Seam samples (Col 1-B and Col 2) showed that sulphur depletion of above D Seam samples is occurring rapidly, and that at current leaching rates the sulphides could be depleted in less than two years.

The same depletion calculations were used in the Trend Coal Mine amendment application (NEMI 2006) with Trend kinetic test results to make long-term projections of potential for acid generation in samples with NP to AP ratios between one and three, and to determine the critical cut-off ratio for development of acidic conditions. The following summarizes the projections from Trend kinetic tests for units that are also present at the Roman property:

- Acidic conditions developed in the two humidity cells of Upper Gates waste rock samples (HC 02 and HC 04) with little NP and NP to AP ratios of less than one.
- Predicted depletion times and the ratios for a humidity column of an Upper Gates sample with NP to AP ratio of 2.2 (Col 06) were originally too close to predict the long-term behaviour of the sample. However, after continued testing (to 127 weeks), the depletion calculations indicated that acidic conditions were unlikely to develop in the long-term.
- Calculations for two humidity cell tests of Middle Gates samples adjacent to coal seams with elevated sulphur, low NP and NP to AP ratios between one and three (HC 03 and HC 05) indicated that acidic conditions could theoretically develop in these samples. However, given the slow sulphide oxidation rates observed, and preferential leaching of carbonates, it was projected to be unlikely that acidic conditions would actually develop in these tests.
- In tests representing all other samples with NP to AP ratios of greater than three from the Middle Gates, below K Seam, Moosebar and Gething Formations (Col 01, Col

02, Col 03, Col 04, Col 05, Col 07, Col 08, Col 09, Col 10, Col 11), calculations indicated that acidic conditions were unlikely to develop.

- Acidic conditions developed in kinetic testis of coal, CCR and tailings samples with NP to AP ratios of less than one (HC 07, Col 12 and Col 13). Calculations for the anoxic column test on a tailings sample indicated that it was theoretically possible for this material to go acidic, but that sulphide oxidation rates would be very slow. A CCR sample that contained excess NP (HC 06) was predicted to remain neutral over the long-term.

All tests with sulphate release rates of greater than 10 mg/kg/week indicated critical NP to AP ratios of less than two for maintaining neutral pH conditions. Thus, it was concluded that acidic conditions are unlikely to develop in discrete samples with NP to AP ratios of greater than two.

3.4 Assessment and Prediction of Geochemical Performance

3.4.1 Overall Potential for ARD

3.4.1.1 Waste Rock Dumps

The testing data indicates that the majority of the waste rock from the Project would have a low potential for ARD due to the low sulphide and high NP content of the rock. However, waste rock from the Upper Gates Formation (above D Seam) (comprising 10 percent of the total waste rock), some of the rock adjacent to the coal seams (comprising less than 3 percent of the waste rock) are potentially acid generating and will need to be managed appropriately. See Section 5 for the proposed management and mitigation measures for each of these materials. In brief, a combination of controlled end-dumping and layering methods will be used to ensure that the PAG waste rock is well distributed through the dumps, and that there is sufficient non-PAG rock surrounding the PAG rock to maintain neutral pH conditions in the dump as a whole. During the first two years of the mine life, CCR and tailings with a mixed potential for ARD (1.33 Mt) will also be incorporated into the dumps using end-dumping and layering methods, and for the remainder of the mine life, non-acid generating CCR (4.70 Mt) will be incorporated into the dumps.

An overall NP to AP ratio for the material in the dumps was calculated using the projected quantities of the waste rock, CCR and tailings (see Table 3.4-1). Using median NPs and APs for each of the materials, the overall NP to AP ratio in the dumps would be 32, using length weighted average NPs and APs, the overall NP to AP ratio would be 34, and using more conservative 75^{th} percentile APs and 25^{th} percentile NPs, the ratio would be nine, indicating that there is sufficient NP for these materials to be incorporated into the waste rock without detrimental effects in terms of acid generation potential. Calculations for materials from the north dump only (including CCR and tailings) and for the south dump only (which contains considerably higher amounts of Moosebar and Gething waste rock) were also completed to assess the effects of separate disposal of these materials (see Table 3.4-1). These calculations indicated that the north dump would have similar NP to AP ratios to the overall mixture, and that the south dump would have NP to AP ratios of 15 based on median or length weighted average NPs and APs, or NP to AP ratios of five based on the more conservative 75^{th} percentile APs and 25^{th} percentile NPs. It should be noted that the above calculations assume equal availability of

NP and AP from all rock types. Due to the blocky nature of the conglomerates and sandstones, the above D Seam material, which has the highest AP is expected to have a relatively coarse particle size distribution compared to rock from the Middle Gates. This will result in a high volume to surface area ratio hence the availability of the AP will be relatively less than the availability of NP in the Middle Gates rock.

Table 3.4-1 Calculation of Overall NP/AP Ratio in Dumps

Material	Overall		North Dump		South Dump		Statistic	Parameters		Average
	(tonnes)	(%)	(tonnes)	(%)	(tonnes)	(%)		AP	NP	NP/AP
Above D-seam	56,748,568	9.5	54,254,156	9.9	2,494,412	5	25th Percentile	0.6	-0.1	2.2
							Median	1.3	0.5	
							75th Percentile	2.2	2.3	
							Max	38.1	52.5	
							Length wt. Average	2.7	5.9	
D- to K-seam	300,304,277	50.3	287,104,250	52.4	13,200,026	26.7	25th Percentile	2.2	25.0	45.9
							Median	2.5	83.1	
							75th Percentile	3.4	192.2	
							Max	13.1	289.5	
							Length wt. Average	3.0	139.0	
Below K-Seam	194,462,358	32.6	185,914,666	33.9	8,547,691	17.3	25th Percentile	2.5	69.8	45.6
							Median	3.1	164.0	
							75th Percentile	3.6	207.3	
							Max	44.1	227.8	
							Length wt. Average	4.3	196.0	
Moosebar	32,312,166	5.4	10,770,722	2	21,541,444	43.6	25th Percentile	12.0	82.8	8.9
							Median	15.6	156.9	
							75th Percentile	18.1	198.0	
							Max	58.8	219.3	
							Length wt. Average	17.4	154.8	
Gething	7,232,853	1.2	3,616,426	0.7	3,616,426	7.3	25th Percentile	2.5	15.8	18.9
							Median	3.8	67.6	
							75th Percentile	14.5	169.6	
							Max	24.4	286.1	
							Length wt. Average	7.9	148.3	
CCR (NAG)	5,580,163	0.9	5,580,163	1	na	na	25th Percentile	0.9	16.1	
							Median	2.2	41.7	
							75th Percentile	6.6	58.0	
							Max	26.9	103.7	
CCR (First 2 yrs D,E,Bird CCR)	202,318	0.03	202,318	0.04	na	na	25th Percentile	6.3	-2.8	
							Median	6.6	1.4	
							75th Percentile	533.4	1.5	
							Max	718.1	5.8	

Table 3.4-1 Calculation of Overall NP/AP Ratio in Dumps (cont'd)

Material	Overall		North Dump		South Dump		Statistic	Parameters		Average
	(tonnes)	(%)	(tonnes)	(%)	(tonnes)	(%)		AP	NP	NP/AP
Tailings (First 2 years)	246,665	0.04	246,665	0.05	na	na	25th Percentile Median 75th Percentile Max	2.0 3.4 10.3 170.3	13.0 35.6 65.1 110.2	
Total - Overall	597,089,367	100								
Total - North Dump			547,689,367	100						
Total - South Dump					49,400,000	100				
Overall	Weighted Average with Median NP's and Median AP's Weighted Average with Length-weighted Average NP's and AP's for WR and Medians for CCR and Tailings Weighted Average with 75th Percentile AP's and 25th Percentile NP's									32 34 9
North Dump Only	Weighted Average with Median NP's and Median AP's Weighted Average with Length-weighted Average NP's and AP's for WR and Medians for CCR and Tailings Weighted Average with 75th Percentile AP's and 25th Percentile NP's									36 39 10
South Dump Only	Weighted Average with Median NP's and Median AP's Weighted Average with Length-weighted Average NP's and AP's for WR and Medians for CCR and Tailings Weighted Average with 75th Percentile AP's and 25th Percentile NP's									15 15 5

NOTES:
Assumed all waste from South Gething Pit goes to South Dump and all North Gething Pit waste goes to North Dump.
Assumed 2/3 of all Moosebar waste rock is from South Gething Pit, and therefore in South Dump.
Assumed 1/2 of all Gething waste rock is from South Gething Pit, and therefore in South Dump.
After quantities of Moosebar and Gething waste were estimated for the South Dump, the remainder of that dump capacity was assumed to be Gates waste rock in overall Gates Pit distribution proportions.
After waste distribution in the South Dump was estimated, all remaining waste was assigned to the North Dump.

The potential effects of very small amounts of PAG rock in the Middle and Lower Gates (approximately 3 percent), Moosebar (approximately 1 percent) and Gething (approximately 5 percent), as well as the small amount of coal loss that could be expected (less than 1 percent), will be offset by the very high NP in the associated interburden waste rock. Because all of the PAG rock occurs in thin layers (less than 1 m), non-deliberate mixing resulting from normal blasting and hauling practices will ensure that they are well distributed in the non-PAG lifts of the dumps thereby limiting the potential for acid generation.

The results of the layered humidity column tests were used to calculate the maximum layer thickness required to achieve an ideal blend where dissolved alkalinity from a layer of non-acid generating rock from the Middle Gates would neutralize acidity generated within potentially acid generating rock from the above D Seam and thereby prevent local acidic conditions from developing. This type of blend is considered to be more ideal because consistently neutral pH conditions would ensure maximum control of metal leaching rates from the dumps.

These calculations showed that the alkalinity in leachate from an overlying layer of Middle Gates waste rock would likely provide sufficient neutralization to control all of the acidity generated in a typical 1 m thick layer of above D Seam PAG rock, but that it would only be sufficient to control acidity in the uppermost 5 to 30 cm of the high sulphur above D Seam PAG rock. These values are considered to be conservative due to the relatively larger particle size distribution (and therefore higher volume to surface area ratio) of the above D Seam rock, the small amounts of alkalinity that might be present within the above D Seam layers and lower field temperatures, which would reduce the rate of sulphide oxidation, but increase the solubility of carbonate minerals.

The layered test results were also used to calculate the amount of non-acid generating rock that would be required to neutralize any acidity generated in an overlying layer of potentially acid generating D Seam rock. The calculations suggest that the acidity produced in a 1 m thick layer of rock could be neutralized within the first 5 cm of an underlying Middle Gates waste rock (assuming a typical NP content of 139 kg $CaCO_3$ eq/tonne, see Table 3.4-2, if no blinding of the carbonates occurs. Similarly, if the underlying layer was Middle Gates rock with lower than normal NPs (lower 25^{th} percentile), the acidity from the PAG above D Seam layer would be neutralized in the top 30 cm of the underlying layer.

The waste rock management plans (Section 5) indicate that all above D Seam waste rock and CCR and tailings from the first two years of production will be placed using either end dumping or layering methods. Controls will be in place to ensure that these materials are placed in layers that are less than 1 m thick and that they alternate with at least 1 m of non-PAG Middle Gates rock. The layered or end dumped waste rock will be placed on a 3-m thick base layer of non-PAG Middle Gates rock. The preceding calculations show that the layering might not be sufficient to maintain an ideal blend that ensures neutral pH conditions throughout the dump. However, it is anticipated that any acidic seepage would be fully neutralized within the dump by underlying non-PAG rock. If consideration is given to the potential differences in particle size and therefore volume to surface area ratio of the PAG and non-PAG materials, it is reasonable to assume that ideal blending conditions would occur in most areas of the pile.

3.4.1.2 Open Pits

In the Gates Pit, all above D Seam material is expected to be mined out of the syncline. Thin hanging wall and footwall layers adjacent to coal seams (less than 1 m) might be locally acid generating resulting in the development of local acidic seeps. However, since the proportion of such materials to be exposed will be very minor (less than 5 percent) relative to the predominance of alkaline strata throughout the pit, it is expected that any small acid generating seeps would be neutralized in-situ.

In the Gething Pit, the complete sequence of Moosebar and Gething units that will be mined out of the Gething Pits will be left exposed in the pit walls, including the Bird and GT seams, which will be exposed along the bottom of each Gething Pit. As such, thin (less than 1 m) hanging wall and footwall layers adjacent to coal seam might be locally acid generating, particularly those associated with the Bird Seam. In addition, the lowermost 1 to 2 m of the Moosebar Formation and a 2-m interval above the third Gething coal zone might be locally acid generating. These thin potentially acid generating units might comprise up to 10 percent of the pit walls and result in the development of local acidic seeps. However, the other 90 percent of exposed strata throughout the pits is predominantly alkaline and therefore expected to be able to neutralize any small acid generating seeps in-situ.

3.4.1.3 Coal, CCR and Tailings Disposal Area

Geochemical testing on coal, CCR and tailings samples indicated a variable potential for ARD, with some seams (F, G, J, K and GT seams) classified as not potentially acid generating and some as potentially acid generating (D, E and Bird Seams). The geochemical evaluation of CCR and tailings were based on a small dataset, generally consisting of no more than two samples per seam per waste type. As such, the acid potential of CCR and tailings will be monitored regularly during the first several months of operations to determine the variability in ARD potential of these materials and to establish a correlation between the coal seams processed and the geochemical properties of the CCR and tailings.

As discussed previously, during the first two years of operation, all CCR (1.08 Mt) and filter pressed tailings (0.25 Mt) will be disposed of in the PAG lifts of the waste dumps, and will be treated in a similar manner as the PAG waste rock.

After the first two years of operations, non-PAG CCR will continue to be placed in the waste rock dumps and all of the tailings and PAG CCR will be deposited in the Gates In-Pit tailings facility. The Gates Pit has a total flooded volume of 7.8 Mm^3, of which 6.2 Mm^3 is available for storage of material underwater. The estimated volume of tailings is approximately 2.1 Mm^3 and the estimated volume of PAG CCR is approximately 1 Mm^3. Therefore, there is also 3.1 Mm^3 of space available for storage of PAG waste rock. Priority will be given to using this area for storage of PAG waste rock with the highest sulphur content. Further work to delineate the distribution of the sulphur content in the above D Seam unit will be completed for the Mine Permit Application, and some refinement of this is likely to be completed during operations. Removal of the high sulphur PAG rock from the other waste rock piles was conservatively neglected in the assessment of overall NP to AP ratios in the waste rock dumps, and in the water quality predictions for the waste rock dumps.

Water balance calculations indicate that the pit will reach its maximum operating water level approximately 15 months after the start of waste deposition, and that the rate of

water infill will far exceed the rate of waste deposition. If it is assumed that deposition of waste rock would start during a winter low flow period (e.g., in January), some of the waste rock might be exposed for a few months (see Figure 3.4-1), but throughout most of the operations, there will be sufficient water cover to allow the CCR, tailings and waste rock to be placed directly underwater. Underwater placement prevents oxidation and metal leaching from these materials. At closure, there is a strongly positive water balance, ensuring that both the tailings and the PAG CCR will continue to remain submerged in the Gates Pit. The storage capacity of the tailings facility have been calculated assuming 5 m of water cover above the maximum elevation of tailing deposition.

3.4.1.4 Summary: Overall Potential for ARD

In general, the results of the ML/ARD prediction indicate that, with appropriate waste management planning and implementation, this site has a low potential for ARD. Mitigation measures to assure that metal leaching and ARD are minimized are further discussed in the ML/ARD Management Plan (Section 5).

The majority of the waste rock has low sulphur and relatively high neutralization potentials and is non acid generating. Waste rock from above D Seam contains variable amounts of sulphur and low amounts of neutralization potential, and is considered to be potentially acid generating. This material will be interlayered with non-acid generating rocks. A conceptual waste rock management plan which discusses how layering will be achieved is presented in Section 4.7. Rocks immediately above and below some of the coal seams also contain somewhat elevated amounts of sulphur and are potentially acid generating. As a result of mixing during the mining process, these are expected to be well blended with non-acid generating rocks. The overall ARD potential for the waste rock dumps is low, with overall NP to AP ratios of 32 based on median NP and median APs.

Removal of the above D Seam material will eliminate most of the potentially acid generating material from the Gates Pit. Some of the coal seams and the associated hanging wall and footwall materials might be locally acid generating. However, interaction of those seems with predominantly alkaline materials in the rest of the pit will ensure that these seems are neutralized within the confines of the pit. Exposures of the Bird and GT seams in the base of the Gething Pits might also lead to some locally acidic seepages. However, alkaline runoff mixing with these waters is expected to neutralize these materials within the confines of these pits.

Coal, CCR and tailings have a variable potential for ARD, with potential for ARD in the D, E and Bird seam materials. During the first two years of mining, these will be layered with the non-acid generating waste rock to prevent ARD. For the remainder of the mine life, these materials will be placed in an in-pit tailings management facility at the lower end of the Gates Pit. This is expected to eliminate any risk of ARD.

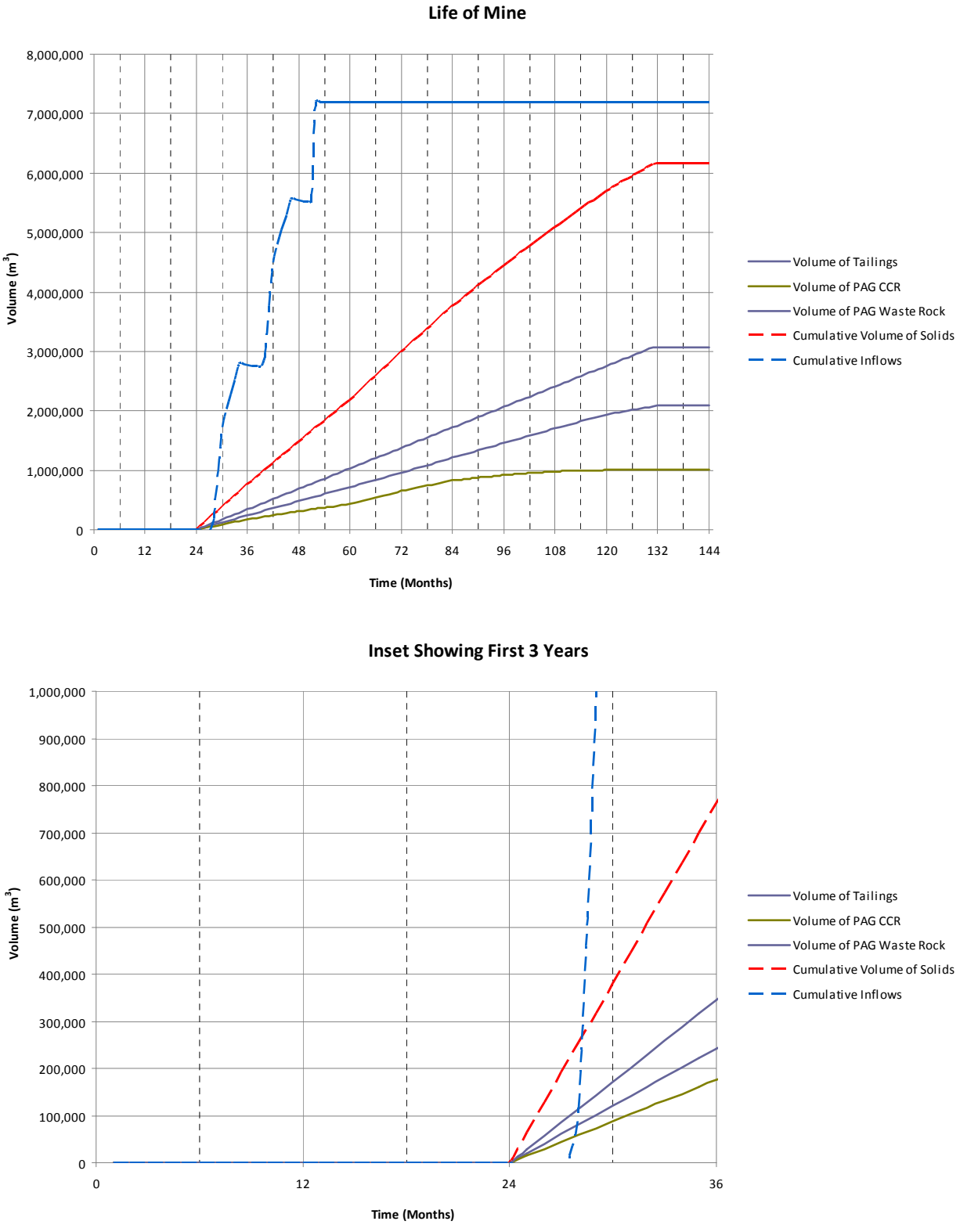

Figure 3.4-1 Filling Rates for Tailings, CCR, Waste Rock, and Water Inflow to the Gates In-Pit Tailings Facility

3.4.2 Source Water Quality Predictions

3.4.2.1 Overview

The geochemical characterization program for Roman together with results from Trend Coal Mine indicated that oxidation and weathering of the waste rock, CCR, coal and tailings might also lead to release of soluble components from the rock into infiltrating waters and runoff. These include major ions associated with dissolution of carbonate minerals and oxidation of sulphide minerals, including alkalinity, sulphate, calcium, and magnesium, and trace elements such as barium, cadmium, cobalt, copper, iron, manganese, nickel, selenium and zinc that are generally associated with weathering of sulphide minerals, or to a lesser extent, organic matter and silicates.

One of the primary objectives of the testing program for Roman was to estimate the chemistry of seepage and runoff that will be in contact with the waste rock dumps and exposed pit walls. These source concentrations are used in the assessment of discharge and receiving water quality (Volume 2, Section 12). The source concentrations represent dissolved concentrations associated with contact waters emerging from these areas prior to dilution from local runoff in undisturbed areas of the catchments.

The approach used to predict the source concentrations was the same as that presented for the Trend Coal Mine (NEMI 2006) and is based on a combination of scale-up calculations, geochemical modelling and extrapolation of monitoring data from geologically similar mine sites in the area. In brief:

1. The laboratory testing data was used to calculate mass loadings and potential concentrations for the pits and waste dumps.
2. Geochemical modelling was then used to establish limits on concentrations resulting from direct secondary mineral controls.
3. Monitoring data and field scale kinetic testing data from the other mine sites were used to establish limits resulting from geochemical controls that cannot be accurately simulated using the available geochemical models.

3.4.2.2 Calculation Methods and Assumptions

Waste Rock Dumps

Key steps and assumption in the calculations were:

1. Estimate Waste Rock Tonnages, Dump Configuration and Hydrology Inputs:
    - Total tonnages of each of the major waste rock types and ore were estimated by the mine planners based on a geological block model of the deposit. For the estimates for waste rock, see Table 3.3-1 and for the estimates for CCR and tailings, see Table 3.3-2. All NAG CCR (5,600,000 t) and the first two years tailings and PAG CCR (247,000 and 202,000 t, respectively) will also be incorporated into the dumps, and have been included in the calculations.
    - Preliminary dump designs, including maximum disturbance limit and total volumes of waste in each dump, were provided by the mine planners, and used to calculate the average height of each dump. The north and south dumps are expected to contain considerably different mixtures of each of the major rock types. Gates waste rock will comprise approximately 95 percent of the north

dump, while the smaller south dump will contain approximately 51 percent Moosebar and Gething waste rock. In addition, all the NAG CCR, and first two years of tailings and PAG CCR will be placed in the north dump, comprising approximately 2.2 percent of the dump volume.

- Infiltration rates into the dumps were assumed to be equal to the mean annual runoff value of 700 mm estimated for the dumps in the hydrological analysis. The total flow was calculated by multiplying the footprint area by this value.

2. Estimate Geochemical Release Rates.

   - The kinetic test results from the Roman testing program, together with those from tests of analogous samples from the Trend (NEMI 2006) and Horizon (unpublished data) testing programs were used to calculate laboratory release rates for each of the major rock types. Test results from Roman and Horizon kinetic tests available up to February 2009 were used for the source water quality predictions presented in this report.

   - An average laboratory release rate was calculated by weighting the above release rates by the percent distribution of rock types from Step 1.

   - Correction factors were applied to account for differences in temperature, grain size and contact effects between the test and the run-of-mine rock.

   - Internal dump temperatures were assumed to be similar to the mean annual air temperature of approximately 5°C, while laboratory temperatures were in the range of 20°C. The effects of temperature on sulphide oxidation rates were determined using the Van't Hoff–Arrhenius equation, assuming an activation energy of 70,000 J/mole. The calculations indicated that release rates could be reduced by a factor of five to account for the differences in temperature.

   - Grain size data from weathered waste rock from other coal mines in the region (Dawson et al. 1998) indicated that approximately 50 percent of the waste rock was coarser than the material used in the kinetic tests. If oversize material was culled from these samples (as is standard practice in geotechnical characterization), the percentage of run-of-mine rock that would be coarser than the material in the humidity cells could be even higher. The laboratory release rates were reduced by a factor of two to account for a minimum of 50 percent oversize material that does not contribute significantly to contaminant release.

   - Contact effects such as flow channelling vary according to the particle size distribution and infiltration rates, with relatively more contact occurring at sites with fine grain size distributions and higher infiltration rates. Based on experience at other sites, a reduction factor of two was applied to account for contact effects.

   - The overall effect of the above adjustments was to reduce the laboratory release rates by a factor of 20.

3. Calculate Potential Concentrations:

   - Potential concentrations were calculated by multiplying the average laboratory release rate by the total tonnage and dividing by the total flows infiltrating through the dumps. Calculations were made for the South Dump (with an average height of 38 m) and the North Dump (average height of 68 m). For the North Dump, calculations were made with and without the first two years of

tailings to test the sensitivity of placing this material in the dump. Calculations indicated that placement of this small amount of tailings (247,000 t) in the North Dump would have a minor effect on the potential concentrations.

4. Establish Secondary Mineral Controls on Concentrations through Geochemical Modelling:

   - The potential concentrations from Step 3 were modelled using a geochemical equilibrium model (MINTEQA2) to determine if there were any secondary mineral controls that could limit concentrations. Minor adjustments to the major ion concentrations were required to ensure the ion balance of inputs were reasonable. The pH was determined assuming equilibrium with calcite (typically in the range of 8 to 8.3). Minerals that are known to form in similar geochemical environments, including microcrystalline gibbsite, gypsum, barite, celestite, ferrihydrite, rhodochrosite, tenorite, and zinc carbonate, were allowed to form if saturation indices exceeded zero. These minerals potentially constrain concentrations of aluminum, calcium, sulphate, barium, strontium, iron, manganese, copper, and zinc. Secondary mineral controls for other elements were not indicated in the modelling.

5. Establish Other Upper Limits by Comparison to Data from Similar Mine Sites and Field Barrels:

   - The concentrations of several trace elements from Steps 3 and 4 were significantly higher than those observed at other coal mines in the region. The relatively low concentrations of these elements at other sites is likely due to attenuation within the waste rock dumps. The most accurate means of establishing attenuation controls in the Roman waste rock dumps is to use data from other similar mine sites in the region. Potential data sources included the Trend Coal Mine, Elkview, Bullmoose, and Quintette mines. Data from the Trend field barrel tests and test pads, and Horizon field barrel tests were also potential candidates.

   - Two upper limit concentrations (best judgment and upper-bound) were selected from data from the Trend, Quintette, Elkview, and Bullmoose mines, and from the Trend field barrel tests and test pads, and Horizon field barrel tests. Scatterplots of these data are provided in Appendix 3F: Scatterplots of Water Quality Data from Regional Coal Mines. The best judgment upper limits are conservative base case selections that represent the upper limits of concentrations from randomly mixed waste rock types from full scale mines and large scale field tests. The upper-bound limit concentrations are highly conservative selections based on valid maximum or 95^{th} percentile concentrations from the scatterplots. Most of these reflect field or laboratory test results on specific materials. The higher concentrations in these tests may be due to a lack of beneficial interactions such as attenuation and neutralization that occur in larger scale facilities. Clear outliers were not considered in this assessment. The best judgment and upper-bound regional limits established for critical parameters are presented in Table 3.4-2.

   - Modelled concentrations adjusted for secondary mineral controls from Step 4 were compared to the regional upper limits. For each parameter, the lesser of the modelled concentration and the best judgment regional limit was taken to represent a best judgment modelled concentration corrected for attenuation.

Similarly, the lesser of Step 4 modelled concentrations and upper-bound regional limits were selected to represent upper-bound modelled concentrations corrected for attenuation.

6. Establish Lower Limits on Concentrations using Field Barrel Data:

   - Geochemical equilibrium modeling can sometimes lead to concentrations that are significantly lower than indicated by field data. Therefore, where best judgment and upper-bound modelled concentrations from Steps 5 were lower than the median or maximum steady state concentrations in the Trend barrel tests, respectively, they were increased to reflect the steady state concentrations unless the potential concentrations from Step 3 were lower than those values.

See Table 3.4-3 for the output from each of the steps used in developing the prediction for the north dump. The same steps were followed for the south dump.

Table 3.4-2 Regional Limits on Concentrations

Parameter	Best Judgment		Upper Bound	
	Value	Source	Value	Source
SO_4	1768	Quintette	4534	Trend PAG Test Pads
Al	0.1	Upper end of range observed for full scale mines.	0.4	Upper end of range observed for all PAG materials
Sb	0.004	Trend Layered Test Pads	0.017	Trend PAG Barrels
As	0.0021	Trend Test Pads	0.016	Trend PAG Barrels
Ba	1	Bullmoose	2.1	Trend PAG Barrels
Cd	0.00074	Trend Layered Test Pads	0.02	Trend PAG Barrels and Test Pads
Ca	325	Quintette	536	Trend PAG Barrels
Co	0.06	Trend Layered Test Pads	1.2	Trend PAG Barrels
Cu	0.003	Trend Sed Ponds	0.05	Trend PAG materials
Cr	0.0012	Trend Sed Ponds	0.004	Bullmoose
Fe	0.17	Trend Sed Ponds	1	Trend Dump Seeps
Pb	0.00019	Trend Sed Ponds	0.0014	Elkview
Mg	235	Quintette	810	Trend PAG Test Pads
Mn	1.6	Trend Dump Seeps	30	Trend PAG materials
Mo	0.03	Trend Layered Test Pads	0.67	Trend Non-PAG Barrels
Ni	0.17	Trend Layered Test Pads	3.2	Trend PAG materials
K	8.8	Trend Non-PAG Barrels	26	Trend PAG materials
Se	0.15	Elkview	0.25	Trend Non-PAG Barrels
Ag	0.00005	Best judgment from all sources	0.0003	Trend Non-PAG Barrels
Na	20	Trend Sed Ponds	200	Quintette
Sr	1.2	Trend Sed Ponds	2.1	Quintette
Zn	0.041	Trend Sed Ponds	3.6	Trend PAG Barrels

NOTE:
Trend PAG materials refers to test pads, field barrel, and kinetic tests of PAG materials.

Table 3.4-3 Concentrations at Key Steps in the Prediction of Source Concentrations for the North Dump

Parameter	Step 2	Step 3	Step 4		Step 5		Step 6	
	Weighted Average Laboratory Leaching Rates	Concentrations from Dumps before equilibrium considerations	Equilibrium Concentrations (from MINTEQA2)	MINTEQ Adjusted Concentrations	Regional Limits (Best Judgment)	Regional Limits Adjusted Concentrations	Median Steady State Barrel Concentrations	Final Concentrations (Best Judgment)
	(mg/kg/week)	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**
Alk	8.303	4199	52	52	295	52	127	127
SO4	6.2	3112	2859	2859	1768	1768	157	1768
Al	0.027	13.5	0.013	0.013	0.10	0.013	0.0048	0.013
Sb	0.0010	0.518	na	0.518	0.004	0.004	0.0065	0.0065
As	0.0006	0.29	0.29	0.29	0.0030	0.003	0.0025	0.0030
Ba	0.08	41.2	0.0054	0.0054	1	0.0054	0.06	0.06
Cd	0.00007	0.036	0.036	0.036	0.00074	0.00074	0.00007	0.00074
Ca	2.855	1444	497	497	325	497	62	497
Co	0.00152	0.77	na	0.77	0.06	0.060	0.0049	0.06
Cu	0.00203	1.03	0.38	0.38	0.003	0.003	0.0015	0.0030
Cr	0.000094	0.05	na	0.05	0.0012	0.001	0.0008	0.0012
Fe	0.4698	238	0.00041	0.00041	0.17	0.00041	0.030	0.03
Pb	0.000099	0.0501	na	0.0501	0.00019	0.0002	0.00008	0.00019
Mg	1.526	772	366	366	235	366	39	366
Mn	0.031	15.4	1.41	1.4	1.6	1.41	0.012	1.4
Mo	0.0041	2.1	2.1	2.1	0.03	0.03	0.15	0.15
Ni	0.006	2.79	0.23	0.23	0.17	0.170	0.037	0.170
K	0.595	301	na	301	8.8	9	5.4	8.8
Se	0.0022	1.1	1.11	1.1	0.15	0.15	0.076	0.15
Na	0.640	324	na	324	20	20	9	20
Sr	0.020	10.3	10.2	10.2	1.2	1.2	0.20	1.20
Zn	0.009	4.4	4.3	4.3	0.041	0.041	0.0046	0.041

NOTE:
Calculation of Upper Bound Final Concentrations followed the same steps shown here but instead used Upper Bound Regional Limits in Step 5 and Maximum Steady State Barrel Concentrations in Step 6.

Pit Walls

Calculations for the pit walls followed the same general calculation steps as for the waste rock. Key assumptions for the pits walls were as follows:

- The distribution of rock types that will be exposed on the pit walls of each of the pits was provided by the mine planners (based on the pre-feasibility mine plan). For a summary of the distribution of rock types for the Gates Pit and the combined distribution of the two Gething pits, see Table 3.4-4.

Table 3.4-4 Distribution of Rock Types in Open Pit Walls

Units	Gates Pit	Gething Pit
D-K (typical)	22.1%	
D-K (PAG)	1.2%	
Below K (typical)	65.3%	
Below K (PAG)	3.4%	
Moosebar	7.7%	55.1%
Gething		39.1%
Coal–NAG	0.4%	3.1%
Coal–PAG		2.7%

- The exposed pit walls were assumed to have a rubbly surface 0.1 m thick. Loading calculations were based on the reactive mass of rubble over this surface zone, and a particle size correction assuming 50 percent of the mass in oversize material.
- Correction factors to account for differences between field and laboratory temperatures and contact effects were not taken into consideration due to the near surface exposure of this material.

Process Water

Tailings slurry discharged to the Gates In-Pit tailings facility will have a moisture content of approximately 70 percent. As this contained water will be process water, the plant process water will contribute to the overall water chemistry of the pit. Water quality data from wash samples (thickener and filter press underpan) from the Trend Coal Mine were used as a surrogate for process water to make predictions of source term concentrations from Roman process water. Very limited data was available (only two sampling rounds); therefore, conservative predictions were made by taking the maximum concentrations.

3.4.2.3 Prediction Results

For final best judgment and upper-bound source concentrations for each of the main site components, see Table 3.4-5. The best judgment results are recommended for use in the downstream effects assessment. These results incorporate a reasonable degree of conservatism in all steps of the calculations and reflect the beneficial interactions that have been observed in other large waste rock dumps in the area. The upper-bound source concentrations reflect more conservative assumptions, particularly in establishing the upper limits on concentrations from the analog data. Values of this magnitude have not

been observed in any of the waste rock piles in the area, and it is considered unlikely that they would occur in the Roman waste rock piles given the similarities in geology.

See Table 3.4-5 also for source term concentrations for process water, as well as updated best judgment and upper-bound source term concentrations for a Trend Coal Mine overall dump (based on the updated analog data). Original best judgment predictions for Trend Coal Mine components, as presented in the Trend Coal Mine Permit Application (NEMI 2006) are provided for comparison.

Table 3.4-5 Estimated Source Concentrations for Each of the Mine Components

Mine Component	Alk (mg/L)	SO_4 (mg/L)	Al (mg/L)	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Cd (mg/L)	Ca (mg/L)	Co (mg/L)	Cu (mg/L)	Cr (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Na (mg/L)	Sr (mg/L)	Zn (mg/L)
North Dump with CCR and First 2 yrs Tailings																						
Best Judgment	127	1768	0.013	0.0065	0.0025	0.057	0.00074	497	0.060	0.0030	0.0012	0.030	0.00019	366	1.4	0.15	0.17	8.8	0.15	20	1.2	0.041
Upper Bound	225	2986	0.14	0.017	0.018	1.4	0.020	497	0.77	0.050	0.0055	0.26	0.0014	479	15.4	0.67	2.5	26	0.25	200	2.1	3.6
South Dump																						
Best Judgment	127	1662	0.015	0.0065	0.0025	0.057	0.00074	284	0.060	0.0030	0.0012	0.030	0.00019	197	0.83	0.15	0.17	8.8	0.15	20	1.2	0.041
Upper Bound	225	1671	0.14	0.017	0.018	1.4	0.011	413	0.23	0.050	0.0055	0.26	0.0014	460	4.5	0.67	0.84	26	0.25	200	2.1	1.4
Gates Pit Runoff																						
Best Judgment	83	62	0.030	0.0065	0.0025	0.057	0.00074	23	0.010	0.0030	0.0012	0.030	0.00019	12	0.056	0.032	0.033	5.1	0.014	12	0.27	0.041
Upper Bound	83	62	0.14	0.012	0.0027	0.83	0.00077	23	0.010	0.032	0.0013	0.26	0.00088	12	0.056	0.032	0.033	5.1	0.014	12	0.27	0.11
Gething Pits Runoff																						
Best Judgment	127	68	0.032	0.0065	0.0025	0.057	0.00039	29	0.0031	0.0030	0.00084	0.030	0.00019	14	0.014	0.057	0.012	4.9	0.025	20	0.34	0.032
Upper Bound	156	68	0.14	0.017	0.0043	0.77	0.00039	29	0.0031	0.015	0.00084	0.26	0.00094	14	0.014	0.057	0.012	4.9	0.025	36	0.34	0.032
Plant Process Water																						
Best Judgment	193	42.5	0.056	0.013	0.00074	3.57	0.00031	488	<0.0025	0.0033	0.031	<0.030	0.000057	81.2	0.23	0.037	0.041	37.1	0.0084	122	9.42	0.029
Updated Overall Dump Predictions																						
Best Judgment	125	1262	0.018	0.0055	0.0030	0.056	0.00074	181	0.060	0.0030	0.0012	0.030	0.00019	162	0.55	0.12	0.17	8.8	0.15	20	1.2	0.041
Upper Bound	225	1262	0.14	0.047	0.018	1.4	0.020	421	0.45	0.050	0.0055	0.26	0.0014	223	3.1	0.44	1.6	26	0.25	46	2.1	3.2
2006 - Trend Predictions for Comparison (Best Judgment)																						
Dumps (Overall)	129	1262	0.018	0.021	0.010	0.063	0.0005	181	0.009	0.0030	0.0025	0.030	0.0020	162	0.17	0.44	0.052	26	0.15	46	2.2	0.034
Gates Pits	28	35	0.026	0.0011	0.008	0.063	0.0005	10	0.009	0.0030	0.00045	0.030	0.00013	5	0.082	0.012	0.041	1.8	0.008	5.1	0.09	0.034
Gething Pits	29	16	0.008	0.0008	0.002	0.040	0.00001	11	0.0005	0.0004	0.00006	0.008	0.00007	6	0.006	0.013	0.0024	1.0	0.006	0.4	0.07	0.002

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The results presented here were used to predict discharge and receiving water quality from the mine and at stations downstream of the mine (Volume 2, Section 12). It should be noted that these concentrations represent dissolved concentrations. Other potential water quality issues include total suspended solids and release of dissolved nutrients associated with explosives residues (Volume 2, Section 12).

3.5 Project Coal Resources

3.5.1 Historical Assessments

Historical coal resource estimates conducted by Denison Mines Limited for the Gates formation coals totalled 27.63 Mt of in-situ coal (Gormley 1976). No estimations were made of the Gething formation coals. An estimated stripping ratio of 7.4:1 had also been published by Quintette, based on an earlier resource estimate of 22.10 Mt of in-situ, unoxidized coal.

An estimate of resources was made in 2002 by Coal-Ex Consulting (Perry 2002). Based on a range of historical reserve estimations, Perry considered the Gates Formation to contain a resource of 26.20 Mt of coal, classified as inferred, in-situ and of immediate interest. Coal-Ex did not publish an estimated stripping ratio.

3.5.2 Resource Classification

The Roman Mountain project area explored between 2005 and 2007 includes the same coal seams used in historical estimates. The Roman Mountain coal resource comprises:

- the Gates Formation seams to the footwall of the J Seams
- the Gething Formation's Bird and GT 1, 2 and 3 seams

The lateral extent of the deposit is defined by Babcock Creek to the northwest, Gordon Creek to the southeast, and the northeast to southwest striking subcrops of the K and GT3 seams, respectively.

As required by National Instrument 43-101 and recommended by the CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM 2005), resource estimates are based on a framework of structural and quality data points (points of observation) defined in GSC Paper 88-21: A Standardized Coal Resource/Reserve Reporting System for Canada (Hughes et al. 1989).

In accordance with GSC Paper 88-21, the Roman Mountain deposit has been classified as structurally complex due to the substantial tectonic deformation and fault-induced offsetting of the stratigraphic units. The in-situ quality of the coal across the deposit does not vary laterally to any great extent and the deposit has therefore been classified as moderate. The exploration program employed a density and distribution of data points sufficient to define a Measured Resource for a structurally complex and qualitatively moderate coal deposit.

Most structural points of observation were determined from geophysical logs of both rotary percussion and core boreholes. Seam tops and bottoms were picked on the basis of an internally-developed standard procedure. True seam thickness was derived from apparent seam thickness (as picked) by the GEMS software during the resource estimation process. Other structural data points were determined from surveyed trench exposures. Coal seam quality data points were determined by coal seam recovery

measurements and composited subseam samples. Seams less than 1 m in thickness were excluded from the resource estimate. The Gething formation seams are classified as an Inferred Resource.

3.5.3 Resource Estimate

For coal resources for Roman Mountain as derived from the GEMS model reported by seam see Table 3.5-1.

Table 3.5-1 Roman Mine Coal Resources

Seam	Volume (Mm^3)			Relative Density	Resources (Mt)			
	measured	indicated	inferred		measured	indicated	inferred	Total
Gates Formation								
D2	1.090	0.207	0.007	1.35	1.485	0.280	0.008	1.773
E1	1.031	0.235	0.000	1.35	1.471	0.314	0.000	1.785
F	1.301	0.282	0.057	1.35	1.885	0.377	0.000	2.262
G	4.368	1.199	0.023	1.35	5.956	1.685	0.000	7.641
J	5.035	2.863	2.023	1.35	7.400	3.688	2.082	13.170
Total Gates	12.825	4.785	2.110		18.197	6.344	2.090	26.631
Gething Formation								
Bird and GT 1,2 ,3	0.000	0.000	1.530	1.35	0.000	0.000	2.065	2.065
Total Gething	0.000	0.000	1.530		0.000	0.000	2.065	2.065
Total	12.825	4.785	3.639		18.197	6.344	4.155	28.696

It should be noted that resources for the K1, K2 and K3 seams were not included in the resource estimate as they were generally only in the order of 0.9 to 1.1 m thick. Although these seams underlie the J Seam and would not normally be considered to have economic potential owing to their thickness and that of the J Seam and K Seam parting, there is potential to mine them when they are intersected in the pit footwall.

3.6 References

3.6.1 Literature Cited

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Roman Coal Mine Project

ENVIRONMENTAL ASSESSMENT REPORT

VOLUME 1, SECTION 4: PROJECT DESCRIPTION AND SCOPE OF PROJECT

Prepared for:
BC Environmental Assessment Office
Victoria, British Columbia

Prepared by:
Peace River Coal Inc.
Vancouver, British Columbia

March 2010

4 Project Description and Scope of Project

4.1 Project Location

The proposed Roman Coal Mine Project (the Project) is located on Roman Mountain in the Peace Region of northeast British Columbia, approximately 30 km south of Tumbler Ridge. The Project is bound to the west by Babcock Creek and to the east by Gordon Creek. In the Peace River Coalfields, the Project is located adjacent to the Trend Coal Mine, which is operated by Peace River Coal Inc. (PRC). The centre of the Project is in UTM Zone 10, NAD 83 at coordinates 6083500 Northing, 630000 Easting (54° 52' 53.832"-120° 58' 24.816") (see Figure 4.1-1).

The Project is located in the southern part of historical Treaty No. 8 lands. Saulteau First Nations and the West Moberly First Nations are located 115 km to the north-northwest and the McLeod Lake First Nations are located 125 km to the west.

The Kelly Lake Communities, which include the Kelly Lake Cree First Nation and the Kelly Lake Métis Settlement Society, are located 70 km to the northeast.

Figure 4.1-2 shows the locations of the administrative offices of the interested First Nations (Section 21) and the location of the Kelly Lake Communities (Section 24) in relation to the Project. Figure 17.3–1 shows the location of archaeological sites identified in and around the Project. Additionally, Figure 24.3–1 identifies culturally sensitive areas identified through the Traditional Interest and Use Assessment undertaken with the Kelly Lake communities.

Lastly, Figures 9.5–1 and 9.5–2 show the Project's proximity to rare plant populations and rare ecosystem respectively, while Figures 10.5–1 and 12.2–3 show ungulate winter range and habitat areas and watercourses and sampling stations located near the proposed Project.

Figure 4.1-1 Regional Map

Figure 4.1-2 Interested First Nations and Interested Kelly Lake Communities in the Project Area

4.2 Sustainability Principles

PRC has seven guiding principles to encourage and promote Sustainable Development.

1. Operate value-creating businesses in a responsible and ethical manner
2. Provide employment opportunities in safe and healthy environments
3. Promote efficiency and innovation in the use of resources
4. Minimize the environmental footprint
5. Demonstrate active stewardship of biodiversity
6. Contribute to the responsible development of the societies within which we operate
7. Engage in regular and transparent dialogue with employees and other stakeholders.

These principles guided all stages of planning for the Project and have informed the development of the suite of environmental management plans detailed in Section 5 and the mitigation and environmental protection measures included in each of the subsequent assessment sections.

4.3 Mine Planning Process

4.3.1 Integration with Trend Operations

In the event that approval to proceed with the Project is been granted, PRC will integrate the Roman Coal Mine development with the existing approved Trend operations in order to optimize operational efficiencies and reduce the incremental environmental footprint of the Project.

Following this principle of integration, the Project will utilize as much of the existing Trend infrastructure as practicable, including existing access roads, power transmission lines, some water management facilities, as well as the Trend coal processing, storage and shipping facilities.

Due to the long construction period the Roman Coal Mine will involve the utilization of Trend facilities such as stockpiles, the process plant and the rail load-out until the full infrastructure has been expanded or replaced.

In other words, the go-forward option or plan is a standalone Roman plant to process all coal from the Trend property according to the Roman Pre-feasibility study, and as presented in this application. However, in the initial years of the Roman project, and until the Roman plant is constructed, the Roman coal will be processed through the existing Trend plant. There is also the possibility that the final Roman Feasibility Study will demonstrate that upgrading the existing Trend processing plant provides better economics than a new Roman plant. In any case, there would be only either a new plant or an upgrade of an existing plant.

Table 4.3-1 summarizes Trend facilities and proposed Roman upgrades and expansions.

Table 4.3-1 Summary of Trend Facilities and Proposed Roman Upgrades and Expansions

	Trend Coal Mine Facilities	Roman Upgrades/Expansions
Primary access/ coal haul route	PDR-46, Trend By-pass Road	No upgrades or expansions proposed
Processing plant	The Trend Plant consists of the following components: • Rotary breaker with reclaiming apron feed—reduces the oversize ROM coal to the required top size, rejecting all the oversize rocks • Heavy media drum—separates coarse coal from coarse refuse for sizes 75 to 10 mm coal. The product top size is then crushed down to minus 50 mm • Heavy media cyclone—material less than 10 mm is then further dry screened at 2 mm and is de-slimed at 1 mm prior to being processed in a heavy media cyclone • Water only cyclone—the slimes washed off the heavy media cyclone feed is classified in water only cyclone cutting at 0.25 mm. The 1 to 0.25 mm material is dewatered using a high frequency screen followed by a centrifuge and added raw into the product. The minus 0.25 mm material is recovered in a thickener and belt filter press and added to rejects	A new processing plant is proposed to replace the existing Trend Plan and process coal from both the Roman and Trend Coal Mines. The proposed Roman processing plant will include: • Rotary Breaker and inclined circular motion screen—reduces the oversize ROM coal to the required top size, rejecting all the oversize rocks • Heavy media cyclone—separate coarse coal from coarse refuse for sizes of 50 to 0.50 mm • Water-only cyclone—used in conjunction with spiral concentrator will be used to separate coal from refuse for sizes between 0.50 to 0.15 mm • Conventional or column froth flotation system—will process ultra fine coal to 0 mm • Fluidized bed thermal dryer—will provide a means of secondary drying Although the completely new facility has been applied for as part of the Project, a decision to upgrade the existing Trend processing plant is still possible
Offices and Administration	The existing 600 m^2 Mine Office includes office space for about 24 staff, a lunch room and meeting rooms	Expansion of the existing building to a 1300m2 mine office to include office space for about 45, a lunch room, library, conference rooms, computer rooms, storage rooms, washrooms and a reception area
Small vehicle shop, fire hall and first aid	There are currently no small vehicle shop, fire hall or first aid building onsite. A first aid room is currently located in the manned site access building (50 m^2), emergency vehicles are parked outside	The proposed small vehicle building, which will occupy an area of about 500 m^2, will garage the ambulance, emergency vehicle and fire truck. It will also include space for a paramedic's office, first aid room, training room and emergency equipment storage locker

Table 4.3-1 Summary of Trend Facilities and Proposed Roman Upgrades and Expansions (cont'd)

	Trend Coal Mine Facilities	Roman Upgrades/Expansions
Truck shop, warehouse, dry complex	The existing maintenance shop (truck shop) is 2500 m^2 and includes several maintenance bays, a wash bay, lubrication storage area, an electrical workshop, and welding stations. The truck shop also has an adjacent 550 m^2 warehouse permitted. A dry which accommodates 240 employs is also permitted	The existing shop will be expanded to a 5400 m^2 truck shop complex with six heavy equipment maintenance bays and four light vehicle maintenance bays, a wash bay, lubrication storage area electrical and welding workshops and warm storage area. An additional 400 m^2 of warehouse space and 600 m^2 cold storage will also be added. A 1000 m^2 dry building will abut the truck shop and will house accommodate approximately an additional 300 employees
Fuel storage facility	Currently 180,000L of fuel storage capacity	Expand with additional tanks to 2.2 million L of fuel storage
Power supply and distribution	Existing 25 kV powerline	Current power feed for Trend has sufficient capacity to satisfy projected demand for the Project. The main power distribution switchgear will be installed in a new substation located adjacent to the existing substation that supplies power to the Trend Coal Mine operation
Domestic water supply	Daily average use of 40 m^3/day supplied by onsite wells	Daily average use anticipated to be 52 m^3/day. Preliminary data indicates that existing Trend wells should provide sufficient water however additional wells may be installed if required
Process plant make up water and fire water supply	Plant make-up water and fire protection water are supplied from common wells and pumped to separate tanks	Plant make-up water and fire protection water will continue to be supplied from common wells (an additional tank will be required) until the commission of the tailings management facility. Following the commissioning, process water will be 95 percent reclaimed from tailings and wells will be used to provide fire protection water and supplement the process plant as required
Sewage	The existing modular wastewater treatment facility will accommodate 230 people	Expand by adding an additional module to a wastewater treatment facility that can accommodate about 450 people
Explosives facility	Onsite explosives base factory (third party contractor)	No upgrades or expansions proposed
Rail load-out facility	The rail load-out facility is currently permitted for automated truck dump, coal loading facility with reclaim feeders capable of handling 2 mtpa. Because of clean coal production shortfalls at the Trend Coal Mine, the construction of the automated system has been deferred and front end loaders continue to be used to load from open stockpiles	Upgrade to batch-weight loading system with enclosed storage capacity for clean coal

Table 4.3-1 Summary of Trend Facilities and Proposed Roman Upgrades and Expansions (cont'd)

	Trend Coal Mine Facilities	Roman Upgrades/Expansions
Water management -mine site (sediment ponds and ditches)	Currently permitted for 5 sediment pond on the South Block of the Trend Coal Mine (SP1A, SP1B, SP2, SP3 and SP4) and associated network of ditches.	As Roman and Trend will overlap, Trend ponds SP1A, SP1B, SP2, SP3 and SP4 will be utilized to treat mine affected run-off from both Projects. In additional sediment RP1, RP2 (which will integrate closely with SP2) and RP3 will be built. RP3 will also be used as a tailings management facility
Water management—rail load-out (sediment ponds and ditches)	Currently permitted for one sediment pond at the rail load-out (LSP1) and associated network of ditches	Roman will utilize existing structures. No upgrades or expansions proposed

4.3.2 Pre-feasibility Study

The primary objective of the Company's Pre-feasibility study is to compare the options identified in the conceptual stage in order to select the single go-forward option to be further studied and optimized in the Final Feasibility stage. During Pre-feasibility, the business case identified in the conceptual stage is firmed up and the potential of the Project is established by rigorously reviewing the chosen set of alternatives for the investment opportunity. From this review, after a full comparative evaluation of the alternative's full value and risk profile, one preferred go-forward option is selected. The Pre-feasibility stage also incorporates the major fieldwork and investigative program necessary to evaluate options, determine the scope of the Project and assess its potential viability. This stage not only demonstrates why an option was chosen but also identifies other Project options and gives clear reasons why these options have been discarded.

During 2008 PRC completed a comprehensive pre-feasibility study for the Project which was informed by knowledge gained from the adjacent Trend Coal Mine operations, input from regulators, First Nations and Kelly Lake communities and the local Tumbler Ridge community. The study identified a number of opportunities to reduce environmental effects in five important areas, including:

- PAG management
- water quality
- fish habitat
- caribou habitat
- dust generation

As a result, several refinements were made to the Roman Coal Mine Plan previously presented in the Project Description submitted to the Environmental Assessment Office (EAO) in August 2007 in accordance with PRC's commitment to minimize harm to the environment.

4.3.3 Roman Coal Mine Plan Refinements

The Project description submitted in August 2007 included a preliminary mine plan (see Figure 4.3-1), which included conceptual phasing for a set of linear open pits to allow coal release from both the Gates and Gething seams with development proceeding from west to east. The majority of the waste rock was to be placed in an external rock dump located in the upper reaches of the Babcock Creek drainage, immediately south of the pits.

Figure 4.3-1 Roman Coal Mine Plan from August 2007 Project Description

The Roman Coal Mine Plan was refined with consideration given to further addressing these areas of environmental concern. Highlights include:

- substantial reduction of the proposed area of disturbance
- removal of the rock drain proposed for Babcock Creek
- addition of an in-pit tailings facility
- addition of covered primary coal stockpiles

Figure 4.3-2 presents the revised mine plan being presented in this application with the maximum disturbance limit (MDL) reduced by approximately 9 percent. This reduction was achieved, in part, by increasing the overlap of Project waste dumps onto areas previously disturbed by the Trend Coal Mine.

Another important modification is the addition of the tailings management facility (TMF) in Phase 1 of the Gates pit, which will allow for subaqueous storage of some PAG materials, including coarse coal rejects. This approach will mitigate the potential for acid generation associated with high sulphur materials through the inhibition of oxidation. As well, the current dump configuration allows for PAG material, not submerged in TMF, to be isolated to the north dump.

Other key changes include removal of the proposed rock drain from the upper reaches of the Babcock drainage and reduction in the area of proposed disturbance in the Gordon Creek catchment. Both of these changes substantially improve the Project with respect to potential effects on water quality and aquatic life.

Caribou habitat loss was also identified as a concern by regulators, First Nations and Kelly Lake Communities. In the revised Roman Coal Mine Plan, disturbance of high quality caribou habitat has been avoided wherever practicable by further increasing the proportion of Project waste that reports to dumps in the Trend Coal Mine pits and reducing the mine footprint.

Trend operations have identified dust control as a prime concern due in large part to the high winds experienced at the mine site. To minimize the source of fugitive dust for the both the Project and the Trend Coal Mine, PRC proposes to construct covered stockpiles at both the processing plant and the rail load-out.

Figure 4.3-2 Revised Roman Coal Mine Plan

4.4 Roman Coal Mine Plan

The Project is designed to mine approximately 30.6 million tonnes (Mt) run-of-mine (ROM) metallurgical coal at an average strip ratio of 8.4:1 bank cubic metre of waste per tonne of in-situ coal (BCM:t). With an average yield of 70.4 percent, clean coal production will be about 1.3 to 2.1 Mt per year for the 10-year Project life. The total planned production over the life of the Project is 21.5 Mt of metallurgical coal.

The Project will contain three linear open pits along strike, that is, one large central Gates pit flanked on each side by a shallower Gething pit. There are six economically viable coal seams in the Gates formation (D, E, F, G, J and K), and four economically viable coal seams in the Gething formation (Bird, GT1, GT2 and GT3) (described in Section 3). The Trend and Roman mine plans will be integrated to ensure the most efficient utilization of the coal resource.

Figure 4.3-2 shows the general layout of the Project. Key components include three open pits, adjacent external dump areas, mine access roads, water management structures, soil stockpiles and the coal processing plant. The maximum disturbance limit (MDL) for the Project ground disturbance is 810.6 ha, with approximately 311.7 ha of the disturbance overlapping pre-existing ground disturbance from the Trend Coal Mine.

Project areas will be cleared and grubbed before commencement of construction or mining activity. Clearing limits will be greater than grub limits to allow for a safety buffer zone against tree fall. Soils will be stockpiled in strategic locations to allow for soil replacement during reclamation. Reclamation will consist of re-sloping waste dumps and fill roads, soil replacement, and re-vegetation. Final closure is envisaged to involve removal of all facilities and infrastructure, as well as decommission and reclamation of roads and water management structures.

The Project will use a conventional truck and shovel method of open pit mining and will advance from northwest to southeast. Mining will begin by drilling and blasting waste rock, which will then be loaded into haul trucks and placed in external dumps or backfilled into previously mined pits in the South Block of Trend Coal Mine. The ROM coal will be loaded into haul trucks and transported to the coal processing plant.

The mine plan allows for backfilling of mined out pit areas where it was deemed feasible. This decreases the incremental footprint of the external dumps and decreases disturbed areas. Backfilling open pits will also reduce the exposed footwall and hanging wall area.

The coal processing plant will process coal from both the Roman and Trend Coal Mines. Raw feed will be crushed using a rotary breaker before entering the plant. The selected coal processing configuration will use a heavy media cyclone to separate coarse coal from coarse refuse. Intermediate-sized material is to be treated in a water-only cyclone used in conjunction with spiral concentrators. All ultra fine coal will be processed by column froth flotation.

A fluidized bed thermal dryer will be used for secondary drying. The resultant product will have an ash of approximately 8 to 9 percent and 8 percent total moisture. The coal will be hauled to Trend Coal Mine's existing rail load-out facility (which will be upgraded to accommodate the extra tonnage), in highway-legal trucks for transport to port at Ridley Terminals, Prince Rupert, British Columbia.

Approximately 375 personnel will be employed directly at the mine site during regular operations, with an additional 40 personnel required for the product coal haul and rail load-out. Construction will take place in 2011 and will employ up to 287 persons directly. Mining of first coal is anticipated in 2012.

4.4.1 Mineable Resource

The minable resource was defined by three-dimensional geological and quality models of the Gates and Gething coal seams (Section 3). The models were used to facilitate volumetric calculations of the Gates and Gething Pits, delineating surfaces between coal seams and waste rock that define hanging-walls, footwalls and waste zones.

With limited exploration in the area, the Gething seams remain classified as an Inferred Resource. There were insufficient data available to develop a detailed model of the Gething seams. Therefore, seams between the Bird seam hanging-wall and Gething-3 footwall were modelled as a single seam having a north and south limb, while narrower seams and partings were modelled as a percentage of seam volume.

Surface modelling of the deposit and subsequent economic pit definition work have identified recoverable coal reserves for both formations, which are summarized in Table 4.4-1. These pits have been designed with the geotechnical parameters defined in Section 4.4.2.7.

Table 4.4-1 Coal Reserves

Seam	ROM Reserves (Mt)				Saleable Reserves (Mt)		
	Proven	Probable	Inferred	Total	Yield % (as delivered)	Yield % (air dried)	Sales (as delivered)
Gates Formation							
D2	1.634	0.308	0.009	1.951	74.1	72.4	1.434
E1	1.650	0.352	0.000	2.002	49.1	48.0	0.975
F	2.137	0.428	0.000	2.565	56.7	55.5	1.444
G	6.332	1.791	0.000	8.123	71.8	70.2	5.784
J	7.671	3.823	2.159	13.653	76.7	75.0	10.388
Total Gates	19.424	6.702	2.168	28.293	70.8	69.2	20.025
Gething Formation							
Bird and GT 1, 2, 3	0.000	0.000	2.298	2.298	66.9	65.4	1.525
Total Gething	0.000	0.000	2.298	2.298	66.9	65.4	1.525
Total	**19.424**	**6.702**	**4.465**	**30.591**	**70.4**	**68.9**	**21.549**

It should be noted that resources for the K1, K2 and K3 seams were not included in the resource and reserve estimate as they were generally only in the order of 0.9 to 1.1 m thick. Although these seams underlie the J Seam and would not normally be considered to have economic potential owing to their thickness and that of the J Seam and K Seam parting, there is potential to mine them when they are intersected in the pit footwall.

4.4.2 Mine Design

4.4.2.1 Approach

The approach to mine design in a pre-feasibility study is to review multiple combinations of mining methodology, equipment selection and mining rate to optimize economics, geo-technical, practical, safety and environmental considerations.

The mining method selected (open pit mining) was evaluated for a variety of through-put rates. Key options were identified including ROM-production rate, coal-mining methodology and equipment fleet selection (larger versus smaller fleets).

Pre-feasibility mine planning also evaluates mining options on qualitative or subjective criteria, based on common sense and previous experience. Incremental quantitative evaluations along with financial modelling are also conducted on each option to ensure an economically viable solution.

4.4.2.2 Assumptions

The main assumptions used in the mine design criteria were:

- owner operator running operation
- 24-hour, seven-days-a-week operation
- high wall design criteria from Trend Coal Mine refined for rock and clay structures
- PAG material management practices similar to Trend Coal Mine
- dump design criteria the same as Trend Coal Mine
- maximum ramp grade of 8 percent
- coal loss and dilutions for various seam configurations (dip angles)
- equipment types which were selected (described in Section 4.4.4)
- weather-related stoppages similar to Trend

Table 4.4-2, lists the mining options considered and the resulting recommendations and a brief summary of the reasons the recommendations were selected. These recommendations were used as the basis for the mine plan.

Table 4.4-2 Alternative Options Studies and Recommendations

Trade-off Study	Recommendation	Reason for Selection
Mining Methods		
Waste Removal Excavation–Dragline vs. Truck and shovel	Truck and shovel	• The steeply inclining seams would require construction of temporary working floors for the dragline. These floors would form rock wedges that would require smaller capacity equipment to uncover coal and re-handle waste • As the coal seams at Roman are relatively narrow, there would not be enough area for a dragline to dispose of waste generated by the next cut

Table 4.4-2 Trade-off Studies and Recommendations (cont'd)

Trade-off Study	Recommendation	Reason for Selection
Mining Direction	West to east	• If mined from west-to-east, the pits would have to be opened at a higher elevation than the base strategy. At the higher elevation, miners would face the challenges of more severe climatic operating conditions while exposing higher volumes of PAG material much earlier in the mine-life • Cost of operation
Underground vs. Open-Pit Mining	Open-Pit Mining	• Its steeply inclining seams preclude tracked machinery or armoured conveyors operating over the footwall; the alternative is to leave a considerable volume of coal in-place as pillars to support the floors that the equipment would work on • The low strengths of the hanging wall rock, footwall rock and the coal combined with steeply inclined seams infer difficult and potentially unstable geotechnical conditions requiring and extensive support systems under roofs and floors
Cast blasting	Not included (but will be investigated further in the Final Feasibility Study)	
Coal mining method (larger "bulk" equipment vs. smaller "selective" equipment)	Smaller selective coal mining	• Improved quality of coal mined • Facilitates PAG management by reducing coarse coal reject produced during plant processing • Economic evaluation
Mining Limits		
Extent of reserves	Updated mine plan	• Facilitates PAG management by placing PAG material into the North Dump only • Protection of water quality and fish habitat • Protection of high value caribou habitat • Avoidance of Five Cabin drainage • Integration with existing Trend Mine disturbance
Consideration to Innovation and New Technology		
Automation of trucks	Manned trucks selected (but automation will be investigated further in the Final Feasibility Study)	• Proven technology • Portability, expandability, flexibility, and compatibility with the existing Trend mining operation

Table 4.4-2 Trade-off Studies and Recommendations (cont'd)

Trade-off Study	Recommendation	Reason for Selection
Coal and Waste Haulage: Trucking vs. conveying	Trucking	• Portability, expandability, flexibility, and compatibility with the existing Trend mining operation • Minimize effects on wildlife and vegetation by not creating incremental disturbance that would be required for a conveyor system • Proven technology • More economically viable
Operations Summary		
Mine equipment fleet evaluation	The preferred mining fleet is given in Section 4.4.4	• Safety • Selected fleet uses fewer but larger excavators thereby reducing GHG emission from fuel combustion and produce less noise • Proven technology • Portability, expandability, flexibility, and compatibility with the existing Trend mining operation • More economically viable • Able to achieve coal recovery for selected mine design • Best option for selected mine design
Waste Management		
Tailings Disposal options; • A new tailings impoundment in Babcock Creek • Co-disposal of tailings as slurry in the waste rock dumps • Pump tailings to an impoundment in Trend Pit • Pump tailings to an impoundment in Roman Pit • Filter tailings and stack in waste dumps • Thicken tailings and place in waste rock dump area • Filter tailings and stack in-pit • Filter tailings and place in-pit • Cyclone tailings • Expand proposed Trend Tailings Impoundment to accommodate tailings from the Roman Pit	Use a temporary tailing dewatering system for the first two years of operations and then switch to pumping slurry tailings into the mined-out Phase 1 Gates pit	In-pit tailings pond: • Proven technology; easy, reliable development and operation with successful precedents in similar operating and climatic conditions • Sub-aqueous storage possible to manage PAG CCR • No additional disturbance required

4.4.2.3 Design Criteria

The detailed designs of the Gates and Gething pits are based on mining economics and geological structures in the pit areas. A series of scenarios were considered to ascertain the economic limits of open pit development. The economic limit, determined in conjunction with geological structures, water management, access corridors and pit slope criteria, drove the refinement of the pit designs.

Geotechnical conditions would support the use of the following pit shell and mine planning design criteria:

- bench height, single-bench mining—12 m
- height between catch benches—12 or 24 m
- bench face angle—65° in rock, 60° in overburden
- berm width—8 to 10 m
- total width allowance for roads—35 m
- running surface—24 m
- minimum road inside radius on corners—20 m
- berms and ditches—10 m wide
- maximum grade of pit ramps—8 percent

Further geotechnical assessment and refinement of the mine plan will occur during Final Feasibility planning.

4.4.2.4 Gates Pit Design

The Gates Pit was designed to mine coal from seams D, E, F, G, J and K. The seams in the area have been folded into a syncline with its axis plunging up to eight degrees towards the northwest. The syncline limbs dip at between 50 and 65° over most of the property, but range from vertical to slightly over-turned on the northwest side.

The angle of the Gates footwall will be controlled by the strata's dip angle. Where strata dip at an angle greater than 65°, the bench face angle will be set to a maximum angle of 65°. Where strata dip at an angle between 45° and 65°, a 9 m wide catch berm will be left on every second bench. At a dip angle of less than 45°, there will be no catch berm. The resulting inter-ramp angle will be less than 50° (see Figure 4.4-1).

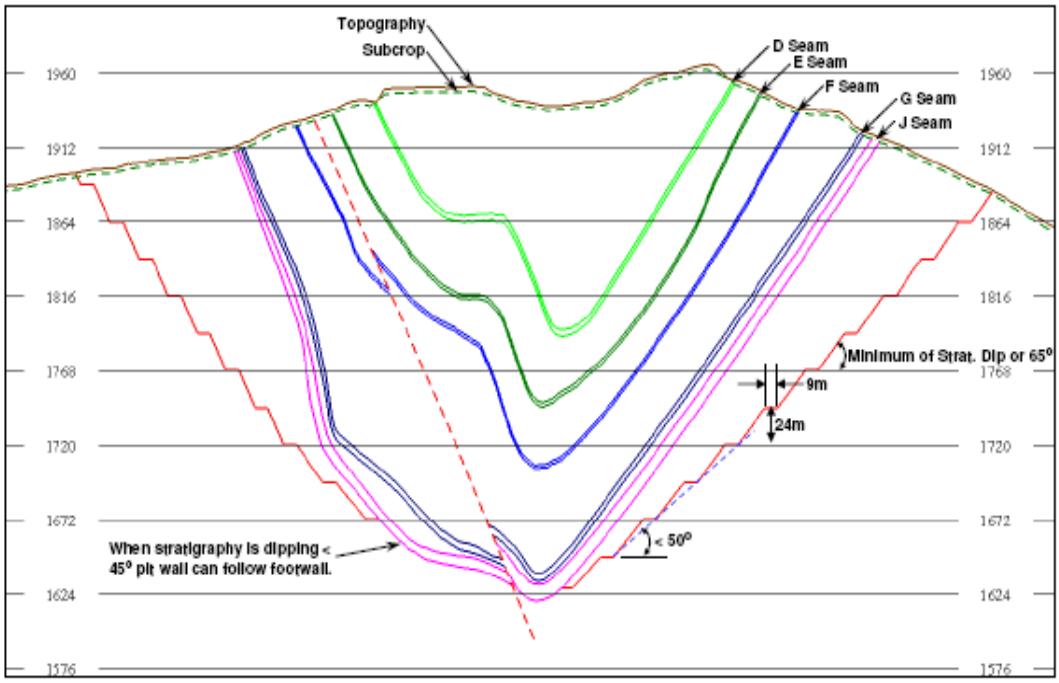

Figure 4.4-1 Gates Footwall Design

The pit design was produced to mine all of the Gates Formation because the thicker seams are within the axis of the syncline. The end wall of the Gates Pit adjacent to Babcock Creek will have a face angle of 65°, an 8 m wide catch berm every second bench, and a resulting inter-ramp wall angle of about 51° (see Figure 4.4-2). Where pit walls intersect thicker overburden, wall angles will be limited to a maximum of about 60°; with a 10 m wide catch berm on each bench. These walls will have a resulting inter-ramp angle through the overburden of about 35°.

Where the hanging-wall of the Gates Pit intersects Moosebar Shales, the hanging-wall will have a face angle of 65°; a 9 m wide catch berm on every 12 m high bench, and a resulting inter-ramp angle of about 39°.

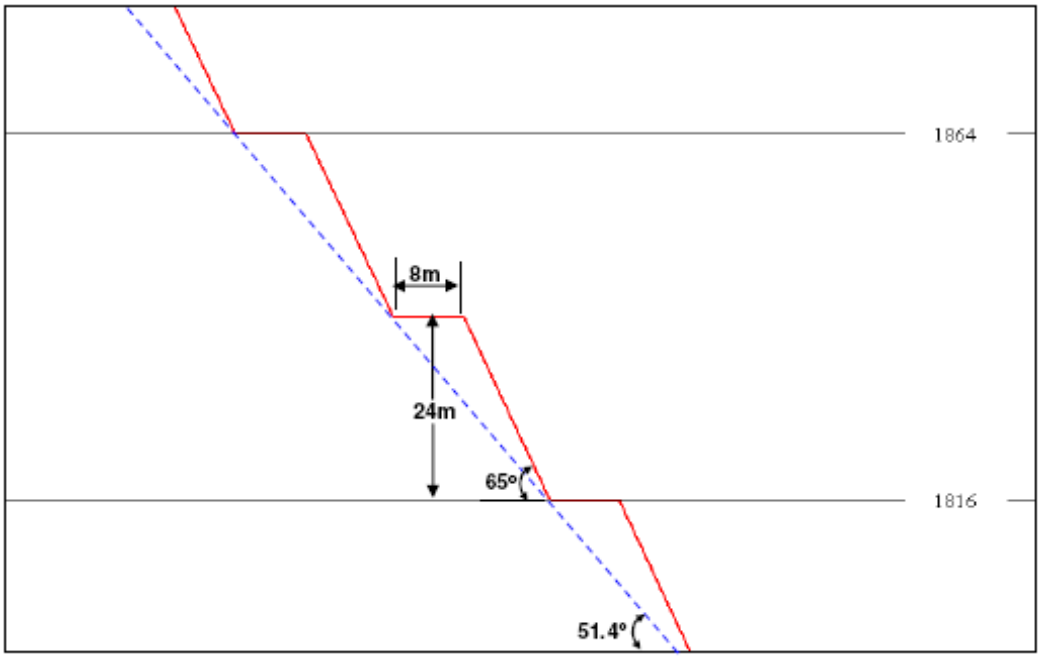

Figure 4.4-2 Gates Pit Northwest Endwall Design

Phase 1

Phase 1 will mine the syncline adjacent to Babcock Creek. The pit bottom will be accessed by a ramp with an eight percent decline built into the northwest pit wall. Where the ramp intersects the syncline, it will turn and then follow the fall line of the syncline axis to the bottom of the J-seam footwall. The intersection of the ramp with the syncline will define the location of the toe of the Phase 1 pit. Once mined-out, the Phase 1 pit will be used to store tailings and PAG coarse coal refuse (CCR) from the coal processing plant (see Figure 4.4-3).

Phase 2

Phase 2 will be a 750 m extension to the southeast of Phase 1. Access to the Gates Pit bottom will be along a second ramp built into the northern wall that follows an 8 degree fall line to where it intersects with the syncline axis. The intersection of the ramp with the syncline axis will define the location of the toe of the southeast wall of Phase 2 (see Figure 4.4-4).

Phase 3

Phase 3 will extend the Gates Pit another 750 m to the southeast to a point where the synclines will daylight above Gordon Creek. Access to the lower benches will be along a third ramp built in the northeast wall as far as its intersection with the syncline axis (see Figure 4.4-5).

Figure 4.4-3 Mine Operations—Phase 1

Figure 4.4-4 Mine Operations—Phase 2

Figure 4.4-5 Mine Operations—Phase 3

4.4.2.5 Gething Pits Design

The Gething pits will be shallow excavations that follow the syncline's outcrop and will target GT1, GT2, GT3 and Bird seams. The Gething pits are too small to have their own access ramps, but they will only be about 100 m from the edge of the Gates pit and, therefore, they will be mined concurrently with the phased development of the Gates pit.

The Gething footwall design is based on the same guidelines as those adopted for the Gates pit (see Figure 4.4-6).

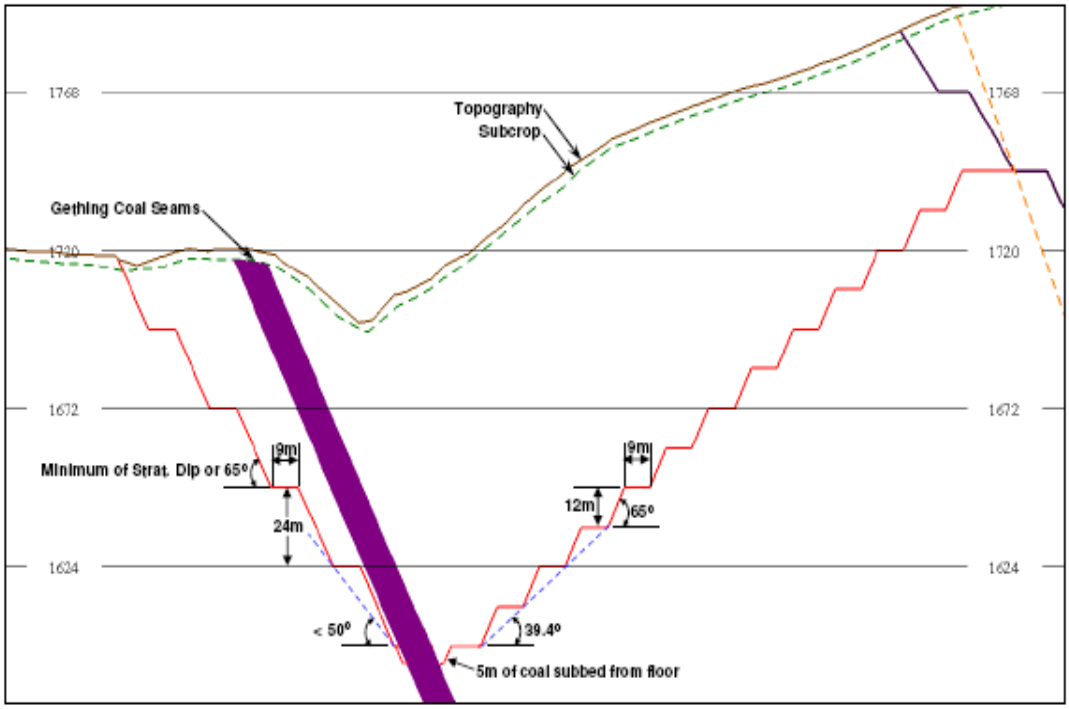

Figure 4.4-6 Gething Pit Footwall Design

Phase 1 North and South Gething Pits

In Phase 1, the Gething pits will be accessed from the benches of the Gates Phase 1 pit. Further extension westward of the Gething pits will be constrained by the increase in the depth of overburden as the pit shell approaches Babcock Creek (see Figure 4.4-3).

Phase 2 North and South Gething Pits

As in Phase 1, the Phase 2 Gething seams will be accessed from the Gates Phase 2 pit and mined at the same time as the Gates seams (see Figure 4.4-4).

Phase 3 North and South Gething Pits

In Phase 3, the upper benches of the Gething pits will merge with those of the Gates pit. Further extension of the Gething pits eastward will be constrained by Gordon Creek (see Figure 4.4-5).

4.4.2.6 Waste Rock Storage

The proposed waste rock dumps for the Project are located on both the north and south slopes of Roman Mountain. The South dump is a hillside dump, constructed to a maximum elevation of 1670 m and extends down to the plateau just above the Babcock Creek valley. The North dumps are constructed to a maximum elevation of 1820 m and are a combination of fill over natural ground between the North Roman Gething pit and the Trend Gething pits, backfill into the Trend pits, and fill over the existing Trend dumps. Figure 4.4-7 shows the general site layout with the proposed Roman pits and dumps, along with the existing and proposed Trend pits and dumps at completion of mining.

For pre-feasibility planning, the following principal dump design criteria and parameters were used:

- angle of repose—35°
- re-contoured angle—25°
- material bulking factor—1.30
- lift height (when building bottom up)—30 m
- total width allowance for roads—35 m

As shown in Figure 4.4-7, where dumps are built from the bottom up, lifts will be stepped so that re-contoured dumps will have a final slope angle of 25° (see Figure 4.4-8). Management of the PAG waste rock and the control of acid generation will influence dump layout and design. Section 4.9 details a conceptual waste rock management plan.

South Dump

Non-acid generating (NAG) rock mined during Phase 1 and Phase 2 will be hauled to the south dump. This dump will be built top-down with wrap-around lifts and an overall slope angle of 25°.

North Dumps

The north dump, which for the most part will be built in lifts from the bottom-up, will cover areas previously disturbed by the Trend Coal Mine. This dump will be the primary dump used to store PAG waste, which will be blended in with NAG waste to reduce acid rock drainage potential. When there is a surplus of NAG waste, it will be used to construct a series of top-down dumps to reduce the length of the waste haul (see Figure 4.4-9). The top-down dumps will eventually be buried by the advancing dumps formed by the bottom-up lifts. The northeastern portion of the north dump will be formed by NAG waste mined from the lower benches of Phase 3. This portion of the north dump will cover some of the mined-out Trend Coal Mine pits and waste dumps, and it will reduce the disturbance of the Project.

Dump sequencing will be based on haul distances and waste rock characteristics. An annual breakdown of dump sequencing is presented in Table 4.4-3.

Figure 4.4-7 Roman Waste Rock Dumps

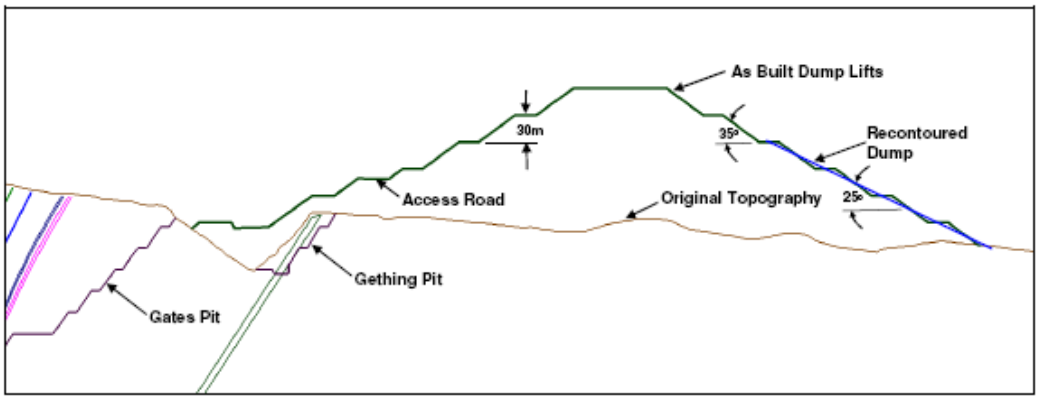

Figure 4.4-8 Section through Re-sloped Waste Rock Dump

Figure 4.4-9 Top-down NAG Dumps within the North Dump

Table 4.4-3 Annual Waste Dump Schedule

Year	Waste Rock to North Dump (bcm x 1000)	Waste Rock to Northeastern (NAG) Dump (bcm x 1000)	Waste Rock to South Dump (bcm x 1000)
1	5,641	0	7,630
2	10,949	0	3,078
3	16,343	0	0
4	16,660	0	0
5	26,324	0	5,474
6	24,604	0	7,328
7	11,430	20,505	0
8	4,929	27,453	0
9	1,052	18,749	0
10	487	13,478	0
11	0	4,448	0

4.4.2.7 Geotechnical Evaluation

A preliminary geotechnical analysis and review of the proposed dumps was conducted by Norwest Corporation. Complete results of the investigation are presented in Appendix 4A and are summarized below.

Geotechnical Evaluation Criteria

For the geotechnical evaluation, the western portion of the north dump is divided into a north and middle dump. The delineation between these dumps is shown in Figure 4.4-10. Limited two-dimensional limit-equilibrium slope stability modelling was done on the proposed south and middle dump structures, to determine the geotechnical factors of safety (FOS). These FOS values were calculated for static and pseudostatic conditions, at the end of construction (angle of repose) and at closure, after they have been resloped to 2H:1V. No analysis was done on the north dumps over the existing Trend Coal Mine dumps or within the Trend Coal Mine Gething pits. Cross-sections were cut through these areas to schematically show the dump configurations and to provide geotechnical recommendations regarding the procedures for dumping over existing dumps. Pit backfilling, as is currently designed, is not expected to generate any geotechnical concerns.

Calculated FOS values were evaluated against published guidelines from the British Columbia Mine Dump Committee (1991). Table 4.4-4 shows the FOS values chosen for evaluation of the Project dumps, selected mainly on current knowledge of foundation conditions.

Figure 4.4-10 Geotechnical Site Investigation Plan

Table 4.4-4 Factors for Safety Used for Evaluation of Roman Waste Rock Dumps

Condition	Minimum Factor of Safety Criteria
Short term, angle of repose (static)	1.3
Long term, resloped (static)	1.5
Pseudostatic stability -peak ground acceleration = 0.04 g (1/2 the 1/1000 year peak ground acceleration)	1.1 to 1.3
NOTE: In this report, all factors of safety are calculated with Spencer's method (Spencer 1967) using Slope/W software (Geoslope International Ltd. 2004)	

There have been a number of failures of coal mine waste dumps in British Columbia, with large runout distances, and many with conditions that show static factors of safety greater than 4.5 to 6. A compilation of about 50 of the higher flowslide runout events indicates that they occurred where the foundation slope angle is steeper than about 17° and for dump heights greater than 60 m. Detailed studies for three of these events (Dawson et al. 1998) shows that they were associated with weak layers of finer grained sandy gravels placed on the dump face and subsequently dumped over. These materials were found in the basal runout zone for all three cases. Poor foundation drainage conditions were also contributing factors. As a result of these experiences, evaluation of geotechnical risks associated with high, end-dumped fills containing undifferentiated material needs to also consider flowslide runout risks and associated risk management strategies. PRC will consider these issues further in the development of the final mine design.

Table 4.4-5 was used as a framework for risk evaluation for the Project dumps with respect to flowslide runout failures. To manage these risks, the final waste rock design should:

- reduce the flowslide potential where practical, by sequencing the dump phases to keep lift heights less than 50 m and on foundation slopes less than 15°
- create restricted access zones in hazardous areas
- create a monitoring program using visual monitoring and instrumentation
- periodically review geotechnical performance of the designs and update operational procedures

As a detailed design of the lift sequencing for the dumps has not been completed, detailed flowslide runout analyses were not undertaken at the prefeasibility study phase. However, these analyses will be undertaken in support of the process of developing the final mine design.

Table 4.4-5 Flowslide Runout Rating for Angle of Repose Waste Rock Dumps

Lift Construction Geometry and Methods		Runout Rating		
		Poorly Drained Foundation	Well Drained Foundation	
			<15°	≥15 to 25°
Undifferentiated Waste Rock Fill	Low lifts (≤50 m) with wrap-around construction	Low to High	Low	Moderate
	High lifts (>50 m) or low lifts dumped parallel to contour	High	Moderate	High

NOTES:

Low	Likelihood of a runout is low for well constructed dump with well defined operating procedures. Detailed runout assessment should not be required; however projection of a shadow angle from the dump crest will be used to delineate restricted access zones
Moderate	Runout not likely to occur during the design life. Runout assessment required to evaluate risks
High	Runout likely to occur during the design life. Runout assessment required to evaluate risks

Foundation Conditions

In conjunction with terrain mapping, several site investigations in 2008 and 2009 were done to collect geotechnical data to evaluate the proposed waste dumps, which included geotechnical drilling and trench excavation. Figure 4.4-10 shows the location of all the drill holes and test pits for the Project, along with the approximated depths to bedrock at each location.

Samples collected from these programs were tested to determine specific geotechnical properties, such as moisture content, Atterberg limits and particle size. Several samples were also tested to determine hydraulic conductivity and maximum dry density of the soil. One triaxial test was done on a combination of glacial till samples (re-compacted to 95 percent Standard Proctor density) to obtain an estimate of soil strength. Logs from these investigation programs and laboratory results are provided in the complete Norwest Geotechnical Evaluation of the Roman Waste Dumps Report in Appendix 4A. Results from the winter 2009 drilling and trenching program will be incorporated into future planning.

Norwest's site investigation results generally agree with the terrain mapping completed. Test pits and drill holes nearest Babcock Creek showed organic cover over mixtures of silty sand and gravel to depths of generally less than 6 m. In general, this material appeared to be saturated below approximately 3 m. Below 6 m, stiff glacial till, consisting mostly of silt, gravel and cobbles, was found overlying bedrock. This material was generally moist, with water encountered in the drill holes just above the bedrock contact. Test pits at higher elevations (NW-1656-TP, NW-1657-TP and NW-1658-TP) showed a thin layer of organics and silt (approximately 0.5 m) overlying silty, gravelly till. Standard Penetration Test (SPT) blow counts for the upper 6 m of silty sand soils ranged from 4 to 36, with an average of 17, indicating compact soils. The harder silty glacial till below 6 m had blow counts ranging from 8 to 71, with an average of 37; indicating dense to very dense soil. It is expected that these soils will not generate substantial excess pore pressures from loading (i.e., they will act as well-drained soils).

Below the surficial cover lies Lower Cretaceous bedrock, which varies from shales and carbonaceous mudstones to siltstones, sandstones and conglomerates. The pits will be excavated to mine coal from the Murray Syncline, which contains strata and coal from the Gates, Moosebar and Gething Formations. The syncline axis is oriented approximately northwest-southeast and plunges to the northwest. The Waterfall Creek Anticline, which is oriented northwest-southeast, is between the Project pits and the Trend Coal Mine pits. Given these orientations, failures in the bedrock would have to occur sub-perpendicular to dipping bedding planes.

Foundation materials for the rock fill dumped in the Trend Coal Mine pits will consist of the same Lower Cretaceous bedrock left in the pit walls. Rock fill dumped over the existing Trend Coal Mine dumps will be founded on existing waste rock. Stability analyses and geotechnical data for the Trend Coal Mine dumps are contained in the 2006 Trend Coal Mine permit submission (Norwest Corporation 2006).

Evaluation of Waste Rock Dump Stability

Cross-sections through the waste rock dumps are shown on Figures 4.2–11 to 4.2–15, and in plan view on Figure 4.4-10. Sections D1, D2 and D3 through the south dump and Section D6 through the middle dump were subjected to two-dimensional limit equilibrium slope stability analysis, using Slope/W software (GeoSlope International Ltd. 2004). Stratigraphic and water table conditions were taken from the drill hole and trench data collected in 2008 and 2009. The remaining sections through the north dump are schematically shown to illustrate recommended procedures and follow-up analyses, once the mine plan has been finalized and lift sequencing is complete.

The failure mode of concern for the sections analyzed is a deep-seated failure through the foundation soils at the base of the dump. Factors of safety were calculated for the full height of the dump at angle of repose, and for the fully-resloped closure conditions. Where the FOS values did not meet the evaluation criteria set out in Table 4.4-4 alternate lift phasing must be considered during Final Feasibility planning, in order to achieve lift heights less than 50 m on low foundation slope angles. FOS values for the sections analyzed are summarized in Table 4.4-6. Slope/W printouts of the critical failure surfaces are provided in Appendix 4A.

Figure 4.4-11 Cross Sections A1 and A2 through North Waste Rock Dumps

Figure 4.4-12 Cross Sections B and C through North Waste Rock Dumps

Figure 4.4-13 Cross Sections D1 and D2 through South Waste Rock Dump

Figure 4.4-14 Cross Sections D3 and D6 through South and Middle Waste Rock Dumps

Figure 4.4-15 Cross Sections N and A through North Waste Dumps

Table 4.4-6 Summary of FOS Values for Roman South and Middle Dumps

Geometry	Analysis Condition	Calculated Minimum Factor of Safety				Evaluation Criteria (Minimum FOS)
		Section D1	Section D2	Section D3	Section D6	
Full height, prior to reslope	Static, critical surface	1.46	1.33	1.39	1.48	1.3
	Pseudostatic, critical surface (earthquake loading, k = 0.04)	1.30	1.22	1.29	1.34	1.1 to 1.3
Resloped, closure conditions	Long-term, static, critical failure	1.50	1.51	1.68	1.59	1.5
	Pseudostatic, critical surface (earthquake loading, k = 0.04	1.33	1.37	1.19	1.43	1.1 to 1.3

The sections analyzed for slope stability meet the evaluation criteria for the full height and closure conditions. Lifts 50 m high were required to meet the stability requirements on Sections D1 and D2; on Section D3, the resloped toe was moved back 50 m from the edge of the Babcock Creek valley. This increased the FOS value and also allows more room for ditching and roads at the base of the dump. The stratigraphy for Section D6 was built using the information from the south dump and it should be reanalyzed once there is information from additional drilling in this middle dump area.

In the stability analyses, the water table was modelled using conditions observed during site investigations or assumed conditions based on topography. Loading due to dumping is expected to change the groundwater conditions and may result in an increase in the phreatic surface. The FOS is sensitive to this rise in water table and the waste dump stability may be affected if the water table rises substantially within the dump. To help manage this risk, organic, soft and fine-grained topsoil should be stripped from beneath the dump footprint, and piezometers should be installed in the foundation soils beneath the dumps to monitor the changes in the phreatic surface.

In order to meet the FOS evaluation criteria, and to minimize flowslide runout risks, lift heights for all the dumps (south, middle and north) should be less than 50 m. Dumping along contour, in a wrap-around fashion will also help to lower the flowslide risk. Detailed sequencing of the dumps was not done; however, when dumping at higher elevations where the foundation slope angle is large (greater than 15°), the construction sequencing should be bottom-up, to allow the higher lifts to be dumped on existing waste rock platforms.

Instrumentation and Monitoring

A detailed instrumentation and monitoring plan should be developed for the waste rock dumps. The purpose of this program is to:

- confirm geotechnical design parameters
- warn of slope movements
- monitor the ground response for possible foundation slip due to unexpected pore water pressure increases or weak foundation layers

Monitoring will be done for:

- pore-water pressures (and any change in the water table) during dump construction
- excessive displacement, velocities or accelerations at the crest or toe of the dump
- cracking at the dump crest or slopes, or bulging of the slopes or toes
- local slumping or deformation due to soft ground conditions

Scheduled and systematic visual inspection of the waste rock dumps by a qualified geotechnical person during construction, resloping, reclamation and for some closure period is a critical element of the monitoring program. Instrumentation such as piezometers, inclinometers and extensometers will likely be required to monitor the stability of the dumps or to confirm design assumptions.

Conclusions and Recommendations

The currently proposed waste dumps were geotechnically evaluated and meet the slope stability criteria based on the British Columbia Mine Dump Committee's 1991 guidelines; however, specific dump phasing will be required before we apply for an approval of the mine plan under the Mines Act. The development sequence for the dumps will be critical to achieve target factors of safety and for managing liquefaction flowslide risks and is an integral part of the geotechnical design. In general, the lift sequence should be construction from the bottom-up, in lifts less than 50 m high, dumped along contour, in a wrap-around manner.

The geotechnical data collected during previous site investigations provides sufficient information for EA and to begin Final Feasibility-level designs of the waste rock dumps. However, additional field investigations will be required before applying for a mine permit. Specifically, foundation soil and depth to bedrock information is required for the middle dump, to confirm the foundation assumptions used in the slope stability analyses.

4.4.2.8 Soil Storage and Dump Reclamation

Based on the advancement of mining and dumps, progressive and concurrent reclamation will be done. This will include dumps being re-sloped and re-vegetated while the mine is still in operation. This will reduce the size of overburden stockpiles, and surplus overburden will either be blended into waste dumps or placed on reclaimed areas to provide a thicker base for vegetation.

Figure 4.3-2 shows the preliminary locations of soil stockpiles which will be preserved for reclamation. A detailed description of soil handling and storage is presented in Section 4.12.1

4.4.2.9 Production Schedule Summary

The preliminary pit sequencing strategy linking estimated volumes of coal and waste volumes by phase and by bench is presented in Appendix 4B. This is a preliminary sequence which will be refined during the Final Feasibility phase of the planning process.

The preliminary production plan for extracting 3 mtpa of ROM coal is shown in Table 4.4-7. A chart of the coal production schedules for hard coking coal and non-coking coal and the inventory of uncovered coal at the end of a period are provided in Figure 4.4-16.

Estimates of the volumes of waste production by type for each year of mine operation are presented in Table 4.4-8 and Figure 4.4-17.

Table 4.4-7 Coal Production Schedule

		Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Coal Uncovered	[t x 1000]	30,591	2,535	3,078	3,136	3,760	3,004	1,970	3,118	3,645	2,500	3,845	-
Coal Mined	[t x 1000]	30,591	1,800	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	1,791
Coal available end of period	[t x 1000]		735	813	949	1,709	1,713	683	801	1,446	946	1,791	-
Coal Source by Phase			**Phase I**		**Phase II**			**Phase III**					
ROM Coal Mined by Seam													
D2 seam	[t x 1000]	1,946	138	158	287	238	259	463	221	108	63	10	1
E1 seam	[t x 1000]	1,996	135	152	299	221	152	291	342	182	148	62	11
F seam	[t x 1000]	2,553	130	139	301	300	227	347	454	291	207	124	35
G seam	[t x 1000]	8,089	474	784	706	812	805	600	570	785	1,036	978	539
J seam	[t x 1000]	13,613	681	1,600	1,077	1,217	1,464	1,005	854	1,356	1,386	1,776	1,197
Gething N	[t x 1000]	1,026	160	110	156	120	67	189	121	44	48	9	1
Gething S	[t x 1000]	1,368	82	58	175	92	25	105	438	235	111	41	7
Total Coal Mined	**[t x 1000]**	**30,591**	**1,800**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**1,791**

Table 4.4-8 Waste Removal Schedule

		Total	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Total Waste Mined	m^3 x 1000	237,167	23,156	28,500	28,500	28,500	28,500	28,500	25,650	22,800	11,600	11,461	-
Overburden	m^3 x 1000	9,836	1,837	3,753	813	911	1,362	588	316	229	27	-	-
Waste PAG	m^3 x 1000	21,825	1,062	2,570	1,871	5,595	6,355	2,218	1,512	587	54	-	-
Waste PAG/Total	%	9%	5%	9%	7%	20%	22%	8%	6%	3%	0%	0%	0%
Waste NAG	m^3 x 1000	204,739	20,167	22,147	25,651	21,970	20,760	25,538	23,642	21,923	11,482	11,458	-
Waste NAG/Total	%	91%	95%	91%	93%	80%	78%	92%	94%	97%	100%	100%	100%
Interburden	m^3 x 1000	767	90	30	165	23	23	156	179	60	37	3	-
Stripping Ratio	m^3 / t	7.8	9.1	9.3	9.1	7.6	9.5	14.5	8.2	6.3	4.6	3.0	-
Waste Source by Phase			**Phase I**	**Phase II**			**Phase III**						
Type 1– Width >40 m		133,321	11,022	14,304	18,741	19,984	15,132	12,517	12,036	15,180	7,777	6,628	-
Type 2– Width <40 m		103,846	12,134	14,196	9,759	8,516	13,368	15,983	13,614	7,620	3,823	4,833	-

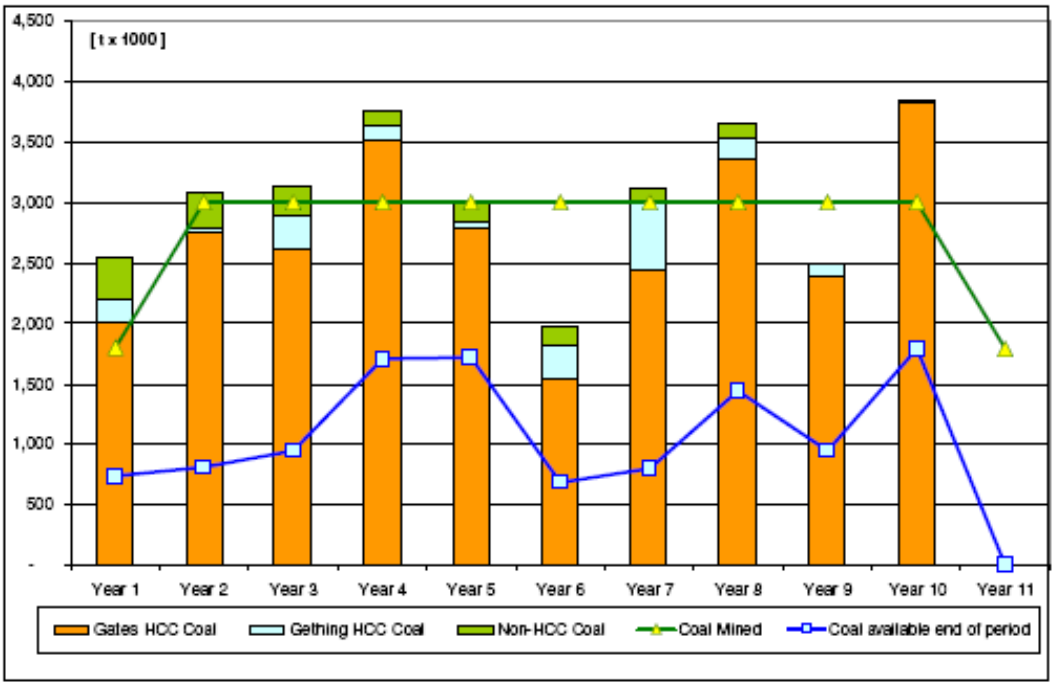

Figure 4.4-16 Coal Production Schedule

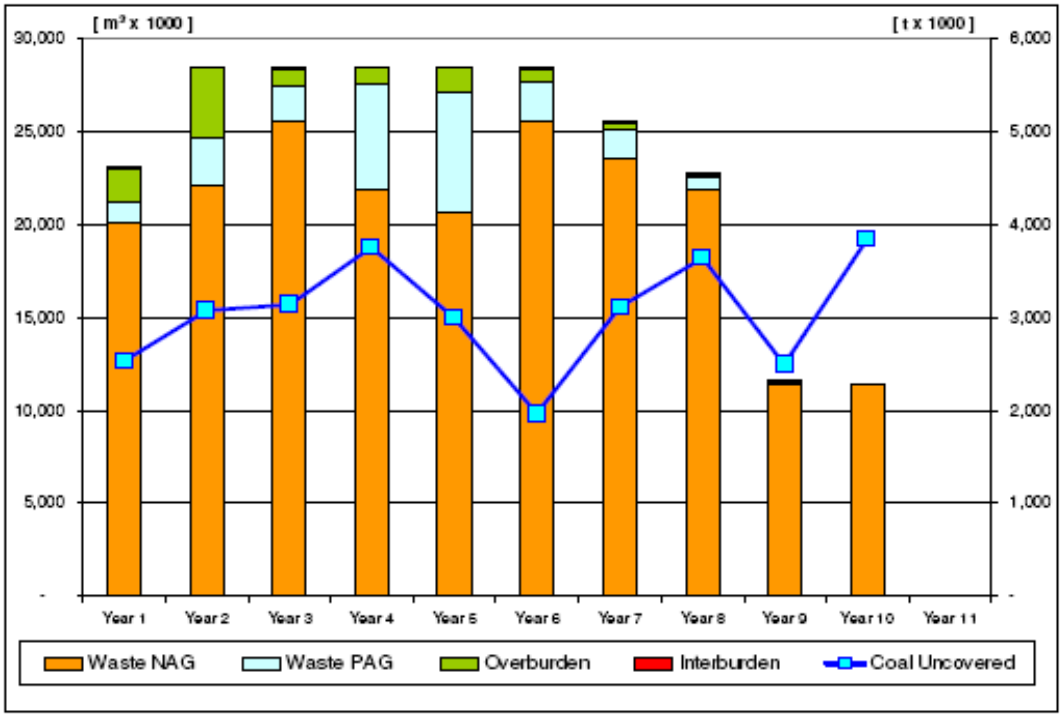

Figure 4.4-17 Waste Removal Schedule

Highlights of the mine schedule are as follows:

- At an annual coal production rate of 3 mtpa of ROM coal, life-of-mine will be 10 years
- Total volume of waste removed during preproduction will be about 9 MBCM
- Phase 1 will be mined-out in the fourth quarter of Year 2 to allow its void to be used for the disposal of the CPP tailings
- Phase 2 will commence in the fourth quarter of Year 2
- The upper portion of Phase 3 will start development in the fourth quarter of Year 4 and be mined concurrently with Phase 2 until the first quarter of Year 6 when Phase 2 will be mined-out
- The highest rate of vertical advance will be in Year 2 of Phase 1 when there will be 12 benches mined
- After Year 2 annual coal production will remain steady at 3 mtpa ROM coal
- Prior to Year 7 annual waste stripping rates will average about 28.5 MBCM
- In Years 7 and 8 annual waste stripping rates will average about 24 MBCM
- After Year 9, annual waste stripping rates will average about 11 MBCM
- The average volume of uncovered coal at the end of each quarter will be about 1.2 Mt
- Maximum inventory of uncovered coal will occur towards the end of Phase 2 when in Year 5 inventory will peak at about 1.5 Mt

Estimates of the annual volumes of uncovered coal by seam and the percent ash content of hard coking coal (HCC) and non-coking coal are presented in Figure 4.4-18.

4.4.3 Site Water Management

The site water management plan for the Project will comprise a network of open channel ditches and sediment ponds strategically located to collect surface runoff and seepage, minimize erosion and remove excessive suspended sediment from flows prior to release to the environment. A detailed description of the water management plan is provided in Section 4.11: Site Water Management Plan.

Open ditches and collector channels will be designed to convey peak flows from a 200-year return period event. Sediment ponds will be designed according to provincial guidelines to remove suspended sediment to acceptable levels during a 10-year, 24-hour flow event. All dam structures constructed for sediment ponds and for diversion or runoff collection purposes will have emergency spillways designed to protect the structures against overtopping during a 200-year return period event.

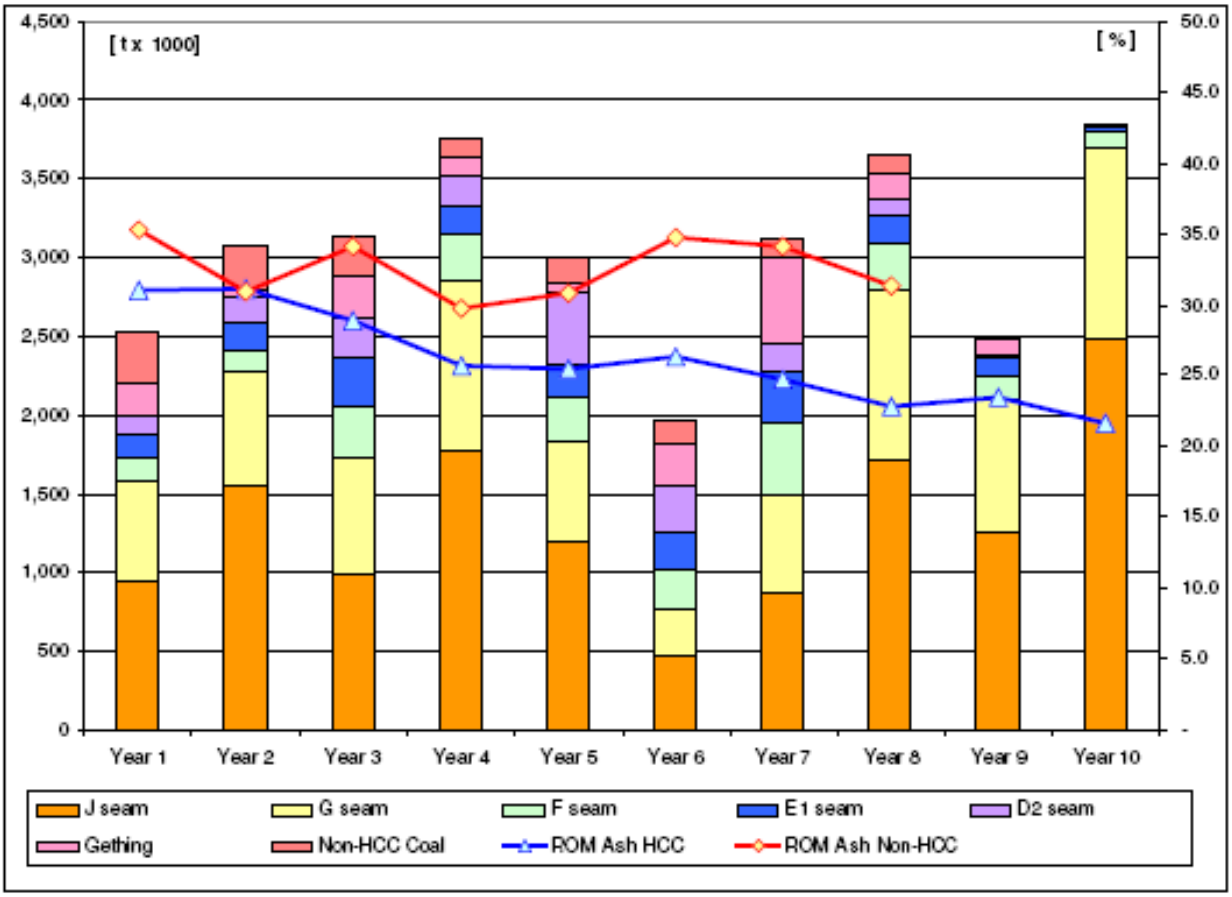

Figure 4.4-18 Coal Uncovered by Seam and ROM Ash Content

Initially, surface runoff water from mining activity areas will collect in two sediment ponds (RP1 and RP2) by means of a series of ditches as shown on Figure 4.4-19. RP1 will collect runoff from the Phase 1 Gates open pit area and south dump, and will discharge into Babcock Creek by way of an armoured overflow spillway. RP2 will be located near Trend Coal Mine's sediment pond (SP2) and will collect runoff and seepage from the developing north dump area located between the Gates pit and Trend Coal Mine's plant site. RP2 will be active throughout the mine-operating period and will discharge to Babcock Creek upstream of the water quality sampling point B2. Runoff from the east dump will be directed towards Trend Coal Mine's sediment pond (SP4) before release to Gordon Creek.

Figure 4.4-19 Start of Mine Water Management

Once Phase 1 of the Gates pit is complete, the void created will be used for a tailings storage facility. This will allow subaqueous deposition of tailings and potential PAG waste material. Pond RP1 will be abandoned for preferential use of the in-pit tailings facility (RP3). At this time, perimeter collector channels will be extended to also direct all runoff and seepage from the southern dump area into the lower portion of the Gates pit. Pit development towards Roman Mountain in the east will continue thereafter with all drainage from the operating pit area also directed into the lower western portion of the pit. The western portion of the pit will serve as a combined tailings pond and sediment pond for the pit catchment area and the southern waste dump area (see Figure 4.4-5) with a total available storage volume of about 8 Mm^3.

Discharge and subaqueous deposition of approximately 1.3 Mt of tailings over an eight-year period will be carried out in the eastern half of the RP3 to maximize settling potential. Water will be reclaimed from the western end of the pit to the processing plant at a rate of up to 95 percent of the inflowing tailings transport slurry water. Potential PAG waste solids will be dumped by truck into the pond so that the solids will become submerged underwater as quickly as possible (discussed further in Section 4.11).

4.4.4 Mining Fleet

4.4.4.1 Introduction

A variety of mining fleet equipment options were evaluated during the pre-feasibility study:

- loaders:
  - electric rope shovel—44 m^3 bucket
  - electric rope shovel—35 m^3 bucket
  - hydraulic shovel—42 m^3 bucket
  - hydraulic shovel—22 m^3 bucket–currently used at Trend Coal Mine
- waste haul trucks: 220 and 184 t capacity
- exclusive coal fleet:
  - backhoe excavators for cleaning-ripping coal
  - hydraulic excavator—14 m^3 bucket
  - hydraulic excavator—5 m^3 bucket
  - front-end loader—30 m^3 coal bucket
  - off-highway truck—184 t with coal box
- drilling, support and ancillary equipment

The decision criteria used to evaluate mining fleet options included:

- total cost of ownership
- environmental concerns
- safety

- proven technology
- portability, expandability, flexibility and compatibility with the existing Trend Coal Mine

The mining fleet equipment options selected are shown in Table 4.4-9 and summarized in the following sections.

Table 4.4-9 Summary of Primary Mining Equipment for Roman Coal Mine (Pre-production Mining and Production Mining)

Machine Type	Example Model	Machines Required
Drilling Equipment		
Rotary Drill–311 mm	Bucyrus Erie 49HR	1
Rotary Drill–250 mm	Pit Viper PV 271	1
Hydraulic Percussion Drill–200 mm	Atlas Copco ROC L-8	2
Waste Loading Equipment		
Electric Rope Shovel–35 m^3	P&H 2800	1
Hydraulic Excavator–22 m^3	Komatsu PC 4000	1
Hydraulic Excavator–15 m^3	Komatsu PC 3000	-
Front End Loader–20 m^3	CAT 994F	1
Waste Hauling Equipment		
Off Highway Truck–220 t	Komatsu 830E AC	5
Off Highway Truck–180 t	Komatsu 730E AC	7
Coal Fleet		
Track Dozer–400 kW	CAT D-10	1
Rubber Tire Dozer–372 kW	CAT 834H	1
Hydraulic Excavator–5 m^3	CAT 385C L	2
Front End Loader–30 m^3–Coal Bucket	CAT 994 F	1
Off Highway Truck–180 t–Coal Box	Komatsu 730 E	2
Support Equipment		
Track Dozer–400 kW	CAT D-10	3
Motor Grader–24'	CAT 24M	1
Motor Grader–16'	CAT 16M	1
Water Truck–100 m^3	Komatsu HD1500WT	1
Rubber Tire Dozer–372 kW	CAT 834H	1
Hydraulic Excavator–5 m^3 with hammer	CAT 385CL with Hammer	1

4.4.4.2 Drilling

A combination of rotary and percussion drills will be used including 311 and 250 mm rotary drills and a 200 mm hydraulic percussion drill depending on the material type to be stripped.

4.4.4.3 Loading

Primary loading will be done using an electric rope shovel with a 35 m^3 bucket. A hydraulic shovel with a 22 m^3 bucket and a front-end loader high lift with a 20 m^3 bucket will be used for overburden and interburden loading, re-handling and shovel support. Bucket size will be adjusted according to the fill factor (to provide for a whole number of passes to load each truck).

Fleet size and composition will be based on estimates of shovel and loader operating hours and production capacities for various machine types, loader and material combinations.

4.4.4.4 Waste Haulage

Haul trucks with 220 t payload capacity will be used for primary waste movement. Haul trucks with a 180 t payload capacity will be applied to secondary waste, overburden, coal, parting, snow handling and other supporting jobs.

Fleet size was based, in part, on estimates for haul truck round-trip cycle time. Haul route profiles from each bench to the waste dumps were defined and then subdivided into segments based on grade. Average speeds on different grades were then estimated assuming limits on maximum speed of 45 km/h on the flat and 40 km/h when descending a ramp.

Truck travel cycle times were based on the haul route profile and estimates of average speed. Haul truck round-trip cycle times were then estimated by adding the travel cycle time to fixed cycle times for loading, dumping and manoeuvring.

4.4.4.5 Coal Mining Fleet

Tasks done by the coal mining fleet include:

- coal cleaning
- coal ripping and extraction
- stockpile construction
- loading of coal
- hauling coal from the pit to the plant
- hauling coarse coal rejects from the coal processing plant to the appropriate waste dump or tailings facility

Coal haul trucks will be equipped with coal-boxes designed to carry a minimum load of 85 percent of its rated tonnage.

Coal Cleaning

Wheel dozers and track dozers will clean the top of benches of coal. Track dozers will clean the seam hanging wall when seams dip at an angle of 25° or less; backhoes will clean the hanging wall where seams dip at angle greater than 25°.

Coal Ripping and Extraction

Track dozers will rip the coal when it dips at an angle less than 25°. Where the seams dip steeper than an angle of 25°, hydraulic backhoes will usually be used to rip and extract the coal from the top of the bench.

Stockpile and Loading of Coal

A front-end loader equipped with a high-lift boom and a coal bucket will build stockpiles of coal and load it into haul trucks.

Coal and Coarse Rejects Hauling

Coal fleet equipment schedules were, in part, based on estimates of coal haul truck round-trip cycle times. Haul route profiles were defined from each bench to the coal breaker at the coal processing plant. Haul distances were estimated and routes subdivided into segments based on grade. Estimates of coal haul truck travel times, round-trip cycle times and truck capacities, along with estimates of the annual volumes of coal to be transported to the coal processing plant, were then used to generate the schedule of coal fleet requirements.

4.4.4.6 Support and Auxiliary Equipment

Tasks to be done by the support equipment include:

- dump clean-up and maintenance
- ramp construction
- bench and road maintenance
- ditch preparation and maintenance
- shovel support and cleanup
- reclamation support
- general maintenance

The 400-kW track dozers will be used for drop-cut development, highwall cleaning, road maintenance and as support for shovel floor maintenance and cleanup. They can also be used for reclamation work and other tasks, as needed. The motor graders will be used for road maintenance, pit and dump floor work, pioneering, road construction and other tasks, as needed. The 100 m^3 capacity water truck will be used for dust control on the pit ramps, pit floor haul roads and dumps. The 372-kW wheel dozer will be used to support waste-dump maintenance, drill pattern cleanup and assisting with coal stockpile maintenance.

Other auxiliary equipment (e.g., fuel trucks, pumps and forklifts) are scheduled as necessary to support the mining operation.

4.5 Project Facilities

4.5.1 Introduction

This section provides brief descriptions of concepts for Project infrastructure, mine site components and other Project-related facilities. Generally, existing facilities supporting the Trend Coal Mine will be expanded to meet the operational requirements of the increased coal production and prolonged life of both mines.

4.5.2 Access Roads Traffic

4.5.2.1 Primary Access

Access to the Project for personnel, supplies and support for mine construction and operations will be via the same access roads currently used to access the Trend Coal Mine. Primary access to the Trend Coal Mine and the Project is via the Heritage Highway from Tumbler Ridge; then the Canadian Natural Resources Limited (CNRL) Road (PDR-46) to a non-status road locally known as the Talisman Road (see Figure 4.5-1). As part of the Trend Coal Mine, the shoulder on either side of PDR-46 was upgraded and 2.6 km of the Talisman Road was upgraded to the same design standard as PDR-46.

PRC has previously undertaken several improvements to the PDR-46 including the construction of a short by-pass (known as the Narrows By-pass) to isolate haul traffic from light vehicle traffic. Further planned improvements undertaken in support of Trend Coal Mine include the realignment of a sharp corner at 6 km and the replacement of several culverts.

With the increased coal production from the Project and the Trend Coal Mine, there will be increased year-round traffic along the current access road (PDR-46) and a section of the Heritage Highway (Section 4.5.2.3).

The maintenance of PDR-46 is the responsibility of a number of industrial users. PRC currently undertakes general road maintenance of PDR-46 including snow removal and grading.

4.5.2.2 Coal Haul Route

In order to reduce the interaction of coal haul trucks with public vehicles, the Project will use the existing dedicated Trend Coal Mine By-pass Road that has previously been constructed by PRC in support of the Trend Coal Mine. Clean coal will be transported from the coal processing plant to the rail load-out facility via PDR-46 to the Trend Coal Mine By-pass Road.

The Trend Coal Mine By-pass Road is an 11 km dedicated coal haul road that takes haul traffic from km 5.5 of PDR-46 to the existing Trend rail load-out facility.

4.5.2.3 Traffic

Project-related traffic will constitute the majority of the traffic on the PDR-46. Traffic levels in support of the Project are expected to increase above current levels. It is anticipated that crews will be transported to site by bus during the construction period (fall of 2011 through winter 2012). Other traffic will include site supervisors, deliveries of materials and consultants. Peak construction traffic is expected to occur at shift change

and comprise 17 trips (2 buses, 4 contractor supervisors, 10 subcontractors or consultants and 2 PRC supervisors). This traffic will be additional to the 145 trips which support current operations at the Trend Coal Mine (crew buses, light vehicles, supply trucks, and coal haul trucks. In addition, there may be periods of increased traffic for specific tasks.

PDR-46 is a radio-controlled road and will continue to be during the lifetime of the Project. All users of the road are expected to follow the Traffic Management Plan which will be written as part of the Mine Permit Application. Access and use procedures will be part of orientation for all PRC employees and contractors.

The Trend Coal Mine By-pass Road is currently a restricted access road. If other industrial users require access, PRC will review these requests on a case-by-case basis. No public traffic will be allowed.

Figure 4.5-1 Roman Coal Mine Access

During operations, there will be approximately 10 highway-legal trucks transporting clean coal from the Project and the Trend Coal Mine to the rail load-out via the Trend Coal Mine By-pass Road and PDR-46. This operation will run 24-hours a day, seven days a week. At maximum production, when Trend and Roman are producing concurrently, there will be an average of 164 round trips daily to meet coal production requirements for both operations; this is compared to 120 daily trips undertaken currently for the Trend Coal Mine operations alone.

Additional traffic will include the buses transporting mine employees, site supervisors in personal vehicles and deliveries of consumables. Peak traffic is expected at shift change. Details of the number of daily trips expected during full operation will be presented as part of the Traffic Management Plan being developed for the Mine Permit Application.

4.5.3 Mine Site Roads

4.5.3.1 Haul Road Design Criteria

A haul road (or haulage road) as defined under the *Mines Act* is "a part of the mine which is used to transport coal or waste rock". The by-pass road is not part of the mine and is, therefore, not considered a haul road under the *Mines Act*. Haul road design criteria and assumptions are as follows:

- width allowance on two-way haul road without separation of light vehicle traffic—40 m
- width allowance on two-way road with separation of light vehicle traffic—49.5 m
- width allowance for a two-way light vehicle access road—8 m
- width allowance on final one-way roads—24 m
- width running surface—24 m
- minimum road inside radius on corners—20 m
- width allowance for berms and ditches—8 m
- maximum grade—8 percent

Outside the pit areas, mine trucks hauling coal and waste rock will be confined to haul roads, while other light vehicle traffic will either use side roads or be separated from the haul road by a safety berm. Minimum roads widths for two-way traffic with and without separation of light-vehicle traffic are as shown in Figure 4.5-2 and Figure 4.5-3. Haul roads will be constructed using fill material and capped with durable NAG waste rock.

The haul road from the coal processing plant to the western edge of the Phase 1 Gates pit (a distance of about 2.6 km), will allow for separation of haul and light vehicle traffic. From the western edge of the Phase 1 Gates pit to the top of Roman Mountain (a distance of about 2.6 km), the haul traffic and light vehicle traffic will share the use of the haul road without separation by a safety barrier.

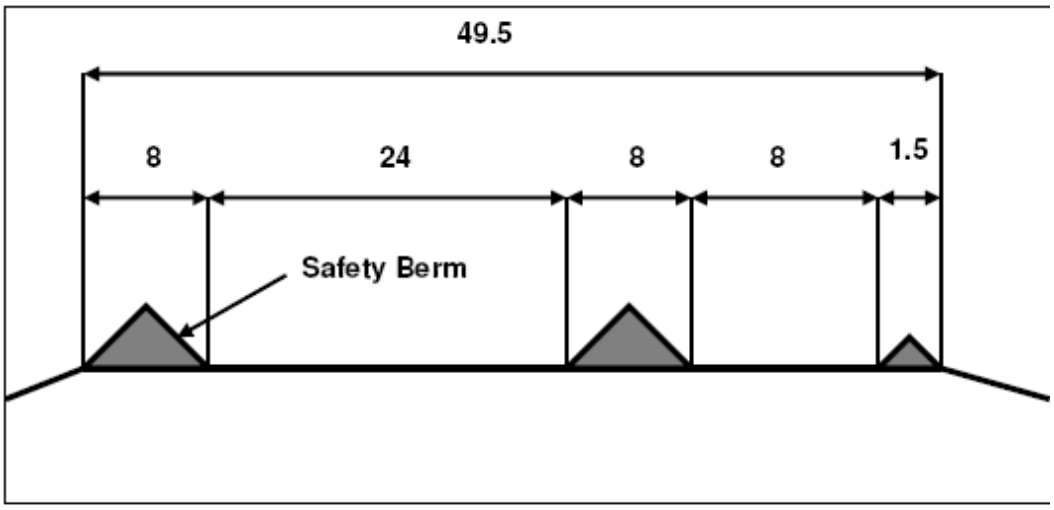

Figure 4.5-2 Cross-section of Divided Haul Road

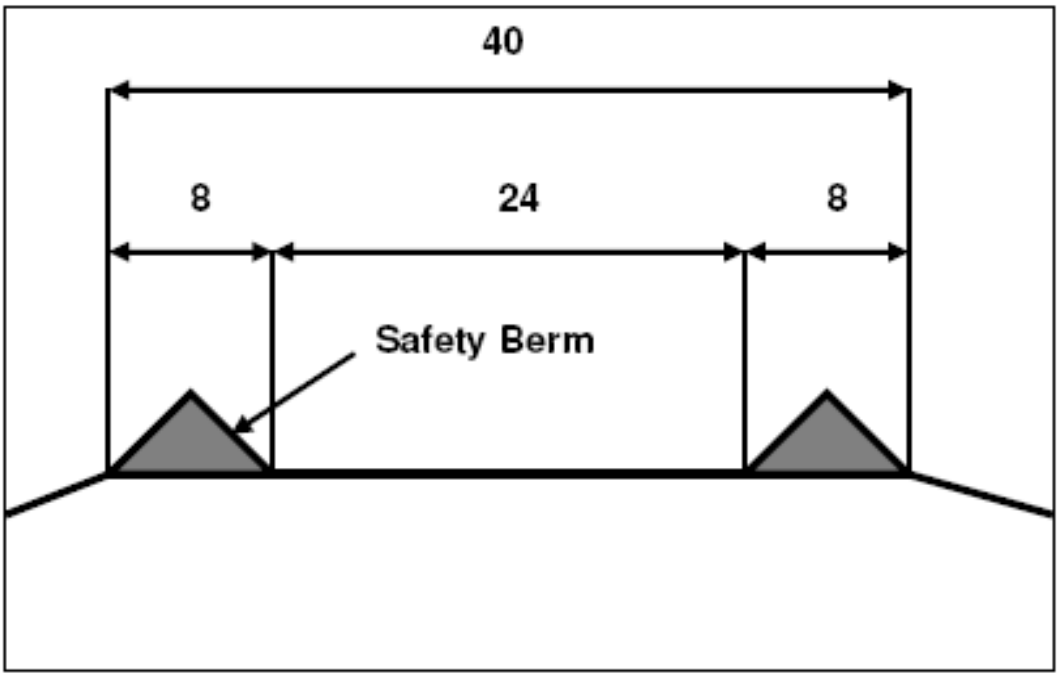

Figure 4.5-3 Cross-section of Shared Traffic Haul Road

4.5.4 Coal Handling and Processing

4.5.4.1 Introduction

This section outlines coal handling and processing for the Project (see Figure 4.5-4).

Figure 4.5-4 Coal Processing Plant Material Flow Sheet

4.5.4.2 Transport to Coal Processing Plant

The following concepts for transporting coal and waste rock by haul truck or by conveyors from the pit were evaluated:

- transport of waste rock from the pit to the waste dumps
- transport of ROM coal from the edge of pit to the coal processing plant (CPP)
- transport of ROM coal from the coal face to the edge of the pit

The criteria used to evaluate conveyor transport options were:

- safety
- environmental effects
- portability, expandability, flexibility and compatibility with the Trend Coal Mine
- proven technology
- total cost of ownership

Transport of ROM Coal from the Edge of Pit to the CPP

The evaluation of the options of transporting coal from the edge of the pit to the CPP by haul truck or by conveyors concluded that transport by haul truck would be the preferred option. Trucks were selected as they are proven technology, easy to operate and maintain. Additionally this option is easily portable, expandable and compatible with the existing system currently used at the Trend Coal Mine.

Transport of ROM Coal from the Coal Face to the Edge of the Pit

The transport of ROM coal from the coal face to the edge of the pit, where the coal would be transferred to the conveying system reporting to the CPP, was also considered. The in-pit conveyor, which would be about 1000 m long, would have to be relocated every three years as the pit developed. This option was rejected due to the lack of portability and flexibility. Additionally, financial analysis proved it to be suboptimal.

Transport of Waste Rock from the Pit to the Waste Dumps

Waste rock will be transported from the pit to the waste dumps by truck. This approach was selected to allow maximum flexibility to effectively achieve the mixing requirements in the current PAG Management Plan (i.e., dumps to be built-up in alternating lifts of PAG covered by NAG). In addition trucks can manage larger rock, avoiding the requirement to further crush PAG rock (increasing surface area) that would be required with a conveyor system.

4.5.4.3 Coal Handling and Processing

Table 4.5-1, lists the processing options considered during the pre-feasibility studies for the Project and the recommendations.

Table 4.5-1 Processing Options Considered

Trade-off Study	Recommendation
Raw coal processing–rotary breaker versus sizer	Rotary breaker
Raw coal storage–silo versus stockpiles (various types)	Silo
Upgrade old plant versus construct new plant	New plant
Plant process (various configurations)	Heavy medium cyclone to 0.5 mm, spirals and flotation
Clean coal storage–silo versus stockpiles (various types)	Silo
Clean coal transportation–trucking, conveyor, pipeline or rail line	Trucking
Train load-out–stockpile (various) feeding over rail bin versus over rail silos	Over rail silos
Product moisture management–thermal, briquette, microwave, low temperature roaster	Thermal dryer

Raw Coal Sizing and Pre-Processing

ROM coal will be screened and sized using an inclined circular motion screen and rotary breaker. The rotary breaker provides sizing as well as pre-cleaning function.

Pre-feasibility studies examined rotary breaker versus low speed primary and secondary sizers. Rotary breaker sizing was selected for the following reasons:

- Given the high Hardgrove Grindability Index (HGI) in both formations, a rotary breaker provides a method to size raw coal and to liberate rock while rejecting large rock in a pre-cleaning phase.
- Recently constructed plants in British Columbia apply screens and rotary breakers.
- The coal processing plant will not process more than 5 mtpa. Therefore a single rotary breaker has capacity to deliver 50 mm x 0 product to raw coal storage. Sizers typically provide a reduction ratio of 4:1. Therefore, at least two sizing stages would be required.
- A rotary breaker requires lower maintenance given the recovery (depending on dilution) and the high HGI. Both options are relatively high maintenance. If the ROM screen is well maintained, the breaker should not be subject to differential loading or plugging with coal fines and clay.
- A sizer was installed on the ROM system at the nearby Willow Creek Preparation Plant (Pine Valley Coal) with poor success. High compressive strength of the surrounding rock caused excessive wear and ultimately failure.

Raw Coal Storage

Silo storage will be used for raw coal between the rotary breaker and the preparation plant.

Although capital intensive, silo storage provides the following advantages over alternatives:

- minimizing coal loss

- preventing moisture addition from rain or snow
- minimizing negative environmental effects such as runoff water and dust
- freezing prevention
- minimization of oxidation and size degradation
- 100 percent live storage eliminates the need for additional mobile equipment between the ROM dump station and the coal processing plant
- Silos are also generally safer than stockpiles. Although there may be silo safety issues concerning working at heights, there is little maintenance work required for a silo and after construction is complete, working at heights is uncommon. For reclaim tunnels, working in a confined space is a safety concern and tunnels must be checked regularly during operation. Furthermore, for an open stockpile, mobile equipment is required, meaning more person-hours and a more safety risks.
- There are environmental issues that must be addressed when stockpiling coal rather than using a silo. Dust control is a large factor in stockpiling coal. Controlling dust requires additional daily operating costs and adds moisture. Excessive moisture aggravates freezing and resultant loading and handling. Due to the extreme cold conditions during winter months at the Project, freezing presents a substantial challenge.

Storage time of 12 to 18 hours will be the target capacity for the coal processing plant as this time period is sufficiently short to prevent freezing and facilitate campaign washing of coal from specific formations.

The following other raw coal loading options were considered:

- radial stacker or stacking tube
- reclaim tunnel
- Stamler feeder

Coal Processing Plant

The selected coal processing configuration uses a heavy media cyclone to separate coarse coal from coarse refuse for sizes of 50 to 0.50 mm. This sizing range maximizes yield as a greater proportion of the feed reports to the more efficient heavy media cyclones than the water only cyclones treating the finer fractions. One disadvantage of using a 0.5 mm size separation is the slightly higher capital cost involved in constructing the plant and increased magnetite consumption.

As discussed, heavy media cyclone circuits are most economical down to a size of 0.50 mm. Intermediate-sized material between 0.50 to 0.15 mm is to be treated in water only cyclones used in conjunction with spiral concentrators. One benefit of water only cyclones used in conjunction with spirals concentrators compared to classifying cyclones is that a lower specific gravity of separation can be achieved. Another benefit is that coal is separated slightly more efficiently, increasing the yield for the same quality product. Recycling the spiral clean coal (back to feed the water only cyclones) substantially increases the efficiency of the water only cyclones.

All ultra fine coal (to zero) will be processed by a conventional or column froth flotation. Since secondary drying is planned, recovering coal to 0 mm is feasible.

Screen bowl centrifuges are used to dry clean coal from intermediate and fine circuits. Approximately one third of minus 0.044 mm material sent to a screen bowl centrifuge will not be recovered in the screen bowl product. Therefore, to maximize recovery screen bowl effluent streams will be sent to a clean coal thickener. There, clean coal will settle and must be dewatered. A belt press has been selected for dewatering because it recovers nearly 100 percent of clean coal.

Drying Options

To achieve the required eight percent product moisture, the following options were considered:

- retain all product and sell a 12 percent or higher moisture product
- high moisture fine coal is discarded until the product is eight percent (mechanical dewatering)
- fluidized bed thermal drying using plant product as fuel
- fluidized bed thermal drying using plant middlings product as fuel
- microwave drying
- briquetting using plant middlings product as fuel to cure the briquettes
- low temperature thermal drying using plant middlings product as fuel

The first drying option was rejected because the product moisture would be at least 12 percent, which is high and may not be saleable or shippable during winter months. The second drying option was rejected because a large amount of fine product (about 20 percent of the total product) must be discarded to meet moisture specifications making it economically undesirable. The third drying option was rejected because the fourth drying option is more economical; however, this may be reviewed at a later date, depending on expert advice from Thermal Dryer suppliers.

The remaining four options involve secondary drying of plant product. Fluidized bed thermal drying receives the entire plant product and dries it to eight percent total moisture. Briquetting receives a fraction of the 0.15 mm by 0 fine coal (about 20 percent of the plant product) and dries it from high moisture to about eight percent total moisture, then recombines the briquettes with the coarse coal for a combined eight percent total moisture product. Before the briquettes can be recombined with the coarse coal, they must be cured for a substantial amount of time in large storage structures to allow the moisture to shed.

Similarly, microwaving and low temperature thermal drying takes a fraction of the 0.15 mm by 0 fine coal (about 24 percent of the plant product) and dries it from high moisture to about 10 percent total moisture, then recombines the dried product with the coarse coal for a combined eight percent total moisture product. Evaporative loads and feed rates for the drying options are summarized in Table 4.5-2.

Table 4.5-2 Drying Options for Coal Processing Plant

Dryer Type	Thermal	Microwaving and Low-temp Thermal	Briquetting
Coal Fed to Dryer (TPH Coal)	264 (50 mm x 0)	64 (0.15 mm x 0)	52 (0.15 mm x 0)
Water Fed to Dryer (TPH H_2O)	38.6	22.7	20.1
Dryer Product Moisture	8.0%	10.0%	8.0%
Dryer Product Water (TPH H_2O)	23.0	7.1	4.5
Evaporative Load (TPH H_2O)	15.6	15.6	15.6

For the Project, a fluidized bed thermal dryer fuelled by middlings has been selected as the preferred option for secondary drying.

Clean Coal Conveyors and Storage at the Preparation Plant

Washed coal will be conveyed from the thermal dryer to silo storage. Adjacent to silo storage is emergency ground storage used under the following conditions:

- coal silos are full or cannot be emptied (in severe winter weather for example)
- online analyzer identifies that clean coal is outside of specification tolerance and requires segregation and blending

Silo storage is suggested for clean coal for the following reasons:

- 100 percent live storage eliminates additional handling between preparation plant and load-out
- live storage reduces environmental concerns
- live storage allows accurate loading of trucks including weighing and ticketing and provides buffer time between the plant and load-out in case truck traffic is restricted

The following other handling options were considered, but not recommended:

- radial stacker ground storage
- stacking tube

Refuse Handling

A refuse collecting conveyor and bin was selected. A fixed stacker discharging from the refuse bin in case the bin is full and no trucks are available can be added, as required.

Fine refuse from the refuse thickener underflow has the option to be pumped to an impoundment or sent to a belt press and trucked. As the tailings facility for the Project will make use of the mining void created by the Phase 1 Gates pit, the fine refuse from the refuse thickener underflow will be dewatered using a belt press and then trucked to the waste rock dumps to be treated as PAG. Following the conclusion of mining in the Phase 1 Gates pit (Year 2 of operations), all fine refuse will be pumped to the tailings facility.

Clean Coal Handling to Load-out

A preliminary evaluation of transport alternatives from the plant to the rail load-out facility was done during pre-feasibility studies. Trucking versus overland conveying options were considered. Based on the current design capacity of the system and reserve life, there is insufficient volume of clean coal to justify an overland conveyor system.

Highway-legal trucks, similar to those used at the Trend Coal Mine, will be used for the Project. At the rail load-out, trucks will dispense directly to a truck dump hopper. Clean coal storage is described in Section 4.5.13: Rail Load-out.

4.5.5 Offices and Administration

The administration office will accommodate approximately 45 management and support staff and occupy an area of about 1300 m^2. In addition to offices, the building will include a lunch room, a library, conference rooms, computer rooms, storage rooms, washrooms and a reception area. The Project will expand existing office and administration buildings currently used in support of the Trend Coal Mine.

4.5.6 Small Vehicle, Fire Hall and First Aid Building

The small vehicle building, which will occupy an area of about 500 m^2, will garage the ambulance, emergency vehicle and fire truck. It will also include space for a paramedic's office, first aid room, training room and emergency equipment storage locker. The Project will use or expand the existing site access building currently used in support of the Trend Coal Mine.

4.5.7 Truck Shop, Warehouse and Dry Complex

The truck shop complex will be a self-contained service building occupying an area of about 5400 m^2 and will expand on existing Trend infrastructure. The workshop will be designed to service and maintain the mining equipment fleet, coal processing plant and other equipment.

Truck shop, warehouse, and dry complex facilities and services will include:

- six drive-through heavy vehicle service bays
- four light-vehicle service bays
- welding service bay
- wash bay
- tire bay
- warehouse
- lubricant storage (outside)
- machine shop
- welding shop
- electrical and instrumentation shop
- warm storage

- tool crib
- elevated mechanical floor for HVAC equipment
- offices, lunchroom, first aid, washrooms and other personnel support spaces including a dry room
- compressor room
- electrical and battery rooms
- battery charging room
- boiler room
- cold storage building

Four overhead travelling cranes, each with a safe working load capacity of 75 t, will service heavy vehicle maintenance bays. The welding shop, machine shop and light vehicle service areas will each be serviced by overhead travelling cranes with a safe working load capacity of 10 t.

A warehouse located in the ground floor of the truck shop will expand the warehouse area by about 400 m^2 and fitted-out with pallet racking, bins and carousels and expand on existing Trend infrastructure. Forklifts and pallet jacks will be provided for handling materials.

The dry-room building will be a two-storey structure abutting the truck shop occupying an area of about 1000 m^2 and expand on existing Trend infrastructure The dry-room will accommodate about an additional 300 mine personnel expand on the existing Trend infrastructure. It will be equipped with separate change rooms for male and female employees, a dispatch room and a service room. The second floor will be used for staff offices, a lunchroom, washrooms, training rooms, conference rooms and related personnel support spaces and a small parts storage area.

Storage for plant and equipment requiring cover but not heat will be provided in a 600 m^2 cold-storage building.

4.5.8 Fuel Storage and Distribution Facility

Diesel for the mine haul trucks and support equipment will be stored in a 2.2 ML capacity fuel storage and dispensing facility located adjacent to the existing Trend Coal Mine fuelling station increasing existing capacity.

Above ground tanks will be used and will be enclosed within a bermed and lined area to contain any spillage. All construction and storage will conform to PRC's Chemical Management Plan and Fuel Handling Plan (see Section 5.12) and applicable regulations.

4.5.9 Power Supply and Distribution

BC Hydro, the provincial authority responsible for supplying electrical power in the Peace River region, reported that at estimated full production the current power feed has sufficient capacity to satisfy projected demand for the Project.

Estimated electrical loads for the Project are presented in Table 4.5-3. These are preliminary estimates as plans for the Project are refined.

Table 4.5-3 Estimate of Electrical Loads

Estimated Connected Load	Estimated Connected Load		Load Factor	Electrical Load
	(HP)	(kW)		(kW)
Process plant	9,907	7,776	0.68	5,288
Truck shop	-	350	0.68	238
Small vehicle shop	-	112	0.68	76
Dry room	-	112	0.68	76
Administration building	-	250	0.68	170
Cold storage building	-	30	1.00	30
Sewage treatment plant	-	112	0.50	56
Water treatment plant	-	112	-	-
Fuel dispensing	-	112	0.10	11
Reclaim barge	-	250	0.75	188
Open pit mine equipment	-	-	-	1,927
Total−Project				8,060
Trend Coal Mine				3,000
Total Electrical Load (combined)				**11,060**

Electrical distribution will consist of switchgear, transformers, starters and feeder breakers for the motor and non-motor loads in common line-ups. The main transformers will be outdoor liquid-filled type. Lighting and small power applications will be fed from transformers and power panels located in the electrical rooms.

The main power distribution switchgear will be installed in a new substation located adjacent to the existing substation that supplies power to the Trend Coal Mine operation.

Site power distribution will be fed from the new substation to the various load centres on new pole lines routed alongside roadways with sufficient clearance for safe haul truck operation. This will require extra high poles for haul road crossings or buried cable in trenches.

Load centres will be fed from taps from the pole line using pole mounted fused disconnect switches, transformers either pole mounted for rating up to 150 kVA and pad mounted for larger units. Teck-type armoured cables will feed the transformer primaries and teck cables will be routed from the transformer secondaries to the distribution equipment at the various area load centres.

4.5.10 Water Supply and Fire Protection Systems

Potable water will be supplied by a modular potable water treatment system with sufficient capacity to serve a staff and labour complement of about 450 persons and will augment existing Trend facilities.

Process water will initially be supplied by groundwater wells similar to those used at the Trend Coal Mine coal processing plant. Following the commissioning of the TMF, a large proportion of the water needed will be recovered from the tailings pond by a barge-

mounted recovery pump and pumped back to the coal processing plant through a 3.5-km long return pipeline.

All ancillary buildings will be equipped with fire protection systems. Water for these systems will be drawn from a local well. Water for dust suppression will be drawn from the sediment ponds.

4.5.11 Sewage

A modular sewage treatment system sized to handle 450 people will be used. This will expand on existing Trend facilities.

If additional capacity is required during construction, additional modules may be leased temporarily. Treated effluent will be discharged to a sedimentation pond. Sewage sludge will be dewatered and trucked offsite for disposal.

4.5.12 Explosives Storage Facility

The on-site explosives factory currently used for Trend Coal Mine will be used for the Project as well. The existing Trend facilities have sufficient capacity to supply both the Trend Coal Mine and the Project, therefore no expansions or upgrades are proposed. The site is located northeast of the proposed plant site and a barricaded magazine is currently located on a separate access off the Talisman road, 1000 m northeast of the Talisman road and more than 690 m east from the ammonium nitrate silos and the nearest site infrastructure (see Figure 4.3-2). This facility is currently permitted to a third party explosives contractor who owns and operates the facility. The explosives factory consists of:

- Emulsion Plant
- Emulsion Silo
- Overhead AN Prill Storage
- Conditioner Storage Tank
- Garage, Lab, Wash Bay, Electrical, Mechanical Building
- Office Trailers and Storage Sea Cans
- Surface Water Collection Sump
- Plant Process Fuel
- Quonset Hut Storage

PRC has provided access and land for the explosives factory and magazine. The explosives contractor will be responsible for Environmental Health and Safety design requirements for the operation of the explosives factory under applicable legislation.

Estimates for annual explosives consumption are summarized in Table 4.5-4.

Table 4.5-4 Annual Explosives Consumption

	Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Blast Rock Volume	bcm x 1000	13,271	14,027	16,343	16,660	31,798	31,932	31,935	32,382	19,801	13,965	4,448
Emulsion	tonnes	1,637	1,398	2,317	2,106	5,008	4,754	4,150	3,793	2,040	1,397	443
Ammonium Nitrate	tonnes	7,944	8,377	9,802	9,977	19,100	19,165	19,130	19,373	11,830	8,340	2,657
Total Bulk Explosives	**tonnes**	**9,582**	**9,775**	**12,118**	**12,082**	**24,108**	**23,919**	**23,280**	**23,167**	**13,870**	**9,737**	**3,100**

4.5.13 Rail Load-out

Existing infrastructure for the Trend Coal Mine allows for the expansion of the Trend rail load-out facility to accommodate the extra clean coal tonnage generated by the Project. Load-out design was driven by the following principles:

- provide the maximum amount of enclosed storage to mitigate environmental concerns and prevent windblown losses
- create a load-out capacity capable of handling 5 mtpa which could be expanded to 8 mtpa
- use 110-car unit trains

Based on a maximum capacity of 8 mtpa of clean coal, batch-weigh loading is the preferred alternative. The following two basic types of batch-weigh systems were considered as alternatives for clean coal storage at the rail load-out:

- clean coal silos reclaimed to batch-weigh load-out (single)
- over-track silos with integral batch-weigh load-out

Before evaluating load-out alternatives, consideration was given to storage capacity required.

Silo Capacity

PRC identified unit trains of 110 cars with approximately 107 t loaded per car making capacity 11,770 t per train set. Silo capacity selection was based on the following factors:

- silo capacity should be less than unit train capacity if blending is required
- silo capacity should be more than a single train if a single product is continuously loaded

Silos with 12,000 t capacity will be used for the Project to allow for maximum operational flexibility. This silo capacity is an approximation and may be adjusted during the Final Feasibility study.

Coal Loading

Over-track silos will be used to load coal onto train cars providing the optimal approach to loading train sets from, a safety, environmental and product quality perspective when compared with open stockpiles. This loading system will require that a small section of new road be constructed within the existing Trend Coal Mine rail loop, directing coal haul traffic from the Trend Coal Mine By-pass Road to the dump station (see Figure 4.5-5).

Clean coal silos and a single batch-weigh load-out were evaluated. The advantages of the off-track clean coal silo system are that capital cost is comparable to the preferred option due to a balance between a single load-out with more conveyors. If required, additional silos could be constructed off track during operations and coal could be blended from silos into rail cars. However, if a high capacity conveying system is required to feed the unit train load-out, two large conveyors are required to complete the system. Coal must be handled twice and a larger footprint would therefore be required.

An over-track, batch-weigh load-out was also considered. The advantages of the over-track clean coal silos are that only A single conveyor is required to feed the silo-load-out system and can be sized to match the mine clean coal capacity, not load-out capacity, leading to a reduced footprint. Train cars can be loaded at a higher rate using dual load-outs, if quality is consistent.

The key limitation of the over-track clean coal load-out is that it is difficult to expand storage capacity during operations (unless additional silos are constructed off track), at lower capacity (5 mtpa).

Figure 4.5-5 Rail Load-out Layout

4.6 Construction Phase Activities

The construction phase of the Project includes all activities that occur prior to commissioning of the coal wash plant, including the development of mine access and development of the initial mining area in Phase 1. This phase will also include the construction of mining infrastructure and offsite facilities. As described in Section 4.3.1, the Project will be closely integrated with operations at the Trend Coal Mine. The construction and operation phases will overlap.

All construction activities are to be completed over a period of approximately18 months with construction slated to begin in the fall of 2011. Due to the long construction period which will be needed to support the Roman Coal Mine while maintaining coal production from the Trend Coal Mine and commencing coal production from the Roman pits, the phasing in of the Project will continue to utilize Trend facilities such as stockpiles, the process plant and the rail load-out until the full infrastructure has been expanded or replaced.

Seasonal fluctuations experienced at site, delays in the issuance of the EA Certificate or other key operational permitting could delay the start of construction until the 2012. A detailed schedule will be refined during the Final Feasibility study.

Key activities undertaken during the construction phase will include:

- Procurement and assembly of mining equipment and training of operators and mine personnel.
- Clearing and grubbing as required for the following infrastructure:
  - water management and sediment control structures (RP1 and RP2)
  - coal wash plant and raw and clean coal storage facilities
  - office and maintenance facilities
  - mine and pit access roads
  - soil salvage and soil stockpile areas
- Installation of initial erosion control measures including diversion ditching with small stilling basins, silt fences and other measures, as required. Erosion and sediment control measures for the construction phase of the Project are outlined in the Surface Erosion and Sediment Control Plan (Section 5.5).
- Construction of collector ditches RN1-3 and RS1, 2 and 4 to capture surface water flows from areas disturbed by the construction of north and east dump and by initial Phase 1 mining activities. These ditches are accessed by dozer initially; rip-rap is placed as required once pre-strip starts in the mine and pioneer access is constructed. All final ditch alignments and sediment pond configurations are determined in the field to satisfy the intent of the overall water management plan.
- Construction of sediment ponds RP1 and RP2 to treat effluent from mine disturbance and associated soil salvaging. Soil will be dozed into windrows along the edges of the sites locally; the windrows will be contoured to minimize erosion and then seeded immediately.
- Site grading for the maintenance facility, coal wash plant and coal storage areas.

- Construction of the coal processing plant and maintenance and office facilities.
- Pioneering pit access from the coal wash plant and tying into the existing Trend Coal Mine coal haul road. Culvert installation at tributary crossings and installation of silt fences will be undertaken as required on all intercepted flows during initial access construction. Soil salvage as per the instructions above.
- Initiation of Phase 1 pit pre-strip activities. Waste from pre-stripping will be used for fill road construction for Phase 1 Roads and the coal haul road, and foundation material for the maintenance yard and coal wash plant. Suitable rip-rap material will be salvaged for lining collection and diversion ditches.
- The mining schedule call for the initial development of the western portion of the Phase 1 Gates pit area for tailings management facility which includes pre-stripping, overburden removal and coal extraction.
- Initially, until the completion of the Roman coal processing plant, the coal extracted from Phase 1 will utilize the Trend the open stockpiles, be processed in the Trend plant and be shipped from the existing PRC rail load-out until the completion of construction of automated rail load-out with silos.
- Topsoil salvaging and stockpiling from disturbed areas including the coal processing plant site. Contouring and seeding soil stockpiles.
- Pioneering the north and south dump access road.
- Commence construction of site infrastructure and facilities.

Construction at the rail load-out will be carried out in parallel with the mine activities and will consist of:

- Grubbing and clearing of the additional area required for the construction of the new section of the access road and clean coal storage facilities. Interim sedimentation controls will be established along with the use of best management practices to minimize effects of construction activities.
- Construction of the new section of road taking haul traffic from the Trend Coal Mine By-pass Road to the truck dump station.
- Commence construction of the required infrastructure including the conveying system and over-track silos.

During construction ongoing environmental monitoring will be done as prescribed by operational permits.

4.7 Operation Phase Activities

4.7.1 Mining

The operations phase includes the period during which coal is being actively mined. Due to a long construction phase of the plant and rail loading facilities, the operations phase will integrate with Trend and the Project will be phased in with initial utilization of Trend facilities such as open stockpiles, the process plant and the existing rail load-out. The operation phase is split into three phases, corresponding to the progression of the active faces of mining. During operations, the mine will have an average production of approximately 3 mtpa of ROM coal for approximately 10 years, with reduced production

levels in the first and last year. Waste stripping will occur concurrently with coal extraction and waste will be trucked to adjacent waste rock dumps. Progressive reclamation will be done throughout the life of the mine as areas become available to be reclaimed.

The mining schedule calls for initial development of the western most-sections of the Gates and Gething Pits (Phase 1), to occur early in the life of the mine. In Year 1 and 2, coal will be extracted from both the Gates and Gething pits with waste rock mainly going to the development of the south dump and the backfilling of the Trend Coal Mine south block pits (later to be covered by the north dump).

During Phase 1 of mining, all mine-affected drainage will be collected by a series of collector ditches, which run parallel to the toes of the north and south dump. The water collected by collector ditch RN1-3, which captures run off from the north dump and the northern flank of the Phase 1 Gates pit and north Gething pit will be directed to an existing Trend Coal Mine sedimentation pond (SP2), which drains into the Project's sedimentation pond (RP2), which drains to Babcock Creek. RS1, 2, and 4 will capture all mine-affected drainage from the southern flank of the Gates pit and south Gething pit and will direct it to sedimentation pond RP1, which drains into Babcock Creek.

In the fourth quarter of Year 2, mining will progress into Phase 2. Phase 2 will consist of a 750 m extension of the Gates and Gething pits to the east and will continue through Year 6. During Phase 2, waste rock will mainly be placed in the north dump, with a small amount of material taken to the south dump.

Early in Phase 2, the Phase 1 Gates pit void will be established as the tailings facility and sedimentation pond, known as RP3. RP3 will receive tailings from the CPP via a direct pipeline. Additionally, RP3 will be used for subaqueous storage of PAG material including some of the above D-seam waste and the CCR generated by the CPP. A waste rock management plan and a tailings management plan are detailed in Sections 4.9 and 4.10 respectively. Once RP3 is commissioned, RP1 will be abandoned along with RS2 and the RS complex of ditches will be joined and extended to discharge to the tailings pond (RS1, 3 and 4). The RP3 pond will also capture all surface run-off collected by the Gates and Gething pits.

The upper portion of Phase 3 will start development in the fourth quarter of Year 4 and be mined concurrently with Phase 2 until the first quarter of Year 6, when Phase 2 will be mined out. Waste rock will be placed on both the north and east dumps.

This phase of mining will take development into the Gordon Creek watershed. In order to minimize effects on Gordon Creek, pit grade will be maintained so that all mine-affected effluent drains to Babcock Creek. Effluent will continue to be directed to RP3 from the pits and south dump via the RS ditch. Surface run-off from the north dump will continue to report to SP2-RP2 ponds via the RN ditch. Runoff from the northeast dump will be directed towards the existing Trend Coal Mine sedimentation ponds (SP3 and SP4) before reporting to Babcock and Gordon Creek respectively.

The following mitigative measures will be undertaken to protect water quality in Gordon Creek:

- To prevent water flowing from the mine into the Gordon Creek drainage, the mining benches will be sloped towards the pit and to Babcock Creek so mine water will flow away from Gordon Creek.

- Blasting powder factors will be reduced above Gordon Creek and blasts will be directed into the pit to limit material scattering beyond the pit limit during blasting.
- Clearing and grubbing of the surface ahead of the mining operation will result in a large amount of disturbance to the ground, which will generate sediment that may drain into Gordon Creek. To avoid this source of sediment, clearing and grubbing will not be done ahead of the mining operation. Where possible organic material will be mined with the waste rock to reduce the disturbed area draining into Gordon Creek.
- There is a risk that when the mining shovel (used for bulk waste rock removal) advances above Gordon Creek the shovel could push material over the edge and into the Gordon Creek watershed, while trying to load its bucket. To prevent this from occurring, the shovel will stop mining when the face has reduced to 3 m high. At this point, a backhoe assisted by a dozer will be used to pull the remaining material into the pit and pile it up for the loader to load out.

As an additional measure to prevent sediment entering Gordon Creek, silt fences will be installed ahead of the mining operations. Mine engineering will determine areas that will be mined in the coming year so that silt fences can be installed in the preceding summer months. The silt fences will be installed annually to cover the following year's mining activity and maintained regularly.

PRC will conduct regular monitoring of the water quality in the Gordon Creek watershed. A preliminary monitoring plan is outlined in Section 5.6 under the Receiving Water Quality Monitoring Plan. If the measures discussed above are not able to maintain adequate water quality then local sumps will be created to collect mine affected water in the Gordon Creek headwaters, which will be pumped back to the pit where it will be directed into the water management system, specifically RP3 for treatment.

During operations effects to air quality will be mitigated for by implementing an Air Quality and Dust Control Plan outlined in Section 5.1.

4.7.2 Coal Handling and Processing

As described in Section 4.3.1, the Project will be closely integrated with operations at the Trend Coal Mine. Until the full infrastructure proposed for the Project has been expanded or replaced, production from the Roman pits, will continue to utilize Trend facilities such as stockpiles, the process plant and the rail load-out.

Once the coal is mined, it will be trucked to the CPP. To mitigate dust generated during transport, road watering will be implemented throughout the mine site as required. At the plant site fugitive coal dust generation will be controlled by using silos for the storage of raw and clean coal. A detailed Air Quality and Dust Control Plan is presented in Section 5.2.

A heavy media cyclone will be used to separate coarse coal from coarse refuse for particle sizes of 50 to 0.50 mm. Intermediate-sized material between 0.50 and 0.15 mm will be treated in water only cyclones used in conjunction with spiral concentrators. All ultra-fine coal (0.15 to 0 mm) will be beneficiated by column froth flotation. Secondary drying will use a fluidized bed thermal dryer. Both coarse and fine coal refuse (CCR and tailings) will be generated during coal processing. Once RP3 is commissioned, CCR and tailings will be deposited in this facility. Tailings will be pumped through an overland pipeline, while CCR refuse will be trucked to RP3. Before commissioning RP3, tailings

will be dewatered using a belt press and then mixed with CCR. The material will then be trucked to waste rock dumps and treated as PAG material.

Clean coal will be transported by highway-legal, 50 t trucks from the CPP to the rail load-out facility. Transport will be approximately 21 km via PDR-46 and the Trend Coal Mine By-pass Road. To minimize the potential for fugitive dust, all haul trucks will have covered loads and regular road watering will be undertaken as required based on weather and road conditions. At the rail load-out, coal will be stored in over-track silos with integral batch-weigh loading. To minimize coal dust emissions, loaded trains will be profiled and sprayed with a latex solution to bind the surface coal particles.

At present a new processing plant is proposed for the Project, a decision to upgrade the existing Trend processing plant is still possible.

4.7.3 Support Facilities

Light vehicle and equipment maintenance will be carried out on-site in a designated maintenance facility (described in Section 4.5.7). In addition, the maintenance facility will house a warehouse, support offices and auxiliary buildings.

Diesel fuel for all mining equipment and support vehicles will be stored in above-ground tanks enclosed within a bermed and lined area to contain any spillage. The fuelling station will be built adjacent to the existing Trend Coal Mine fuelling station and will supplement the current facilities.

Propane will be used to heat various facilities at the current Trend Coal Mine and will also be used for the Project facilities. Propane storage will be located adjacent to the existing Trend Coal Mine coal processing plant building and will supplement the current facilities as required. The storage tanks are vendor owned and operated. Propane is currently piped underground to the existing facilities and will be upgraded as required for the new and expanded infrastructure.

Electrical power to support operational demands will be supplied by extending the existing 25 kV powerline, which currently services the power demands of the Trend Coal Mine. Further details are provided in Section 4.5.9.

Process water will initially be supplied by groundwater wells. Following the commissioning of RP3 pond, process water will be recovered from the tailings pond by a barge-mounted recovery pump and pumped back to the CPP through a 3.5-km long return pipeline. Domestic water to the office sinks, toilets, showers and maintenance facility sinks will supplied from wells located on the site. Potable water will be treated by a modular potable water treatment system that will augment existing facilities at the Trend Coal Mine. Water for dust suppression will be supplied from sedimentation ponds. Water for fire control will be supplied by groundwater wells and may be supplemented from the sedimentation ponds. A site water balance is presented in Section 4.11.8.

The on-site explosives factory, operated by a third party contractor currently used for the Trend Coal Mine will be used for the Project as well. The explosives factory consists of ammonium nitrate silos, an emulsion silo, a facility to wash explosive contractor's equipment a small workshop and other auxiliary structures. Further details on the facility are presented in Section 4.5.12

4.7.4 Waste Management

Solid waste and chemical (hazardous) waste management plans are detailed in Section 5: Environmental Management Plans. An overview is provided below.

Domestic waste, including food waste and non-hazardous industrial waste, will be sorted and segregated on site for recycling purposes. All recyclable waste will be transported to recycling facilities at Tumbler Ridge. All non-hazardous, non-recyclable waste will either be transported directly to the landfill at Tumbler Ridge or be placed in an onsite landfill as per the current Trend Coal Mine refuse permit.

All hazardous waste will be stored in accordance the Chemical Management Plan in Section 5.12 and applicable federal and provincial regulations. All hazardous liquid wastes will be stored within a lined and bermed area or other secondary containment and will be transported from site by a licensed waste contractor for specialist disposal.

A modular sewage treatment system will be expanded as part of initial construction infrastructure. If additional capacity is required during construction, additional modules may be leased temporarily. Treated effluent will be discharged to an existing Trend sedimentation pond as per current Trend permits. Sewage sludge will be dewatered and trucked off site for disposal.

4.7.5 Personnel Requirements

The Project will have an operational schedule of seven days per week, with two 12-hour shifts per day. The mine is assumed to operate 365 days a year. Shift rotation will depend on job requirements and its classification.

Mine operations staff and labour up to the level of supervisor, along with maintenance and support staff, will rotate on a four-on and four-off shift rotation—a schedule that requires four crews to provide full coverage (see Table 4.7-1).

With the exception of blasting crews and general labourers, all hourly labour and supervisory personnel will rotate between day and night shifts. Managers and technical staff will work a standard eight-hour day shift, five-days a week.

Equipment labour requirements are based on those for equipment operating hours. Estimates for other support labour within the mining operation are based on the support activities considered and experience at other mining operations. Maintenance labour requirements are based on ratios of maintenance staff to equipment operators.

Table 4.7-1 Crew Rotation

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Crew A																
Crew B																
Crew C																
Crew D																
Legend:																
		Day Shift				Night Shift				Days Off						

A schedule for total annual labour requirements for operations and maintenance staff to support mining operations over the mine life including during closure (represented by Year 11) is summarized in Table 4.7-2. Operations staff will include equipment

operators, blasting crews and field supervisors. Maintenance staff includes tradesmen (i.e., mechanics, welders and helpers), servicemen (fuel truck drivers, lube men and tire repairmen) and maintenance-related labourers.

Table 4.7-2 Annual Labour Requirements (Number of People)

Year	1	2	3	4	5	6	7	8	9	10	11
Operations	184	120	192	232	232	228	212	200	156	174	45
Maintenance	116	132	120	138	138	136	129	123	104	96	29

This schedule excludes any allowances for senior management, general management, sales or administration staff, those associated with the coal processing plant, safety and security, and other staff and labour not involved directly in mine operations and maintenance. In total the Project is anticipated to employ 285 people during construction and up to 375 permanent employees throughout the life of the mine. Further optimization may result in revised personnel requirements.

4.8 Decommissioning and Reclamation Activities

The Project has a reserve base of 30.6 Mt of ROM coal and a mine life of approximately 10 years with an annual production of rate 3 mtpa. Proposed end land use objectives for all the Project components and a conceptual reclamation plan are outlined in Section 4.12. A summary of decommissioning and reclamation activities are provided below.

Closure activities will include all reclamation activities not yet completed when mine production ceases.

Sedimentation ponds, ditches, and pond access will be maintained until sediment control is no longer required, that is once reclamation vegetation has established, typically 1 to 2 years). Sediment ponds SP2 and RP2 will be drained and re-contoured such that water is not retained. Stockpiled soil will be spread over the surface as required and re-vegetated. Natural drainage patterns will be re-established, wherever possible. The in-pit pond, RP3 will remain in place after closure.

All plant site infrastructure will be decommissioned by removing structures, breaking up foundations, applying growth medium and re-vegetating.

Unless the responsibility for the Trend Coal Mine By-pass Road is assumed by the Crown or another company, the road will be decommissioned, consistent with resource road deactivation requirements. Decommissioning activities will include:

- removal of culverts
- ripping of the road surfaces
- replacement of top soil
- seeding the resoiled areas
- cutting cross ditches to re-establish drainages

In general, reclamation of the Project will be progressive and will consist of:

- soil salvage before mining
- re-sloping dump faces and fill roads to 25°
- re-contouring of sedimentation ponds, ditches and service roads

- re-establishment of original drainage channels
- soil will be salvaged and stockpiled, windrowed, or placed directly
- soil spreading to the prescribed depth in Section 4.12 on all disturbed areas
- re-vegetation of all disturbed areas

Soils from mine infrastructure such as sediment ponds, ditches, service roads and the clean coal haul road soils will be windrowed up-slope locally. At decommissioning, soils will be spread back over the re-contoured area and revegetated. Associated monitoring for wildlife, water quality and invasive plants including proposed schedules for the monitoring can be found in Section 10.6.3.2, 5.6 and 5.4 respectively.

Table 4.8-1 provides a preliminary schedule for decommissioning and reclamation activities

Table 4.8-1 Decommissioning Schedule

Activity		Year 1	Year 2
Reclamation of remaining un-reclaimed dumps and mine roads			
	Re-sloping of dump faces and fill roads to 25°	✓	
	Placement of soil cap	✓	✓
	Seeding the soil capped areas	✓	✓
Spreading of remaining stockpiled soil			✓
Re-vegetation of spread soil			✓
Draining of Sediment ponds SP2 and RP2		✓	
Re-contouring of Sediment ponds SP2 and RP2			✓
Maintenance of sedimentation ponds, ditches and pond access (until sediment control is no longer required)		✓	✓
Re-establishment of natural drainage patterns in accessible areas		✓	✓
Plant Site Decommissioning			
	Removal of preparation plant structures	✓	
	Breaking up foundations of plant site		✓
	Re-vegetation of plant site		✓
Trend Coal Mine By-pass Road decommissioning (unless the responsibility for the Road is assumed by the Crown or another company)			
	Removal of culverts	✓	
	Ripping of the road surfaces	✓	
	Cutting cross ditches to re-establish drainages	✓	
	Placement of soil cap		✓
	Revegetation of the soil capped areas		✓
Mine Machinery Decommissioning			
	Dismantling of power lines	✓	
	Dismantling of major equipment (shovels, drills)	✓	
	Preparation for relocation/deposition		✓
	Relocation/Storage of mobile equipment		✓
Associated monitoring for wildlife, water quality and invasive plants including proposed schedules for the monitoring as per Section 10.6.3.2, 5.6 and 5.4 respectively.			

4.9 Mine Waste Management

Representative samples of waste rock, raw coal, CCR and tailings were tested to characterize the potential for acid rock drainage and metal leaching from the pit walls, waste dumps, CCR and tailings that will be produced during mining of the Project. The geochemical testing program to characterize each major lithologic unit and possible wastes included acid base accounting, elemental analyses and kinetic testing (Section 3.3: Acid Rock Drainage and Metal Leaching Assessment). The data were used to develop waste rock management plan and an ML/ARD Mitigation Plan (Section 5.8).

Estimates of the volume of coal and PAG/non-PAG waste generated from the Project were calculated from the three-dimensional block model, pre-feasibility mining schedules and the geochemical characterization. A breakdown of volumes of the main stratigraphic formations is summarized in Table 4.9-1.

Table 4.9-1 Waste Rock Volumetric Analysis

Waste Rock	Volume (m^3 X 1000)	Rock Type	Distribution (%)
Overburden	9,836	Non-PAG	4
Rock above Conglomerate	3,708	PAG	2
Conglomerate	15,536	PAG	7
Rock above D Seam	2,583	PAG	1
Rock above E Seam	20,534	Non-PAG	9
Rock above F Seam	20,224	Non-PAG	9
Rock above G Seam	53,369	Non-PAG	23
Rock above J Seam	5,421	Non-PAG	2
Rock above K Seam	15,953	Non-PAG	7
K Seams Group	10,951	Non-PAG	5
Rock below K Seam	63,842	Non-PAG	27
Rock above Gething Seams North Limb	3,616	Non-PAG	2
Rock above Gething Seams South Limb	8,812	Non-PAG	4
Gething Interburden North Limb	228	Non-PAG	0
Gething Interburden South Limb	487	Non-PAG	0
Rock below Gething Seams North Limb	826	Non-PAG	0
Rock below Gething Seams South Limb	1,241	Non-PAG	1
Total Waste	**237,167**		**100**

Geochemical data indicates that the majority of the waste rock from the Project would have a low potential for ARD due to the low sulphide and high NP content of the rock. However, for waste rock from the Upper Gates Formation (above D-seam) (comprising 10 percent of the total waste rock), some of the rock adjacent to the coal seams (comprising less than three percent of the waste rock) are potentially acid generating, and will need to be managed appropriately.

A combination of controlled end-dumping and layering methods will be used to facilitate good distribution of PAG waste rock through the dumps, and establish sufficient non-PAG rock surrounding the PAG rock to maintain neutral pH conditions in the dump as a

whole. Preliminary data shows that, similar to Trend Coal Mine, 1 m lifts of PAG alternating with 1 m lifts of NAG will be required during the first two years of the mine life. CCR and tailings with a mixed potential for ARD (1.33 Mt) will also be incorporated into the dumps using end-dumping and layering methods, and for the remainder of the mine life, non-acid generating CCR (4.70 Mt) will be incorporated into the dumps. The north dump will be the only PAG dump.

Following the commissioning of the TMF in Year 2, tailings and PAG CCR deposited in the TMF. The estimated volume of tailings to be deposited in the TMF is approximately 2.1 Mm^3, and the estimated volume of PAG CCR is approximately 0.8 Mm^3; therefore, an additional 3.3 Mm^3 of space available for storage of PAG waste rock. Priority will be given to using this area for storage of PAG waste rock with the highest sulphur content.

Currently at the Trend Coal Mine, material is defined as PAG based on if a Neutralizing Potential (NP) to Acid Potential (AP) ratio is less than two (where NP is based on the Sobek procedure and AP is calculated from the total sulphur content). High sulphur PAG is defined by the above criterion and a total sulphur content of greater than 0.5 percent.

4.9.1 Waste Rock Layering

4.9.1.1 Horizontal Layering Procedure

The initial PAG layer is placed in a lift over a minimum 3 m base layer of the non-PAG waste rock so that groundwater seepage along the base of the pile does not come into contact with any PAG material. In addition, the base layer also provides a source of added buffering to neutralize any acidity that may develop within the PAG layers. The segregated PAG lift will be spread to a thickness of approximately 1 m. PAG rock located above the D-seam has a relatively coarse grain size distribution. To minimize the generation of reactive fines, this material is handled as little as possible before placement into a designated PAG lift. A minimum of 1 m of non-PAG rock from the Middle Gates waste is placed over each PAG lift. This material provides a source of alkalinity, helping to maintain neutral pH conditions in the underlying rock. It also limits the potential for runoff from the surface of the pile to come into contact with the PAG material.

For PAG layers with greater than 0.5 percent total sulphur, known as high sulphur PAG (high-S-PAG), the same procedure is followed, but the lifts are 30 cm thick.

This methodology will continue to be used where the proposed end dumping procedure is not practical.

4.9.1.2 End Dumping Procedure

When the dump is not being built on top of an existing dump lift, a minimum 3 m base layer of the more common non-PAG waste rock situated below the D-Seam will be constructed first. This will prevent groundwater seepage along the base of the pile from coming into contact with the PAG material. In addition, the base layer will also provide a source of added buffering to neutralize any acidity that may develop within the PAG layers.

Once the non-PAG waste rock base has been built, the construction of the PAG and non-PAG blended dump can begin. The blended portion of the dump will be created by controlled end dumping of haul trucks. The spotting dozer on the dump will spot each load to provide control of layer thickness. For PAG rock, a 1-m vertical thickness will be

created and for high sulphur PAG rock, a 30 cm layer will be created. After each layer a minimum of a 1-m thick non-PAG rock layer will be created (see schematic in ML/ARD Management Plan in Section 5.8).

The results of the layered humidity column tests were used to calculate the maximum layer thickness required to achieve an ideal blend where dissolved alkalinity from a layer of non-PAG would neutralize acidity generated within PAG rock from above the D-Seam and thereby prevent local acidic conditions from developing. These calculations showed that the alkalinity in leachate from an overlying layer of Middle Gates waste rock would likely provide sufficient neutralization to control all of the acidity generated in a typical 1 m thick layer of above D-Seam PAG rock, but that it would only be sufficient to control acidity in the uppermost 5 to 30 cm of the high sulphur above D-Seam PAG rock.

The outer surface of all dumps will be built from non-PAG material such that the PAG material is not exposed during recontouring for reclamation. The thickness of the outer surface non-PAG layer will depend on the dump height as shown in Figure 4.9-1. On a typical 20 m high lift the outer 8 m of the dump will be built of non-PAG rock. If sufficient non-PAG waste is not available then a non-PAG layer can be added after the dump has been resloped for reclamation.

To control the PAG layer thickness for blending, the spotting dozer will move between dumped truck loads. The distance the spotting dozer moves between loads depends on the desired layer thickness, the height of the dump lift and the size of the trucks. Depending on the lift height the spacing between dumped loads will vary as described in Section 5.8.

For building PAG layers through end dumping the lift must be at least 6.5 m high and a minimum of 22.5 m high for high sulphur PAG. If these minimum heights are not available then the current practice of building horizontal layers will be used as described in Section 4.9.1.1.

Further procedures are provided in the ML/ARD plan presented in Section 5.8.

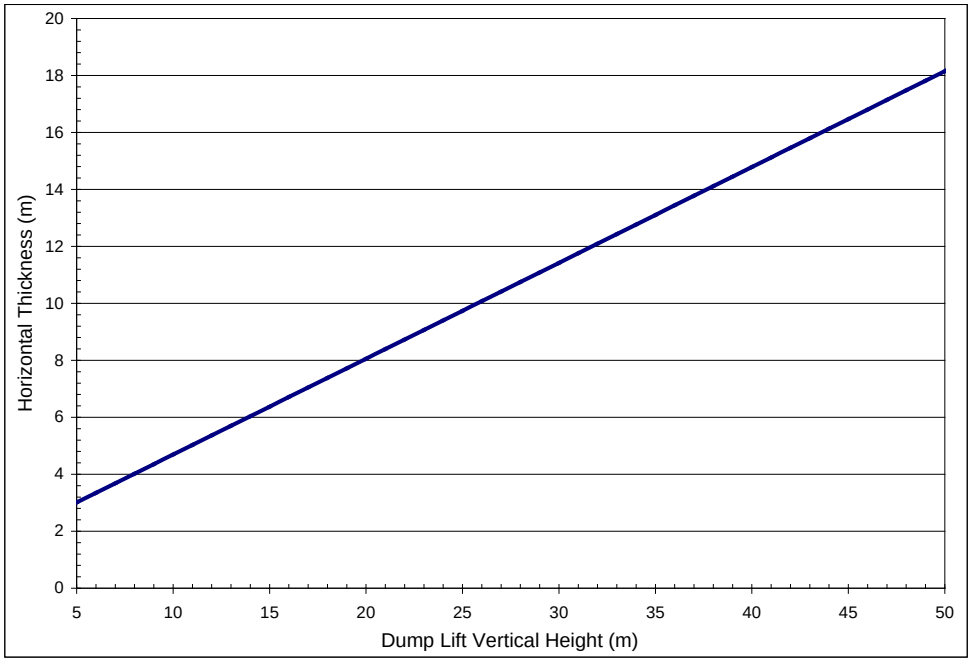

Figure 4.9-1 Non-PAG Outer Surface Thickness

4.10 Tailings Management

4.10.1 Introduction

In the first two years of operations (active mining), tailings produced by the coal processing plant will initially be filter-pressed, mixed with CCR and layered in the waste rock dumps as PAG material. Following the completion of mining of the Phase 1 Gates pit, tailings will be deposited into the void formed by the mined out Phase 1 Gates pit (RP3). Tailings will be transported to the TMF through a pipeline in 30 percent slurry. Deposition will be at the eastern half of the TMF to allow for maximal settling. Water quality will be closely monitored for metals and total suspended solids to assure that provincial water quality guidelines and site specific objectives are being met. If required, flocculants may be introduced into the pond to meet quality objectives. Planning for tailings disposal remains at a conceptual level only, and issues remaining to be resolved in the Final Feasibility study include those associated with geotechnical and hydrological conditions in the pit and scheduling backfilling of mined-out portions of the pit.

4.10.2 Fine Waste Production

The mine plan is based on the production of 21.5 Mt of clean coal (as delivered). Total rejects are estimated to be about 8.8 Mt (dry basis). The coal rejects will be split into CCR and fine tailings. Table 4.10-1 presents estimates of CCR and tailings quantities.

Table 4.10-1 CPP Waste Production Summary

Seam	Feed to Plant (Tonnes)	Dry Rejects (Tonnes)		Dry Rejects—Total Volume (m^3)	
		CCR	Tailings	CCR	Tailings
Bird	597,000	86,947	36,599	74,257	106,927
GT1	952,000	119,855	74,090	102,363	216,460
GT2	544,000	44,447	31,561	37,960	92,207
GT3	204,000	45,107	19,927	38,524	58,217
D	1,951,000	646,663	66,763	552,288	195,053
E	2,002,000	620,793	75,135	530,194	219,512
F	2,565,000	545,584	179,470	465,961	524,335
G	8,123,000	3,109,448	247,410	2,655,649	722,826
J	13,653,000	1,958,624	974,592	1,672,779	2,847,338
Total	**30,591,000**	**7,177,468**	**1,705,548**	**6,129,974**	**4,982,876**

The physical characteristics of the waste products are summarized in Table 4.10-2.

Table 4.10-2 CPP Waste Characteristics

Waste Product	Process/Deposition Parameters	
Tailings	Specific Gravity (SG)	1.4
	Dry Density (t/m^3)	0.7
CCR	Specific Gravity (SG)	2.0
	Dry Density (t/m^3)	1.5

4.10.3 In-pit Water Balance

Key assumptions used to develop a preliminary in-pit water balance for mining operations include the following:

- Tailings will be transported by pipeline as a slurry from the CPP at approximately 30 percent solids by weight.
- Of the CCR, 25 percent will be placed with the tailings (for eventual submergence); deposition was assumed evenly distributed for the life of the Project. The remainder will be placed in the waste rock dumps and treated as PAG.
- Tailings will be deposited flat (no sloping beaches).
- Inflows will include:
  - tailings and coarse coal refuse
  - slurry water
  - direct precipitation (1100 mm per year)
  - catchment runoff (assumed to be 25 ha)
- Outflow losses will include:
  - water reclaimed for the coal processing plant (assumed at 90 percent efficiency)
  - loss of water to tailings and CCR voids
  - evaporation

Key findings of the water balance are as follows:

- Operational diversions will be required to reduce the catchment of the RP3 and prevent the pit prematurely filling with runoff water and eventual discharge.
- Freshwater make-up to the coal processing plant will be contingent on reclaim volume (which may depend on pond water quality).
- Pond water reclaim will be used to manage the pit pond level and prevent premature spilling.

A full water balance is presented in Section 4.11.8.

4.10.4 Tailings Management during the Operations Phase

Tailings will be deposited directly from the end of pipeline into the tailings pond. Reclaimed water will be pumped back to the coal processing plant by a floating barge through a return pipeline. If reclaim water quality becomes a concern, the separation distance between the tailings discharge pipe and the barge intake could be increased and a rockfill dike installed to filter the tailings water.

PAG CCR will be trucked to RP3 and deposited in a manner that will allow it to be submerged by the final pond. A refined operational CCR dumping plan will be established as part of the Final Feasibility study.

By reclaiming a large portion of the process water, pond water levels will be controlled. However, water balance analyses indicate that the combination of local runoff and tailings and waste deposition will result in the water level in RP3 rising each year. The pit

will thus be in water surplus each year with total water inflows greater than losses and could potentially overflow by about Year 6 to 8 of operations. In order to prevent uncontrolled overflows from the pit to Babcock Creek during operations, excess water will be removed from the pit each year by pumping at a controlled rate into the northern ditch system leading to sediment ponds SP2 and RP2. Additional settling and flocculation (if required) of water pumped from the pit will occur in pond RP2 before final release to Babcock Creek. Direct discharge to Babcock Creek is also being considered; however, it will be contingent on water quality (total suspended solids). Water quality will be constantly monitored in the pit pond to optimize the tailings and waste material deposition locations and procedures to maximize solids settling within the pit pond.

The end pit wall material which will form the barrier between RP3 and Babcock Creek will require further investigation to ensure that there will be no transport of water between RP3 and Babcock Creek. If, during detailed design, the end pit wall material is shown to be unable to provide a satisfactory barrier then an engineered dyke will be constructed to prevent water transport in either direction.

4.11 Site Water Management Plan

4.11.1 Overview of Site Water Management Plan

In general, the Project development will proceed from west to east with mining beginning in the northwest end of the Gates and Gething pits, moving southeast towards Roman Mountain and Gordon Creek. The Site Water Management Plan incorporates some of the existing water management structures used at Trend Coal Mine as well as the construction of several new structures.

The Site Water Management Plan comprises a network of open channel ditches and sediment ponds strategically located to collect surface runoff and seepage, minimize erosion and remove excessive suspended sediment from flows prior to release to the environment.

Open ditches and collector channels will be designed to convey peak flows from a 200-year return period event. Sediment ponds will be designed in accordance with British Columbia provincial guidelines to remove suspended sediment to acceptable levels during a 10-year, 24-hour flow event. Provisions will be included for the addition of flocculants (if required) to meet discharge water quality objectives. All dam structures constructed for sediment ponds and for diversion or runoff collection purposes will have emergency spillways designed to protect the structures against overtopping during a 200-year return period event.

Figure 4.4-19 shows the proposed Site Water Management Plan at during initial mine development, while Figures 4.4–3 through 4.4–5 show the Site Water Management Plan at the end of Phase 1, 2 and 3, respectively. Initially, surface runoff water from areas disturbed by mining activities will report to two sediment ponds designated RP1 and RP2 by means of a series of ditches (see Figure 4.4-19)**.** Pond RP1 will collect runoff from the developing Gates pit area and south dump and will discharge into Babcock Creek by way of an armoured overflow spillway. Pond RP2 will be located near the Trend Coal Mine sediment ponds (SP1B and SP2) and will collect runoff and seepage from the eastern portion of the developing north dump area located between the Gates pit and the Trend Coal Mine plant site. Pond RP2 will be in place throughout the mine operating period and will discharge via an armoured overflow spillway to Babcock Creek. Runoff from the

middle and eastern portion of the Project's northern dump will be directed towards the existing Trend Coal Mine sediment ponds SP3 and SP4 before controlled release to Babcock and Gordon Creek.

Once the western end of the Gates pit has been completed to allow subaqueous deposition of tailings and potential PAG waste material, sediment pond RP1 along with the associated ditch RN2 will be decommissioned. This is expected to occur at about Year 2 of operations. At this time, perimeter collector channels will be extended to direct all runoff and seepage from the south dump area into the western end of the Gates pit. This configuration is shown on Figure 4.4-3 and will last until the end of mine operations (see Figure 4.4-5). Pit development towards Roman Mountain in the east will continue thereafter with all drainage from the operating pit area flowing by gravity to the lower western portion of the pit. The western portion of the pit will thus serve as a combined tailings pond and sediment pond (designated sediment pond RP3) for the pit catchment area and the south dump area. Excess water accumulating within the pit will be pumped into the ditch system draining to sediment pond RP2.

After the completion of mining activities, all waste dumps will be reclaimed. The water management and collection system will continue to be operated until the runoff from all areas of the site is deemed acceptable for direct release to the environment without the need for treatment. At that time, all ditches and ponds will be decommissioned and reclaimed. Overflows from the Gates pit will be directed into a permanent erosion-resistant spillway into Babcock Creek. Flows from reclaimed waste dump areas will be returned to, or directed into, natural gullies and channels, wherever possible. Permanent erosion protection measures will be installed as required to achieve long-term stability of the system.

4.11.2 Site Hydrologic Setting

The Project is located in the foothills of the Rocky Mountains within the mountainous, southwest corner of the Flatbed Creek catchment. Elevations within the Flatbed Creek catchment range from about 790 m above sea level (masl) at the mouth to 2027 masl at the peak of Roman Mountain. All areas above 1500 masl are located in the southwest corner of the catchment.

The climate is dictated by a variety of factors including latitude, altitude and location relative to a mountain barrier. The property is located in the rain shadow of the Rocky Mountains but, because the property is on high ground and is in reasonably close proximity to the spine of the Rocky Mountains (within about 40 km), the annual precipitation is not extremely low (average 1091.4 mm/yr). The region encompassing the Project is occasionally subject to intense low pressure systems that draw warm, tropical air into the region from far to the south. These systems are occasionally associated with extreme flooding, as occurred in the summer of 1987 for example.

The initial development of the Project will be wholly contained within the headwaters of Babcock Creek, the largest tributary to Flatbed Creek. As development progresses the MDL (part of the pits and part of the waste dumps) will extend into the headwaters area of Gordon Creek, the largest tributary to Babcock Creek. Portions of the waste dumps associated with the Project will be constructed overtop of existing waste dumps created during mining of the Trend Coal Mine. Runoff from Flatbed Creek eventually makes its way to the Peace River, via the Murray River (at Tumbler Ridge) and the Pine River.

4.11.3 Available Climate and Hydrologic Data

Available regional and site climate and hydrologic data and the analyses carried out to define baseline conditions for the Project are presented in Section 11.3: Baseline Conditions for Surface Water Hydrology. Regional data included:

- 12 climate stations operated by the Meteorological Service of Environment Canada
- 6 snow-course survey stations operated by the BC Ministry of Environment
- 30 Water Survey of Canada (WSC) streamflow gauging stations

Catchment areas for the WSC stations vary from 29.5 to 12,100 km^2.

Site area hydrologic data available on Babcock Creek, Gordon Creek, Barbour Creek and the outflows from the Trend Coal Mine sediment ponds from 2003 to 2008 included:

- precipitation and climate monitoring stations around the Trend Coal Mine area
- local snow depth monitoring
- streamflow monitoring stations

Catchment areas for these stations varied from 0.6 to 82.6 km^2. Water levels have been monitored with a combination of staff gauges and automatic pressure transducers. The pressure transducers were generally operated only during the open water season to avoid potential freezing damage to the instrumentation. Regular measurements of streamflow have been made with a current meter at the pressure transducer-equipped stations to develop rating curves. Some limited spot measurements of winter flows have been carried out on Babcock and Gordon creeks.

4.11.4 Peak Flow Estimates

4.11.4.1 Methodology

Estimates of peak daily and peak instantaneous flood flows were required as part of the design of the Site Water Management Plan. For the Project, regional analysis using WSC data were the basic method used to estimate the required flood flows. The results of the regional flood frequency analysis were checked against the results of a comprehensive flood study carried out by the Alberta Department of Transportation. Details of the above analyses are presented in Section 11.3: Baseline Conditions for Surface Water Hydrology.

4.11.4.2 Results

Based on the results of the flood frequency analyses, peak instantaneous 200-year return period flows were estimated for the catchment areas contributory to all the collector ditches and to the sediment ponds. The 200-year peak instantaneous flows were used to size the collector ditches and the spillways from the sediment ponds. The 10-year, 24-hour flows were estimated in order to size the required plan area and volume of the sediment ponds. The results are shown in Table 4.11-1.

Table 4.11-1 Peak Flow Estimates

Item	Catchment Area (km^2)	Design Flows (m^3/s)	
		10-Year 24 Hour	200-Year Peak Instantaneous
Sed. Pond RP1	1.30	0.70	4.80
Sed. Pond RP2	3.41	1.70	10.8
Sed. Pond RP3	3.65	1.80	11.4
Ditch RN1	1.12	0.62	4.30
Ditch RN2	1.70	0.91	6.00
Chute RN2-RN3	2.09	1.10	7.20
Ditch RN3	3.15	1.60	10.1
Ditch RS1	0.80	0.46	3.20
Ditch RS2	0.81	0.46	3.20
Ditch RS3	1.25	0.69	4.70
Ditch RS4	0.70	0.41	2.90

4.11.5 Run-off Collection Ditches

Over the Project, approximately 4550 m of open channel collector ditches will be constructed in order to direct runoff and seepage from mine facilities and disturbed areas to sediment ponds for removal of suspended sediment prior to release to the receiving environment. Ditch locations are shown on Figure 4.4-19 and Figure 4.4-5. Open channels will be excavated into native ground and lined with appropriate filter material and erosion-resistant riprap comprised of clean, hard, competent rock placed on the bed and banks of the channels.

Figure 4.11-1 shows a typical ditch cross section. Riprap will be sized to be stable for estimated local flow velocities during a 200-year flood event. Due to the fine nature of many of the native soils filtering beneath the riprap will consist of a layer of geotextile filter fabric overlain by a layer of clean, competent granular filter material. Diversion dams with appropriate erosion protection will direct runoff flows from natural gullies into the collector ditches.

Table 4.11-2 summarizes collection ditch dimensions. The ditch depths shown include a freeboard allowance of 0.3 m over and above the maximum estimated 200-year event flow depth. Based on experience at the Trend Coal Mine, ditches will be excavated with side slopes varying from 2H:1V to 2.5H:1V depending on local material properties. Table 4.11-3 summarizes riprap type dimensions.

Wherever the proposed collector channels cross road alignments, culverts will be sized to convey the design peak discharge with a maximum headwater depth to diameter ratio of 1:1 (no surcharge). Culvert slopes will equal the local channel slope and appropriate erosion protection measures will be installed at the culvert inlets and outlets.

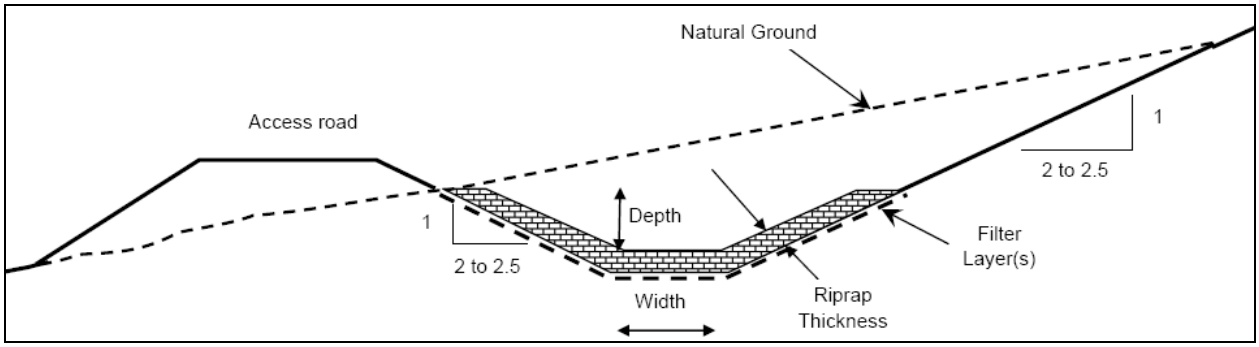

Figure 4.11-1 Typical Collector Ditch Section

Table 4.11-2 Runoff Collection Ditch Dimensions

Ditch Number	Length (m)	Ditch Slope (%)	Base Width (m)	Depth (m)	Riprap Type
Ditch RN1	450	1	2.0	1.0	1
Ditch RN2	600	2	2.0	1.1	2
Chute RN2-RN3	200	24	2.0	0.8	3
Ditch RN3	600	1	2.0	1.4	1
Ditch RS1	550	1	2.0	0.9	1
Ditch RS2	700	1	2.0	0.9	1
Ditch RS3	450	1	2.0	1.1	1
Ditch RS4	1000	1	2.0	0.8	1

Table 4.11-3 Riprap Type Dimensions

Riprap Type	D_{50} (mm)	Layer Thickness (mm)
1	100	200
2	300	600
3	700	1400
4	1000	2000

4.11.6 Rail Loop and Coal Load-out

Expanded coal handling facilities, which will be sufficient to ship up to 5 mtpa, will be constructed at the existing Trend rail load-out. These facilities will be completely contained within the existing water management facilities. The existing ditches and sedimentation pond (LSP1) has operated for 5 years, is functioning well, and will be capable of fully containing and settling any increased sediment as a result of construction and operation of the expanded rail load-out.

4.11.7 Roman Coal Mine Sediment Ponds

Three new sediment ponds will be used as part of the Site Water Management Plan (see Figure 4.4-19). Two of the sediment ponds (RP1 and RP2) will be constructed separately to collect and treat runoff and seepage from the waste dumps and other disturbed areas:

- Pond RP1 will be located south of the developing Gates pit, will only operate for a few years collecting seepage and runoff from the southern dump area and the initial stages of pit development, and will discharge to Babcock Creek via an armoured spillway channel.
- Pond RP2 will be located near the existing Trend Coal Mine sediment ponds (SP1B and SP2) and will operate throughout the mine life collecting runoff from the western portion of the North Dump and other disturbed areas, and will discharge to Babcock Creek.

The pond designated RP3 will be developed as a result of excavation of the western end of the Gates pit and will serve as a combined tailings pond and sediment pond for runoff from the pit walls and the southern waste dump area. Water accumulating within the Gates pit RP3 will either be pumped to the plant for process use or will be pumped into the ditch system, which discharges to pond RP2 and Babcock Creek.

As per the BC Ministry of Environment, all the sediment ponds will be sized to remove fine to medium silt sized sediment by gravity settling during a 10-year return period 24-hour inflow event. Due to the fine-grained nature of soils in some locations around the site, all the ponds will include provision for the addition of flocculants (as required) to attain required discharge suspended sediment limits (Section 4.11.10.4).

Ponds RP1 and RP2 will be developed by a combination of dam construction and excavation in the reservoir area to develop the required pond storage volumes for water and settled sediment. Sediment ponds will be, as much as possible, rectangular with a 5:1 length:width ratio to maximize flow path lengths and settling efficiency and to minimize potential short-circuiting of flows. If construction of the ideal rectangular shape is precluded by topographic or other constraints, provision will be made to install flow baffles within the pond to increase flow path lengths and optimize settling and retention times. Pond volumes will be sufficient to contain a minimum of 20 hours of the 10-year, 24-hour flows plus a minimum 1 m allowance for settled sediment.

Each sediment pond will include a spillway and associated outlet channel designed to pass inflows up to the 200-year return period design event. Spillways have been conservatively sized at this time to pass the peak instantaneous 200-year discharge without any flood routing or attenuation of flows passing through the sediment pond. The crest elevation of pond embankments will include a minimum 0.5 m freeboard over maximum estimated pond levels during the design 200-year event. Spillways and outlet channels will be either excavated into bedrock or lined with heavy erosion protection (large riprap, grouted material and gabion baskets) to maintain stability during the design event. Appropriate erosion protection measures will also be included at the point where spillway flows enter the natural receiving waters.

Pond maintenance will include the cleanout of deposited sediments to maintain adequate settling depth and volume in the ponds. Sediment removed from the ponds (RP1 and RP2) could be placed:

- in soil stockpiles for use during reclamation activities
- within the waste dumps in a manner that does not adversely affect dump stability

- into pond RP3 (Gates pit)

Deposited sediment will not be removed from pond RP3 since active tailings deposition will be on-going.

As described in Section 4.11.8.2, some of the plant water supply will initially be taken from existing groundwater wells or the Trend Coal Mine sediment ponds. Provision will be included at each pond to draw the pond down by pumping over the winter period to maximize water storage availability before the following year's high flows during the freshet. After Year 2 of operations all plant water requirements will be met by pumping from pond RP3 (Gates pit) thereby reclaiming tailings slurry water.

Table 4.11-4 summarizes all sediment pond and spillway dimensions.

Table 4.11-4 Sediment Pond and Spillway Dimensions

Pond	Required Pond Size		Desired Pond Dimensions		Spillway Dimensions	
	Area m^2	Volume m^3	Width m	Length m	Width m	Depth m
RP1	17,500	50,000	60	290	3.0	1.0
RP2	41,000	120,000	90	450	5.0	1.2
RP3	44,000	130,000	95	465	5.0	1.3

As it fills, the Gates pit RP3 will approach a maximum surface area of about 120,000 m^2 with dimensions of about 160 m by 720 m, in excess of the required desirable dimensions (see Table 4.11-4). Pond RP3 is expected to provide adequate settling and retention times for the fine tailings discharge as well as sediment generated from deposited waste rock materials, the pit walls and active pit areas. Provision for flocculation addition into the pit will be made (Section 4.11.10.4). The management of pond levels and pond volumes during operations is described in Section 4.11.10.3.

4.11.8 Water Demands and Water Supply

4.11.8.1 Overall Water Usage Requirements

Based on the mine plan, with 3.5 mtpa mill throughput, the average daily demands for water can be summarized as follows:

- Mill Process Plant Usage = 82 m^3/hour
- Domestic Usage = 2.2 m^3/hour
- Dust Suppression Usage = 31 m^3/hour
- Total Average Usage = 115 m^3/hour

4.11.8.2 Plant Make-Up Water Requirements

Maximum make-up water demand for the process plant will occur during the first two years of operation, before disposal of tailings into the Gates pit. During these first two years there will be minimal recycle of process water and the total make-up water demand is estimated to be 82 m^3/hour as follows:

Make-up Water = Clean Coal Moisture OUT (53 m^3/hour)
+ Refuse Moisture OUT (29 m^3/hour)

+ Underflow OUT (42 m^3/hour)
- Raw Water IN (42 m^3/hour)
= 82 m^3/hour

The make-up water demand will be met initially by a combination of pumping from storage in the sediment ponds and pumping from groundwater wells. Simulations of the site water balance indicate that runoff to the sediment ponds (Trend Coal Mine SP1A, SP1B, SP3 and north dump SP2 and RP2) will be capable of meeting most of the make-up water demand and that groundwater will only be needed at a sustained rate of about 6.8 m^3/hour (1.8L/sec) over a six month period each year which is below the 75 L/sec EA threshold. The capacity of existing wells at Trend Coal Mine is estimated to be greater than 40 m^3/hour.

After the second year of operation, tailings will be deposited into the Gates pit (as described in Sections 4.11.7 and 4.11.10.3). At that time, runoff to, and the reclaim of tailings slurry water from the pit (designated as pond RP3), will essentially eliminate the need for groundwater pumping to satisfy mill make-up water requirements. Storage within the Gates pit RP3 will meet all plant demands.

4.11.8.3 Plant Fire Water Supply

Plant fire protection water will be stored in separate tanks supplied from groundwater wells or from the sediment ponds. Fire protection pumps adjacent to the tanks will be designed to supply the fire protection system at the necessary flow rates and pressure. The sediment ponds could be used to provide additional or emergency sources of fire protection water, if necessary.

4.11.8.4 Plant Site Domestic Water Supply

Maximum peak and average daily domestic water demands for the process plant, office and maintenance facility, including mine dry, warehouse, and offices are based on the quantities required for showers during shift change plus daily consumption for personnel. Maximum peak and average daily water flow demands estimated by scaling Trend Coal Mine estimates are as follows:

- maximum peak flow = 7.3 L/s
- average (24-hour) flow = 52 m^3/day

Existing wells around the Trend Coal Mine suggest that the above domestic consumption requirements will be readily met by wells.

4.11.8.5 Dust Control Water Supply

Water for dust suppression through road watering will be drawn from the sediment ponds. Water demand for road watering will be seasonal and will vary with weather conditions and when in use will consume 31 m^3/hr of water.

4.11.8.6 Sewage and Wastewater Treatment

A modular sewage treatment system sized to handle 450 people will be used. This will expand on existing Trend facilities.

If additional capacity is required during construction, additional modules may be leased temporarily. Treated effluent will be discharged to a sedimentation pond. Sewage sludge will be dewatered and trucked offsite for disposal.

4.11.9 Water Management during Construction

Water management facilities consist of water diversion channels, water collection channels and sediment ponds. Channel construction will occur throughout the Project as the mine develops. Water management facilities will be designed to manage mine water through operational and closure phases of the Project.

PRC staff will be on site to monitor and manage construction activities.

Water management structures (channels and ponds) will be constructed before mine development activities to provide adequate runoff and sediment control. Road drainage will be established along with road development. Installation of road culverts will occur at grade, and a rock splash pad or straw-bale check dams will be placed below the outlet of the culvert. Road cut and fill slopes will be either hydro-seeded with a seed-mulch mix following construction, or will have a thin veneer of clean gravel covering the road cut slopes. Grubbed woody material will be used to construct brush fences at the base of road fills to minimize sediment transport out of the disturbed area.

Collector ditches will be constructed in an upstream direction. Any in-stream work will be undertaken during low-flow periods. Riprap and other materials placed within the wetted perimeter of channels will be carefully selected to be clean and free of any deleterious substances. Temporary training berms, pumped diversions or temporary gravity diversion channels and protective works will be used to prevent natural flows from effects channel construction activities, especially where collector channels cross existing gullies and creek channels. Construction of major earthworks such as sediment pond embankments will be carried out in the non-freezing season to allow for proper fill placement and compaction. Off-stream channel excavation and placement of filter material and riprap armour may continue into the winter months depending on snow depths and snow removal requirements.

All exposed and disturbed areas will be protected from erosion as described in the Surface Erosion and Sediment Control Plan (see Section 5.5). Excess excavated soil will be stockpiled, used in embankment construction, or isolated and revegetated to minimize erosion. Best management practices will be used to control or collect potential sediment-carrying flows as the collector ditches, sediment ponds, pits and waste dump areas are initially developed. Practices could include the use of brush silt fences around the perimeter of work areas or at the base of cut slopes and the installation of a series of smaller sumps within the pit and ditches to settle out coarser sediments disturbed during construction. Alternative sediment control measures, such as staked-straw-bale structures or geofabric silt curtains, could also be used where warranted. The amount of area disturbed at any time over the initial construction period will be minimized through careful development planning. All disturbed ground will be stabilized by progressive temporary and permanent reclamation as required.

4.11.10 Water Management during Operations

4.11.10.1 Waste Dump Runoff

Water management around the waste rock dumps will evolve over time, depending on the extent and height of each dump. Waste rock dumps will be built in lifts with dumping from near-horizontal benches with a safety berm constructed along the crest of the bench perimeter. Bench surfaces will be graded to direct flow away from the outer slopes towards perimeter collector ditches leading to the primary collector ditches. Runoff water draining over the face of the dumps will be limited to prevent erosion resulting from gully formation on the dump faces.

Waste material for the Project will be placed into the south dump and the north dump. The south dump located south of the Gates pit will be developed first. Runoff and seepage from the south dump and the developing pits will be collected in ditches RS1 and RS2 and directed into sediment pond RP1 for removal of suspended sediment. Pond RP1 will discharge into Babcock Creek via an armoured spillway and outlet channel.

As the south dump expands and pit development continues, ditch RS1 will be extended to the south via ditch RS4 and to the north via ditch RS3. At this time ditch RS2 and pond RP1 will be decommissioned and all runoff and seepage collected from the south dump will be directed northwards by gravity into the west end of the Gates pit pond RP3.

Before placement of any waste materials in the north dump area, ditches RN1, RN2 and RN3 will be constructed flowing north and leading into the new sediment pond RP2 located near the Trend Coal Mine sediment ponds SP1B and SP2. These ditches will be located above and roughly parallel to Babcock Creek over a distance of about 1500 m and will intercept runoff and seepage from the active north dump area.

As described in Section 4.11.10.3, water will also be pumped into ditch RN1 from the Gates pit pond RP3 starting in Year 2 of operations. Pond RP2 has been sized to accommodate pumped flows from pond RP3 as well as runoff flows from the north dump area.

4.11.10.2 Tailings Disposal

Initially, the CCR and fine tailings (-0.15 mm) will be dewatered using a filter press and placed in waste dumps as PAG layers. As described in Section 4.11.10.3, after the second year of operations all fine tailings and PAG CCR will be transported in a slurry pipeline and via truck respectively to the Gates pit pond RP3 at a rate of about 0.32 mtpa of solids (fine tailings at 0.179 mtpa plus PAG CCR at 0.144 mtpa). Tailings slurry will contain about 30 percent solids by weight and the tailings will settle with an estimated dry density of 0.7 t/m^3. Settling tests will be done to determine the need (or not) for flocculants to optimize tailings solids settling. Water will be reclaimed from pond RP3 at a rate sufficient to satisfy the plant water demand (Section 4.11.8.2).

4.11.10.3 Pit Water Management

Runoff from areas disturbed by pre-stripping and initial pit development will be collected in ditch RS1 and directed to sediment pond RP1 for suspended sediment removal before discharge to Babcock Creek. As the western end of the pit deepens, local runoff and seepage accumulating within the pit will be pumped out from the pit sumps into ditch RN1 leading to sediment pond RP2. Pump locations will vary as the pit is developed, and

pump locations and capacities will be selected so as to minimize disruptions to pit operations.

After about Year 2, no further pit development will take place at the western end of the Gates pit. Pond RP3 will be developed within the pit (see Figure 4.11-2), ditch RS1 will be abandoned and all runoff and seepage from the south dump area will be directed in the pit. Also at this time, the discharge of tailings and the dumping of PAG waste material into the pit will commence. Pond RP3 will have a total available storage volume of about 7.3 Mm^3 up to elevation 1417 m, the estimated low point at the western end of the pond with 6.2 Mm^3 available for tailings, PAG CCR and PAG waste deposition.

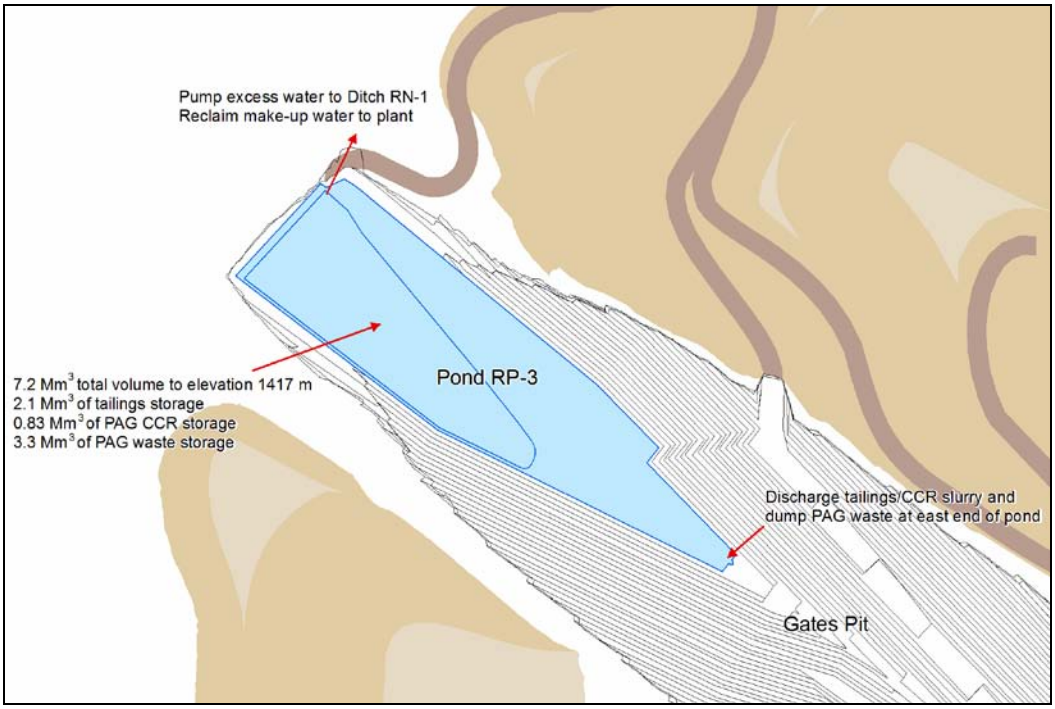

Figure 4.11-2 Gates Pit Pond RP3

Over an eight-year period, the pre-feasibility mine plan calls for the discharge and subaqueous deposition of approximately 1.4 Mt (2.1 Mm^3) of tailings, 8.25 Mt (3.3 Mm^3) of potential PAG waste, and 1.15 Mt (0.83 Mm^3) of CCR into the Gates pit. Tailings discharge will be carried out at the eastern end of the pit pond to maximize flow path lengths and settling potential. Potential PAG waste and CCR solids will be dumped by truck also into the eastern end of the pond so that the solids will become submerged underwater as quickly as possible. Dumping locations will vary as the pond fills but will be situated as far from the western end of the pond as practical. Water will be reclaimed from the western end of the pit to the processing plant at a rate of 82 m^3/hour, sufficient to meet plant water demands (Section 4.11.8.2).

Water balance analyses indicate that the combination of local runoff and tailings and waste deposition will result in the water level in the Gates pit rising each year. The pit will be in water surplus each year with total water inflows greater than losses and could potentially fill to overflowing by about Year 6 to 8 of operations. In order to prevent uncontrolled overflow of pond RP3 into Babcock Creek during active mining operations,

excess water will be removed from the pit each year by pumping at a controlled rate into the northern ditch system leading to sediment pond RP2. On average, approximately 2.2 Mm^3 per year of excess water could be pumped from the pit towards pond RP2 to maintain water balance. Pumping rates will adjusted to match the Babcock Creek hydrograph; maximum pumping rates will occur during snowmelt with minimum rates during the winter. Sufficient freeboard will be maintained in the pit pond at all times during operations to allow for storage of local runoff from a 10-year return period snowmelt runoff or storm event without overflow into Babcock Creek.

Water quality will be constantly monitored in RP3 to optimize the tailings and waste material deposition locations and procedures while maximizing the settling rate of suspended solids within the pit pond. If necessary, flocculants will be added to the tailings discharge to encourage settling. Additional settling and flocculation (if required) of water pumped from the pit will occur in pond RP2 before final release to Babcock Creek.

Detailed annual and monthly water balance analyses and year-to-year waste placement schedules and dumping locations will be developed during the Mine Permit Application stage.

The eastern limit of the pit will eventually extend past the peak of Roman Mountain into the Gordon Creek drainage. Due to extremely steep topography and the existence of avalanche chutes and unstable ground it will not be feasible or practical to construct conventional runoff collector ditches or large sediment ponds around or close to the advancing pit perimeter. Potential suspended sediment generation towards Gordon Creek from pit operations will be controlled and limited by mine operations using some or all of the following best management practices when mining operations advance to and beyond the catchment divide between Babcock and Gordon creeks:

- Mining benches will be sloped towards Babcock Creek so that all pit runoff will be directed west towards pond RP3.
- Blasting powder factors will be reduced and blasts will be directed into the pit to limit material moving east beyond the pit rim during blasting.
- Clearing and grubbing will not be done ahead of the mining operation. Organic material will be combined with waste rock for this sensitive area.
- Smaller backhoe and dozer operations will replace large mining shovel operations in close proximity to the advancing pit rim.
- Silt fences, straw bales or other appropriate sediment control measures could be installed annually ahead of planned mining operations. Maximum use would be made of hand labour and small equipment to minimize ground disturbance during installation.
- If necessary, small local sumps with pumps could be established in existing gullies close to the advancing pit perimeter. Any sediment-containing runoff would be pumped back into the pit to drain to the west.

During the last years of operation a permanent erosion-resistant spillway will be constructed leading from pond RP3 to Babcock Creek. As described in Section 4.11.11, after the completion of active mining operations and once water quality in pond RP3 meets discharge criteria, pumping from the pond will stop and the pond will eventually fill to spillway level and discharge into Babcock Creek.

4.11.10.4 Flocculation Requirements

Sediment ponds will be designed in accordance with British Columbia Guidelines to remove non-filterable residue or TSS from disturbed area runoff. On occasions when the water from the sedimentation pond system is at risk of not meeting TSS discharge limits or surface water quality guidelines, source erosion control measures and settling aids, including flocculants, will be used to maintain levels below guidelines. In the event discharge limits for turbidity or TSS in sediment pond discharges are not met, site-specific best management practices will be implemented before flocculants are added to decrease sediment loads to acceptable levels. Flocculant use and management is described in greater detail in the Flocculant Management Plan presented in Section 5.

Sediment ponds RP1 and RP2 will be equipped with flocculation plants to add coagulants and flocculants to the pond inflows if necessary to improve suspended sediment settling within the pond. If necessary, flocculants could be added to the fine tailings slurry to improve settling in pond RP3.

Site-specific sediment control best management practices (BMPs) are the preferred mitigation strategy and it is understood that a flocculation program will be implemented only when sediment control BMPs and the sediment ponds are insufficient to meet British Columbia water quality standards, notably at the compliance points on Babcock Creek. The Flocculant Management Plan addresses both the short-term mitigation measures to control the TSS levels in the existing channels and constructed ditches through ongoing development and the long-term measures to control the TSS levels leaving the site during the operations period. Flocculant products and doses have been recommended based on their effectiveness and toxicity. The flocculants are effective in attaining the specified turbidity limits, yet are not present in concentrations that may be toxic to aquatic biota in the receiving streams.

4.11.10.5 Maintenance and Inspections

During operations, all ditches and culverts will be monitored on a monthly basis with additional inspections carried out after any major precipitation events. Monitoring will include physical inspection of the facilities and regular water quality sampling at key locations to continually evaluate system performance. Plugged culverts or ditches and areas of excessive erosion will be promptly repaired. Alternative suspended sediment control measures will be developed and applied where warranted. Annual evaluations of water quality compliance at the outlet of the ponds and surveys of the deposited sediment level in the ponds will be done to determine the need for cleaning. Sediment removed from ponds will be disposed within the waste dumps, into RP3 or mixed with reclamation soils if deemed suitable.

4.11.11 Post-closure Water Management

Progressive reclamation of disturbed areas and non-active or completed waste dumps will be done throughout the mine operating period. After all mining activities have ceased, all non-reclaimed waste dumps and disturbed areas will be reclaimed as per the Reclamation Plan. Reclamation material (topsoil and subsoil) will be replaced on the waste dump benches and slopes and contoured and vegetated to shed water and minimize erosion. Topsoil will be replaced on the facilities area and will be re-vegetated in compliance with the Reclamation Plan.

The water management and collection system will continue to be operated until such time as the runoff from all areas of the site is deemed acceptable for direct release to the environment without the need for treatment. At that time all ditches and sediment ponds (except RP3) will be progressively decommissioned and reclaimed. The intent is, as much as possible, to return site drainages to pre-existing patterns within stable channels that will mimic natural pre-mining flow and runoff processes.

Pond RP3 within the Gates pit will remain as a permanent pond. Overflows from the pond will be directed into a permanent erosion-resistant spillway and outlet channel into Babcock Creek. Due to concerns regarding selenium uptake in aquatic vegetation, the establishment of aquatic vegetation will be discouraged.

Pond RP2 will be drained, deposited sediment removed, the reservoir and dam embankment reclaimed and re-vegetated, and a stable flow channel established through the pond area along the natural drainage path.

Flows from reclaimed waste dump areas will be returned to or directed into natural gullies and channels wherever possible. All runoff collector channels and unused site roads will be decommissioned by re-grading, removing all culverts and re-vegetating. Permanent erosion protection measures will be installed as required at key locations.

Monitoring and inspections of the post-closure water management system will be done for a few years after completion of mining until the establishment of reclamation vegetation and a stable system. Repairs will be made as necessary to achieve long-term stability of the system.

4.11.12 Post-closure Site Water Balance

4.11.12.1 Water Balance Model Description

A continuous simulation monthly spreadsheet water balance model was developed to assess flows at various locations at and downstream of the Project during the closure period after completion of mining operations. Figure 4.11-3 shows a schematic drawing of the model, which extends from the upper catchments of Babcock and Gordon Creeks to the Murray River downstream of the confluence with the Wolverine River. The model includes the following modules for calculation of average and dry year monthly flow volumes from the Project and Trend Coal Mine facilities:

- the south dump draining via pond RP3 to Babcock Creek
- the north dump draining partly towards Babcock Creek and partly towards Gordon Creek
- the completed Gates pit pond RP3 draining to Babcock Creek
- reclaimed areas of the Trend Coal Mine draining to Babcock Creek in the area of sediment ponds SP1B, SP2 and SP3
- reclaimed areas of the Trend Coal Mine draining towards Gordon Creek in the area of sediment pond SP4

Key modeling locations in the downstream receiving waters were:

- Babcock Creek at B2, the location of the streamflow gauging station
- Babcock Creek at B5, approximately 3.6 km downstream of Babcock falls

- Babcock Creek at B3, the heritage highway crossing upstream of Flatbed Creek
- Gordon Creek at G3, downstream of the Trend facilities
- Flatbed Creek at F3, the Water Survey of Canada gauging station 07FB009
- Murray River at M2, downstream of the confluence with Flatbed Creek and upstream of the Wolverine River confluence
- Murray River at M3, downstream of the confluence with the Wolverine River

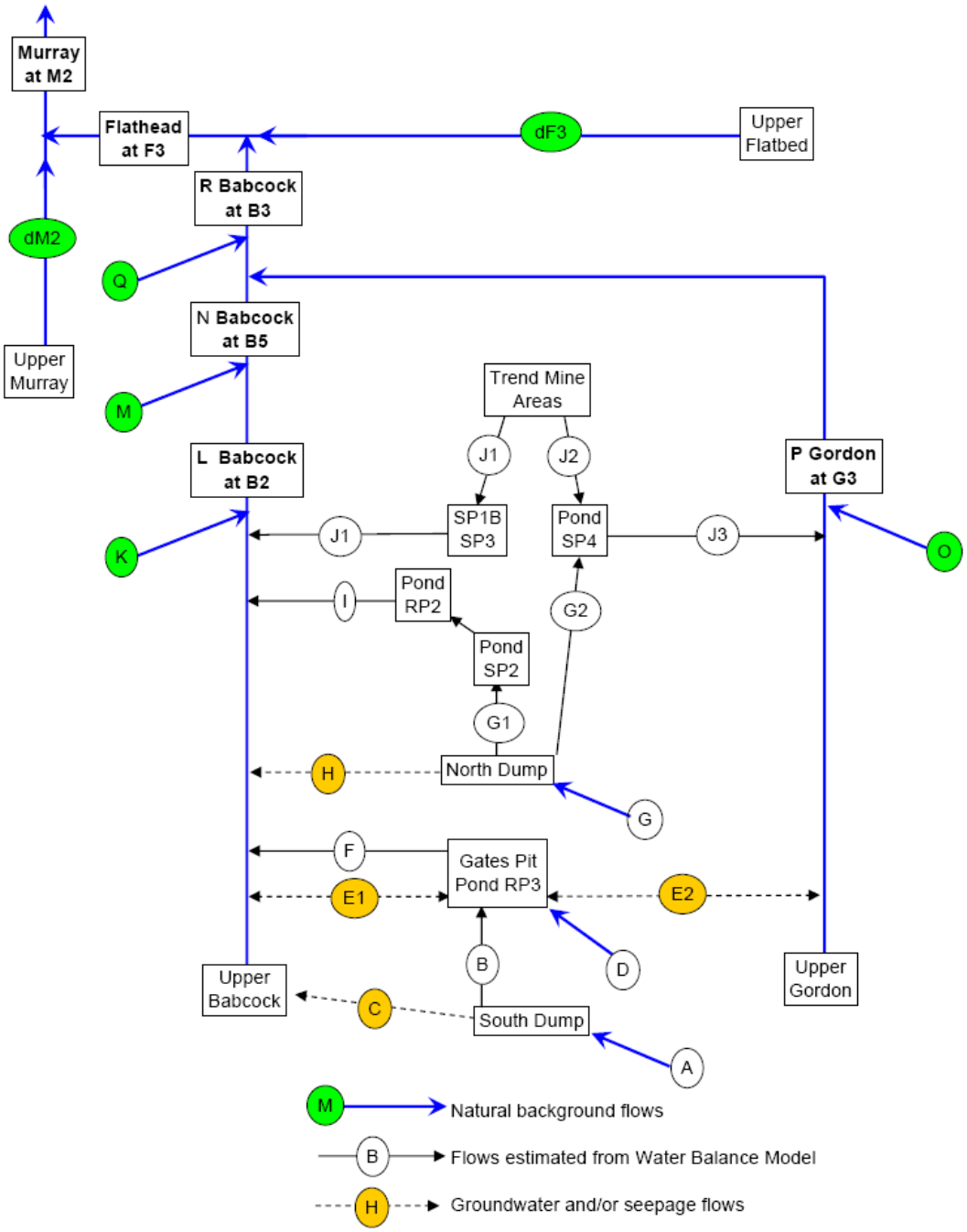

Figure 4.11-3 Roman Coal Mine Site Water Balance Schematic

Catchment areas for all locations in Figure 4.11-3 are summarized in Table 4.11-5. The figure shows the relative location of the various sediment ponds around the Project and Trend Coal Mine. At closure, all ponds will ultimately be decommissioned and flows from the various mine sub-areas will go directly to the local receiving waters.

Table 4.11-5 Mean Annual Runoff (mm) at Key Locations

Location	Catchment Area (km^2)	Average Catchment Elevation (m)	Mean Annual Runoff MAR (mm)
Babcock at B2	22	1,620	740
Babcock at B5	40	1,540	622
Gordon at G2	15.7	1,532	606
Gordon at G3	26.2	1,475	531
Babcock at B3	116	1,400	467
Flatbed at F3	486	1,180	271
(07FB009)	2,410	1,456	748
Murray at 07FB006	2,968	1,409	660
Murray at M2	3,883	1,375	567
Murray at M3			

4.11.12.2 Data and Assumptions

Mean Annual Runoff

The mean annual runoff (MAR) is the average depth of runoff from a given catchment area where runoff is defined as the net of precipitation minus evaporative losses. For the Project and downstream receiving waters the MAR was estimated using a combination of regional flow data from the Water Survey of Canada (WSC) and local site streamflow data collected since 2004. The data show that MAR decreases in a northerly direction from Roman Mountain in the south to Flatbed Creek in the north and is a function of elevation and area. Table 4.11-6 summarizes the estimated MAR for all key model locations. Site streamflow data suggest that MAR may be slightly higher at the higher elevation areas at the Project than at the Trend Coal Mine. For the purposes of the water balance model, it was conservatively assumed that the higher Project MAR applies also to the areas of the to-be-reclaimed Trend Coal Mine.

Evaporation and Evapotranspiration

Lake evaporation and land evapotranspiration rates were estimated using the computer model WREVAP developed by Environment Canada's National Hydrology Research Institute (NHRI 1985). WREVAP is a semi-empirical, semi-physical model that estimates evaporation from meteorological data (humidity, air temperature and sunshine duration). Details of the calculations are provided in the Baseline Hydrology section of the EA report.

For the Project area, annual lake evaporation was estimated to be about 550 mm with average land evapotranspiration losses from undisturbed ground of 290 mm, approximately 53 percent of lake evaporation. Evaporative losses from disturbed ground

were estimated to be 25 percent of lake evaporation rates or about 140 mm per year. Table 4.11-7 summarizes estimated monthly values for all evaporative losses.

In addition to evaporation losses during the non-freezing season, sublimation losses will occur from the snowpack during the winter months. Based on an assessment of regional snowpack data, annual average sublimation losses were estimated to be about 60 mm from October to March.

Precipitation

Some precipitation data have been collected at the Trend Coal Mine since 2004; however, the record length is inadequate to fully characterize Project area precipitation. As described in the Baseline Hydrology report, regional analyses of precipitation and snowpack data were used to develop relations between elevation and mean annual precipitation (MAP) in the Project area. For the water balance model the MAP was estimated to be 1090 mm based on the above evaluations of mean annual runoff, evapotranspiration losses, and sublimation losses. The 10-year return period dry year precipitation was estimated to be about 860 mm based on correlations with, and frequency analyses of, precipitation data collected at Bullmoose Mine. The Bullmoose Mine monthly data were also used to generate the estimated monthly precipitation distribution at the Project. Table 4.11-7 summarizes monthly average precipitation at Bullmoose Mine and the estimated average monthly precipitation at the Project. The table also shows estimated annual precipitation for extreme wet and dry conditions at both sites.

As previously noted for MAR, the Trend Coal Mine is possibly drier (lower MAP) than the Project due, in part, to lower elevations. For the purposes of the closure water balance model it was conservatively assumed that the Project and the Trend Coal Mine will experience similar annual average precipitation and runoff values.

Receiving Water Flows

Annual average and 10-year dry year (drought year) hydrographs were estimated for all key receiving water locations based on the regional and site streamflow data. Monthly flows for the hydrographs are summarized in Table 4.11-8 and Table 4.11-9. In the water balance model, mine catchment areas (i.e., waste dumps and pits) were subtracted from the receiving water location catchment areas and background receiving water flows were estimated for the remaining catchment areas at the key locations in the receiving waters.

For each key location, extreme low flows were also estimated using empirical equations developed from the regional and site data. The low flow statistics estimated were:

- mean annual minimum 7-day flow (7QMa)
- 10-year return period annual minimum 7-day flow (7Q10a)
- mean summer minimum 7-day flow (7QMs)
- 10-year return period summer minimum 7-day flow (7Q10s)

The first two statistics represent the average flow during the lowest part of the annual hydrograph, or more specifically the lowest seven consecutive days. The lowest flows will typically occur in the winter after a prolonged period of freezing. The last two statistics represent the average flow during the lowest seven consecutive days of the

period June 1 to September 30. The low flows for the key receiving water locations are shown on Table 4.11-10.

Waste Dump Behaviour

Runoff from and flow through waste dumps as a result of snowmelt, rainfall and infiltration is a complicated process due to variable grain-size material within the dumps, retention of infiltrated water on particle surfaces, the possible existence of preferential flow paths through the dump, and variable permeability layers on top of and within the dump. In an attempt to simulate this complex behaviour the following simplifying assumptions were made:

- All waste dumps will be reclaimed (capped with topsoil and revegetated in accordance with the reclamation plan) at the end of active mining operations.
- Potential monthly runoff from a dump surface corresponds to total precipitation minus evapotranspiration losses. Snowmelt runoff corresponds to cumulative winter precipitation (snowfall) minus sublimation losses.
- Average snowmelt was assumed to be distributed 10 percent in April, 60 percent in May and 30 percent in June each year.
- Monthly total infiltration into the dumps was assumed to be 40 percent of potential monthly runoff.
- Of the water infiltrating to a dump, 10 percent will be retained within the dump due to on-going wetting of dump material and a further 10 percent will eventually go into the local groundwater regime.
- Seepage from the dump, equal to net infiltration (total infiltration minus losses to wetting and groundwater), will exit the dump toe in a "lagged" fashion as follows: 40 percent of the current month net infiltration plus 30 percent of the previous month net infiltration plus 20 percent of net infiltration from two months prior plus 10 percent of net infiltration from three months prior.
- The infiltration water going to local groundwater will enter the local receiving water (Babcock Creek or Gordon Creek) following a typical groundwater recession curve estimated from regional and local streamflow data.

Open Pit Behaviour

The Gates pit was assumed to fill to overflowing at the end of mining operations. The total pit volume, estimated to be 7.3 Mm^3, will be partly filled during operations with tailings, PAG and other waste material and supernatant water. At closure, inflows to the pit will be from runoff from the pit walls and the local upslope catchment area. Outflows will be by seepage or overflow to Babcock Creek. Seepage from the pit was estimated by SRK to be 5 L/s to Babcock Creek with no seepage going to Gordon Creek.

For months when runoff inflows exceed evaporation plus seepage losses, surface overflow to Babcock Creek will occur. For months when evaporation plus seepage losses exceed runoff inflows, the pit volume will decrease. Overflow will occur again after the pit has filled up to the maximum volume.

4.11.12.3 Water Balance Results

The monthly water balance model was set up as a continuous simulation over a typical three year period after closure. The first two years represent average precipitation and runoff conditions and the third year represents a 10-year return period dry or drought conditions. The water balance model input data and results are summarized as follows:

- Table 4.11-7 summarizes all input data and assumptions.
- Table 4.11-8 presents monthly precipitation depths, evaporation losses and net runoff depths by area type (undisturbed or reclaimed land such as reclaimed waste dumps, disturbed ground such as exposed open pit walls, and water-covered land such as ponds).
- Table 4.11-9 presents monthly runoff volumes for each sub-area around the Project over the three-year simulation period.
- Table 4.11-10 shows monthly runoff volumes for all key receiving water locations including background (natural) flows and mine-related flows.
- Table 4.11-11 summarizes annual volumes of mine-related flows and background receiving water flows and the associated annual dilution ratios for average conditions (second year of simulation) and 10-year return period dry year (drought) conditions (third year of simulation).

The tables indicate that total Project post-closure water releases will be distributed about 73 percent to Babcock Creek and 27 percent to Gordon Creek. On an annual average basis about 6.3 and 2.4 Mm^3 of runoff will be generated from the mining areas to Babcock and Gordon creeks, respectively.

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Table 4.11-6 Estimated Background Pre-mining Flows at Key Locations

Item	Units	B2 Babcock Creek at Gauging Station	B5 Babcock Creek 3.6 km Downstream of Babcock Falls	G2 Gordon Creek at Talisman Road	G3 Gordon Creek 2.1 km Downstream of G2	B3 Babcock Creek at Heritage Highway	F3 Flatbed Creek at Heritage Highway	M2 Murray River below Flatbed Creek	M3 Murray River below Wolverine River
Catchment area	km^2	22.0	40.0	15.7	26.2	116	486	2,928	3,883
Average catchment elevation	m	1,623	1,541	1,532	1,476	1,400	1,181	1,409	1,375
Mean annual runoff									
as an equivalent depth	mm	740	622	606	531	467	271	660	567
as a long-term average flow	m^3/s	0.52	0.79	0.30	0.44	1.72	4.17	61.2	69.7
Mean monthly flow									
January	m^3/s	0.068	0.105	0.040	0.059	0.228	0.555	12.6	14.2
February	m^3/s	0.046	0.073	0.028	0.042	0.170	0.459	10.8	12.2
March	m^3/s	0.044	0.076	0.029	0.046	0.199	0.615	12.0	13.8
April	m^3/s	0.343	0.592	0.230	0.362	1.55	4.74	35.8	42.0
May	m^3/s	1.80	2.75	1.05	1.54	5.98	14.5	152.4	174.5
June	m^3/s	1.64	2.44	0.932	1.33	5.06	11.4	198.5	224.6
July	m^3/s	0.487	0.846	0.329	0.518	2.23	6.86	108.2	123.9
August	m^3/s	0.405	0.626	0.240	0.353	1.39	3.49	54.6	62.4
September	m^3/s	0.434	0.642	0.245	0.350	1.32	2.91	48.9	56.0
October	m^3/s	0.435	0.615	0.233	0.322	1.15	2.10	48.5	55.3
November	m^3/s	0.359	0.498	0.189	0.256	0.895	1.47	32.7	36.5
December	m^3/s	0.118	0.173	0.066	0.094	0.351	0.752	17.1	19.0
10-year drought hydrograph									
January	m^3/s	0.031	0.048	0.019	0.028	0.110	0.284	8.37	9.54
February	m^3/s	0.017	0.029	0.011	0.018	0.076	0.227	7.38	8.41
March	m^3/s	0.014	0.024	0.009	0.015	0.063	0.189	6.75	7.69
April	m^3/s	0.253	0.427	0.166	0.257	1.09	3.23	25.7	29.3
May	m^3/s	1.60	2.38	0.911	1.31	4.96	11.2	144.3	164.6
June	m^3/s	1.28	1.86	0.709	0.998	3.69	7.65	149.7	170.6
July	m^3/s	0.380	0.662	0.250	0.334	1.14	3.77	86.6	96.2
August	m^3/s	0.122	0.180	0.069	0.098	0.371	0.821	47.3	53.9
September	m^3/s	0.145	0.202	0.077	0.105	0.371	0.639	31.3	35.6
October	m^3/s	0.181	0.254	0.096	0.132	0.467	0.813	27.5	31.4
November	m^3/s	0.077	0.115	0.044	0.063	0.243	0.565	13.6	15.5
December	m^3/s	0.051	0.076	0.029	0.042	0.163	0.383	9.9	11.2
Annual	m^3/s	0.347	0.524	0.200	0.284	1.07	2.49	46.7	53.1
Low flow statistics									
7QMa	m^3/s	0.022	0.038	0.012	0.019	0.103	0.360	9.36	10.65
7Q10a	m^3/s	0.009	0.015	0.004	0.007	0.043	0.110	6.21	7.07
7QMs	m^3/s	0.157	0.229	0.079	0.113	0.469	1.00	29.0	33.0
7Q10s	m^3/s	0.038	0.057	0.019	0.027	0.122	0.160	15.6	17.7

NOTES:
Most of the flow statistics in this table were estimated using Regional Analysis. Exceptions were F3 (all flow statistics), B2 (MAR and mean monthly flows), Unnamed Creek (MAR) and G2 (MAR). The flow values for these exceptions were based on streamflow gauging stations operated at these locations.
The Water Survey of Canada has operated a streamflow gauging station at F3 since 1982 (WSC Station 07FB009). Flows for this site were based on statistical analyses of the station's 26-year long streamflow record.
Mean monthly flows were estimated based on the normalized monthly flow distributions for Stations B2 and F3 (07FB009). The seasonal runoff distributions for Unnamed Creek, B5, G2, G3 and B3 were assumed to follow patterns intermediate to those observed at B2 (high-elevation catchment) and F3 (low-elevation catchment).
For purpose of low flow analysis, summer was defined as period June 1 to September 30. The 7Q10s flow for each site (except F3) is the average of two estimates, one using regional analysis and the other obtained by prorating the 7!10s flow for F3 according to the ratio of average flows at the given site and F3.

Table 4.11-7 Roman Coal Mine Monthly Water Balance–Closure–Input Data

Hydrology

Snowmelt Distribution 10% in April, 60% in May, 30% in June
Winter Snowpack Losses = 60 mm (October to March)
Assume Snowfall is from November to March, plus
30% of October Total Precipitation
60% of April Total Precipitation
(i.e. any minor rainfall from Nov to March is treated as snowfall)

Estimated MAP = 1092 mm = MAR + Actual ET Loss + Sublimation
Estimated MAR = 740 mm

Disturbed Ground Losses = 25% of Pond Evap.
Annual Evapotranspiration = 53% of Pond Evap.

Waste Dump Runoff Distribution

Infiltration = 40% Apr to Jun Snowmelt
40% July to October
(as % of Potential Runoff = P - E/T)

Total to Void Losses = 10% of Infiltration
Total To Groundwater = 10% of Infiltration

Waste Dump Seepage Outflow Distribution

Current Month = 40% of Current Month Net Infiltration
plus 30% of Month -1 Net Infiltration
plus 20% of Month -2 Net Infiltration
plus 10% of Month -3 Net Infiltration

Seepage to/from Gates Pit

Gates to Babcock = 5 L/s
Gates to Gordon = 0 L/s
(values estimated by SRK)

Maximum Pit Volume = 7.8 Mm3

Average Monthly Conditions (mm)

	at Bullmoose Mine			Average Conditions at Roman Mine				
Month	Average Rainfall	Average Snowfall	Average Precip	Average Precip	Pond Evap	Actual EvapoTrans	Disturbed Losses	% of G'Water Baseflow
Jan	5.1	63.9	69.0	95.5	0.0	0.0	0.0	3.0%
Feb	7.8	41.9	49.7	68.8	0.0	0.0	0.0	1.9%
Mar	5.5	42.8	48.3	66.8	22.0	11.7	5.5	2.4%
April	12.8	20.4	33.2	45.9	57.0	30.2	14.3	5.4%
May	36.6	4.6	41.2	57.0	93.0	49.3	23.3	8.2%
June	94.0	0.3	94.3	130.5	108.0	57.2	27.0	10.3%
July	89.5	0.0	89.5	123.8	118.0	62.5	29.5	12.2%
Aug	73.5	1.0	74.5	103.1	93.0	49.3	23.3	13.6%
Sept	59.6	6.5	66.1	91.5	42.0	22.3	10.5	13.6%
Oct	52.9	30.6	83.5	115.5	17.0	9.0	4.3	13.6%
Nov	12.0	70.3	82.3	113.9	0.0	0.0	0.0	10.9%
Dec	6.8	50.4	57.2	79.2	0.0	0.0	0.0	4.9%
YEAR	456.1	332.7	788.8	1091.5	550.0	291.5	137.5	100%

Annual Precipitation & Runoff Probability (mm)

		Bullmoose Mine		Roman Mine	
Return Period		Precip.	Runoff	Precip.	Runoff
25 yr Dry	0.5	547	196	788	436
10 yr Dry	1	596	245	858	507
5 yr Dry	1.5	647	296	932	580
Average	2	758	407	1092	740
5 yr Wet	5	891	540	1283	932
10 yr Wet	10	970	619	1397	1045
25 yr Wet	25	1,060	709	1526	1175
50 yr Wet	50	1,130	779	1627	1276
100 yr Wet	100	1,190	839	1714	1362
200 yr Wet	200	1,250	899	1800	1448

Catchment Areas (ha)

	Total	Pond	Reclaimed	Disturbed
Operating Mine Areas				
South Dump Area (A)	80	0	80	0
Gates Pit Area (D)	285	12	30	243
North Dump Area (G1)	252	0	252	0
North Dump Area (G2)	142	0	142	0
Trend SP1B-SP3 (J1)	222	0	222	0
Trend SP4 (J2)	201	0	201	0

	Total	Background	Mine Area
Background Flow Areas			
Babcock at B2 (K)	2,200	1,361	839
Babcock at B5 (M)	4,000	3,161	839
Babcock at B3 (Q)	11,600	10,418	1,182
Gordon at G2 (O1)	1570	1227	343
Gordon at G3 (O2)	2,620	2,277	343
Flathead at F3	48,600	47,418	1,182
Murray at M2	292,800	291,618	1,182
Murray at M3	388,300	387,118	1,182

Table 4.11-8 Roman Coal Mine Monthly Precipitation and Runoff Depths (mm) by Area Type

Month	Return Period	Total Precip (mm)	Evaporative Losses (mm)			Cumulative Net Snowfall	Snowmelt	Net Runoff (mm) from Area Types			Dump Areas Runoff (mm) – Reclaimed Land				Dump Areas Runoff (mm) – Disturbed Land				Pit Area Runoff
			Pond	Land	Disturbed			Ponds	Reclaimed Land	Disturbed Ground	Surface Runoff	Seeps	To Ground Water	Ground Water Discharge	Surface Runoff	Seeps	To Ground Water	Ground Water Discharge	
October	Average	115.5	17	9	4.3	24.7	0	69	74.6	77.9	44.7	23.9	3	4	46.7	24.9	3.1	4.8	77.2
November	Average	113.9	0	0	0	128.5	0	0	0	0	0	0	0	3.2	0	0	0	3.8	0
December	Average	79.2	0	0	0	197.7	0	0	0	0	0	0	0	1.4	0	0	0	1.7	0
January	Average	95.5	0	0	0	283.2	0	0	0	0	0	0	0	0.9	0	0	0	1.1	0
February	Average	68.8	0	0	0	341.9	0	0	0	0	0	0	0	0.6	0	0	0	0.7	0
March	Average	66.8	22	11.7	5.5	398.8	0	0	0	0	0	0	0	0.7	0	0	0	0.8	0
April	Average	45.9	57	30.2	14.3	392.1	39.2	34.8	45.5	51.9	27.3	14.6	1.8	1.6	31.1	16.6	2.1	1.9	50.5
May	Average	57	93	49.3	23.3	352.9	235.3	199.3	243	269	145.8	77.8	9.7	2.4	161.4	86.1	10.8	2.9	263.4
June	Average	130.5	108	57.2	27	117.6	117.6	140.1	190.9	221.1	144.5	61.1	7.6	3	132.7	70.8	8.8	3.6	214.5
July	Average	123.8	118	62.5	29.5	0	0	5.8	61.3	94.3	36.8	19.6	2.5	3.6	56.6	30.2	3.8	4.3	87.1
August	Average	103.1	93	49.3	23.3	0	0	10.1	53.8	79.8	32.3	17.2	2.2	4	47.9	25.5	3.2	4.8	74.2
September	Average	91.5	42	22.3	10.5	0	0	49.5	69.2	81	41.5	22.1	2.8	4	48.6	25.9	3.2	4.8	78.4
October	Average	115.5	17	9	4.3	24.7	0	69	74.6	77.9	44.7	23.9	3	4	46.7	24.9	3.1	4.8	77.2
November	Average	113.9	0	0	0	128.5	0	0	0	0	0	0	0	3.2	0	0	0	3.8	0
December	Average	79.2	0	0	0	197.7	0	0	0	0	0	0	0	1.4	0	0	0	1.7	0
January	Average	95.5	0	0	0	283.2	0	0	0	0	0	0	0	0.9	0	0	0	1.1	0
February	Average	68.8	0	0	0	341.9	0	0	0	0	0	0	0	0.6	0	0	0	0.7	0
March	Average	66.8	22	11.7	5.5	398.8	0	0	0	0	0	0	0	0.7	0	0	0	0.8	0
April	Average	45.9	57	30.2	14.3	392.1	39.2	34.8	45.5	51.9	27.3	14.6	1.8	1.6	31.1	16.6	2.1	1.9	50.5
May	Average	57	93	49.3	23.3	352.9	235.3	199.3	243	269	145.8	77.8	9.7	2.4	161.4	86.1	10.8	2.9	263.4
June	Average	130.5	108	57.2	27	117.6	117.6	140.1	190.9	221.1	114.5	61.1	7.6	3	132.7	70.8	8.8	3.6	214.5
July	Average	123.8	118	62.5	29.5	0	0	5.8	61.3	94.3	36.8	19.6	2.5	3.6	56.6	30.2	3.8	4.3	87.1
August	Average	103.1	93	49.3	23.3	0	0	10.1	53.8	79.8	32.3	17.2	2.2	4	47.9	25.5	3.2	4.8	74.2
September	Average	91.5	42	22.3	10.5	0	0	49.5	69.2	81	41.5	22.1	2.8	4	48.6	25.9	3.2	4.8	78.4
October	10 yr Dry	90.8	17	9	4.3	17.3	0	51.7	57.3	60.6	34.4	18.3	2.3	2.8	36.4	19.4	2.4	3.5	59.9
November	10 yr Dry	89.5	0	0	0	96.8	0	0	0	0	0	0	0	2.2	0	0	0	2.8	0
December	10 yr Dry	62.2	0	0	0	149	0	0	0	0	0	0	0	1	0	0	0	1.3	0
January	10 yr Dry	75.1	0	0	0	214.1	0	0	0	0	0	0	0	0.6	0	0	0	0.8	0
February	10 yr Dry	54.1	0	0	0	258.2	0	0	0	0	0	0	0	0.4	0	0	0	0.5	0
March	10 yr Dry	52.6	22	11.7	5.5	300.7	0	0	0	0	0	0	0	0.5	0	0	0	0.6	0
April	10 yr Dry	36.1	57	30.2	14.3	288.2	28.8	20.5	31.2	37.6	18.7	10	1.2	1.1	22.5	12	1.5	1.4	36.2
May	10 yr Dry	44.8	93	49.3	23.3	259.4	172.9	124.7	172.9	194.5	103.8	55.3	6.9	1.7	116.7	62.2	7.8	2.1	189.3
June	10 yr Dry	102.6	108	57.2	27	86.5	86.5	81.1	131.8	162.1	79.1	42.2	5.3	2.1	97.2	51.9	6.5	2.6	155.5
July	10 yr Dry	97.4	118	62.5	29.5	0	0	-20.6	34.8	67.9	20.9	11.1	1.4	2.5	40.7	21.7	2.7	3.1	60.7
August	10 yr Dry	81.1	93	49.3	23.3	0	0	-11.9	31.8	57.8	19.1	10.2	1.3	2.8	34.7	18.5	2.3	3.5	52.1
September	10 yr Dry	71.9	42	22.3	10.5	0	0	29.9	49.7	61.4	29.8	15.9	2	2.8	36.9	19.7	2.5	3.5	58.9
Annual Totals (mm)																			
Average		1091.5	550	291.5	137.5		392.1	508.6	738.3	875.1	443	236.3	29.5	29.5	525.1	280	35	35	845.3
10-year Dry		858.2	550	291.5	137.5		288.2	275.3	509.5	641.8	305.7	163	20.4	20.4	385.1	205.4	25.7	25.7	612.5

Table 4.11-9 Roman Coal Mine Monthly Runoff Volumes (m^3) by Area

Month	Return Period	South Dump		Gates Pit				Gates Pit Water Volume	North Dumps				Trend Coal Mine		Total Mining-related Releases				
		B	C	D	E1	E2	F		1 (=G1)	G2	H1	H2	J1	J2	Roman Coal Mine		Trend Coal Mine		J3=G2+J2
		Total Runoff	Seepage to Babcock	Gates Pit Net Runoff	Seepage to Babcock	Seepage to Gordon	Gates Pit Surface Discharge		Total Runoff to Babcock	Total Runoff to Gordon SP4	Seepage to Babcock	Seepage to Gordon	Total from SP1B-3 Area	Total from SP4 Area	to Babcock ck	to Gordon Ck	to Babcock Ck (J1)	to Gordon Ck (J2)	Total to Gordon (SP4)
October	Average	53,070	3,213	219,959	13,392	0	259,637	7,800,000	167,171	94,200	10,121	5,703	156,186	141,412	453,534	99,903	156,186	141,412	241,315
November	Average	10,648	2,575	0	12,960	0	0	7,797,688	33,541	18,900	8,112	4,571	36,694	33,223	57,187	23,471	36,694	33,223	56,693
December	Average	5,590	1,158	0	13,392	0	0	7,789,886	17,608	9,922	3,647	2,055	18,724	16,953	35,804	11,977	18,724	16,953	28,930
January	Average	1,909	709	0	13,392	0	0	7,778,403	6,014	3,389	2,233	1,258	7,264	65,773	22,347	4,647	7,264	6,577	11,224
February	Average	0	449	0	12,096	0	0	7,766,307	0	0	1,414	797	1,246	1,128	13,959	797	1,246	1,128	1,925
March	Average	0	567	0	13,392	0	0	7,752,915	0	0	1,786	1,006	1,573	1,425	15,745	1,006	1,573	1,425	2,431
April	Average	26,503	1,276	143,921	12,960	0	110,379	7,800,000	83,485	47,043	4,019	2,264	77,086	69,794	212,118	49,308	77,086	69,794	119,102
May	Average	145,023	1,937	750,604	13,392	0	882,235	7,800,000	456,821	257,415	6,102	3,439	407,814	369,237	1,360,488	260,854	407,814	369,237	630,091
June	Average	132,168	2,433	611,432	12,960	0	730,640	7,800,000	416,329	234,598	7,665	4,319	373,519	338,186	1,170,027	238,917	373,519	338,186	577,103
July	Average	63,972	2,882	248,352	13,392	0	298,932	7,800,000	201,511	113,550	9,079	5,116	185,520	167,971	525,796	118,666	185,520	167,971	286,636
August	Average	52,036	3,213	211,360	13,392	0	250,003	7,800,000	163,912	92,363	10,121	5,703	153,315	138,812	440,641	98,066	153,315	138,812	236,878
September	Average	52,463	3,213	233,444	12,960	0	262,947	7,800,000	165,258	93,122	10,121	5,703	154,501	139,886	454,499	98,825	154,501	139,886	238,710
October	Average	53,070	3,213	219,959	13,392	0	259,637	7,800,000	167,171	94,200	10,121	5,703	156,186	141,412	453,534	99,903	156,186	141,412	241,315
November	Average	10,648	2,575	0	12,960	0	0	7,797,688	33,541	18,900	8,112	4,571	36,694	33,223	57,187	23,471	36,694	33,223	56,693
December	Average	5,590	1,158	0	13,392	0	0	7,789,886	17,608	9,922	3,647	2,055	18,724	16,953	35,804	11,977	18,724	16,953	28,930
January	Average	1,909	709	0	13,392	0	0	7,778,403	6,014	3,389	2,233	1,258	7,264	6,577	22,347	4,647	7,264	6,577	11,224
February	Average	0	449	0	12,096	0	0	7,766,307	0	0	1,414	797	1,246	1,128	13,959	797	1,246	1,128	1,925
March	Average	0	567	0	13,392	0	0	7,752,915	0	0	1,786	1,006	1,573	1,425	15,745	1,006	1,573	1,425	2,431
April	Average	26,503	1,276	143,921	12,960	0	110,379	7,800,000	83,485	47,043	4,019	2,264	77,086	69,794	212,118	49,308	77,086	69,794	119,102
May	Average	145,023	1,937	750,604	13,392	0	882,235	7,800,000	456,821	257,415	6,102	3,439	407,814	369,237	1,360,488	260,854	407,814	369,237	630,091
June	Average	132,168	2,433	611,432	12,960	0	730,640	7,800,000	416,329	234,598	7,665	4,319	373,519	338,186	1,170,027	238,917	373,519	338,186	577,103
July	Average	63,972	2,882	248,352	13,392	0	298,932	7,800,000	201,511	113,550	9,079	5,116	185,520	167,971	525,796	118,666	185,520	167,971	286,636
August	Average	52,036	2,313	211,360	13,392	0	250,003	7,800,000	163,912	92,363	10,121	5,703	153,315	138,812	440,641	98,066	153,315	138,812	236,878
September	Average	52,463	3,213	223,444	12,960	0	262,947	7,800,000	165,258	93,122	10,121	5,703	154,501	139,886	454,499	98,825	154,501	139,886	238,710
October	10 yr Dry	43,003	2,217	170,694	13,392	0	200,306	7,800,000	135,460	76,330	6,984	3,936	125,486	113,616	358,359	80,266	125,486	113,616	193,882
November	10 yr Dry	9,320	1,777	0	12,960	0	0	7,796,360	29,359	16,543	5,598	3,154	30,795	27,882	49,694	19,698	30,795	27,882	47,580
December	10 yr Dry	4,705	799	0	13,392	0	0	7,787,673	14,820	8,351	2,516	1,418	15,273	13,828	31,527	9,769	15,273	13,828	23,597
January	10 yr Dry	1,467	489	0	13,392	0	0	7,775,748	4,620	2,603	1,541	868	5,427	4,914	20,041	3,471	5,427	4,914	8,385
February	10 yr Dry	0	310	0	12,096	0	0	7,763,652	0	0	976	550	860	778	13,382	550	860	778	1,328
March	10 yr Dry	0	391	0	13,392	0	0	7,750,260	0	0	1,233	695	1,086	983	15,016	695	1,086	983	1,678
April	10 yr Dry	18,162	880	103,105	12,960	0	58,567	7,800,000	57,211	32,238	2,773	1,563	52,843	47,845	132,391	33,801	52,843	47,845	81,645
May	10 yr Dry	103,105	1,337	539,478	13,392	0	629,190	7,800,000	324,781	183,011	4,211	2,373	289,826	262,410	972,911	185,384	289,826	262,410	447,794
June	10 yr Dry	91,649	1,679	443,081	12,960	0	521,771	7,800,000	288,696	162,678	5,290	2,981	258,987	234,488	830,395	165,658	258,987	234,488	400,147
July	10 yr Dry	40,065	1,989	172,918	13,392	0	199,591	7,800,000	126,205	71,115	6,265	3,530	116,700	105,660	347,442	74,646	116,700	105,660	180,306
August	10 yr Dry	32,353	2,217	148,568	13,392	0	167,528	7,800,000	101,911	57,426	6,984	3,936	95,931	86,857	292,033	61,361	95,931	86,857	148,218
September	10 yr Dry	36,519	2,217	167,732	12,960	0	191,291	7,800,000	115,034	64,820	6,984	3,936	107,492	97,324	328,486	68,756	107,492	97,324	166,080

Table 4.11-10 Roman Coal Mine Monthly Runoff Volumes (m^3) at Key Receiving Water Locations

Month	Return Period	Babcock at B2		Babcock at B5		Gordon at G2		Gordon at G3		Babcock at B3		Flatbed at F3		Murray at M2		Murray at M3	
		K	L	M	N=M+L-K	O1	1=O1+E2 +J3	O	P=O+E2+ J3	Q	R	dF3	F3	dM2	M2	dM3	M3
		Background Flow	Total Flow	Background Flow	Total Flow	Background Flow	Total Flow	Background Flow	Total Flow	Background Flow	Total Flow	Background Flow	Total Flow	Background Flow	Total Flow	Background Flow	Total Flow
October	Average	720,704	1,330,425	1,300,844	1,910,564	488,694	730,009	748,544	989,859	2,768,720	3,619,756	5,482,773	6,333,809	129,814,101	130,665,137	148,064,612	148,915,647
November	Average	575,399	669,281	1,019,629	1,113,510	382,113	438,806	576,702	633,396	2,082,448	2,233,023	3,706,515	3,857,090	84,654,675	84,805,250	94,518,267	94,668,841
December	Average	195,939	250,467	367,078	421,607	138,565	167,495	218,325	247,254	843,419	926,877	1,965,665	2,049,123	45,811,073	45,894,531	50,887,404	50,970,862
January	Average	113,486	143,098	221,439	251,050	84,009	95,233	136,205	147,428	548,190	589,025	1,451,191	1,492,026	33,645,559	33,686,394	38,077,728	38,118,563
February	Average	68,314	83,519	139,203	154,408	53,081	55,005	88,512	90,437	369,906	387,035	1,082,670	1,099,799	26,024,622	26,041,751	29,528,963	29,546,092
March	Average	72,307	89,626	160,330	177,649	61,706	64,137	108,034	110,465	479,339	499,089	1,605,978	1,625,727	32,220,090	32,239,839	37,008,144	37,027,893
April	Average	550,073	839,277	1,213,025	1,502,230	466,583	585,685	814,484	933,586	3,601,408	4,009,715	11,980,931	12,389,238	92,695,811	93,104,118	108,900,047	109,308,354
May	Average	2,983,179	4,715,481	5,816,169	7,584,471	2,206,318	2,836,409	3,575,146	4,205,237	14,378,132	16,776,525	37,979,512	40,377,905	408,134,392	410,532,785	467,330,875	469,729,267
June	Average	2,627,070	4,170,616	4,991,333	6,534,879	1,887,450	2,464,554	3,004,190	3,581,293	11,779,354	13,900,003	28,823,031	30,943,680	514,641,591	516,762,240	582,233,678	584,354,327
July	Average	807,517	1,518,833	1,790,622	2,501,938	689,151	975,788	1,206,587	1,493,224	5,353,706	6,351,659	17,938,026	18,935,978	289,768,842	290,766,794	331,740,643	332,738,596
August	Average	671,316	1,265,272	1,324,796	1,918,752	503,281	740,159	822,158	1,059,036	3,343,460	4,174,294	9,111,904	9,942,738	146,272,768	147,103,602	167,053,657	167,884,491
September	Average	696,472	1,305,471	1,315,463	1,924,462	497,070	735,780	787,829	1,026,539	3,070,094	3,917,803	7,364,918	8,212,628	126,674,678	127,522,388	145,220,149	146,067,859
October	Average	720,704	1,330,425	1,300,844	1,910,564	488,694	730,009	748,544	989,859	2,768,720	3,619,756	5,482,773	6,333,809	129,814,101	130,665,137	148,064,612	148,915,647
November	Average	575,399	669,281	1,019,629	1,113,510	382,113	438,806	576,702	633,396	2,082,448	2,233,023	3,706,515	3,857,090	84,654,675	84,805,250	94,518,267	94,668,841
December	Average	195,939	250,467	367,078	421,607	138,565	167,495	218,325	247,254	843,419	926,877	1,965,665	2,049,123	45,811,073	45,894,531	50,887,404	50,970,862
January	Average	113,486	143,098	221,439	251,050	84,009	95,233	136,205	147,428	548,190	589,025	1,451,191	1,492,026	33,645,559	33,686,394	38,077,728	38,118,563
February	Average	68,314	83,519	139,203	154,408	53,081	55,005	88,512	90,437	369,906	387,035	1,082,670	1,099,799	26,024,622	26,041,751	29,528,963	29,546,092
March	Average	72,307	89,626	160,330	177,649	61,706	64,137	108,034	110,465	479,339	499,089	1,605,978	1,625,727	32,220,090	32,239,839	37,008,114	37,027,893
April	Average	550,073	839,277	1,213,025	1,502,230	466,583	585,685	814,484	933,586	3,601,408	4,009,715	11,980,931	12,389,238	92,695,811	93,104,118	108,900,047	109,308,354
May	Average	2,983,179	4,751,481	5,816,169	7,584,471	2,206,318	2,836,409	3,575,146	4,205,237	14,378,132	16,776,525	37,979,512	40,377,905	408,134,392	410,532,785	467,330,875	469,729,267
June	Average	2,627,070	4,170,616	4,991,333	6,534,879	1,887,450	2,464,554	3,004,190	3,581,293	11,779,354	13,900,003	28,823,031	30,943,680	514,641,591	516,762,240	582,233,678	584,354,327
July	Average	807,517	1,518,833	1,790,622	2,501,938	689,151	975,788	1,206,587	1,493,224	5,353,706	6,351,659	17,938,026	18,935,978	289,768,842	290,766,794	331,740,643	332,738,596
August	Average	671,316	1,265,272	1,324,796	1,918,752	503,281	740,159	822,158	1,059,036	3,343,460	4,174,294	9,111,904	9,942,738	146,272,768	147,103,602	167,053,657	167,884,491
September	Average	696,472	1,305,471	1,315,463	1,924,462	497,070	735,780	787,829	1,026,539	3,070,094	3,917,803	7,364,918	8,212,628	126,674,678	127,522,388	145,220,149	146,067,859
October	10 yr Dry	300,475	784,320	537,754	1,021,600	201,794	395,676	307,011	500,893	1,123,298	1,801,025	2,123,300	2,801,027	73,762,465	74,440,192	84,008,414	84,686,141
November	10 yr Dry	122,844	203,333	235,667	316,155	89,223	136,802	142,983	190,563	566,140	694,208	1,428,082	1,556,151	35,186,290	35,314,359	40,087,078	40,215,146
December	10 yr Dry	83,787	130,587	161,485	208,285	61,172	84,769	98,347	121,944	391,184	461,581	1,000,451	1,070,848	26,407,754	26,478,150	30,021,538	30,091,935
January	10 yr Dry	51,165	76,633	102,307	127,775	38,926	47,311	64,138	72,523	263,861	297,714	741,813	775,666	22,431,496	22,465,349	25,551,551	25,585,404
February	10 yr Dry	25,794	40,035	56,167	70,408	21,575	22,904	37,404	38,732	164,053	179,622	536,544	552,113	17,858,016	17,873,585	20,339,461	20,355,030
March	10 yr Dry	23,705	39,807	51,661	67,762	19,846	21,524	34,422	36,099	151,051	168,830	494,570	512,349	18,091,658	18,109,437	20,604,179	20,621,958
April	10 yr Dry	405,505	590,739	875,240	1,060,474	335,888	417,533	579,458	661,103	2,526,584	2,793,464	8,159,941	8,426,821	66,606,949	66,873,829	76,038,029	76,304,909
May	10 yr Dry	2,650,266	3,913,003	5,042,535	6,305,272	1,907,147	2,354,941	3,038,591	3,486,386	11,931,563	13,642,094	29,330,051	31,040,583	386,609,863	388,320,394	440,834,476	442,545,008
June	10 yr Dry	2,053,012	3,142,394	3,811,203	4,900,585	1,436,990	1,837,137	2,248,941	2,649,088	8,600,794	10,090,323	19,357,532	20,847,061	388,056,572	389,546,101	442,197,520	443,687,050
July	10 yr Dry	629,643	1,093,784	1,402,122	1,866,263	524,036	704,343	777,859	958,165	2,730,736	3,375,184	9,851,985	10,496,433	231,998,481	232,642,929	257,726,478	258,370,925
August	10 yr Dry	202,136	590,099	382,036	770,000	144,371	292,589	228,928	377,146	892,730	1,428,912	2,146,429	2,682,611	126,785,773	127,321,955	144,357,483	114,893,665
September	10 yr Dry	231,867	667,844	414,332	850,310	155,448	321,527	236,209	402,289	862,518	1,464,575	1,615,984	2,218,041	81,047,824	81,649,881	92,286,993	92,889,051

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Table 4.11-11 Roman Coal Mine–Annual Flow Volumes and Dilution Summary

	Average Precipitation Conditions			10-year Dry Year Conditions		
Item/Location	Annual Volumes (m^3)			Annual Volumes (m^3)		
South Dump Seepage to Babcock	23,625			16,303		
South Dump Runoff to Gates Pit	543,381			380,347		
Local Runoff to Gates Pit	2,409,072			1,745,576		
Gates Pit Seepage to Babcock	157,680			157,680		
Gates Pit Seepage to Gordon	0			0		
Gates Pit Discharge to Babcock	2,794,773			1,968,243		
North Dump Seepage to Babcock	74,420			51,355		
North Dump Runoff to Babcock	1,711,649			1,198,094		
North Dump Runoff to Gordon SP4	964,501			675,117		
North Dump Seepage to Gordon	41,935			28,938		
Trend Releases to Babcock	1,573,442			1,100,706		
Trend Releases to Gordon	1,424,602			996,585		
	Annual Volumes	**% of Total Flow**	**Dilution Ratio**	**Annual Volumes**	**% of Total Flow**	**Dilution Ratio**
Total Mine Releases	8,724,692			6,164,084		
Total Mine Releases to Babcock	6,335,589	72.6%	n/a	4,492,382	72.9%	n/a
Total Mine Releases to Gordon	2,389,103	27.4%	n/a	1,671,702	27.1%	n/a
Babcock at B2						
Total Release of Mine Waters	6,335,589	38.6%	1.6	4,492,382	39.9%	1.5
Background Flow	10,081,777	61.4%		6,780,197	60.1%	
Total Flow	16,417,366			11,272,579		
Babcock at B5						
Total Release of Mine Waters	6,335,589	24.4%	3.1	4,492,382	25.6%	2.9
Background Flow	19,659,933	75.6%		13,072,509	74.4%	
Total Flow	25,995,521			17,564,891		
Babcock at B3						
Total Release of Mine Waters	8,724,692	15.2%	5.6	6,164,084	16.9%	4.9
Background Flow	48,618,176	84.8%		30,204,511	83.1%	
Total Flow	57,342,868			36,368,595		
Gordon at G2						
Total Release of Mine Waters	2,431,038	24.6%	3.1	1,700,640	25.6%	2.9
Background Flow	7,458,020	75.4%		4,936,416	74.4%	
Total Flow	9,889,059			6,637,056		
Gordon at G3						
Total Release of Mine Waters	2,431,038	16.7%	5.0	1,700,640	17.9%	4.6
Background Flow	12,086,715	83.3%		7,794,291	82.1%	
Total Flow	14,517,753			9,494,931		
Flatbed at F3						
Total Release of Mine Waters	8,766,627	6.4%	14.7	6,193,022	7.5%	12.4
Background Flow	128,493,113	93.6%		76,786,681	92.5%	
Total Flow	137,259,740			82,979,703		
Murray at M2						
Total Release of Mine Waters	8,766,627	0.45%	220	6,193,022	0.42%	238
Background Flow	1,930,358,201	99.5%		1,474,843,138	99.6%	
Total Flow	1,939,124,828			1,481,036,160		
Murray at M3						
Total Release of Mine Waters	8,766,627	0.40	251	6,193,022	0.37%	270
Background Flow	2,200,564,166	99.6		1,674,053,200	99.6%	
Total Flow	2,209,330,793			1,680,246,222		

4.12 Reclamation Plan

The reclamation plans for the Project are based on identified capability objectives, soil handling plans and replacement strategies to achieve these objectives, and on resultant predicted post-closure ecosystem units within the Project's MDL. The MDL includes:

- areas that have forest cover cleared but the underlying vegetation and soils have not been disturbed
- areas that have been cleared of forest cover and the soils disturbed
- previously mined land from the adjacent Trend Coal Mine

In order to minimize the footprint of the Project, some of the waste rock generated from Project pits will be placed over pre-existing waste dumps and pits associated with the Trend Coal Mine. The Project's reclamation plan will address the entire MDL including the portions of the Trend Coal Mine that fall within the Project MDL. The reclamation and soil handling plans for the Trend Coal Mine will be superseded by the Project's plans where there is overlap.

The reclamation plan will have an emphasis on habitat protection and habitat re-establishment for the key indicator wildlife species (including the woodland caribou) and re-establishment of forest cover.

4.12.1 Material Handling Plan

The following material handling plan is based on baseline soils information and determination of soil suitability for reclamation and determination of vegetation layer materials suitable for salvage for re-establishment of woodland caribou habitat.

4.12.1.1 Soil Suitability for Reclamation

The *Guide to Preparing a Mine Permit Application under the British Columbia Mines Act* (Hall 2006) recommends using the Soil Quality Criteria Relative to Disturbance and Reclamation developed by Alberta Agriculture (AAFRD 1987) as a general guideline for determination of soil suitability for reclamation. This set of criteria was adapted to the site-specific conditions and designated end land use goals of the Project to determine the reclamation potential of soils. Section 8.2.2 details the baseline conditions for soils in the Project area, for example, soil texture, coarse fragment content, soil metal levels, and reclamation potential of soils.

Baseline soil metal levels and soil pH are discussed in more detail in Section 8.2.2.3. Overall, soil metals and pH were not considered to be limiting factors for reclamation suitability. One sample was found to have arsenic and nickel concentrations slightly above CCME Guidelines (CCME 1999) for agricultural soil, while another had a slightly elevated cadmium concentration, and selenium concentration at the guideline limit. One additional sample was found to have selenium concentrations at guideline limits.

The slightly elevated metal levels were excluded as limiting factors from the soil suitability for reclamation rating. The naturally elevated baseline metals are not reflected in the vegetation. The vegetation metal assessment reports that all elements were below toxic levels for dietary intake by cattle (and by extension, wild ungulates) for all sites and species based on thresholds (see Volume 2, Section 9.3.2.5: Trace Metal Concentrations in Vegetation). More importantly, selenium levels in the vegetation tissues are within the cited normal range for uncontaminated areas (Kabata-Pendias 2001). Additional

strategies, including sediment and erosion control measures, will be in place to prevent soil from getting into waterways (see Section 4.12.3), and additional metal testing on vegetation will take place following reclamation, to confirm vegetation element concentrations (see Section 4.12.4.1).

The reclamation potential of soils in the Project area was based on the coarse fragment content and the texture of soil samples. Soil suitability ratings for the area were then derived from these factors; soils were rated as good, fair or unsuitable for reclamation. The ratings are discussed in Section 8.2.2. Overall, mineral soils rated as "good" occupy approximately 158 ha, mineral soils rated as "fair" occupy approximately 143 ha, organic material overlaying fair mineral soils covers approximately 40 ha, soils rated as "unsuitable" occupy approximately 120 ha and soils under disturbed areas cover approximately 349 ha (see Tables 8.2–5 and 8.3–8). Table 8.3–9 details the potential soil volume present in the portion of the MDL that is situated outside of the Trend Coal Mine; approximately 2.5 Mm^3 of soil is estimated within this area. Maps showing soil reclamation suitability and soil salvage depth classes within the MDL are provided in Figure 8.2–1 and Figure 8.3–2, respectively.

4.12.1.2 Material Salvage and Replacement Strategy

Trend Coal Mine Salvaged Soils

Soils for use in reclamation of the Project will be sourced from the Project and Trend Coal Mine portions of the MDL. It is proposed that surplus soils remaining after all Trend Coal Mine dumps and mine roads have been capped, will be used to cap Project dumps and mine roads. It is expected that there will be a surplus of salvaged soil from the Trend Coal Mine operation due to the Project covering many of the Trend Coal Mine disturbances. The soil stockpiles, which would have been used to cap these Trend Coal Mine areas, are therefore expected to be available to cover the Project. The incremental soil material required for capping the remaining disturbances will be salvaged within the Project portion of the MDL.

Based on soil salvage volume estimates derived from the Trend Coal Mine Permit Application, a total of 2.06 Mm^3 of soil is to be salvaged for the South Block section of the Trend Coal Mine, portions of which the Project MDL will eventually cover. Based on areas provided by the current Trend Coal Mine operation, the portions of the mine which will remain uncovered by Project disturbances will require approximately 1.09M m^3 of soil for reclamation. This leaves approximately 0.97 Mm^3 of stockpiled soil available for capping Project disturbances. The remaining soil required for reclamation will be salvaged from new areas to be disturbed by mining.

The Trend Coal Mine Permit Application and the 2008 Trend Coal Mine Annual Reclamation Report indicate that several soil stockpiles are situated in areas that are proposed for Project waste dumps. To avoid loss of this resource, the soil material in these stockpiles will be moved to stockpiles outside of the Project waste dump areas or used in progressive reclamation being done for the Trend Coal Mine.

Stripping Sequence and Methods

In general, all soils for use in reclamation programs will be salvaged from areas to be disturbed by mining. The replacement of the salvaged soil on the same area post-mine will facilitate the development of post-mine ecosystems that are similar to pre-

disturbance conditions. During mine life, salvaged soil will be placed in stockpiles located as close as possible to where the soil will be used for capping but in a secure location outside of the operations area. Direct placement of soils from salvage areas to reclamation sites will be done wherever and whenever feasible. More detailed soil stripping, stockpiling and replacement plans, including a soil material handling balance, will be developed as part of the more detailed reclamation plan to be included with the Roman Coal Mine Permit Application.

Soils for salvage and use in subsequent reclamation will consist of both developed soil horizons and underlying parent materials. Soils will be stripped in a single lift, resulting in a mixture of organic surface litter materials and other vegetative materials, developed soil horizons, and underlying parent material (for more detail on soil suitability for reclamation, see Section 4.12.1.1). Because of the textural similarities of replaced materials to pre-development conditions, it is projected that post-closure landforms will either have similar moisture regimes as the pre-development ecosystems, or, in some cases, may be slightly drier due to replacement over an underdrained substrate (waste rock). Soil nutrient conditions will initially be poorer due to disturbance of the nutrient-rich litter layers. However, this situation will be ameliorated through through fertilizer application and through use of nitrogen fixing plant species in the revegetation prescriptions.

The objective of the soil salvage and replacement plan is to target re-establishment of pre-disturbance conditions. The emphasis on direct placement of salvaged soil materials wherever practicable will minimize soil mixing disturbance associated stockpiling, while providing native plant seeds and rootstock, and preserving the active biological component of newly salvaged soil.

Project infrastructure requirements (e.g., roads, plant site, tailings impoundment and explosives storage areas) will be met by using the mine infrastructure components developed for the Trend Coal Mine where possible. Soil volume requirements, replacement volumes and reclamation for those features are detailed and dealt with in the Trend Coal Mine Permit, C-224.

Approximately 29 ha of the MDL is affected by water management features (19.5 ha for RP3, 5.4 ha for RP1and RP2 and 4 ha for ditches). Sedimentation ponds RP1, RP2 and Gates pit pond RP3 and their associated diversion ditches will be developed to manage mine-affected drainage from the Project (and will be integrated with the existing Trend water management system). The affected areas of the MDL will be subject to clearing and ground disturbance, with no deposition of mine waste materials anticipated.

The soils underlying all water management features will be salvaged during construction. Sediment ponds RP1 and RP2 will have soil windrowed along the edge of the disturbed area. Soil salvage will be carried out in such a manner that the topsoil layers will be kept separate from the underlying lower soil horizons in the windrows. At the time of final reclamation and soil replacement, this will allow for the lower soil horizons to be replaced first into the disturbance area, with the topsoil placed on top of them. The volume of soils salvaged from the proposed sedimentation ponds and ditches will be dependent on the amount of material required to be removed for construction. In total, approximately 4045 m of ditches and 24.9 ha of sedimentation ponds will undergo soil salvage and windrowing.

With the exception of sedimentation pond RP3, all ponds will be decommissioned at the time or reclamation. Pond RP3 within the Gates pit will remain as a permanent pond after

reclamation for the storage of tailings. Refer to Section 4.11.11 for a description of water management structures decommissioning.

In addition to the salvage of soil material within the MDL, vegetation layers located in high capability caribou habitats, such as in the alpine tundra zone, will be salvaged wherever possible. Salvaging these materials will involve stripping sections of the vegetation, root and soil layers using heavy equipment such as front end loaders, which are capable of stripping the layers as complete and intact clumps. The salvaged vegetation layers will then be placed in temporary stockpile sites located outside of the operations area until required for final reclamation, or directly salvaged and transplanted onto suitable reclamation sites. Timing of salvaging, equipment selection and plans for access to salvage sites will be described in more detail in the Mine Permit Application for the Project when sequential mining plans are available. Ideally, salvaging will be done once equipment access to the salvage sites is available Salvage and replacement of vegetation layers for caribou habitat reclamation is discussed further in Section 4.12.4.4.

A conceptual soil salvage schedule is presented below.

Table 4.12-1 Conceptual 5 Year Soil Salvage Schedule

	Units	Yr1	Yr2	Yr3	Yr4	Yr5	5yr Total
Intial balance Soil from Trend	Mm^3	0.97					
Intial balance Soil from Roman	Mm^3	-					
Initial balance of Soil (Trend + Roman)	Mm^3	0.97	1.07	1.45	1.52	1.40	0.97
Soil Salvaged from Roman	Mm^3	0.10	0.38	0.39	0.23	0.21	1.32
Soil Replaced	Mm^3	-	-	0.32	0.35	0.35	1.03
End of year balance of Soil in Stockpile	Mm^3	1.07	1.45	1.52	1.40	1.26	1.26

Material Replacement Strategy

Soil capping material for the dumps, mine roads and pit floors will be replaced using a one-lift layer of salvaged materials. Soil replacement treatments have been developed based on pre-mining on-site information, including baseline soils and vegetation surveys and geotechnical trenching data. This information shows that rooting depths in the Project area range from approximately 30 to 80 cm, with an average depth of 50 cm. Rooting depths are greatest below the treeline and shallower in the parkland and alpine ecosystems. Based on this information, a soil replacement depth of 50 cm for waste dumps below the tree line elevation (1720 m elevation) has been specified; disturbance areas, such as waste dumps above the tree line elevation, will receive a soil replacement depth of 30 cm. A soil capping depth of 30 cm has been specified for pit floors and in-pit roads. A 30 cm soil replacement depth is also specified for resloped haul roads at any elevation. The rationale for this shallower cap is that the roads are considered a relatively shallow disturbance to the soil since the subsoil will remain intact and will be resloped to original contour at closure. It should also be noted that coal spoil is an acceptable rooting medium, and has been shown at other coal mines in British Columbia to provide a productive substrate for forest stand development (Straker et al. 2005). Thus, rooting will not be limited to the replaced soil alone, and it is expected that this 30 to 50 cm soil replacement on coal spoil will meet equivalent capability obligations.

The sedimentation pond and diversion ditches will be capped with the soils stockpiled in the windrows adjacent to these sites. Soil replacement will be carried out in such a

manner that the lower soil horizons will be replaced first into the disturbance area, with the topsoil placed on top of them. The volume of soils replaced will be dependent on the amount of material required to be removed during construction. Approximately 4045 m of ditches and 5.4 ha of sedimentation pond will undergo soil replacement.

Surplus soil remaining in the stockpiles at mine closure will be contoured and reclaimed in place.

Table 4.12-2 summarizes the volumes of soil required for reclamation capping of mine roads, pit areas and waste dumps in the MDL. In order to monitor soil requirements between the Project and the Trend Coal Mine portions of the MDL, the soil replacement areas have been differentiated between Project disturbances situated on the Trend Coal Mine portion of the MDL and the Project-only portion of the MDL. Based on the post-closure areas of the mine dumps, roads and pit floors, the MDL covers 810.6 ha, of which 545.4 ha will require soil capping. The remaining 265.3 ha will not be capped and consists of exempt pit walls, pit pond, permanent roads and the vegetation cleared (logged or brushed) zones on the outside edge of the MDL.

The 545.4 ha capping area will require approximately 2.3 Mm^3 of soil to meet the specified capping depth of 50 cm for waste dumps below treeline and 30 cm for waste dumps above treeline, mine roads and pit floors and haul roads. Of that, 295.4 ha and 1.3 Mm^3 of soil will be required for the Project disturbances situated on the Trend Coal Mine; 249.9 ha and 1.1 Mm^3 of soil will required for disturbances on the Project-only portion of the MDL. Based on the Trend Coal Mine Reclamation Plan, it is predicted that there will be 0.97 Mm^3 of salvaged soil surplus to the needs of the Trend Coal Mine. The surplus is a result of the Project covering Trend Coal Mine areas of which soil will be stockpiled for capping. Taking into account the surplus soil from the Trend Coal Mine (0.97 Mm^3) the total amount of soil needed to be salvaged will be 1.35 Mm^3. This volume of soil would be salvaged from areas to be disturbed by mining within the Project portion of the MDL.

The vegetation, root and soil layers salvaged from high capability caribou habitats will be transplanted directly from salvage sites that will be disturbed by mining onto reclamation sites, or from temporary stockpile sites. The layers will be placed onto the reclamation sites after site preparation activities have been completed on the reclamation areas. The layers will then be placed onto the reclamation sites using heavy equipment such as front end loaders, which are capable of moving and placing the layers as intact clumps. Once planted, the clumps will require future monitoring to track the establishment and growth of the transplanted vegetation. Maintenance activities such as replanting, fertilizing, or weed control may be required to address any failures or threats to revegetation success that are identified during monitoring. Salvage and replacement of vegetation layers for caribou habitat reclamation is discussed further in Section 4.12.4.4.

Table 4.12-2 Soil Replacement Areas and Volumes Required for Reclamation within Roman Coal Mine MDL

Sites	Project Disturbance not overlapping Trend			Project Disturbances overlapping Trend		
	Area (ha)	Soil Capping Depth (cm)	Soil Volume Required (m^3)	Area (ha)	Soil Capping Depth (cm)	Soil Volume Required (m^3)
Areas requiring soil capping						
Mine Roads (located between Roman pits; all elevations)	38.78	30	116,340			
Pit Areas (pit floors/haul roads above treeline)	9.24	30	27,720			
Pit Areas (pit floors/haul roads below treeline)	17.26	50	86,300			
Pit Areas (pit walls in overburden- below treeline)	3.4	50	17,000			
Waste Dumps (above treeline)	50.34	30	151,020	105.14	30	315,420
Waste Dumps (below treeline)	130.96	50	654,800	190.25	50	951,250
Subtotals Capping Areas and Soil Volumes	249.98		1,053,180	295.39		1,266,670
Total Soil Volume Required(within Roman MDL)	2,319,850.0 m^3					
Total Capping Area (within Roman MDL)	545.37 ha					
Areas not requiring soil capping						
Exempt pit walls	156.81	NA	NA			
Pit pond (RP3)	19.58	NA	NA			
Permanent Roads	1.42	NA	NA	1.92	NA	NA
Cleared/undisturbed zone along outside edge of Roman MDL	42.02	NA	NA			
Area of Trend located within the Roman MDL buffer zone				43.52	NA	NA
Subtotals Non-Capped Areas	219.83			45.44		
Total Non Capped Area (within Roman MDL)	265.26 ha					
Roman MDL area	810.63 ha					

NOTES:
1) The MDL includes Project-only disturbances and Project disturbances situated on Trend Coal Mine.
2) Sites requiring or not requiring soil capping were differentiated between Project disturbances situated on the Trend Coal Mine portion of the MDL and the Project-only portion of the MDL.

4.12.2 Environmental Monitoring and Surveillance

PRC will maintain responsibility for the operation of the Project and all environmental programs and reclamation activities on site.

The PRC Chief Environmental Scientist will maintain overall responsibility for all environmental issues on site. The Chief Environmental Scientist will be responsible for ensuring that all environmental monitoring and reclamation programs are carried out during construction, operation and closure. These programs will be implemented with the use of additional staff, consultants and contractors where necessary.

During construction, an environmental monitor will be on site to monitor activities and to monitor compliance with the provisions of all applicable permits, licenses and approvals. The environmental monitor will:

- conduct monitoring programs as required under the respective permits, licenses and approvals and report the results of such programs, as required
- see that soil salvage and replacement activities are completed appropriately to meet reclamation objectives
- see that vegetative erosion control cover is established on soil stockpiles and on any other areas of disturbance, as appropriate
- provide direction and recommend implementation measures aimed at avoiding or minimizing adverse environmental effects
- implement erosion control measures such as riprap, silt fences and filter fabric

In the environmental monitor's absence, the PRC Chief Environmental Scientist will appoint a person to fulfill these responsibilities.

Early Mine Closure

In the event of early mine closure, measures to mitigate the effects on reclamation include:

- progressive soil salvage—salvage soil as incremental area is disturbed by mining
- progressive reclamation—soil replacement and revegetation of disturbed sites as soon as mining activities on these sites are inactive

4.12.3 Erosion Control and Sediment Retention Plan

Erosion control practices specific to reclamation activities on the Project are practiced in complement to the Best Management Practices (BMPs) detailed in the Surface Erosion and Sediment Control Plan (SEPSCP) in Section 5.

For reclamation purposes, conservation of topsoil is as important as the prevention of sediment release to water courses; therefore, erosion control measures will focus on preventing soil loss from wind and water forces rather than catching and containing sediments. Temporary reclamation of waste dumps, ditches, road cuts and embankments will begin during construction and continue through operation, and will primarily involve seeding exposed soils with an erosion control seed mix or hydroseeding with a mulch and tackifier as soon as possible. If required, soil erosion control measures such as installation

of erosion control blankets or application of a bonded fibre matrix onto the soil surface will be carried out; silt fences may also be installed to contain sediments eroding off sites. Slope stabilization techniques such as terracing or installation of bioengineering structures, such as wattle fences or modified brush layers, may also be used on highly erodible soils or unstable slopes.

Soil stockpiles will also be seeded with erosion control seed mixes as soil is added or removed, and will be placed within the runoff diversion and collection ditch catchments. As portions of the stockpile completed, the slopes will be resloped to a shallower 2:1 grade in order to minimize erosion off the slope and aid in vegetation establishment. Soil windrows will be constructed with shallow slopes so as to minimize erosion. Completed portions of soil windrows and soil stockpile slopes and platforms will be seeded with an erosion control seed mix in order to establish a long-term vegetation cover.

Waste rock dumps will also be resloped to 2:1 grades to reduce erosion and encourage vegetation establishment. Temporary erosion control seeding of waste rock dumps may be done before final reclamation on particularly susceptible slopes; final reclamation will be done following resloping and soil replacement to appropriate depth (Section 4.12.1.3).

4.12.4 Conceptual Final Reclamation Plan

A conceptual final reclamation plan for the closure and abandonment of the mining operation is a requirement of both the environmental assessment review process and the mine permitting process. It must include a discussion of end land use and productivity capability objectives and for the Project area; treatment of mine Project structures and equipment; reclamation of various mine disturbances such as waste dumps, tailings, pits, haul roads, and watercourses; trace element uptake in vegetation growing in the Project area and research opportunities unique to the Project such as reclamation of high elevation coal spoil.

Information is presented below on end land use and capability objectives for the post-closure area and on reclamation methods proposed to achieve these objectives. The conceptual final reclamation plan is based on:

- the soil handling plans and replacement strategies
- integration of the identified primary end land use objectives of wildlife habitat and forestry, and mapping of probable post-closure ecosystem unit development
- First Nations input on culturally important species that could be used for site re-vegetation and future traditional use
- baseline data on metal uptake in vegetation growing in the Project area

4.12.4.1 End Land Use Objectives

Introduction

End land use objectives are based on information on pre-development site conditions. The general concept applied to Project reclamation and end land use is that reclamation will be done with the goal of restoring equivalent capability, such that a variety of end land uses can be achieved. This is similar to pre-development conditions, where in this case, primarily forested ecosystems provided a range of values, from traditional use and recreation to commercial forestry to wildlife habitat. Thus, the primary focus of the

reclamation program is to foster return to appropriate and functional ecosystems, supported by soil salvage and replacement strategies that will facilitate the establishment of self-sustaining vegetation communities suited to post-closure conditions.

The selection of wildlife habitat with caribou focus and forestry as the end land use objectives for this Project is consistent with the adjacent Trend mine and other mine developments in the vicinity. More specifically, wildlife use of the Project area was clearly established at baseline, and the development will affect habitat recognized as regionally important, particularly for caribou, by government agencies, local stakeholders and First Nations and aboriginal groups. Although there is no recent or planned forest harvesting activities within or immediately adjacent to the mine development, the affected forested area is part of the Dawson Creek Timber Supply Area and selection of forestry as the second end land use objective recognizes the importance of maintaining the regional forested land base.

Pre- and post-development forest capability for the Project was determined using Site Index—Biogeoclimatic Ecosystem Classification (SIBEC) correlations (Ministry of Forests 2008, Internet site), based on terrestrial ecosystem mapping (TEM). This system correlates potential site productivity (site index, or projected dominant tree height at age 50) with ecological classification units (site series), and is the currently accepted method in British Columbia for estimating site productivity without on-site measurements.

SIBEC correlations were developed for application in commercial forestry, but can be used to evaluate general reclamation success, as it can be assumed the capability for commercial tree species will also correlate with capability of non-commercial vegetation production.

Wildlife capability ratings were developed using *British Columbia Wildlife Habitat Rating Standards* (RIC 1999). Detailed wildlife habitat capability in the baseline and Project case is discussed for the key indicator (KI) species in Section 10. Wildlife habitat capability ratings on the conceptual reclamation plan (see Figure 4.12-1) are based on the highest ratings for a species out of all life requisites and seasons assessed; for example, where Pl–Kinnikinnick–Lingonberry habitats were rated as having grizzly bear spring, summer and fall feeding capability values of three, three and four, respectively, the overall rating used for the conceptual reclamation plan was three for grizzly bears in that habitat.

Forest capability baseline is summarized in Table 4.12-3 below. Site index categories are based on estimates for lodgepole pine (*Pinus contorta*) and were defined as follows:

- Low—site index 9–12 m
- Moderate—site index 12.1–18 m
- High—site index >18 m

Sites with moderate-high forest capability have the potential to be suitable for commercial forestry operations, while those in the low category are generally non-commercial.

Figure 4.12-1 Conceptual Reclamation Plan

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Table 4.12-3 Pre-mining Ecosystem Units and Forest Productivity

BEC Subzone	Site Series	Map Code	Name	Site Index Category	Area (ha)
AT	00	AH	Alder–hellebore avalanche track	non-forested	0.6
	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	61.6
	00	CG	Cryptogam–Altai fescue	non-forested	4.9
	00	ES	Exposed soil	non-forested	0.0
	00	FK	Subalpine fir krummholz	non-forested	0.0
	00	FL	Alpine fescue–Lichen dry meadow	non-forested	15.2
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	0.7
	00	HL	Heather–Lichen meadow	non-forested	35.8
	00	HW	Netted willow–Four-angled mountain heather	non-forested	10.3
	00	RO	Rock outcrop	non-forested	35.6
	00	TA	Talus	non-forested	2.3
ESSFmvp2	00	AH	Alder–hellebore avalanche track	non-forested	0.2
	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	9.1
	00	CG	Cryptogam–Altai fescue	non-forested	9.5
	00	ES	Exposed soil	non-forested	4.4
	00	FH	Bl–Heather krummholz	non-forested	13.9
	00	FK	Subalpine fir krummholz	non-forested	44.7
	00	FL	Alpine fescue–Lichen dry meadow	non-forested	1.8
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	3.1
	00	HL	Heather–Lichen meadow	non-forested	12.8
	00	HW	Netted willow–Four-angled mountain heather	non-forested	8.4
	00	RO	Rock outcrop	non-forested	7.2
	00	RZ	Road	non-forested	0.1
ESSFmv2	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	1.6
	00	CG	Cryptogam–Altai fescue	non-forested	0.0
	00	ES	Exposed soil	non-forested	0.0
	00	FK	Subalpine fir krummholz	non-forested	0.5
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	5.7
	00	HL	Heather–Lichen meadow	non-forested	1.9
	00	RO	Rock outcrop	non-forested	0.5
	00	SE	Sedge fen	non-forested	2.1
	00	WS	Willow–sedge fen	non-forested	3.1

Table 4.12-2 Pre-mining Ecosystem Units and Forest Productivity (cont'd)

BEC Subzone	Site Series	Map Code	Name	Site Index Category	Area (ha)
	01	FR	Bl–Rhododendron–Feathermoss	moderate	85.0
	02	FL	Bl–Lingonberry	low	7.1
	03	BT	BlSb–Labrador tea	low	16.3
	04	FO	Bl–Oak fern–Knight's plume	moderate	38.0
	06	FH	Bl–Alder–Horsetail	moderate	17.8
		Trend Coal Mine			**349.0**
			Total New Area		461.7
			Previously Disturbed Area		349.0
			Total area		810.7
			Summary of Forest Productivity Areas	**Percent (%)**	**Area (ha)**
			Moderate Capability	30	140.8
			Low Capability	5	23.4
			Non-forested	64	297.5

Post-mine Ecosystem Units

Post-mine ecosystem mapping was done by integrating knowledge of post-closure material characteristics and landform topography to estimate soil moisture and nutrient regime and to derive slope and depth-based modifiers. In general, post-closure site series are similar to pre-development ecosystems, as replaced soil materials and depths are very similar to pre-development conditions. Under-drained conditions created by placing capping material on top of waste materials (as opposed to the underlying compact tills or bedrock existing in the pre-disturbance landscape) have been represented by downgrading (drying) moisture regimes in the reclaimed landscape, particularly on waste dump slopes. Where clearing has been the only disturbance associated with development or the soil has not been removed (e.g., on cleared only areas, where windrowed soils are replaced and surface roads are returned to original contour), post-closure site series have been left identical to those found in the same area before development.

Post-mining forest productivity projections were developed based on mapped post-closure ecosystem units using SIBEC correlations. It should be emphasized that the goal of the reclamation program for the Project is to return to equivalent capability for a variety of end land uses, and not to steward to a particular end land use at the expense of all others. If this objective is achieved, ecosystem variety and vegetation dynamics will allow for the post-closure landscape to be capable of productively supporting a range of simultaneous end land uses (e.g., an area with potential for commercial forestry will also provide valuable wildlife habitat) and thereby maintain biodiversity.

Pre-mining ecosystem units and forest productivity conditions are listed in Table 4.12-3 and post-mining ecosystem units and forest productivity conditions are listed in Table 4.12-4. For comparison, the post-mine ecosystem Table 4.12-4 includes ecosystem units only for the Project portion of the MDL, so it is comparable to pre-mine conditions, whereas the Trend Coal Mine portion of the MDL is disturbed mine land. Table 4.12-5

contains the post-mining ecosystem units and forest productivity conditions for the entire MDL.

At post-mine conditions there will be a net loss of forest potential land due to an increase in the amount of higher elevation area as a result of the creation of waste dump features and a decrease in the forest potential land due to creation of open pits. Overall there is a loss of 60.2 ha of land with the potential to support forest cover, corresponding with a 28.2 ha increase in rock outcrop (open pit) and conversion of 32 ha of lower elevation forest potential area (ESSFmv2) to parkland ecosystem (ESSFmvp2). Table 4.12-4 indicates that 18 percent of the post-mining area will have moderate forest capability compared to 30 percent pre-mine; and two percent of the post-mining area will have low forest capability compared to 5 percent pre-mine and the remaining 80 percent is comprised of non-forested site types (including exposed soil, rock outcrop, krummholz vegetation communities, alpine ecosystems and anthropogenic sites). Table 4.12-5 summarizes post-mining ecosystem units and forest productivity of the entire reclaimed MDL and shows similar proportions of forest productivity with 18 percent of the area rated as moderate forest productivity and one percent of the area rated as low forest capability.

Table 4.12-4 Post-mining Ecosystem Units and Forest Productivity for Project Portion of MDL

BEC Subzone	Site Series	Map Code	Name	Site Index Category	Area (ha)
AT	00	AH	Alder–hellebore avalanche track	non-forested	0.0
	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	28.8
	00	CG	Cryptogam–Altai fescue	non-forested	1.3
	00	FL	Alpine fescue–Lichen dry meadow	non-forested	25.9
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	0.0
	00	HL	Heather–Lichen meadow	non-forested	8.0
	00	HW	Netted willow–Four-angled mountain heather	non-forested	14.8
	00	RO	Rock outcrop	non-forested	60.2
		TM	**Trend Coal Mine**		**109.8**
ESSFmvp2	00	AH	Alder–hellebore avalanche track	non-forested	0.0
	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	7.9
	00	CG	Cryptogam–Altai fescue	non-forested	1.0
	00	ES	Exposed soil	non-forested	0.1
	00	FH	Bl–Heather krummholz	non-forested	1.6
	00	FK	Subalpine fir krummholz	non-forested	28.3
	00	FL	Alpine fescue–Lichen dry meadow	non-forested	15.0
	00	FW	Altai fescue–dwarf willow	non-forested	37.8
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	0.4
	00	HL	Heather–Lichen meadow	non-forested	2.0

Table 4.12-3 Post-mining Ecosystem Units and Forest Productivity for Project Portion of MDL (cont'd)

BEC Subzone	Site Series	Map Code	Name	Site Index Category	Area (ha)
	00	HW	Netted willow–Four-angled mountain heather	non-forested	14.0
	00	RO	Rock outcrop	non-forested	73.2
	00	WA	Willow–mountain arnica meadow	non-forested	1.7
		TM	**Trend Coal Mine**		**134.4**
ESSFmv2	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	0.7
	00	FK	Subalpine fir krummholz	non-forested	0.2
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	1.1
	00	HL	Heather–Lichen meadow	non-forested	0.4
	00	OW	Open water	non-forested	19.6
	00	RO	Rock outcrop	non-forested	28.7
	00	RZ	Road	non-forested	1.4
	00	SE	Sedge fen	non-forested	0.4
	00	WS	Slender wheatgrass–Saskatoon	non-forested	0.6
	01	FR	Bl–Rhododendron–Feathermoss	moderate	76.6
	02	FL	Bl – Lingonberry	low	3.7
	03	BT	BlSb–Labrador tea	low	6.9
	04	FO	Bl–Oak fern–Knight's plume	moderate	4.8
	06	FH	Bl–Alder – Horsetail	moderate	2.8
		TM	**Trend Coal Mine**		**96.7**
			Total New Area		469.8
			Total Trend Coal Mine Area		340.9
				Total area	810.7
			Summary of Forest Productivity Areas	**Percent (%)**	**Area (ha)**
			Moderate Capability	18	84.2
			Low Capability	2	10.6
			Non-forested	80	375.0

Table 4.12-5 Post-mining Ecosystem Units and Forest Productivity for Entire Roman Coal Mine MDL

BEC Subzone	Site Series	Map Code	Name	Site Index Category	Area (ha)
AT	00	AH	Alder–hellebore avalanche track	non-forested	0.0
	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	68.8
	00	CG	Cryptogam–Altai fescue	non-forested	1.3
	00	FL	Alpine fescue–Lichen dry meadow	non-forested	52.9
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	0.0
	00	HL	Heather–Lichen meadow	non-forested	8.0
	00	HW	Netted willow–Four-angled mountain heather	non-forested	53.0
	00	RO	Rock outcrop	non-forested	60.2
	Trend Clearing Limit				4.6
ESSFmvp2	00	AH	Alder–hellebore avalanche track	non-forested	0.0
	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	10.2
	00	CG	Cryptogam–Altai fescue	non-forested	1.0
	00	ES	Exposed soil	non-forested	0.1
	00	FH	Bl–Heather krummholz	non- forested	1.6
	00	FK	Subalpine fir krummholz	non- forested	65.0
	00	FL	Alpine fescue–Lichen dry meadow	non-forested	17.9
	00	FW	Altai fescue–dwarf willow	non-forested	57.3
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	0.4
	00	HL	Heather–Lichen meadow	non-forested	2.0
	00	HW	Netted willow–Four-angled mountain heather	non-forested	78.8
	00	RO	Rock outcrop	non-forested	73.2
	00	WA	Willow–mountain arnica meadow	non-forested	1.7
	Trend Clearing Limit				8.1
ESSFmv2	00	AW	Entire-leaved white mountain avens–Netted willow	non-forested	0.7
	00	FK	Subalpine fir krummholz	non- forested	0.2
	00	HB	Hellebore–Sedge–Bluejoint seepage meadow	non-forested	1.1
	00	HL	Heather–Lichen meadow	non-forested	0.4
	00	OW	Open water	non-forested	19.6
	00	RO	Rock outcrop	non-forested	28.7
	00	RZ	Road	non-forested	3.3
	00	SE	Sedge fen	non-forested	0.4
	00	WS	Slender wheatgrass–Saskatoon	non-forested	0.6

Table 4.12-4 Post-mining Ecosystem Units and Forest Productivity for Entire Roman Coal Mine MDL (cont'd)

BEC Subzone	Site Series	Map Code	Name	Site Index Category	Area (ha)
	01	FR	Bl–Rhododendron–Feathermoss	moderate	140.6
	02	FL	Bl–Lingonberry	low	3.7
	03	BT	BlSb–Labrador tea	low	6.9
	04	FO	Bl–Oak fern–Knight's plume	moderate	4.8
	06	FH	Bl–Alder–Horsetail	moderate	2.8
	Trend Clearing Limit				30.7
				Total Area	810.7
			Summary of Forest Productivity Areas	**Percent (%)**	**Area (ha)**
			Moderate Capability	18	148.2
			Low Capability	1	10.6
			Non-forested	80	651.8

The steep rock slopes of the pit are impractical to reclaim and are exempt from reclamation as per Section 10.7.14 of the *Health, Safety and Reclamation Code for Mines in British Columbia* (MEMPR 2008).

There are some sites in the Project area that have productive forest capability, but are located on 2:1 dump slopes. On these sites, consistent with other mine sites, the initial reclamation objective will be control of surface erosion, to prevent degradation of the soil cap. This objective will be achieved through seeding of an agronomic grass-legume ground cover. This ground cover will reduce water impact velocities and run-off on the slopes, but may compete with planted container seedlings. In time, it is expected that these areas will evolve into productive forest ecosystems, and provide a variety of changing habitat over time on the reclaimed mine site. Reclamation experience on the Bullmoose mine site indicates excellent natural regeneration, primarily from deciduous tree species (balsam poplar) on sites reclaimed with agronomic ground covers in close proximity to natural seed sources. Initially, these sites will provide summer forage for some ungulate species; as natural regeneration progresses they will provide a diversity of habitat through the presence of deciduous tree and shrub species and volunteer conifer seedlings, eventually evolving into mature forest ecosystems.

With the implementation of the reclamation plan, the post-mine landscape will be characterized by a combination of coniferous and deciduous forests, cool and warm aspect slopes, level areas, krummholz and alpine vegetation, and rock outcrop. By enhancing the diversity and biomass of the understory and maintaining connectivity with the surrounding landscape the mine can become a valuable contributor to wildlife diversity of the area.

Forest productivity and wildlife habitat ratings are presented on the final Conceptual Reclamation Plan (see Figure 4.12-1).

Traditional Use

While not an explicit end land use objective for the Project, plants used by First Nations for traditional medicine, food and spiritual purposes are an important consideration. The reclamation program objective to return the land to equivalent pre-mine capability will include planting of traditional use vegetation species in the revegetation of Project disturbed areas. Key species identified by the McLeod Lake Indian Band (MLIB) are listed in Table 4.12-9 and discussed in Appendix 21A. The species suggested for reclamation for wildlife or ecosystem value also have traditional use value; notably black huckleberry. Other edible berry-bearing shrubs such as raspberry, blueberries and black currant will also be components of the post-mine vegetation community (refer to Volume 3, Section 21.2.7.2 for detailed discussion on traditional use). Ideal berry-growing areas of the post-closure landscape will be former soil stockpile clearings. The risk of increased metal uptake from mine waste is not expected to be an issue as the proposed berry growing sites will have minimal soil disturbance having only been cleared of forest and vegetation cover. It is expected that metal levels in the proposed berry growing sites will be similar to the undisturbed offsite areas. If required, PRC will monitor metal levels in berries growing in the proposed berry growing sites to ensure they are safe for consumption. The position of the soil stockpile areas at the bottom of dumps and close to road access will make them accessible for harvesting. If required, PRC will post signs identifying the locations of the berry growing areas so that berry pickers will know where they are.

4.12.4.2 Capability Productivity Objectives

Capability productivity objectives for various end land uses are discussed by use below, along with related assessment parameters.

Wildlife

The end land use objectives for the Project include wildlife habitat, in combination with forestry over the majority of the Project. KI species for the Project for which there is habitat capability on the reclaimed landscape include woodland caribou (northern ecotype), Rocky Mountain elk, grizzly bear, moose, fisher, marten, mountain goat and northern goshawk. The wildlife habitat end land use objectives and reclamation strategies are based on meeting the habitat requirements of these species, in particular, woodland caribou. The selection of wildlife key indicator species is discussed in detail in Section 10.2.3.1.

Rationale for Selection of Caribou as a Focal Species for Reclamation

The caribou that inhabit the Roman Mountain area are part of the Quintette Herd of northern ecotype woodland caribou that are identified as a Species at Risk under the federal *Species at Risk Act*. The Project is located within an area identified as core caribou winter and summer range for these caribou (Section 10.5.1). In particular, the windswept alpine and parkland ridges that are rich in terrestrial lichens are considered critical habitat. Given their conservation status and the high value of the habitat on Roman Mountain, caribou are a logical choice for the focus of the reclamation plan. This focus is supported by specific interest from regulators and First Nations and Aboriginal groups in the reclamation of caribou habitat in the South Peace region. Finally, caribou are vulnerable to wolf predation and traditional reclamation approaches that use plant species attractive to moose (e.g., willow thickets) are likely to increase the potential for

caribou mortality due to wolf predation. Because of this status, reclamation efforts will be focused on selection of reclamation species that encourage caribou use and will de-emphasize the use of reclamation species that are preferred by moose and other ungulates (see Table 4.12-6). Some species such as alder, which is not a preferred species by either caribou or moose, can be used as an important reclamation species due to its nitrogen fixing abilities.

Table 4.12-6 Wildlife Use of Reclamation Plant Species

Common Name	Scientific Name	Wildlife Species Use			
		Grizzly Bear	Mountain Goat	Caribou	Moose
Subalpine fir	*Abies lasiocarpa*		X		X
Lodgepole pine	*Pinus contorta*				X
Alder	*Alnus spp.*		X		
Trembling aspen	*Populus tremuloides*		X		X
Willows	*Salix spp.*		X	X	X
Saskatoon	*Amelanchier alnifolia*	X	X		
Huckleberries	*Vaccinium spp*	X		X	
Blueberries	*Vaccinium spp*	X			
Raspberries	*Rubus pedatus*	X		X	X
Grasses	*Agropyron spp.*		X		
Grasses	*Bromus spp.*	X	X	X	
Grasses	*Calamagrostis spp*		X		
Grasses	*Festuca spp*		X	X	
Grasses	*Phleum alpinum*			X	
Grasses	*Poa spp.*	X	X		
Bog birch	*Betula glandulosa*			X	X
White clover	*Trifolium repens*	X			
Red clover	*Trifolium pratense*	X			

SOURCES:
ASRD, 2003, BCMWLAP 2004, Ciarniello et al 2003, IGBC 1987, Johnson et al 2000, MCTAC 2002, Saxena and Bilyk 2000, Shackleton 1999.

A list of candidate species for use in reclamation programs in the Project area is provided in Table 4.12-7 (tree species listed in brackets are minor conifer components). These species are presented by projected post-closure site series, as they are indicative of particular site series and these species will naturally establish on these sites based on their ecological adaptation. This recognizes that some species that may not be desirable, such as cottonwood, because it is a preferred moose browse species and may become naturally established as was observed at the Bullmoose mine. Additional reclamation species specific to the use by woodland caribou are presented in Table 4.12-8. These species have been selected because they are important forage species for woodland caribou. It is recognized that establishment of some of the species is difficult and species such as arboreal lichens cannot be established until a mature conifer stand is present. Identifying successful methods for establishing species important to caribou in high elevation locations has been identified as important reclamation research initiatives (Section 4.12.4.10).

Table 4.12-7 Ecosystem Based Candidate Species for Reclamation of the Project

BEC Unit	Site Series	Map Code	Site Series Name	Tree Species	Shrub and Forb Species
ESSFmv2	01	FR	Bl-Rhododendron-Feathermoss	Engelmann/hybrid spruce subalpine fir (lodgepole pine)	black huckleberry black gooseberry white-flowered rhododendron
	02	FL	Bl–Lingonberry	lodgepole pine Engelmann/hybrid spruce	black huckleberry lingonberry white-flowered rhododendron
	03	BT	BlSb–Labrador tea	lodgepole pine (black spruce)	black huckleberry velvet-leaved blueberry white-flowered rhododendron
	04	FO	Bl–Oak Fern–Knight's Plume	Engelmann/hybrid spruce subalpine fir (lodgepole pine)	black huckleberry black gooseberry western mountain ash
	06	FH	Bl–Alder–Horsetail	Engelmann/hybrid spruce lodgepole pine	white-flowered rhododendron black gooseberry red raspberry
ESSFmvp2	00	FL	Alpine fescue–Lichen dry meadow	Subalpine fir	mountain-heather dwarf willow terrestrial lichen sedges Festuca spp. Bromus spp. horsetail and moss
		HW	Netted willow–Four-angled mountain heather		
		FW	Altai fescue–Dwarf willow		
AT	00	AW	Entire-leaved white mountain avens–Netted willow		dwarf willow mountain heather terrestrial lichen sedges Festuca spp. Bromus spp. horsetail and moss
		FL	Alpine fescue–Lichen dry meadow		
		HL	Heather–Lichen meadow		

Table 4.12-8 Forage Species Identified for Northern Ecotype Woodland Caribou by Season

Spring Forage	Summer/Fall Forage	Early Winter Forage	Late Winter Forage
forbs and graminoids: *Bromus* spp. *Festuca* spp. *Phleum alpinum* *Pedicularis arctica* *Trisetum spicatum* *Linnaea borealis* terrestrial lichens arboreal lichens	forbs graminoids terrestrial lichens fungi leaves of some shrubs: *Abies lasiocarpa* *Arctoshaphylos* spp. *Dryas* spp. *Ledum groenlandicum* *Menziesia glabella* *Potentilla nivea* *Salix* spp. *Sorbus* spp. *Vaccinium vitis-idaea* horsetails and mosses: *Dicranum scoparium* *Equisetum* spp. *Pleurozium schreberi* *Ptilium* spp.	terrestrial lichens: *Cladina* spp. *Cladonia* spp. *Cetraria* spp. *Peltigera apthosa* *Stereocaulon* spp. arboreal lichens (during milder winters): *Bryoria* spp. sedges: *Eriophurum* spp. *Carex* spp. shrubs: *Salix* spp.	arboreal lichens: *Bryoria* spp. *Evernia mesomorpha* *Stereocaulon paschale* *Usnea* spp. terrestrial lichens: *Cladina* spp. *Cladonia* spp. *Peltigera apthosa*
SOURCES: Petro-Canada 1981, Stevenson and Halter 1985, Saxena and Bilyk 2000, BCMWLAP 2004			

Reclamation activities to meet the wildlife end land use objectives specific to the KI species and beneficial to other wildlife species include the following:

- Plant the forested areas to a diversity of native tree and shrub species, focusing replanting programs on a mix of coniferous and broadleaf tree species, linking tree species selection to ecosystem properties (see Table 4.12-5 and DeLong et al. 1994).
- Plant areas as soon as possible to test revegetation success, especially of selected browse species, and to further test metal uptake in browse species.
- Provide a visual break along road edges through combination of topographic features (berms) and dense plantings of conifers and large deciduous plants to provide visual breaks for grizzly bear, caribou and other wildlife.
- Seed areas susceptible to surface erosion such as steep slopes as soon as possible after placement of soil with a grass-legume erosion protection seed mix. In some areas a compromise may be necessary to balance the use of agronomic species required for erosion protection and native plant species required to provide forestry and wildlife habitat.
- Add large logs, rock piles, stumps and other coarse woody debris to future forested areas to provide micro-habitats for small mammals and insects, and cover and hunting habitat for future marten and potential bear dens.

- Build soil berms and place rock piles on the high elevation windswept areas to provide wind protection and snow capture to assist in the establishment of vegetation and small mammal habitat.
- Retain, as much as possible, areas of forest, small patches or individual trees in order to recover wildlife populations as quickly as possible or to add structural diversity to future stands.
- Plant native coniferous and deciduous plants in dense clumps or islands interspersed with open herbaceous cover areas to provide visual breaks for wildlife, and diversity in habitat structure.
- Consider planting artificial snags to provide wildlife tree habitat for cavity-nesters, feeding habitat for birds such as woodpeckers and raptor perches. Installation of artificial snags would be done in suitable habitats that wildlife tree using species are likely to be located in such as lower elevation sites planted to forest cover.
- Wherever possible, maintain forested connections to connect habitat patches within the MDL with surrounding forest to enable movement and dispersal of animals and plants.

This measures form the basis of the biodiversity action plan. Reclamation measures specific to the habitat re-establishment for woodland caribou include:

- salvaging vegetation layers located in high capability caribou habitats and transplanting onto suitable reclamation sites
- retaining undisturbed areas that contain arboreal or terrestrial lichen populations
- propagation of preferred browse and forage species, as well as research into transplant and propagation techniques of terrestrial lichen
- restricting human access to habitat areas
- limiting line-of-site along linear disturbances

The habitat capability for the post-closure landscape was rated for all species and those with the highest ratings are shown on Figure 4.12-1. The post-closure landscape contains projected site series with high ratings for grizzly bear, woodland caribou, marten and mountain goat. Planting trees, shrubs and forbs used by these species will help to meet their habitat requirements (see Tables 4.12–8, 4.12–9 and 4.12–10). Meeting these objectives will promote the development of wildlife habitat after closure and maximize the wildlife potential of the area. Complete descriptions of wildlife and their seasonal use of the area are provided in Section 10.4.1.

Table 4.12-9 Selected Plants of Cultural Significance to the MLIB

Common English Name	Latin Name
Balsam Fir	*Abies lasiocarpa*
Yarrow	*Achillea millefolium*
Sitka Alder	*Alnus viridis ssp. fruticosa*
Saskatoon	*Amelanchier alnifolia*
Cut Leaf Anenome	*Anemone multifida*
Redberry	*Arctostaphylos uva-ursi*
Brittle Horsehair Lichen	*Bryoria lanestris*

Table 4.12-8 Selected Plants of Cultural Significance to the MLIB (cont'd)

Common English Name	Latin Name
Indian Paintbrush	*Casteilleja miniata*
Caribou Moss	*Cetraria islandica*
Whiskey Jack Plant	*Cornus Canadensis*
Bear's Berry	*Cornus stolonifera*
Waterberry	*Empetrum nigrum*
Fireweed	*Epilobium angustifolium*
Horsetail	*Equisetum*
Wild Strawberry	*Fragaria vesca (and virginiana)*
Alpine Sweet Vetch	*Hedysarum alpinum*
Wild Rhubarb (Cow Parsnip)	*Heracleum lanatum*
Common Sweetgrass	*Hierochloe odorata*
Juniper	*Juniperus communis*
Muskeg Tea	*Ledum groenlandicum*
Beaver Berries	*Lonicera involucrata*
Arctic Lupine	*Lupinus arcticus*
Stiff Club Moss	*Lycopodium annotinum*
Ground Cedar	*Lycopodium complanatum*
Caribou Lichen	*Peltigera aphthosa*
White Spruce	*Picea glauca*
Lodgepole Pine	*Pinus contorta*
Trembling Aspen	*Populus tremuloides*
White-Flowered Rhododendron	*Rhododenron albiforum*
Frogberries	*Ribes hudsonianum*
Wild Grapes or Black Gooseberry	*Ribes lacustre*
Loganberry	*Rubus pubescens*
Mooseberry	*Sorbus scopulina*
Red Sphagnum Moss	*Sphagnum capillaceum*
Common Dandelion	*Taraxacum officinale*
Red Clover	*Trifolium pratense*
Cattail	*Typha latifolia*
Stinging Nettle	*Urtica dioica*
Dwarf Blueberry	*Vaccinium caepitosum*
Huckleberry	*Vaccinium membranaceum*
Velvet-leaved Blueberry	*Vaccinium myrtilloides*
Lingonberry (Low Bush Cranberry)	*Vaccinium vitis-idaea*
Sitka Valerian	*Valeriana sitchensis*

Table 4.12-10 Selected Element Concentrations by Site and Plant Species on the Trend Property

Site	Site Description	Species	Notes	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Mo (mg/kg)	Se (mg/kg)	Zn (mg/kg)
1	West end of Extension Block pit	Salix	Subalpine fir and Engelmann Spruce coniferous forest	<0.1	4.4	3.6	0.1	<0.01	<0.1	0.2	111
		Amelanchier		<0.1	0.08	3.4	0.1	<0.01	0.6	0.2	11.1
		Populus		<0.1	1.42	4.6	0.2	<0.01	<0.1	<0.2	93.1
		Vaccinium		<0.1	0.14	8.3	0.2	<0.01	0.1	<0.2	29.9
3	West end of Extension Block pit	Salix	Krummholz	<0.1	4.5	3.9	0.2	<0.01	<0.1	<0.2	182
		Betula		<0.1	0.27	4.5	0.2	<0.01	<0.1	<0.2	234
		Vaccinium		<0.1	0.07	6.7	<0.1	<0.01	<0.1	<0.2	39.2
4	West end of Extension Block pit	Sorbus	Krummholz	<0.1	0.17	2.7	0.1	<0.01	0.1	<0.2	46.7
9	South Block Pit	Salix	Krummholz	<0.1	17.4	3.6	<0.1	<0.01	<0.1	<0.2	124
		Sorbus		<0.1	0.41	3.8	0.2	<0.01	0.3	<0.2	71.8
		Vaccinium		<0.1	0.09	8.5	0.1	<0.01	0.2	<0.2	33.7
10	South Block Pit	Salix	Subalpine fir and Engelmann spruce coniferous forest	<0.1	0.83	6.6	0.2	<0.01	0.4	<0.2	30.6
		Amelanchier		<0.1	0.15	3.7	0.2	<0.01	0.3	<0.2	8.2
		Populus		<0.1	3.43	8.1	0.2	<0.01	<0.1	0.2	108
		Vaccinium		<0.1	0.1	7.2	0.1	<0.01	0.2	<0.2	43.3
11	South Block Pit	Salix	Krummholz	<0.1	3.88	6.7	0.2	<0.01	0.3	<0.2	204
		Sorbus		<0.1	0.27	2.7	<0.1	<0.01	0.7	<0.2	34.4
		Vaccinium		<0.1	0.08	5.2	0.2	<0.01	0.1	<0.2	22.9
13	Mid-pit Extension Block	Salix	Krummholz	<0.1	4.58	5.4	0.2	<0.01	<0.1	0.3	137
		Amelanchier		<0.1	0.09	3.8	0.2	<0.01	0.3	<0.2	15
14	Mid-pit Extension Block	Salix	Alpine Tundra	<0.1	5.86	6	0.2	<0.01	<0.1	<0.2	172
15	Downslope of mid-pit Extension Block	Salix	Krummholz	<0.1	9.44	5.7	0.3	<0.01	<0.1	<0.2	197
		Vaccinium		<0.1	0.16	7	0.2	<0.01	<0.1	<0.2	43.2
16	Mid-pit Extension Block	Salix	Krummholz	<0.1	1.07	3.8	0.4	<0.01	0.1	0.2	235
17	Mid-pit Extension Block	Salix	Subalpine fir and Engelmann Spruce coniferous forest	<0.1	3.12	4.4	<0.1	<0.01	<0.1	<0.2	80.6
		Vaccinium		<0.1	0.19	6.3	0.1	<0.01	0.1	<0.2	28.9

Table 4.12-11 Selected Element Concentrations by Site and Plant Species on the Roman Property

Site	Site Description	Species	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Mo (mg/kg)	Se (mg/kg)	Zn (mg/kg)
RV100	Engelmann Spruce and Subalpine fir coniferous forest	*Salix spp.*	<0.1	1.53	7.2	<0.1	<0.01	0.2	<0.2	105
		Calamagrostis canadensis	<0.1	0.28	7.9	<0.1	<0.01	0.4	<0.2	34.6
RV110	Engelmann Spruce and Subalpine fir coniferous forest	*Salix spp.*	<0.1	1.04	5.9	<0.1	<0.01	0.2	0.2	83.6
		Calamagrostis canadensis	<0.1	0.05	7.8	<0.1	<0.01	1.1	<0.2	36.3
RV118	Engelmann Spruce and Subalpine fir coniferous forest	*Salix spp.*	<0.1	1.99	6.6	<0.1	<0.01	0.2	<0.2	94.4
RV131	Boreal altai fescue alpine	*Salix spp.*	<0.1	1.01	7	0.1	<0.01	0.4	<0.2	111
		Carex podocarpa	<0.1	0.14	4.4	0.1	<0.01	1.3	<0.2	46
RV135	Boreal altai fescue alpine	*Erigeron peregrinus*	<0.1	0.64	12	<0.1	<0.01	0.6	<0.2	49
		Salix spp.	<0.1	2.99	6.8	<0.1	<0.01	0.3	<0.2	127
		Hedysarum alpinum	<0.1	0.04	8.2	<0.1	<0.01	2.1	0.3	40.2
RV142	Engelmann Spruce and Subalpine fir coniferous forest	*Hedysarum alpinum*	<0.1	0.03	5.9	<0.1	<0.01	1.3	<0.2	29.3
		Salix spp.	<0.1	4.3	5.4	<0.1	<0.01	0.1	<0.2	125

Forestry

Return of forestry values to the forested subzone of the Project is also a priority of the reclamation program. The soil replacement and reclamation program has been developed to target equivalent capability forestry in this area. It should be noted that substantial capping depths over mine waste materials have been specified to maintain similarity in soil physical properties with pre-disturbance conditions, and thus to provide similar moisture regimes between pre- and post-development forest stands. As detailed in Section 4.12.1.2, coal waste can provide a productive substrate for forest stand development (Straker et al. 2005). Because of this, effective rooting depths will be greater than those associated with various capping strategies. Additional reclamation strategies, such as seedling, fertilization and interseeding plantations with nitrogen-fixing ground cover species, will be employed to enhance initial site nutrient status and establish productive early growth.

Sites designated for establishment of tree seedlings will be planted at appropriate densities and with appropriate species to comply with Ministry of Forests and Range stocking standards for the region (MOFR 2000).

Assessment Parameters for Wildlife and Forestry End Land Uses

As indicated above, the primary reclamation objective for the Project is to return equivalent capability for wildlife and forestry, as well as the ability of the reclaimed landscape to support a range of end land uses similar to that which existed before development. In order to evaluate the success of the reclamation program in achieving these objectives, the following assessment parameters are considered:

- Soils. Post-replacement assessment will be completed for reclaimed areas, to document that post-closure materials are consistent with the reclamation plan, within an acceptable range of variation. Assessment will also include analysis of soil chemical properties to determine that soil fertility and metals and trace element concentrations are within target ranges, or will not be deleterious, to re-establishing vegetation communities.
- Vegetation. Reclamation success will be measured using vegetation productivity, community composition and sustainability parameters, such as stand densities, species presence and productivity (growth or biomass production). These parameters will be evaluated repeatedly after reclamation, to confirm that trajectories of vegetation community succession are tracking towards equivalency with pre-development conditions. Where possible measures of convergence with pre-development conditions such as vegetation community percent similarity may be employed. Additionally, the forage quality of wildlife habitat vegetation food species will be evaluated following reclamation through a program of foliar tissue sampling, as required by the Health, Safety and Reclamation Code.

4.12.4.3 Treatment of Structures and Equipment

The Project will use or expand facilities established for the Trend Coal Mine. By using or expanding existing facilities and infrastructure incremental disturbances will be minimized for facilities, such as the rail load-out, coal processing plant site, tailings management facility and explosives storage areas developed for the Project. In general,

soil volume requirements, replacement volumes, and reclamation for those features are detailed and dealt with in the Trend Coal Mine Permit Application.

4.12.4.4 Waste Dump Reclamation

The Project will consist of waste dumps that are situated on both the Trend Coal Mine and on the MDL adjacent to Trend Coal Mine. Approximately 295 ha of waste dumps will be located on the Trend Coal Mine and approximately 181 ha on the MDL. Project dumps situated in the Trend Coal Mine will predominantly be covering pre-existing waste dumps and open pits.

All waste dumps will be resloped to an angle of 2H:1V soon after they become inactive; at mine closure remaining waste dumps will be resloped. After completion of resloping activities, waste dumps located below the treeline will be capped with a minimum of 50 cm of salvaged soil material; dumps located above tree line in the alpine zone will be capped with 30 cm of salvaged soil. Soil material will either be supplied as direct placement from active soil salvage operations or from soil stockpiles. Refer to Table 4.12-2 for waste dump areas and soil volume requirement details. Soil will be trucked to the dump platforms and spread by dozer down the resloped dump face. The resloped 2H:1V dump slopes are at a gradient that will allow the dozer to operate effectively to spread overburden. Soil placed on the platform may require ripping before revegetation if the surface becomes compacted due to truck or equipment traffic. Where soil stockpiles are located adjacent to the waste dump, soil material may be directly pushed from the stockpile by a dozer and spread on the adjacent dump surface. Once the sites have been capped they will be revegetated to establish a long-term self-sustaining vegetation cover that will provide erosion and invasive plant control and foster the establishment of productive ecosystems. Refer to Section 4.12.4.2 for reclamation practices suitable for the waste rock dumps such as building soil berms and placing rock piles to provide wind protection and snow capture and assist in the establishment of vegetation and provide small mammal habitat.

If required to stabilize dump slopes, measures such as installation of erosion control blankets, application of a bonded fibre matrix or installation of bioengineering structures such as wattle fences, and modified brush layers may be undertaken. Refer to Section 4.4.2.7 for details on geotechnical evaluations of waste dumps.

The Project will have waste dumps developed over moderate to high capability caribou habitat in the alpine tundra and forested sub-alpine zones within the MDL. In order to mitigate the environmental effects on caribou habitat the following specific reclamation measures may be carried out:

- Before the development of the dumps in the high capability caribou habitat areas, the vegetation layers will be salvaged wherever practicable. In addition, vegetation layers may also be salvaged from other mine disturbance areas such as pits or roads. This salvaging is proposed in order to preserve graminoid- and lichen-dominated vegetation communities that form an important component of caribou diets by re-establishing these communities as part of the reclaimed mine site. The salvaged vegetation layers will include any trees, shrubs, herbaceous vegetation or terrestrial lichens that are present on the salvage site, along with the roots and soils. Salvaging will involve stripping sections of the vegetation, root and soil layers as complete and intact clumps using heavy equipment such as front end loaders. Wherever possible, the salvaged vegetation units will be directly salvaged and transplanted onto suitable reclamation sites. Alternatively, where direct placement is not possible, this material

will be temporarily placed in stockpile sites until suitable sites become available for reclamation. The transplant clumps will be placed on suitable sites once site preparation and soil capping activities have been completed. Suitable sites will include areas that have appropriate soil moisture regimes and protected aspects that will allow the transplanted clumps to become established and spread out. Once planted, the clumps will be monitored to track growth, vigour and species composition. Maintenance and mitigation measures will be implemented as required to facilitate successful establishment.

- The waste dumps will be contoured to create gently rolling terrain with a variety of aspects and slopes. If required, material will be brought in to develop berms on dump platforms in order to create rolling terrain. On the dumps located in the alpine tundra zone, the higher elevation dump platforms will be contoured to form a combination of open exposed ridge tops interspersed with depression and bowl areas. The vegetation clumps will be planted on the protected portions of the ridge slopes and bowls while the more exposed ridge tops can be seeded with hardier native forbs and a mixture of native and agronomic grasses. At the time of soil replacement on exposed windy ridge tops, soils will be strategically placed in the protected depression and bowl areas so that exposure to winds is minimized to reduce erosion. Waste dumps located in the lower elevation forested ecosystems will be planted with a variety of trees, shrubs, grasses and forbs to form a mixture of dense canopy coniferous forests capable of supporting arboreal lichens, interspersed with open canopy shrublands and forb dominated open meadows that are capable of supporting terrestrial lichens. In addition, transplanting of vegetation layer clumps will also be undertaken. Candidate species for planting and transplanting to recreate caribou habitat are listed in Tables 4.12–8, 4.12–9 and 4.12–10.
- Other than the gradual increase in the amount of rock and the surface area of the facilities, no changes are anticipated that would affect the assessment of ML/ARD potential and the water quality predictions presented in Section 3.4. The orientation of the stratigraphy is such that the Gates and Gething Pits will be mined from west to east and will continuously intercept all stratigraphic units. An early mine closure would therefore not be expected to result in significantly different waste dump compositions than have been predicted for the full 10-year life of mine. The ML/ARD potential and source term water quality predictions are therefore applicable throughout the life of mine, rather than just the final configuration.

4.12.4.5 Tailings Reclamation

During the early phases of operation, the Project conceptual tailings disposal strategy will be to mix the tailings with CCR and move them to the waste dumps to be treated as PAG and layered between layers of neutralizing rock. During the later part of operation, when the western end of the Roman Gates Pit is complete, tailings will be deposited in the pit floor. At mine closure a water cover will be maintained over the tailings to control oxidation of the PAG tailings. There will be no opportunity for terrestrial reclamation and due to the concern of selenium uptake in aquatic vegetation; the establishment of aquatic vegetation at the margins of RP3 will not be encouraged.

4.12.4.6 Pit Reclamation

At closure, a large portion of the western end of the Gates Pit (RP3) will remain inundated and will be a permanent water feature within the pit used as a storage facility

for PAG tailings material and will not be reclaimed. The focus of pit reclamation will be the eastern portions of the Gates Pit as well as the two smaller Gething Pits (see Figure 4.12-1).

Before development of the pits, the areas will be cleared of forest cover and the topsoil will be salvaged and placed in local stockpiles. Reclamation of pit floors and haul roads will be contingent upon establishment of safe access for personnel and equipment to carry out site preparation and soil capping, and the Final Feasibility of reclaiming these sites. Reclamation of pits may not be feasible where it is not safe for personnel to enter after mining to complete tree planting on narrow pit benches which are exposed to rock fall from the pit walls above. Wherever practicable, the pit floors and haul roads will be capped with 30 cm of salvaged soil material. It is estimated that approximately 26 ha in the pits will require reclamation. Approximately 3.4 ha of pit walls are constructed in overburden material and are required to be reclaimed as per the Health, Safety and Reclamation Code for Mines in British Columbia. These pit walls will be resloped and capped with 50 cm of soil, if the overburden material is not already suitable for vegetation growth. Soil material will either be supplied as direct placement from active soil salvage operations or from soil stockpiles. Soil will be trucked to the pit floors, haul roads and walls and spread by dozer. The soil capping may require ripping before revegetation if the surface becomes compacted due to truck or equipment traffic. Refer to Table 4.12-2 for pit areas and soil volume requirement details.

Once the sites have been capped, they will be revegetated to establish a long-term self-sustaining vegetation cover that will provide erosion and invasive plant control and help to establish productive ecosystems. In addition, to prevent the pit haul roads from becoming travel corridors for caribou predators, hunters and ATVs, the road surface will be extremely roughened, wood debris and rock piles will be distributed along the length of the roads and the road corridor densely planted with trees in order to create line of sight and travel barriers. Refer to Section 4.12.4.2 for reclamation objectives suitable for pits.

A potential problem which may occur is that the pit haul roads may collect water runoff from adjacent pit walls and convey the water down to the pit floors and potentially could become channels. This could result in the erosion of the soil capping material. To control and prevent erosion of the soil capping, the following measures can be undertaken:

- installation of cross-ditches and waterbars across the road to impede down slope surface water flow and direct surface water off the road
- heavy application of an erosion control grass seed mix on the soil cap in order to establish a dense vegetation cover on all soil surfaces

Other than the gradual increase in the amount of rock and the surface area of the facilities, no changes are anticipated that would affect the assessment of ML/ARD potential and the water quality predictions presented in Section 3.4. The orientation of the stratigraphy is such that the Gates and Gething Pits will be mined from west to east and will continuously intercept all stratigraphic units. An early mine closure would therefore not be expected to result in significantly different pit wall compositions than have been predicted for the full 10-year life of mine. The ML/ARD potential and source term water quality predictions are therefore applicable throughout the life of mine, rather than just the final configuration.

4.12.4.7 Watercourse Reclamation

After closure, the water management structures including the sedimentation ponds and diversion and collection ditches will remain in place until the reclamation earthwork activities, such as resloping dump faces, have been completed and vegetation has been established to prevent surface erosion. Once the reclamation activities have been completed and there is no longer a need for sediment control, the collection ditches will be backfilled to original topography and capped with windrowed topsoil. This will allow surface waters to flow along the natural local drainage systems. The sedimentation pond containment berms will be removed to pond height so the pond surface will be free draining and not impound water. The captured sediment will be retained within the containment pond and the berm material will be graded over the surface to assist in dust control and revegetation. Soil replacement of constructed ditches will be to the same depth that was originally salvaged from the disturbance site. Soil replacement will be carried out in such a manner that the lower soil horizons will be replaced first into the disturbance area with the topsoil material placed on top of them. Refer to Section 4.11 for more details on site water management.

Once the sites have been capped they will be revegetated to establish a long-term self-sustaining vegetation cover that will provide erosion and invasive plant control and promote the establishment of productive ecosystems. Approximately 5.4 ha of sedimentation pond and 3500 m of diversion and collection ditches will be reclaimed.

4.12.4.8 Mine Haul Road Reclamation

The Project will use the access road network established for the Trend Coal Mine. It will consist of:

- access roads outside of waste dumps and pits, the clean coal haul road
- PDR-46
- Trend Coal Mine By-pass Road
- access roads to the explosives storage, magazine factory, and tailings area
- and an existing gas well access road (Talisman)

Soil volume requirements, replacement volumes, and reclamation for the roads which require reclamation are detailed and dealt with in the Trend Coal Mine Permit Application.

Project haul roads that are constructed on the waste dumps will be reclaimed as part of the waste dump and undergo the same reclamation treatments as the dumps.

The mine haul road areas that will be located between the Project pits will consist of short internal road sections connecting between the pits. Road lengths will vary between 20 to 100 m. Before soil replacement on these disturbances, the roads will undergo permanent deactivation activities including:

- removal of culverts
- re-establishment of drainages
- pullback of sidecast material and backfilling of cutbanks to re-establish the original ground contours

These haul road areas are likely to undergo soil disturbance and potentially some soil loss may occur; therefore, they will be capped with 30 cm of soil material. Once these roads have been capped they will be revegetated to establish a long-term, self-sustaining vegetation cover that will provide erosion and invasive plant control and promote the establishment of productive ecosystems. Approximately 39 ha of road disturbance will be reclaimed. Refer to Table 4.12-2 for haul road areas and soil volume requirement details. If required for slope stabilization on remaining road cutbanks and fill slopes, installation of erosion control blankets, application of a bonded fibre matrix, or installation of bioengineering structures such as wattle fences, and modified brush layers may be done. Due to short lengths of these internal roads, they are not anticipated to become travel corridors for caribou predators from lower elevation forested ecosystems. Also, there will not be any long sight lines on these short internal roads. During the reclamation process, these roads will most likely disappear as they are proposed to undergo permanent deactivation activities and be covered by soil capping, thereby blending in with the surrounding topography. To make the roads even less visible, the sections located in the lower elevation forested ecosystems will be planted with coniferous and deciduous trees (sections in the alpine tundra zone will be planted with shrubs). Tables 4.12–8, 4.12–9 and 4.12–10 list candidate species for planting in areas identified as important caribou habitat.

After closure, one road about 2 km in length will remain to provide access to the tailings pond outlet for inspection and water sampling. The road will traverse the dump slopes located in the north-western corner of the MDL. It is proposed that this road will be a narrow track sufficient for ATV access. The road will be left in a semi-permanent, deactivated condition, which will allow the road to remain passable and also environmentally stable. Semi-permanent deactivation measures include:

- installation of cross-ditches and waterbars across the road to direct road surface water off the road
- removal or breaching of windrows along the road edge
- outsloping and insloping of the road surface as appropriate
- revegetation of exposed soil surfaces for erosion and invasive plant control

This road traverses the lower slopes in the forested zone and does not provide a connecting link to the upper subalpine or alpine tundra zone and therefore is not expected to provide a corridor for predator movement or motorized vehicle access.

4.12.4.9 Trace Element Uptake in Vegetation

Introduction

A baseline measure of vegetation tissue element composition is required to evaluate pre- and post-disturbance element concentrations in flora. It is important to determine if any potentially harmful elements (e.g., arsenic, cadmium, selenium) are present at naturally elevated levels on the site before disturbance so that elevated levels following disturbance are not erroneously attributed to industrial activities, as opposed to pre-existing mineralization. The following discussion presents information on baseline terrestrial vegetation elemental concentrations.

Selenium is the contaminant of particular interest on this site, as it is frequently associated with coal deposits (Kabata-Pendias 2001). Selenium can readily be taken up

by plants and stored in seeds and growing tips, the latter of which ungulates will browse preferentially. Selenium is a dietary requirement of both cattle and wild ungulates (and humans), but at elevated levels has been demonstrated to cause selenium toxicity in cattle. It is presumed that wild ungulates are susceptible to the same toxicity effects, as they have a ruminant digestive system similar to that of cattle. However, no known cases of selenium toxicity have been recorded in deer or other wild ungulates, and research on dietary tolerances of ungulates in naturally seleniferous areas indicates that these animals are adapted to elevated selenium levels in forage, and do not show toxicity symptoms at concentrations substantially in excess of published toxic thresholds (Raisbeck et al. 1995).

The proposed Project sites are used by several ungulate species. Caribou and mountain goats use the area year-round, while moose are present during the summer. Therefore, monitoring of selenium concentrations in terrestrial vegetation consumed by these species will be a focus of post-closure monitoring on the site.

Baseline Vegetation Sampling

Vegetation samples for metals analysis were collected at 12 survey locations on the MDL. Within each plot, samples (leafy branches or stems) of several common plant species were gathered, with preference given to commonly browsed plants. New shoots were collected where possible, as well as flowers and seeds. Vegetation species were chosen for sampling based on use by ungulates and people, the ability of the plant to accumulate heavy metals (*Salix),* as well as to provide a full range of vegetation types (e.g., shrub, forb, grass). Once collected, vegetation samples were bagged by species and labelled with a plot number and species name. The samples were stored in a freezer, and later shipped to CANTEST in a cooler for analysis. A full summary of analysis data are contained in Section 9, Appendix 9G.

Species selected for monitoring were:

- willow (*Salix spp.)*
- bluejoint reedgrass (*Calamagrostis canadensis*)
- shortstalk sedge (*Carex podocarpa*)
- subalpine daisy (*Erigeron peregrines*)
- alpine sweetvetch (*Hedysarum alpinum*)

Previously, on the Trend Coal Mine, vegetation samples for metals analysis were collected from areas that reflected the range of soil types on the Trend Coal Mine and were primarily located along the drilling access roads in areas of maximum soil profile exposure. Within each plot, samples (leafy branches or stems) of several common shrub species were gathered, with preference given to collection of shrub species that are commonly browsed by ungulates. Once collected, vegetation samples were bagged by species and labelled with a plot number and species name. The samples were stored in a refrigerator and later shipped to CANTEST in a cooler for analysis.

Species selected for monitoring were:

- willow (*Salix spp*.)
- birch (*Betula papyrifera*)
- aspen (*Populous tremuloides*)

- Saskatoon (*Amelanchier alnifolia*)
- black huckleberry (*Vaccinium membranaceum*)
- mountain ash (*Sorbus sitchensis*)

Lab Analyses

All 12 of the samples collected from the Project were selected for analysis.

All elements were analyzed using inductively coupled plasma mass spectrometry (ICP-MS) at CANTEST in Richmond, British Columbia.

Results

Results of lab analyses are presented in Table 4.12-10 (Trend Coal Mine) and Table 4.12-11 (the Project).

Discussion

The dietary tolerances of wild ungulates for the elements considered have not been determined; however, the thresholds established for cattle have been used to predict effects on wild ungulates. All elements were below toxic levels for dietary intake by cattle for all sites and species (Puls 1994), and were within normal ranges published in scientific literature, (see Table 4.12-12, Kabata-Pendias 2001).

Table 4.12-12 Dietary Tolerances for Cattle and Sheep

Element	Species	Normal	Adequate	High	Toxic
Aluminum (Al)l (ppm)	cattle	<300	–	–	>1200
	sheep	<300	–	–	>1200
Arsenic (As) (ppm)	cattle [a]	unknown			
	sheep [a]	10–20 ppm is tolerated in most toxic form 1000 ppm is tolerated in least toxic form			
Barium (Ba) (ppm)	Cattle	0.5–20		>20	
Boron (B) (ppm)	cattle	1–50	–	50–150	>200
Calcium (Ca) (%)	cattle	–	0.38–0.81	>1.4	–
	sheep	–	0.36–1.4	–	–
Cadmium (Cd) (ppm)	cattle	0.01–0.5	–	5–50	50–500
	sheep	<0.5	–	5–30	50–500
Chromium (Cr) (ppm)	cattle	0.1–0.5	–	–	>40
Cobalt (Co) (ppm)	sheep		0.10–0.25	4.0–20	>30
Copper (Cu) (ppm)	deer	–	10–25	–	–
	sheep	–	5–10	10–20	>20
Iron (Fe) (ppm)	cattle	–	100–500	1000–2000	>4000
	sheep	–	50–280	–	–
Lead (Pb) (ppm)	cattle	<1.0	–	5–50	>100
	sheep	<1.0	–	3–60	5–1000
Mercury (Hg) (ppm)	cattle	<0.01–0.10	–	1.0–5.0	4–30

Table 4.12-13 Dietary Tolerances for Cattle and Sheep

Element	Species	Normal	Adequate	High	Toxic
Magnesium (Mg) (%)	cattle	–	0.25–0.35	–	1–4
	sheep	–	0.20–0.30	0.5	>0.80
Molybdenum (Mo) (ppm)	cattle	0.5–3.5	–	>5.0	10–203
	sheep	0.5–3.5	–	4.0–24	–
Nickel (Ni) (ppm)	cattle		1.—10.0	50–1,000	>1,500
	sheep		0.9–2.00	10	11
Phosphorus (P) (%)	cattle	–	0.35–0.45	0.40–1.0	>1.0
	sheep	–	0.25–0.50	–	–

NOTES:
Toxic dose varies by form (e.g., trivalent or pentavalent). Unknown dietary role, though sheep and cattle may develop dependency on high As forage if fed continuous sub-lethal doses; poisoning uncommon.
ppm = parts per million
SOURCE:
Mineral Levels in Animal Health (Puls 1994).

Isolated willow samples showed elevated levels of cadmium as defined by concentrations exceeding normal dietary ranges. All samples identified as having elevated cadmium concentrations on the Project remained below the lower part of the high range of recommended dietary intake levels for cattle (5 to 50 mg/kg) (Puls 1994), and are thus well below known chronic or acute toxicity levels. Two samples collected on the Trend Coal Mine were within the lower part of the high range of recommended dietary intake levels for cattle, and are below known chronic or acute toxicity levels.

Willow is a known accumulator of heavy metals, particularly cadmium, and it will selectively take up cadmium where it is present at high concentrations in the soil to levels higher than would be found in other forage vegetation. As a result, willow should not be considered indicative of overall cadmium bioavailability in soils, or as a reference species for baseline dietary availability of cadmium in the Project area, though it is a favoured browse item. It is, however, important to recognise the greater propensity of willow to accumulate cadmium for future monitoring.

Overall, element concentrations in sampled species on site are within ranges considered normal for undisturbed locations and adequate for consumption by local wildlife species. Selenium levels are within the normal range for uncontaminated vegetation, while marginally elevated concentrations of cadmium in willow species were detected only in isolated samples.

4.12.4.10 Research Opportunities

Approximately 70 percent of the MDL is located in the alpine and subalpine zones, thus research will focus on the challenges associated with reclamation of high elevation coal spoil. High elevation dumps present unique challenges due to climatic factors, which create difficulties in establishing agronomic grass and legume species commonly used for reclamation at lower elevations. Research opportunities exist in the:

- collection of native seeds
- propagation and planting methods for plants suited to the high elevation habitats

- propagation and cultivation of rare plant species
- direct seeding
- propagation of terrestrial lichens

Also likely components of future reclamation research are:

- selection of appropriate browse species for ungulates, selection and testing of suitable grass and legume species for long term reclamation
- monitoring vegetation productivity and growth on reclaimed sites
- measuring the growth and survival of deciduous and coniferous tree and shrub species on reclaimed sites

4.12.5 Operational and Post-closure Monitoring

PRC will conduct a range of monitoring programs to document:

- compliance with permits, licenses and approvals issued for the Project
- compliance with applicable provincial and federal legislation relating to mine operations and environmental protection
- the success of reclamation programs
- uptake of metal in reclamation vegetation
- the geotechnical stability of structures, including waste dumps, diversion ditches, sediment control ponds and soil stockpiles (see Section 4.4.2.7 for details on geotechnical evaluation of mine features)
- the results of measures to minimize effects on the environment

Post-closure reclamation monitoring for the mine site will continue until a self-sustaining vegetation cover that meets end land use objectives has been established and confirmed by monitoring results.

4.13 References

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Roman Coal Mine Project

ENVIRONMENTAL ASSESSMENT REPORT

VOLUME 1, SECTION 5: ENVIRONMENTAL MANAGEMENT PLANS

Prepared for:
BC Environmental Assessment Office
Victoria, British Columbia

Prepared by:
Peace River Coal Inc.
Vancouver, British Columbia

March 2010

5 Environmental Management Plans

5.1 Overview

The Environmental Management Plans (EMPs) have been designed to encompass all aspects of the proposed Roman Coal Mine Project (the Project) from construction through operation and to closure. The plans presented in this application are drafts and will be modified and refined through feasibility planning and are subject to permitting requirements. In order to aid efficient use of the document discipline areas have been identified and individual plans have been compiled for each discipline. The discipline areas and sub categories are listed below.

- Air Quality and Dust Control Plan
- Wildlife Protection and Monitoring Plan
    - Caribou Protection Plan
- Invasive Plants Management Plan
- Surface Erosion and Sediment Control Plan
    - Flocculant Management Plan
- Receiving Water Quality Monitoring Plan
- Selenium Management Plan
- Metal Leaching and Acid Rock Drainage Management Plan
- Fish Habitat Protection Plan
- Solid and Hazardous Waste Management Plan
- Chemical Management Plan
    - Fuel Storage, Handling and Transportation
    - Explosives Handling
    - Emergency Response Plan
- Access Management and Traffic Management Plan
- Routine Environmental Site Inspections
- Archaeology and Traditional Land Use Site Protection Plan

5.1.1 Introduction

Peace River Coal Inc. (PRC) has compiled a series of EMPs for the Project. The Project is adjacent to the Trend Coal Mine and both projects will share common infrastructure, so integrated management plans have been developed and will be used for both operations. The EMPs will address the environmental supervision, mitigation, environmental effects monitoring, and review required to manage the potential adverse effects of the Project during construction and operations. The EMPs will continually be revised as needed to

include any additional permitting requirements and incorporate adaptive management principles determined through the planning and implementation of the Project.

These EMPs integrate existing corporate environmental policies and procedures and provide Project-specific environmental management information.

5.1.2 Roles and Responsibilities

PRC has developed a management and reporting structure that will ensure environmental protection at the Project is incorporated into all plans and decisions made for the site. In keeping with its commitment to Corporate Policy, PRC believes that assigning environmental responsibility throughout all management levels of the company will ensure that the Project is developed in an economically and environmentally sound manner.

All site personnel, including PRC employees and contract workers, will be held accountable for performing their assigned duties in a safe and environmentally sound manner. All site personnel will be expected to work in accordance with all safety and environmental policies, rules and procedures put in place by PRC.

5.1.3 Organization Structure

PRC's General Manager and CEO will have overall responsibility for the Project both for associated construction projects as well as on-going mine operations. The General Mine Manager will be appointed with overall day-to-day operational responsibility for the Project. The Operations Manager will provide strategic environmental direction to the General Mine Manager while the Chief Environmental Scientist and the Environmental Coordinator will have overall responsibility for ensuring that the site is developed and operated in accordance with the EMP and applicable permits and legislation.

The Environmental Coordinator will be responsible for the implementation of the Environmental Management Plans and all required monitoring, inspections and reporting and will report to the Chief Environmental Scientist. Once the Project enters the operational phase, the Project will enter into a routine monthly and annual reporting cycle with the regulatory agencies.

The Environment and Regulatory Manager (Vancouver), who reports directly to the General Manager and CEO, is responsible for PRC's corporate environmental policy.

The organization structure during operations is shown in Figure 5.1-1.

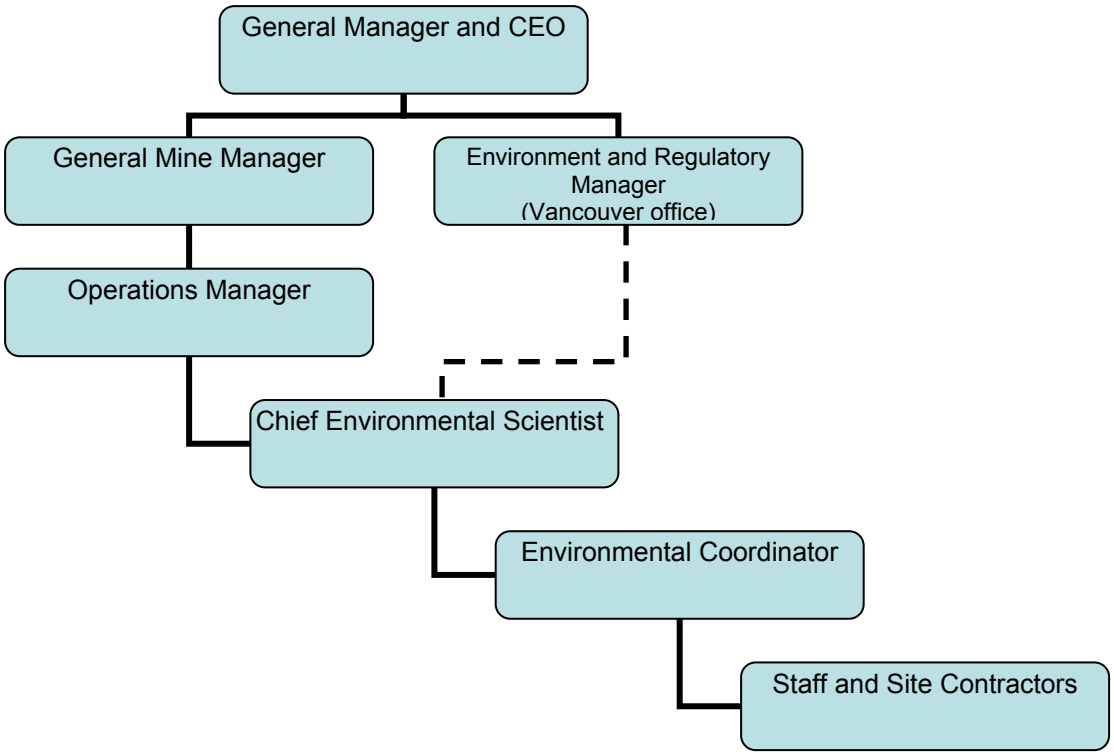

Figure 5.1-1 Organization Structure

5.1.3.1 Environment and Regulatory Manager (Vancouver)

The Environmental and Regulatory Manager is responsible for ensuring that plans and designs for the Project conform to the applicable permits and legislation and complies with PRC's corporate environmental policy and objectives. The Manager is also responsible for monitoring the mine's environmental performance.

5.1.3.2 General Mine Manager

The General Mine Manager, appointed pursuant to Section 21 of the *Mines Act* has responsibility for ensuring that the mine is operated in conformance to the *Mines Act* and the Health, Safety and Reclamation Code for Mines in British Columbia.

5.1.3.3 Operations Manager

The Operations Manager (reporting to the General Mine Manager), is accountable for ensuring that the EMP as a whole is meeting the operational requirements of PRC's facilities and is integrated with operations.

5.1.3.4 Chief Environmental Scientist

The Chief Environmental Scientist will have overall responsibility for ensuring that the site is developed in accordance with the EMP and applicable permits and legislation. In respect to environmental control, the Chief Environmental Scientist will be responsible for supervising all environmental monitoring and regular site inspections during

construction and operations, and will provide technical support to the Operations Manager. An Environmental Coordinator will support the Chief Environmental Scientist in checking the day-to-day environmental operations.

5.1.3.5 Environmental Coordinator

The position of Environmental Coordinator will report to the Chief Environmental Scientist and will assist in ensuring conformance of the EMP through regular, routine inspections, monitoring and reporting.

5.1.3.6 Staff and Contractors

All staff and contractors are required to perform all work in compliance with the EMP, and PRC's Environmental Policies. Staff and contractors are considered the first line of defence for emergency situations including spill response.

5.1.4 Training

All PRC employees and contractors will be trained appropriately for their job tasks on the Project. In addition, they will receive training, as agreed by PRC in site-specific safety and environmental policies, rules and procedures. Employees are required to obtain assistance and clarification if they find any of the policies, rules and procedures unclear or unworkable or unfeasible.

5.2 Air Quality and Dust Control Plan

The air quality and dust control plan (AQDCP) for the Project outlines the best management practices and mitigation measures that will be undertaken to minimize the air quality effects of the mining operations. The plan considers the operations at the Roman mine site, rail load-out and along the haul route. The plan will be implemented for the expected lifetime of the Project.

Specific objectives of the AQDCP are to:

- control fugitive dust emission from the Project
- minimize effects on the human health and safety of workers
- protect the natural environment

Ambient monitoring of dustfall is currently being done near the Roman and Trend mine sites and rail load-out while PM_{10} and $PM_{2.5}$ are being monitored at the Tumbler Ridge Airport, which is located approximately 3 km southeast of the rail load-out. Another PM_{10} and $PM_{2.5}$ monitor has been set up at the Industrial Park, which is located about 1 km northeast of the Rail load-out. Stack testing of the coal dryer stack at the Project for NO_2, SO_2, TSP, PM_{10} and $PM_{2.5}$ is recommended. The ambient air quality objectives of NO_2, SO_2, dustfall, $PM_{2.5}$ and PM_{10} are identified and are shown in Section 7.2.9 of the Air Quality Assessment. If these objectives are exceeded or if visual observations indicate that dust management is not adequate, contingency measures will be undertaken.

5.2.1 Emission Sources

5.2.1.1 Construction Phase

The site preparation and construction of additional plant and load-out infrastructure will contribute to fugitive dust and other criteria air contaminant emissions; however, these emissions will be of limited duration and are expected to have a negligible effect compared to the emissions that will be released during mining operations.

5.2.1.2 Operations Phase

Fugitive dust, greenhouse gases and products of combustion will be emitted by the Project. Fugitive dust emissions will be the major source of air emissions from the Project and they are also the primary concern for potential human health effects. Operations that involve the movement of overburden material or coal, and those that expose erodible surface areas will generate fugitive dust emissions. Mine site processes such as screening and conveying will also contribute to fugitive dust emissions. Sources of air emissions at the mine site will include:

- drilling and blasting
- coal extraction from the pit
- coal loading into mine haul trucks
- coal unloading at the truck-dump hopper
- crushing
- screening
- coal conveying
- coal drying
- coal stockpiling
- haul-truck loading
- mobile equipment operation (hydraulic shovels, front-end loaders, haul trucks)

Sources of air emissions at the load-out will include:

- coal unloading at the truck dump
- coal conveying (electric drive conveyors)
- emergency coal stockpiling
- potential wind erosion from stockpiles
- railcar loading
- mobile equipment operation (three front-end loaders, service and operator trucks)

Product haul trucks travelling to and from the load-out will be sources of fugitive dust, greenhouse gas (GHG) and criteria air contaminants (CAC) emissions. The haul trucks will be covered with tarps both when delivering coal to the load-out and when returning to the mine. Therefore the main source of fugitive dust will be re-suspension of crustal dust from the road surface.

5.2.1.3 Reclamation and Decommissioning Phase

After mine closure, reclamation of the mine site will include activities related to site decommissioning. Site decommissioning will consist of removal of all facilities, re-sloping, replacement of soils, seeding waste dumps, and decommissioning of roads and water management structures. Decommissioning activities will be of short duration and will be spread out over a large area. Nonetheless reclamation activities will result in emissions of fugitive dust, CAC and GHG.

5.2.2 Fugitive Dust Management

Effective dust control measures will be important in order to reduce the potential for high particulate concentrations during all phases of the Project. The following sections outline by activity specific mitigation measures that will be incorporated into the design and a few recommendations to limit fugitive dust emissions.

5.2.2.1 Drilling and Blasting

Drilling rigs will be equipped with dust-suppression devices such as cyclones or bag filters. Overburden discharged adjacent to the drilling rig should be wetted down.

Blasting results in the instantaneous release of a large dust cloud. High concentrations of ground-level particulate matter can result when wind speeds are low. Emissions can be controlled by restricting blasting to periods when wind speeds are high. When possible, blasting should be avoided when winds will carry the dust cloud towards sensitive areas. Another mitigation measure for blasting is to use selective stemming. Normal practice at most mines is to use the drill cuttings as they are conveniently available, cost nothing, and pack in well. However, drill cuttings are suitable only if they are moist or if the very coarse fractions are used.

5.2.2.2 Material Handling and Processing

The transfer of overburden and coal into trucks and the transportation of materials by bulldozing, front-end loaders, and grading operations can cause considerable fugitive dust emissions. To minimize and mitigate material handling emissions, the following measures will be considered:

- Whenever possible topsoil should be stripped while moist to reduce dust generated by scraper and dozer operations; however, if the soil is worked when it is too moist (i.e., with a moisture content of more than about 12 percent) its structure can break down, rendering the soil unsuitable for rehabilitation.
- The heights from which excavated materials are dropped will be kept as low as practical to minimize fugitive dust emissions.
- Operators will not overload trucks to reduce the potential for spillage on haul routes.

During dry and windy conditions, fugitive dust emissions may attain levels that require additional temporary mitigation measures. During these conditions, water may need to be applied to overburden at the pit. Working areas will also be watered during dry conditions to reduce dust arising from machinery movements.

The following mitigation measures will be used during coal processing to minimize fugitive dust emissions:

- Mine site
  - the raw coal feed hopper will be semi-enclosed
  - water will be applied to problematic areas
  - screen and crusher will be enclosed
- Load-out
  - truck dump with enclosed feeder
  - water will be applied to problematic areas

5.2.2.3 Conveyors and Transfer Points

A number of conveyors are used at the mine site and the load-out to transport coal at various stages of the coal processing. The primary source of dust emissions associated with the conveyors occurs when material is dropped from a height onto a pile. Such emissions will be greatest as a result of wind gusts or during high wind conditions. The proposed conveyors incorporate the following mitigation features:

- Mine site
  - conveyor transfer points will have enclosures or skirting
  - material drop heights will be minimized
- Load-out
  - conveyor covers
  - enclosed transfer chutes at conveyor transfer points
  - discharge heights minimized

5.2.2.4 Coal Dryer

During operations, the coal dryer will emit CO_2, NO_2, SO_2 and particulate matter. Mitigation measures will be used to reduce fugitive dust and to reduce SO_2 from the coal dryer. These mitigation measures include a high-energy scrubber, cyclone and mist eliminator.

5.2.2.5 Stockpiles

The main mitigation measure for minimizing fugitive dust from wind erosion is storing the coal in silos or enclosures. In the event that the silos are full, excess coal may be stockpiled.

The concern with stockpiles is the generation of fugitive dust by strong winds. At rail load-out, the incremental area of forest that will be cleared to accommodate upgraded load-out infrastructure has been minimized to maintain as much of a windbreak as possible.

If wind erosion from the stockpile is observed it can be readily controlled by stabilizing the affected surfaces via the application of a dust suppressant. However as coal stockpiles associated with the project will be active (continuously disturbed), this mitigation is not effective.

If the above mitigation measures are not effective and ambient air quality monitoring results indicates that additional mitigation is required, the following measures will be considered:

- minimizing height of piles to minimize emissions
- installation of ROM wind fences to provide some reduction in wind speed and thus reduction in wind-blown dust emissions. A wind fence with 50 percent porosity generally provides a flow retardation zone on the order of 10 to 20 times the height of the fence
- construction of berms upwind to reduce wind speed in the lee of the structure. Berms work in a similar manner to wind screens but tend to have a smaller area of influence. Berms with fences installed on top are often used and prove an effective combination

5.2.2.6 Railcars

Clean coal will have a moisture content of approximately 6 percent as a result of beneficiation. Once the coal is loaded into the rail car it is profiled then sprayed with an emulsion to form a crust on top of the coal to control dust emissions during transport. If load adjustments of the railcars are made after the rail car has been sprayed, the load should be levelled and re-sprayed with sealant prior to departure from the load-out.

5.2.2.7 Unpaved Roads

A haul route which includes a series of unpaved roads will be used to transport coal approximately 21 km from the Roman Coal Mine site to the load-out.

Vehicle Speed Controls

High vehicle speed increases the amount of dust stirred up from unpaved roads. Lowering the speed of a vehicle from 72 to 56 km/h can reduce crustal dust emissions by up to 22 percent (Washington State Department of Ecology 2003). Therefore traveling speeds will be controlled to reduce traffic-induced dust dispersion and re-suspension from the operation of haul trucks. On the haul route, the posted speed limits will be adhered to. For traffic within the mine site and load-out, vehicle speeds will be restricted to 50 km/h.

Road Watering

A water truck will be used to control potential fugitive dust emissions during dry conditions. Water will be applied to the entire length of the haul road as well as around the mine site and at rail load-out. The control efficiency of watering unpaved haul routes depends on the amount of water used, the frequency of application, the volume of traffic, and the prevailing weather conditions. To be effective, watering of unpaved areas should be conducted several times a day during periods of dry weather.

Application of Chemical Dust Suppressant

Chemical dust suppressants may also be applied to the haul routes. The application rate will depend on the type of chemical dust suppressant that is selected. Water absorbing suppressants (e.g., magnesium chloride, calcium chloride or sodium chloride), organic petroleum products and lignin derivatives generally require one to two treatments per season. Tall oil derivatives, synthetic polymer derivatives and clay additives need only one treatment every few years whereas vegetable oils need to be applied once per season.

Dust suppressants work by either agglomerating the fine particles, binding the surface particles together, or increasing the density of the road surface material. They reduce the ability of the surface particles to be lifted and suspended by either vehicle tires or wind.

Chemical dust suppressants should be applied using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments. Chemical treatment can reduce emissions by 30 to 80 percent (Washington State Department of Ecology 2003).

PRC currently uses calcium chloride dust suppressant to treat the haul routes of the Trend Coal Mine.

Grading Snow into Road Top Surface in Winter

Watering cannot be used to manage fugitive road dust emissions in winter. However, snow can be graded into the top surface of roads in winter to decrease dust emissions. This method has been effective for mines in southeast British Columbia as well as for the Trend Coal Mine.

5.2.2.8 Haul Trucks

Coal will be transported to the load-out by haul trucks. Once haul trucks are loaded with coal at the mine site, they will be covered for the duration of the haul to the load-out. Once the coal is unloaded, the trucks will be re-covered for the trip back to the mine site. This practice will reduce fugitive coal dust emissions during the transport of the coal.

5.2.2.9 Reclamation

Rapid reclamation of land is an important mitigation strategy for fugitive dust emissions and exposed ground surfaces will be re-vegetated as soon as they are no longer needed for mining. Temporary soil stockpiles, road cut banks and fill slopes will also be seeded as soon as practical to control dust and erosion. Mitigations for wind erosion are further discussed in the Surface Erosion and Sediment Control Plan (Section 5.5).

5.2.3 Open Burning Plan

Land clearing for construction of the mine site will result in the removal of trees and other vegetation. Most of this material will be stockpiled for use in reclamation programs although some of the larger non-merchantable trees will likely be disposed of by open burning. All burning will be done in compliance with local government bylaws, the British Columbia Open Burning Smoke Control Regulation and the Forest Fire Prevention and Suppression Regulation. Burning will not be undertaken if the local airflow will cause smoke to have a negative effect on nearby residences. A fire reference number will be obtained from the British Columbia Forest Service Fire Center office (1-

888-797-1717) before any burning any land debris. It will also be determined whether a permit or approval from the Ministry of Environment (MOE) is required.

Prior to burning, all possible options to reduce, reuse or recycle as much of the material as possible will be explored.

To minimize the potential effect on air quality associated with open burning the following best management practices will be implemented:

- ensure that the ventilation index is "good" on the day you start the burn and forecast to be "good" or "fair" on the following day (to obtain the ventilation index call the Omenica and Peace Region Burning hotline: 250-565-6457)
- burn only if the wind direction and speed are forecast to be such that smoke will not impact residences or other environmentally sensitive areas
- closely monitor the open burn to assess smoke dispersal and direction
- for major burns, conduct a test burn to determine if smoke dispersal will be adequate
- ensure that smoke from open burning does not pose a hazard at highways by significantly reducing visibility
- ensure vegetation is thoroughly dry before burning
- minimize the amount of dirt in the material being burned to reduce smouldering
- extinguish open burns completely to ensure that material does not continue to smoulder
- burn only on the same site from which the material was gathered and do not include material from offsite
- do not burn substances that normally emit dense smoke or noxious odours
- do not burn prohibited materials (tires, plastics, drywall, demolition waste, domestic waste, asphalt and asphalt products, treated lumber, railway ties, manure, rubber, paint and paint products, tar paper, fuel and lubricant containers)
- ensure satisfactory control and feeding of the fire, and make sure adequate equipment and staff are available to ensure the regulatory limits are met

5.2.4 Contingency Measures

In the event that the target ambient levels of dustfall, $PM_{2.5}$ and PM_{10} are continuously exceeded, PRC will consider the following contingency measures:

- Mine site
  - total enclosure of crusher
  - reduced size of active stockpiles
  - filtered vent on load-out bin
  - agglomeration of fines before transfer to the product coal conveyor
  - additional dust control in the wash plant, at the truck dump, and at the clean coal load-out

- covers on all conveyors
- additional water or chemical dust suppression for problematic areas

- Load-out
  - dust control at truck unloading station and rail loading station
  - filtered vent on load-out bin
  - additional water or chemical dust suppression for problematic areas
  - covers on all conveyors
  - reduced size of active stockpiles
  - enclosure of truck unloading area
- Haul Routes
  - increased frequency of watering problematic roadway sections
  - increased frequency in application of chemical dust suppressants
  - reduction in speed limits

5.2.5 Management of Common Air Contaminants

PRC will consider the following measures to reduce fuel consumption and emissions from the vehicle fleet:

- prescribe low NO_x and SO_2 vehicle emissions when tendering the truck fleet, or replacing the truck fleet in the future
- buy low sulfur diesel fuel for the truck fleet
- utilize group transport (buses and carpooling) for workers to and from the site
- explore the use of low-pollution shuttle buses to transport workers to and from the mine site

5.2.6 Greenhouse Gas Management

5.2.6.1 Position of PRC

PRC will consider steps and measures that can be taken to reduce emissions of greenhouse gases from the Project. It is recognized that efforts to reduce greenhouse gases often result in increased efficiency of operations and ultimately result in savings.

5.2.6.2 Sources of Greenhouse Gas Emissions

There are two major sources of greenhouse gases associated with the Project: fuel combustion—associated with mobile equipment, the vehicle fleet and coal dryer—and the inadvertent release of coal bed methane emissions when mining and processing raw coal. Some greenhouse gas emissions will also be attributed to electricity consumption at the mine site and the load-out. In order to limit greenhouse gas production electric equipment was considered for this Project. Primary loading will be done using an electric rope shovel (Equipment Fleet is discussed in Section 4.2.4). Further analysis to optimize

the fleet selected for the Project will be conducted throughout the feasibility, engineering and procurement planning for the Project.

5.2.6.3 Best Management Practices

The greenhouse gas emissions will be managed to focus on the efficient operation of the vehicle fleet and coal dyer. Fuel efficiency is a priority when purchasing, upgrading, or maintaining the vehicle fleet. The amount of time that vehicles idle will be minimized. Use of the coal dryer will be minimized and regular maintenance will be applied.

Recovery and on-site use of coal bed methane emissions is a possible, but remote, GHG reduction measure.

5.2.7 Summary of Commitments

Table 5.2-1 summarizes the mitigation measures that will be implemented. Where the action is not automatic, visual observation of a dust event will trigger the mitigation response. A dust event is defined as visible dust dispersion beyond the cleared area. At the rail load-out, the cleared area boundary ends on one side at the Heritage Highway. This action represents a real-time response to a real-time trigger.

Outside the coal washplant, the General Mine Manager, the Chief Environmental Scientist or the Environmental Coordinator will instruct contractors and staff to implement dust control measures. At the plant, the Plant Superintendent or the Environmental Coordinator will instruct workers to implement dust control procedures. To ensure a timely response to a dust event, any workers in the area of the rail load-out will determine when additional dust control measures are required, implement dust control measures and immediately notify management.

Table 5.2-1 Summary of Mitigation Measures for Air Quality and Dust Control

Potential Contaminant	Activity/Source	PRC Mitigation Measures	Response Category	Method
Fugitive Dust	Drilling and Blasting	• drilling rigs equipped with dust-suppression devices	• automatic	• cyclones or • bag filters
		• use of selective stemming for blasting	• automatic	• worker compliance
Fugitive Dust	Material Handling and Processing	• Coal storage in silos or enclosures	• automatic	• design
		• topsoil stripped while moist	• when feasible	• worker compliance
		• drop heights minimized	• automatic	• worker compliance
		• no overloading of material in trucks or railcars	• automatic	• worker compliance
		• water application to problematic areas	• as required (seasonal)	• water truck or spray
		• semi-enclosure of raw feed hopper	• automatic	• construction
Coal Dust	Screening and Crushing	• water application	• as required	• mist sprays
		• chemical dust suppressant	• if required	• spray
		• screen and crusher enclosed	• automatic	• enclosures
		• discharge heights minimized	• automatic	• design
Coal Dust	Conveyors and Transfer Points	• PRC will use skirting at transfer points	• automatic	• construction
		• water application	• as required	• mist sprays
		• conveyor covers	• where feasible	• construction
		• enclosed transfer chutes	• automatic	• design
		• coal dryer equipped with dust-collection devices and control devices of gaseous pollutants	• automatic	• high-energy scrubber • cyclone • mist eliminator
GHG and CAC Emissions	Coal Dryer	• efficient operation of coal dryer	• automatic	• worker compliance
		• minimize use of coal dryer	• automatic	• worker compliance
		• regular maintenance	• as required	• worker compliance
		• storage of coal in silos or enclosures where feasible	• automatic	• design

Table 5.2-1 Summary of Mitigation Measures for Air Quality and Dust Control (cont'd)

Potential Contaminant	Activity/Source	PRC Mitigation Measures	Response Category	Method
Coal Dust	Coal Stockpiles	• minimize stockpile size and height of piles	• automatic	• construction
		• application of water or dust suppressant	• as required (seasonal)	• spray truck
Fugitive dust	Soil Stockpiles	• soil stockpiles stabilized and seeded/re-vegetated as soon as possible	• automatic	• by hand
		• Minimize height of piles	• where feasible	• pile design/ construction
		• vehicle speed is restricted to 60 km/hour	• automatic	• driver compliance
Road Dust	Traffic on Unpaved Roads	• water will be applied to roads	• as required, if no rain and in non-freezing weather conditions	• water truck
		• chemical dust suppressant	• application if required	• spray truck
		• grading snow into top surface of road	• as required in winter	• grader
		• work crews will be transported by bus between town and the site to limit the number of trips on the road	• automatic	• contractor compliance
Coal Dust	Transportation of Clean Coal along Haul Route	• prohibit haul trucks from parking in the town of Tumbler Ridge when not in use	• automatic	• driver compliance
		• tree break from prevailing winds will be maintained	• automatic	• construction
		• loaded and empty product haul trucks will be covered in transit	• automatic	• driver compliance

Table 5.2-1 Summary of Mitigation Measures for Air Quality and Dust Control (cont'd)

Potential Contaminant	Activity/Source	PRC Mitigation Measures	Response Category	Method
Fugitive Dust	Material Handling at Rail Load-out	• storage of coal in silos or enclosures at the load-out	• automatic	• design
		• enclose feeder at truck dump	• automatic	• construction
		• dust suppressant application to the coal stockpile	• if required (seasonal)	• spray truck
		• installation of windscreens or berms	• if required	• construction
		• after the top of the rail car is profiled, a polymer emulsion will be applied to secure the coal surface	• automatic	• automated train spray system
GHG and CAC Emissions	Vehicle Fleet	• efficient operation of vehicle fleet	• automatic	• worker compliance
		• minimize vehicle idling	• automatic	• worker compliance
		• consider fuel efficient vehicles	• automatic	• design
		• regular maintenance	• automatic	• worker compliance
		• work crews will be transported by bus between town and the site to limit the number of trips	• automatic	• worker compliance

5.3 Wildlife Protection and Monitoring Plan

This Wildlife Protection and Monitoring Plan (WPMP) is intended to provide clear direction to Project personnel and contractors on the restrictions, mitigation measures, best management practices, and follow-up activities put in place by PRC for the protection of wildlife. A detailed operational version of this plan will be developed at the post-certification stage and will be accompanied by communication and resource tools (e.g., presentations, caribou sign identification guide) and data forms (e.g., caribou observation data forms). The operational WPMP will be maintained and updated as a living document to reflect new information and management priorities.

The mitigation measures, monitoring plan, and follow-up programs identified as part of the wildlife effects assessment (see Volume 2, Sections 10.6.1 and 10.6.3) are an integral part of the WPMP and are included below. The WPMP is also supported and enhanced directly and indirectly by the other plans presented as part of the overall EMP for the Project.

5.3.1 General Wildlife Protection Plan

5.3.1.1 General Restrictions for Wildlife Protection

The basis of the WPMP is a set of general restrictions for wildlife protection. Project personnel and contractors will be advised of the following restrictions, and violations may be subject to disciplinary action according to company policy. The following apply on and near the Project at all times and en route to and from the site on workdays:

- PRC has a zero tolerance “no firearms” and “no hunting” policy for Project personnel and contractors. It is also expected that a ‘no shooting’ zone will be posted for the Project area
- feeding of wildlife is prohibited
- harassment of wildlife is prohibited
- Project personnel and contractors must not destroy or disrupt nests, eggs, dens, burrows and other similar objects and features
- pets are not permitted onsite

As discussed in Volume 2, Section 10.2.2, potential Project effects on wildlife are: indirect (sensory disturbance) and direct (removal) effects on habitat availability; disruption of movement patterns; increases in mortality risk; and effects on wildlife health. The following sections provide an overview of the specific recommendations intended to mitigate these potential effects.

5.3.1.2 Wildlife Habitat Availability

The most direct measure to mitigate Project effects on wildlife habitat availability is the progressive Reclamation Plan (see Section 4.12), and deactivation and reclamation of the By-pass Road following mine closure. In addition, the following measures will be incorporated into Project planning and operations in order to mitigate potential Project effects, both direct and indirect, on wildlife habitat and wildlife habitat features:

- Site clearing will be minimized to ensure the retention of patches or strips of intact vegetation cover within the Project footprint. Even if small, these patches will have benefits to wildlife and wildlife habitat (e.g., landscape connectivity through "stepping stones", seed sources for post-closure re-establishment of vegetation cover) and should be protected from further disturbance during the life of the mine. Stepping stones are small habitat patches or habitat features (e.g., remnant trees) within a disturbed matrix that provide connectivity among larger habitat patches.
- Outer boundaries of clearing areas will be surveyed for the presence of wildlife habitat features (e.g., mineral licks, dens, nest trees, snags, rocky outcrops, small ponds and seepages). The scope of this survey program will be developed by PRC in consultation with wildlife professionals and reviewed by BC MOE. Any identified wildlife habitat features will be evaluated for potential mitigation measures.
- Retain actual or potential wildlife trees (i.e., dead or dying trees and snags, and living or dead deciduous trees) wherever possible and safe to do so as per provincial guidelines (MOF, 2006 Internet Site).
- PRC proposes a bat roost box program to involve local communities, perhaps as an educational activity. Bat boxes to be set-up along forest edges adjacent to mine site in areas where suitable habitat may have been removed (e.g., at lower elevations in the ESSF (near but not within the mine site) and in the BWBS around the rail load-out.
- Reduce visual disturbance by providing or maintaining vegetation cover where feasible (e.g., maintain vegetation along road corridors, patches of undisturbed ground near waste rock dumps and adjacent to areas of concentrated activity).
- Mitigation measures for other VECs and KIs are applicable:
  - alpine and parkland ecosystems (Volume 2, Section 9.5.5)
  - wetland ecosystems (Volume 2, Section 9.5.3)
  - riparian ecosystems (Volume 2, Section 9.5.4)
  - fish habitat (Volume 2, Section 14)
  - periphyton and benthos (Volume 2, Section 15)
- Implement Caribou Protection Plan (Section 5.3.3)

The following environmental management plans are also directly or indirectly applicable to wildlife habitat: Surface Erosion and Sediment Control Plan (Section 5.5); Air Quality and Dust Control Plan (Section 5.2); Receiving Water Quality Monitoring Plan (Section 5.6); Metal Leaching and ARD Management Plan (Section 5.8); Selenium Management Plan (Section 5.7); and Invasive Plants Management Plan (Section 5.4). In addition, traffic controls presented under "Mortality Risk" (see Section 5.3.1.3), and in the Access Management and Traffic Control Plan (see Section 5.14) will reduce sensory disturbance (and habitat displacement) from the noise and visual stimuli of vehicles.

5.3.1.3 Mortality Risk

The main mortality risk concerns are: direct mortality from site clearing (birds); increased risk of vehicle-wildlife interactions due to the Project-related increase in traffic on existing roads; and increased risk of wolf predation (caribou). Mitigation measures to minimize mortality risk associated with problem wildlife situations will be addressed

separately (see Section 5.3.1.6). No new road access is being developed outside of the mine site but measures to minimize human access-related mortality risk implemented for the Trend Coal Mine will remain in place or be expanded to encompass the Roman Coal Mine. The Access Management and Traffic Control Plan (see Section 5.14) will provide the main direction for the reduction of mortality risk associated with access and vehicles. Specifically, the following measures will be incorporated into Project planning and operations in order to mitigate potential Project effects on wildlife mortality risk:

- Posted maximum speed limit (60 km/h on the haul route and 50 km/h on mine site roads).
- Provide and maintain signage that warns and reminds Project personnel and contractors (and other road users) to be vigilant for wildlife on roads. Signage should be targeted at areas where potential problems are anticipated or known to occur (e.g., areas of poor visibility, known or likely crossing points).
- Proactive radio communication among authorized road users will be promoted (e.g., wildlife sightings in road corridor).
- The critical timeframe for songbirds in the Peace Region is May 1 to July 31 (BC MOE 2008). PRC acknowledges that best practice is to avoid this timeframe for site clearing and vegetation management activities (BC MWLAP 2004). However, when working outside this timeframe is unavoidable PRC will review the situation with BC MOE.
- If active nests are discovered they will be reported to the Environmental Coordinator, and evaluated with respect to potential mitigation measures.
- PRC will work with the BC Ministry of Transportation, BC Ministry of Environment and other road users to ensure prompt removal of roadside vehicle-killed or hunter-killed wildlife carcasses before animals (e.g., bears, canids, corvids) are attracted to feed on them.
- PRC will minimize or eliminate the use of vegetation that is attractive to bears and ungulates (e.g., legumes) in seeding mixtures used along roadsides.
- Ditches and sediment ponds will be designed to reduce entrapment of wildlife (see Section 4.11).
- No shooting zone around Project area during life of mine.
- Restricted access (no public use) of bypass road (during operations).
- Controlled access through mine site along Talisman Road (during operations).
- Restricted (gated) access to road to tailing management facility (TMF) (post-mine).
- Decommissioning of roads up to Roman Mountain (post-mine).
- Implementation of the Caribou Protection Plan (Section 5.3.3).
- Compliance with General Wildlife Restrictions (Section 5.3.1.1).

The following environmental management plans are also directly or indirectly applicable to wildlife mortality risk: Chemical Management Plan (see Section 5.12) and Emergency Response Plan (see Section 5.13).

5.3.1.4 Disruption of Movement Patterns

The disruption of daily and seasonal movement patterns may occur, but will be mitigated by many of the same measures described under "Habitat Availability" (see Section 5.3.1.2) and "Mortality Risk" (see Section 5.3.1.3). In addition, the following measures will be undertaken to mitigate potential Project effects on wildlife movement patterns:

- provide wildlife crossing points along extensive open ditches
- provide wildlife crossing points in the ploughed snow banks along access roads and the coal haul route. PRC will maintain roads in the winter so that there are low areas (i.e., 1 m or less) in the ploughed snow banks at regular intervals. These low areas will facilitate wildlife movements across and out of road corridors

5.3.1.5 Wildlife Health

Environmental contaminants may be an issue if they are known to affect wildlife health. The main concerns are related to accidental spills and water quality issues associated with sediment ponds and receiving waters. These concerns are addressed by the following environmental management plans: Chemical Management Plan (see Section 5.12), Receiving Water Quality Monitoring Plan (see Section 5.6), Metal Leaching and ARD Management Plan (see Section 5.8) and the Selenium Management Plan (see Section 5.7). Coal dust inhalation is not recognized as a significant problem in wildlife (see Section 10.1.1), but will be minimized, nonetheless, according to dust control measures described in the Air Quality and Dust Control Plan (see Section 5.2).

In order to discourage wildlife use of mine features that may be a concern with respect to wildlife health (water quality) the following measures will be implemented:

- The growth of vegetative cover (including forage species) at sediment pond edges will be controlled (minimized). No attempt will be made to reclaim sediment pond shorelines.
- No attempt will be made to reclaim the TMF shoreline.

5.3.1.6 Problem Wildlife

Although food wastes are the typical wildlife attractant implicated in the creation of problem wildlife, there are other attractants that may be a concern. These include wildlife carcasses (e.g., road and hunter kills), and roadside vegetation. In addition to the general wildlife restrictions (see Section 5.3.1.1) the following measures will be implemented:

- Prohibit littering at the mine site, and along access roads and the haul route.
- Deposit all garbage, including organic wastes (e.g., orange peels), in designated garbage receptacles (or remove from the site).
- Report animal carcasses observed on or in the vicinity of the Project site and along access roads to the Environmental Coordinator or Chief Environmental Scientist as soon as possible.
- Wildlife incidents related to garbage or human food attractants will be reported to the Environmental Coordinator or Chief Environmental Scientist as soon as possible. Direct verbal reporting of wildlife incidents as they occur (see Section 5.3.4) will ensure that the proactive rather than reactive measures can be taken to prevent a serious outcome (e.g., human injury, destruction of the problem animal).

- Project personnel and contractors will be instructed to be "Bear Aware" (see Section 5.3.2).
- Comply with safe handling, storage and disposal practices for food and food wastes to avoid the creation of "problem" animals (in particular bears, but also other animals such as foxes and coyotes) that are attracted or habituated to Project facilities.

Measures related to the control of wildlife attractants are intended to minimize or eliminate the development of problem wildlife. However, in the event a problem wildlife situation arises, the Operations Manager or Chief Environmental Scientist will initiate the appropriate response actions. Any direct intervention with respect to problem wildlife will be done by authorized personnel only in consultation with, and as approved or directed by, the BC MOE. PRC will opt for non-lethal solutions (e.g., aversive conditioning, relocation) whenever it is considered appropriate and safe to do so.

5.3.2 Bear Aware and Bear Safety

A Bear Aware Program and bear safety training program will be integral to the operation of the Project. Information on these topics will be presented and made available to Project personnel and consultants, as a standard part of the health and safety orientation. Where specialized training in bear safety is required for field survey crews, and personnel designated for problem bear responses, a professional trainer will provide the appropriate training course. Course content will be submitted to the BC Ministry of Environment for approval.

As noted in Section 5.3.1.6, any direct intervention with respect to problem bears will be done in consultation with, and as approved or directed by, the BC MOE.

5.3.3 Caribou Protection Plan

5.3.3.1 Introduction

This Caribou Protection Plan (CPP) presents a range of mitigation measures and best management practices for the Project. The basis for the plan is the recommendations of Seip (2007) and Pate (2007) supplemented with information specific to the Quintette caribou herd. Four considerations (modified from Pate 2007) are intended to improve the effectiveness and success of caribou protection and management plans:

- Coordinate operations across and between sectors. For example, more than one company operating in the same area should share ideas, concerns, and solutions regarding caribou management. To this end, PRC will continue to participate in the Peace Region Shared Stewardship meetings.
- Be strong advocates for caribou management at all stages of the Project. Raise awareness of the need to protect caribou and the company's commitment to engage in best management practices. As part of this commitment, PRC will continue to support caribou research in the South Peace.
- Use signs and other forms of communication to raise awareness about caribou concerns and best management practices among Project personnel, contractors and the general public.
- Develop a caribou field guide for Project personnel and contractors. This tool facilitates the involvement of Project personnel and contractors in the caribou

protection and management process and contributes to the local caribou knowledge base.

The caribou in the Project area are part of the Quintette caribou herd and are blue-listed in British Columbia and designated as Threatened federally. These caribou are also listed under Schedule 1 of the *Species at Risk Act*. Information on this herd, particularly as it related to the Roman Mountain area, is presented in detail in Volume 2, Section 10.5.1.3. The Project is located within core winter and summer areas for caribou (see Volume 2, Section 10, Figure 10.5–1). For the purposes of this caribou protection plan it is important to note that some portion of the caribou herd in the Roman Mountain area remain in high elevation habitats all year-round.

As indicated in Section 5.3.1.1, potential Project effects on wildlife are: indirect (sensory disturbance) and direct (removal) effects on habitat availability; disruption of movement patterns; increases in mortality risk; and effects on wildlife health. Specifically for caribou, the potential effects associated with the Project include, but are not limited to:

- habitat fragmentation or loss through clearing activities
- inaccessible habitat due to sensory disturbance
- inaccessible habitat due to removal or blockage of movement corridors
- reduced reproductive success due to sensory disturbance, habitat loss, and predation
- removal or reduction of high quality forage
- sensory disturbance to foraging, resting, and reproductive behaviours
- mortality through site contamination or collision with vehicular traffic
- increased predation or hunting due to improved access to caribou range

Obviously, many of measures identified under the General Wildlife Protection Plan (see Section 5.3.1) are applicable to caribou. However, recognizing the high caribou value of the complex of mountains in the Project area and the conservation status of these caribou, a standalone Caribou Protection Plan was considered essential. This plan should be considered in concert with the General Wildlife Protection Plan.

5.3.3.2 Mitigation Measures and Best Management Practices

Training and Orientation

Part of implementing a successful and effective caribou protection plan at the Project will be to provide appropriate training and orientation to all permanent full- and part-time staff, all subcontractors and visiting workers, and all suppliers and other site visitors. This will occur as part of the overall orientation for the WPMP. Additionally, a brief caribou presentation (e.g., PowerPoint) should be given to everyone working on or entering the Roman Coal Mine site. Caribou protection should be a permanent agenda item on regular health and safety meetings. Updates or revisions to the CPP should be communicated in a timely and effective manner to all Project personnel, contractors and the general public (where applicable).

Effectiveness Monitoring

Evaluating the effectiveness of the CPP will be conducted through a documentation and reporting system. Mine personnel should be encouraged to document incidences of caribou disturbance, injury, and mortality and such information should be recorded on a standardized data form and filed in the main site office. This monitoring will be included as a component of the Wildlife Monitoring Program (see Section 5.3.4).

Mitigation Measures and Best Management Practices for Caribou

The following general mitigation measures for caribou are primarily intended to minimize the direct loss or alteration (avoidance) of caribou habitat and to prevent an increase in the risk of caribou-wolf interactions.

- Caribou are a key focus species for the Reclamation Plan (see Section 4.12). The Reclamation Plan includes reclamation procedures intended to minimize or eliminate the recovery of forage species attractive to other ungulates, particularly moose and elk. This approach is intended to minimize the risk of increased caribou-wolf interactions.
- Within the core winter and summer areas for the Quintette herd, PRC will instruct mine-related helicopter and fixed-wing traffic to maintain a minimum ferry altitude of 300 m above-ground-level to avoid sensory disturbance to caribou (as per Culling et al. 2004 [boreal caribou]). Note that in the vicinity of the mine site air traffic is already restricted (must maintain distance of more than 1 km).
- Snowmobile and ATV activity has been identified as a major concern for caribou, particularly in high elevation areas during the winter. The recommended best management practice for caribou range is to close the area entirely to snowmobiles and ATVs or to control access by these types of vehicles. As indicated in Section 5.3.1.3, access into and through the mine site will be controlled and restricted. However, the local area around Roman Mountain and the divide between Five Cabin Creek and Babcock Creek is a popular snowmobiling destination. PRC will not have any control over these activities. PRC will post signage around the Roman Coal Mine site boundary and at the entrance to the mine site with the intent of raising the awareness of snowmobilers and ATV users to the potential for disturbance of caribou. Examples signs are shown in Appendix 5A.
- Mitigation measures described for alpine and parkland ecosystems (see Volume 2, Section 9.5.5) are also applicable.

5.3.3.3 Caribou Encounters

It is possible that at any time, Project personnel and contractors may encounter caribou directly while working in or near the mine site and its associated access routes. Direct contact can have immediate disturbance effects, and may range from disruption (e.g., decreased predator awareness, increased nervousness) or displacement (e.g., premature departure from an area during feeding and resting) to injury or mortality (e.g., vehicular collisions, fallen or tangled wires). The most likely encounters and the associated best management practices are the following:

While Driving

All vehicles should follow posted speed limits and drive with lights on. Driving speeds should be reduced accordingly with weather (e.g., fog, rain,) or ground conditions (e.g., mud, wet clay, snow, ice) to allow for adequate stopping distances if caribou occur in front of the vehicle. At night, use high-beams when other vehicles and workers are not likely to be affected. Turn high-beams off upon encounter with caribou.

When caribou are encountered on roads or other driving areas, personnel should either:

- STOP immediately if caribou present a collision hazard, and allow caribou to move off the road on their own. If caribou appear reluctant to move, assess their behaviour carefully. If caribou are feeding or acquiring minerals, allow them to finish by either waiting, or going to another work area by back-tracking along the original approach. If caribou are simply standing on the road, approach very slowly until they move off. Do not use the vehicle horn or other loud alarm. Notify other mine staff using radios as to the location and circumstances regarding the encounter. Note the encounter on a Caribou Observation Data Form (see Section 5.3.4) and submit the form to the main field office.
- SLOW DOWN if caribou are observed near roads. The recommended driving speed is half the posted limit, but conditions should be evaluated to determine if collision or heightened disturbance risk warrants even slower speeds (e.g., near versus distant proximity to road, road conditions and stopping ability). Notify other mine staff using radios as to the location and circumstances regarding the encounter. Note the encounter on a Caribou Observation Data Form (see Section 5.3.4) and submit the form to the main field office.

Around the Mine Site

Keeping the mine site in good order can limit incidental injury to caribou. The following are examples of possible hazards to caribou:

- Spills. Spill response measures described as part of the Chemical Management Plan (see Section 5.12) and Emergency Response Plan (see Section 5.13) will minimize the risk to caribou from this hazard.
- Wires and Ropes. Wires and ropes should be properly stored in equipment boxes or sheds. Wires and ropes that are on or slightly above the ground are a hazard for wildlife and can cause foot or leg injuries to caribou. Wires and ropes that are suspended higher could potentially snag on antlers. Recommended height for suspended wires and ropes is more than 3 m.

5.3.3.4 Caribou Field Guide

As part of the detailed post-certification WPMP, PRC will develop a caribou field guide for use by Project personnel and contractors and interested members of the general public. The field guide will include information on the identification of caribou (males, females, and calves) and on how to recognize caribou sign (tracks, cratering) and important habitats (areas with high cover of terrestrial lichen). The field guide will also include a Caribou Observation Data Form and instructions on completing and submitting it.

5.3.4 Wildlife Monitoring Plan

PRC will implement a daily wildlife monitoring program during the construction phase and a weekly wildlife monitoring program during the operations phase. The construction monitoring program will be confined to the construction zone while the operations monitoring program will include all Project components (mine site, rail load-out, access road, haul road). These monitoring programs will include 1) site inspection for compliance with the WPMP and CPP; and 2) compilation, interpretation and communication of wildlife observations made on or adjacent to the applicable Project components (e.g., mine site, haul road). The monitoring team will report any wildlife concerns that are identified to the Chief Environmental Scientist and each concern will be evaluated with respect to potential mitigation measures. Mitigation measures may be short term (e.g., heavy machinery operation may be temporarily suspended or re-routed to allow for safe animal passage through the site) or longer term (e.g., warning signs and a reduced speed limit implemented at a wildlife crossing 'hot spots' identified along the haul route). Caribou are a key focus species of this monitoring program, but all wildlife will be considered. While PRC recognizes that the critical timeframe for northern ecotype caribou in the Peace Region is January 15 to July 15 (BC MOE 2008) it is intended that the wildlife component of the construction monitoring program occur throughout the entire construction phase, regardless of the time of year. The presence of the monitor does not preclude the reporting of wildlife observations or concerns by other personnel (as per directions presented elsewhere in Section 5) either over the radio or directly to the monitor or Chief Environmental Scientist (and this practice will be confirmed as part of the compliance inspection).

In addition to the above program, a number of monitoring programs identified for other VECs or a part of other management plans have implications for wildlife e.g., water quality monitoring.

5.3.5 Wildlife Follow-up Program

Seven follow-up programs have been identified for wildlife (see Volume 2, Section 10.6.3.1):

- PRC has supported the ongoing Central Rockies caribou research Project (Central Rocky Mountain Recovery Implementation Group, 2009 Internet Site) since 2005, primarily through the provision of funds for the purchase and deployment of telemetry collars for animals in the Quintette herd. PRC will continue to support this Project. This Project addresses several areas of relevance to the Project: population census, winter and summer core area delineation, and wolf-caribou interactions.
- PRC will undertake an RSF analysis to examine in more detail the effect of mining disturbance on the distribution of caribou in the Quintette herd. The results of this analysis will improve the level of confidence in the prediction of indirect habitat loss described in Volume 2, Section 10.5.1.4. This analysis could be expanded in the future as more telemetry data are collected and mining activities progress.
- PRC will record all Project-related wildlife-vehicle collisions or near misses. These data will be regularly reviewed by the Environmental Coordinator. If a problem area is identified appropriate actions will be taken (e.g., warning signs, site-specific speed limits). In addition, PRC will report any wildlife mortalities resulting from Project vehicles to the BC Ministry of Environment regional office and the BC Ministry of Transportation.

- PRC will follow-up on all problem wildlife incidents, and if required, the issue will be dealt with according to established protocols (developed in consultation with the BC MOE). A high number of incidents would precipitate a re-evaluation of the effectiveness and enforcement of existing problem wildlife prevention measures.
- As they have done since 2004, PRC will maintain a wildlife observation log. The log will include wildlife observation from the mine site area, the rail load-out, and along the coal haul route. The log will be submitted to the BC Ministry of Environment regional office upon request, and observations of caribou will be provided to the Central Rockies caribou research team lead on a quarterly basis. Project personnel and contractors will be encouraged to report sightings of wildlife on and around the Project site. Ideally, reports will include the date, time, description of location, species, number of individuals, and the activity (e.g., feeding, nesting).
- PRC will incorporate wildlife use data collection into the regular reclamation monitoring protocol. One approach would be to provide wildlife observation data forms to the reclamation field crews.
- Follow-up visits to the bat boxes proposed as a mitigation measure in Volume 2, Section 10.5.10.4 are recommended in order to maintain the boxes and determine bat use. PRC would like to involve local community groups in this activity.

These follow-up programs will be detailed as part of the post-certification operational WPMP, and will be reviewed and approved by the appropriate regulatory agencies. The follow-up programs will be conducted in the context of an adaptive management approach, and will be integral to the evaluation and refinement of the operational WPMP. PRC will ensure that responsibility for the follow-up program tasks is clearly assigned, and that the monitoring tasks are conducted at appropriate intervals, and reviewed in the context of adaptive management (see below).

5.3.6 Responsibilities

Table 5.3-1 summarizes the mitigations presented in WPMP and identifies the party responsible for ensuring that all mitigations are complied with. The mitigations are categorized by effect

Table 5.3-1 Wildlife Mitigation Measures and Responsibility and Reporting Tasks

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Habitat Availability	• Minimize site clearing where feasible to and retain patches and strips of intact vegetative cover with the Project Footprint • Control vehicle access to reclaimed areas • Implement an access closure plan for strategic locations in the Project area in order to improve habitat effectiveness • Survey outer boundaries of clearing areas for the presence of wildlife habitat features (e.g., mineral licks, dens, nest trees, snags, rocky outcrops, small ponds/seepages). Evaluate any identified wildlife habitat features for potential mitigation measures. • Retain wildlife trees where possible • Establish a bat roost box program • Reduce visual disruption by maintaining vegetative cover where possible • Minimize helicopter activity, and maintain an acceptable altitude	Environmental Coordinator and Chief Environmental Scientist	Any non-compliance/ issues to be reported to Mine Manager
Mortality Risk	• Implement speed limits on access roads (e.g., maximum of 60 km/h on haul road and 50 km/h on mine site) • Provide signage that warns/reminds Project personnel (and other road users) to be vigilant for wildlife on roads. Signage should be targeted at areas where potential problems are anticipated or known to occur (e.g., areas of poor visibility) • Proactive radio communication among authorized road users will be promoted (e.g., wildlife sightings in road corridor). • Work to avoid site clearing and vegetation management activities during the critical timeframe for songbirds; May 1 to July 31 (BCWLAP 2004). However, when working outside this timeframe is unavoidable PRC will review the situation with BC MOE • If active nests are discovered they will be reported to the Environmental Coordinator, and evaluated with respect to potential mitigation measures • Ensure wildlife carcasses (e.g., road kills) are reported and removed from the road corridor to prevent the attraction of bears and other animals to the roadside • PRC will minimize or eliminate the use of vegetation that is attractive to bears and ungulates (e.g., legumes) in seeding mixtures used along roadsides • Ditches and sediment ponds will be designed to reduce entrapment of wildlife • No shooting zone around the Project area during the life of mine	Environmental Coordinator and Chief Environmental Scientist	Any non-compliance/ issues to be reported to Mine Manager

Table 5.3-1 Wildlife Mitigation Measures and Responsibility and Reporting Tasks (cont'd)

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
	• Restrict access of By-pass Road during operations • Control access through mine site along Talisman Road during operations • Restrict (gated) access to the tailings management facility post-closure • Decommission roads up to Roman Mountain following closure • Restrict Project-related traffic (including ATVs and snowmobiles) to the Project areas and access roads during Project and decommission roads following closure • Practice safe handling, storage and disposal of food and food wastes to avoid creation of 'problem' animals (in particular bears, but also other animals such as foxes and coyotes) that are attracted/habituated to Project facilities. All garbage will be continuously collected, contained in bear proof containers and promptly transported for disposal at an onsite landfill • Implement Caribou Protection Plan • Comply with General Wildlife Restrictions (see Section 5.3.1.1) • Project personnel will be instructed to be "Bear Aware"		
Sensory Disturbance	• Prohibit pets from any Project associated sites or along the access roads • Comply with all operating and safety procedures to ensure that all spills, leaks and other releases from Project facilities and equipment are dealt with promptly and effectively • Restrict all Project personnel and Project related activities to the Project areas and access roads • Minimize activity, where practical, in valley bottoms to avoid sensory disturbance of wildlife along these potential travel corridors • Prohibit harassment of wildlife from the air (e.g., low altitude circling), during Project related helicopter activities • Reduce visual disturbance by providing or maintaining vegetation cover, where feasible (e.g., maintain vegetation along road corridors and adjacent to areas of concentrated activity)	Environmental Coordinator and Chief Environmental Scientist	Any non-compliance/issues to be reported to Mine Manager
Wildlife Health	• Comply with all operating and safety procedures to ensure that all spills, leaks and other releases from Project facilities and equipment are promptly and effectively dealt with • Control and minimize vegetative growth at sediment pond edges and do not attempt to reclaim shore line of tailings management facility	Environmental Coordinator and Chief Environmental Scientist	Any non-compliance/issues to be reported to Mine Manager

Table 5.3-1 Wildlife Mitigation Measures and Responsibility and Reporting Tasks (cont'd)

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Disruption of Movement Patterns	• Provide wildlife crossing points along extensive open ditches • Provide wildlife crossing points in the ploughed snow banks along roadways	Environmental Coordinator and Chief Environmental Scientist	Any non-compliance/issues to be reported to Mine Manager
Monitoring and Adaptive Management	• Maintain a wildlife records program that includes wildlife observations, location of wildlife features (e.g., active nests or dens), traffic incidents (e.g., road kills, near collisions), and wildlife incidents (e.g., aggressive encounters) • The wildlife records will be regularly reviewed to identify any issues of concern (e.g., road segments with a high incidence of road kills, active dens), and a strategy to address the concern will be developed in consultation with the appropriate agencies • Implement a daily wildlife monitoring program during the construction phase and a weekly wildlife monitoring program during the operations phase. These monitoring programs will include 1) site inspection for compliance with the WPMP and CPP; and 2) compilation, interpretation and communication of wildlife observations made on or adjacent to the applicable Project components (e.g., mine site, haul road) • Monitor wildlife use of reclaimed units during the course of the progressive reclamation program	Environmental Coordinator and Chief Environmental Scientist, Monitoring Team	The monitoring team will report any wildlife concerns that are identified to the Chief Environmental Scientist and each concern will be evaluated with respect to potential mitigation measures Any WPMP or CPP non-compliance/issues to be reported to Mine Manager Certain wildlife concerns (e.g., problem wildlife) will be promptly reported to the BC Ministry of Environment in Fort St John, British Columbia All road kills to be reported to the local Provincial Conservation Officer and if warranted the local Police Department

5.4 Invasive Plant Management Plan

5.4.1 Overview

Due to the large amount of disturbed ground that is created in mining operations, development of an Invasive Plant Management Program is necessary, to prevent invasive plants and noxious weeds from becoming a management problem on the mine site and associated disturbances.

Mining activities that could potentially facilitate the introduction or spread of invasive plants or noxious weeds include:

- removal of native vegetation during clearing operations in a manner that exposes soil and thereby removes competition for invasive plants, and creates a seed bed which will allow invasive plant seed to establish on
- topsoil salvage and stockpiling which results in exposed soils at both the stockpiles and the salvage areas
- road and power line construction and maintenance activities that disturb sites and create exposed soil
- movement of machinery related to the above activities that may be carrying invasive plant seeds thereby spreading seed between disturbance sites
- long term exposure of disturbed ground (e.g., inactive waste rock dumps, exposed ground in plant site areas)

The Invasive Plant Council of British Columbia defines invasive plants as: “any invasive alien plant species that has the potential to pose undesirable or detrimental effects on humans, animals or ecosystems” (BC Ministry of Forests 2005).

Under the *Weed Control Act* (RSBC 1996), noxious weeds may meet one or more of the following criteria:

- they aggressively invade natural resources and agricultural crops or are detrimental to them
- they are poisonous or injurious to livestock
- they are exceptionally difficult to control by standard methods
- there is a need to enforce control to prevent expansion of new invaders

The Act also states:

> “Every occupier shall control, in accordance with the regulations, noxious weeds growing or located on land and premises, and on any other property located on land and premises, occupied by him.”

The establishment of invasive plants or noxious weeds on the Project area and, prevention of such, will be addressed by PRC through development and implementation of an Invasive Plant Management Program from pre-construction through to the end of closure.

5.4.2 Prevention

The primary goal related to management of invasive plants and noxious weeds in the Project area is to carry out mining activities in a manner that prevents the introduction or spread of invasive plants or noxious weeds.

PRC will adopt the following beneficial management practices for preventing invasive plant establishment on mine disturbed ground:

1. Minimize soil disturbance during all phases of the mining operation in order to limit the availability of exposed, unvegetated ground to invasive plant seed deposition.
2. Establish a vegetation cover as soon as possible after ground disturbance as follows:
    - Seed ground disturbed due to construction or mining activity with a rapidly establishing agronomic seed mix for erosion protection and weed control.
    - Seed soil stockpiles; water management features such as ditches and sediment pond berms; borrow pits; road edges; powerline access roads and power pole installation sites; inactive sections of plant site areas, storage and equipment yards; waste rock dumps; and generally any disturbed ground where invasive plant infestation is a concern.
    - Where warranted, seed areas that are inactive for some time and that are capable of supporting vegetation (e.g., soil stockpiles) with interim reclamation grass seed mixtures to prevent weed establishment. Active mine areas do not require control as invasive plant species do not have a chance to become established.
    - Specify high quality grade grass and legume seed in any seed mix that is used for erosion and weed control; temporary reclamation or final reclamation. Low quality grade seed may contain a portion of weed seed in the seed lot. As a minimum, ensure the seed used for revegetation is of the grade Canada Common #1 Forage Mixture. If seed with another grading is used, it must be invasive plant free. Seed analysis certificates will be requested from the supplier for the seed lots that are in the mix to determine the presence of any invasive plants. Candidate grass and legume species for revegetation seed mixes will be reviewed to ensure that they are not considered invasive to the region.
3. Minimize invasive plant seed delivery to disturbance sites as follows:
    - Refrain from driving through areas infested with invasive plants.
    - Where practical wash all construction equipment before it comes on site in a designated wash area with specialized drainage control to allow capture of most weed seeds.
    - Before moving equipment or vehicles from a weed infestation area to a non-infested area, inspect the undercarriage and remove attached plants or wash the undercarriage to dislodge any mud, dirt or plant parts prior to leaving infested area.
    - Where possible, limit road maintenance to the road surface to retain the vegetated areas along roads.
    - Confirm that ground materials used for construction (e.g., gravel for road construction) do not contain invasive plant seed or rhizomatous plant parts by using reputable suppliers.

- Keep equipment yards and vehicle storage facilities free of invasive plants.
- Train personnel on preventing the spread of weeds by checking and removing seeds and plant parts from clothing and equipment.

5.4.3 Control

If prevention measures fail and invasive plants or noxious weeds do establish on disturbance sites, physical, chemical and biological methods will be utilized to control or eradicate the infestations.

The strategies for managing invasive plants include:

- pulling
- mowing or cutting
- burning
- herbicide spraying
- biological control

Biological control agents are natural organisms that can be used to reduce weed populations. Typically they are insects, nematodes, fungi or viruses that infect or invade the weed plants and weaken the target weed by decreasing seed production and reducing weed density.

In the event that invasive plant populations do become established on the Roman Coal Mine site or associated disturbances, PRC will use one or a combination of these eradication methods to control these infestations. PRC will undertake control efforts on species that are listed as provincial and regional noxious weeds and any other invasive plant species that pose a threat to humans, animals or ecosystems. In addition, PRC will liaise with the North East Invasive Plant Council (NEIPC), Peace River Regional District, and other proponents in to keep informed of invasive plant species and management strategies in the region.

The NEIPC has developed a *NEIPC 2008 Plan and Profile* report which details the current status and control methods of invasive plants that are of concern in the northeast BC region; categories of invasive plants based on the threat they pose to the northeast region; and priorities of infestation sites. This categorization of the plants and infestation sites helps to prioritize management actions. PRC will use the invasive plant management strategies developed in the NEIPC Plan and Profile as a guideline in its management efforts of invasive plants on its properties. Table 5.4-1 lists the invasive plants of concern in northeast BC and the categories they occupy as developed by the NEIPC. The NEIPC Plan and Profile further identifies the following species as requiring priority attention. PRC will endeavor to carry out early detection and rapid response before they become established.

- yellow star thistle, rush skeleton weed, hawkweeds, knapweeds, knotweeds, spurges, marsh thistle, field scabious, common tansy, blueweed, plumeless thistle, loosestrife, oxeye daisy, tansy ragwort, Dalmatian toadflax, nodding thistle, St. John’s-wort.

5.4.4 Assessment and Monitoring

The program will include annual monitoring of all disturbed lands in the Project area by environmental staff to detect the establishment of invasive plant or noxious weed species. Monitoring will be conducted on both revegetated and unvegetated disturbed areas. The surveys will be conducted in late spring/early summer so that plant control measures can be undertaken prior to seed dispersal in late summer/early fall.

The program will include:

- survey and mapping of infestation locations
- identification of invasive plant species present
- assessment of the degree of invasive plant growth, distribution, and density present at the infestation sites
- implementation of recommended control measures
- assessment of success and follow up control work as required
- reporting and record keeping of infestation sites, species present and densities, control measures undertaken, and control success

Table 5.4-1 Invasive Plant Categories for North East British Columbia

1. Prohibited Invasive Plants **Prohibited invasive plants are highly competitive with an ability to spread rapidly.**	2. Primary Invasive Plants. **Primary invasive plants have the ability to spread rapidly but are not as aggressive as prohibited invasive plants.**	3. Secondary Invasive Plants **Secondary invasive plants can spread easily but the requirement to contain them is usually site specific. Invasive plants under successful biological control and native plants that behave in a weedy like fashion may be included in this category.**
hawkweeds, orange and yellow *(Hieracium spp.)*	blueweed *(Echium vulgare)*	bladder campion *(Silene cucubalus)*
hound's tongue *(Cynoglossum officinale)* (not reported in the region but expected to show up soon)	tartary buckwheat *(Fagopyrum tataricum)*	western bluebur *(Lappula echinata)*
goatgrass, jointed *(Aegilops cylindrica)*	burdocks *(Arctium spp.)*	wild buckwheat *(Polygonum convolvulus)*
diffuse knapweed *(Centaurea diffusa)*, spotted	Canada thistle *(Cirsium arvense)*	bull thistle *(Cirsium vulgare)*
knapweed *(C. maculosa)*;and others that may show up	scentless chamomile *(Matricaria maritime)*	chickweed, mouse eared *(Cerastium spp.)*
Japanese and giant knotweed *(Polygonum spp.)*	white cockle or campion (*Lychnis alba)*	chicory (*Cichorium intybus)*
leafy spurge and cypress spurge *(Euphorbia esula and cyparissias)*	hoary cress *(Cardaria drapa)*	cleavers *(Galium aparine)*
marsh plume thistle *(Cirsium palustre)*	green foxtail *(Sertaria viridis)*	curled dock and sheep sorrel *(Rumex crispus and R. acetosella)*
field scabious or blue buttons *(Knautia arvensis)*	pepper weed *(Lepidium spp.)*	American dragonhead *(Dracocephalum parviflorum)*-native
rush skeletonweed *(Chondrilla juncea)*	plumeless thistle *(Carduus acanthoides)* (not reported in the region)	goat's-beard or oyster plant *(Tragopogon dubious)*
common tansy *(Tanacetum vulgare)*	kochia *(Kochia scoparia)*	flixweed *(Descurainia sophia)*
velvetleaf *(Abutilon theophrasti)*	loosestrife *(Lythrum spp.)*	foxtail barley *(Hordeum jubatum)*-native?
	wild mustard *(Sinapsis arvensis)*	common groundsel *(Senecio vulgaris)*
	night-flowering catchfly *(Silene noctiflora)*	narrowleaf hawksbeard *(Crepis tectorum)*
	oxeye daisy *(Chrysanthemum leucanthemum)*	hemp nettle *(Galeopsis tetrahit)*
	Russian thistle *(Salsola kali)*	lamb's-quarters *(Chenopodium album)*

Table 5.4-1 Invasive Plant Categories for North East British Columbia (cont'd)

1. Prohibited Invasive Plants Prohibited invasive plants are highly competitive with an ability to spread rapidly.	2. Primary Invasive Plants. Primary invasive plants have the ability to spread rapidly but are not as aggressive as prohibited invasive plants.	3. Secondary Invasive Plants Secondary invasive plants can spread easily but the requirement to contain them is usually site specific. Invasive plants under successful biological control and native plants that behave in a weedy like fashion may be included in this category.
	sow thistles *(Sonchus spp.)*	mallow (*Malva neglecta)*
	tansy ragwort *(Senecio jacobeae)* (not reported in the region)	mullein *(Verbascum thapsus)*
	common and Dalmatian toadflax *(Linaria vulgaris and dalmatica)*	dog mustard *(Eruscastrum gallicum)*
		mustards *(Sisymbrium spp.)*
		nodding thistle *(Carduus nutans)*
		pineapple weed *(Matricaria matricarioides)*
		prickly lettuce *(Lactuca serriola)*
		quackgrass *(Agropyron repens)*
		smartweed *(Polygonum spp.)*
		St. John's-wort *(Hypericum perforatum)*
		stinkweed (*Thlaspi arvense)*
		stork's bill *(Erodium spp.)*
		corn spurry *(Spergula arvensis)*
		tarweed *(Madia glomerata)*- native?
		western water hemlock *(Cicuta douglasii)*- native
		wild carrot *(Daucus carota)*
		wild oats *(Avena fatua)*
		wormwood or absinthium *(Artemisia absinthium)*
		yarrow *(Achillea millefolium)*- native

SOURCE:
North East Invasive Plant Committee NEIPC, 2006 Plan and Profile, May 2 2006.

5.5 Surface Erosion and Sediment Control Plan

The Surface Erosion and Sediment Control (SESC) Plan establishes a framework for surface erosion and sediment control for the construction and operational phases of the Project. This plan is based on the SESC Plan for the Trend Coal Mine, which has been operating since December, 2005. It is envisaged that the Trend Coal Mine Permit will be amended to include the Project. As a result, the SESC Plan described herein represents a feasible management plan that has been demonstrated to the BC Ministry of Environment.

The SESC Plan includes the Project and all segments of the haul road linking the Project to the rail load-out. As a component of the Environmental Management Program for the mine, the SESC plan describes design and planning measures as well as the implementation of Best Management Practices (BMPs) for minimizing surface erosion and the potential for significant sediment release to the receiving environment.

5.5.1 Overview

The potential for surface erosion and sediment release to occur is typically highest during construction, when vegetation cover is first removed and soils and sub-soils are excavated or otherwise disturbed. Rates of erosion and sediment release then generally decrease as disturbed areas are revegetated and construction of runoff management and permanent sediment control structures are completed. Minimizing erosion and controlling sediment will help conserve soil required for reclamation and protect the water quality of the aquatic receiving environment located downstream of the Project.

The water management system for the Project will consist of a system of collection ditches, diversion channels and sediment ponds (see Section 4.9). Collection ditches will convey surface runoff to the sediment ponds and diversion channels will divert non-contact water around the mine site. Minimizing erosion and the potential for significant sediment release within each catchment until such time as the permanent sediment pond in that catchment is operational is a primary objective of the design and planning measures and BMPs described in the SESC Plan. Upon completion of the water management system, erosion and sediment control BMPs will continue to mitigate land disturbance by reducing the overall sediment load received by the permanent sediment ponds.

The SESC Plan will guide development of more detailed site-level prescriptions by:

1. identifying specific construction activities and mine facilities
2. integrating baseline data regarding soil erosion susceptibility, where available
3. describing associated erosion and sediment control issues
4. identifying the appropriate combination of erosion protection, runoff management, and sediment control BMPs

Section 5.5.2 (Best Management Practices Applicable to All Project Components) provides a description of BMPs for surface erosion protection and sediment control with general applicability to all construction phase components of the Project. Section 5.5.3 provides a description of BMPs for specific components of the Project and all segments of the haul road.

5.5.1.1 Erosion Control Measures

Specific BMPs are referenced throughout these sections. Diagrams or photographs and technical specifications for these BMPs are provided as Appendix 5B and include the following erosion control measures:

- ditch armouring with rock, geotextile, plastic sheeting or vegetation slash
- temporary non woven geotextile sediment trap
- temporary sediment basin and temporary ditching
- brush layer
- coir logs
- live stake
- energy dissipater
- erosion control blanket
- rock check dam
- rock lined channel
- rolling dip and waterbar
- grooved or serrated slope
- sediment fence
- stepped or terraced slope
- straw anchoring
- straw log wattles
- straw mulching
- surface roughening and furrowing
- wattle fences

Additional techniques include the application of polymer spray coatings (tackifier) to stabilize and minimize erosion of recently disturbed soils. This method is currently being assessed for use at the mine site. The tackifier is an effective technique to control wind erosion from exposed soil, particularly soil stockpiles prior to vegetation establishment.

5.5.2 Best Management Practices Applicable to All Project Components

Best Management Practices (BMPs) with general applicability to the Project have been organized into four groups:

- contingency planning and monitoring
- erosion control
- runoff management and sediment control
- maintenance of erosion control applications and sediment control structures

Together these four groups of BMPs provide a framework for considering erosion and sediment control issues that result from land disturbed during Project development. The framework provides guidance for applying erosion and sediment control practices and adapting a suite of BMPs to specific construction components.

5.5.2.1 Contingency Planning and Plan Implementation

Minimizing surface erosion and controlling sediment during the construction phases related to Project development requires proactive planning to anticipate problems and develop BMPs before vegetation removal and soil disturbance. The use of the SESC Plan can be considered a BMP in and of itself because a proactive rather than reactive approach is taken to minimizing erosion and the potential for significant sediment release to the aquatic receiving environment.

Effective implementation of the SESC Plan will require continuous monitoring so that the plan is properly implemented, management practices can be adapted and, if needed, more detailed site-specific prescriptions can be completed. In this context, the SESC Plan is considered a working document that will evolve as construction and development of the mine proceeds. To ensure the SESC Plan is properly implemented and monitored, PRC will ensure onsite mine staff have erosion and sediment control experience or training and will retain appropriate professionals as required. Onsite mine staff or retained professionals dedicated to monitoring and implementing of the SESC Plan will be responsible for adapting BMPs in response to unforeseen circumstances such as large weather events and development of more detailed site specific prescriptions, if required.

5.5.2.2 Erosion Control Management Practices

Project development will involve significant land disturbance in the form of land clearing and road or trail building. BMPs for minimizing erosion applicable to most or all construction components have been grouped accordingly.

Scheduling and Staging Land Disturbance and Revegetation

For any land disturbance, minimizing the total area of disturbance and staging removal of vegetation so that only those areas required for immediate use are affected will be a primary BMP for minimizing erosion.

Disturbed landscapes will be stabilized using techniques outlined in Section 5.5.1.1 Erosion Control Measures. Bare soils and areas where no further disturbance is anticipated will be revegetated as soon as possible using an appropriate grass and legume seed mixture developed for PRC. Particular attention will be given to cut, fill and side slopes associated with roads and trail areas surrounding constructed water management structures and soil stockpiles. Scheduling of land disturbing activities will include consideration of time of year, scheduling of waste dump construction, acknowledging the shorter growing season, and the need to provide surface erosion protection from runoff generated in the spring from melting snow. Revegetation measures will be monitored over time. Where necessary, site-specific revegetation prescriptions will be developed to ensure a surface layer of vegetation is established.

Temporary Erosion Control and Permanent Revegetation

Temporary erosion control measures such as manually applied straw mulches, erosion control blankets, and hydraulically applied mulch or mulch with tackifier will be used as

necessary to provide short term erosion control until permanent protection is established (i.e., establishment of stable vegetation, placement of rock armouring). The utility of these measures will be considered when completing more detailed site-specific planning for unavoidable land disturbance in soils that are fine-textured and more erosive, and located in high risk areas, which are prevalent throughout the Project footprint. Certain locations within the Project footprint are also at higher risk for erosion such as aspects that face prevailing winds and sites adjacent to existing watercourses.

Slope length and grade are factors that affect rates for soil erosion. For an exposed slope surface, any management practice that shortens the length of a slope and disrupts surface flow paths (reducing slope length and uniformity) will decrease the rate and total amount of erosion. Surface roughening or furrowing using tracked heavy equipment or simply using brush (slash) left over from vegetation clearing to form slash windrows along the slope contour have proven effective and will be used in this capacity where the practice is applicable.

Biotechnical slope stabilization techniques such as coir logs, straw log wattles, wattle fences, or modified brush layers installed along the slope contour at specified intervals down the slope are also effective at shortening slope lengths and decreasing the erosive power of surface water as it flows downslope. Using heavy equipment to create grooves or serrations in the slope or actual terraces in stockpiled soils or graded landscapes function in a similar manner and provide microsites for vegetation to establish. These BMPs will be considered on a site-specific basis for areas where more erosive soils are present and or a higher level of risk for sediment release to the aquatic receiving environment exists.

5.5.2.3 Runoff Management and Sediment Control

Managing runoff and controlling sediment will be important when existing native vegetation is initially removed and soil is disturbed. Particular attention will be given to implementing effective runoff management and sediment control BMPs adjacent to watercourses.

Temporary Sediment Basins and Temporary Ditching

Temporary runoff management and sediment control BMPs will be implemented immediately in conjunction with staged land clearing and road construction. Temporary ditching and construction of small, temporary sediment basins will be a primary means for managing runoff and controlling sediment as vegetation is removed and land is cleared. The purpose of this BMP is to capture and convey sediment-laden surface runoff either to stable, well vegetated areas or to small excavated sediment basins. These sediment basins will either exfiltrate runoff into the ground or discharge to areas downslope.

Armouring temporary ditches with rock, plastic sheeting or vegetation slash made available during land clearing or road building provides effective protection from channel erosion during runoff events.

Mounding vegetation slash into rows parallel to the slope contour in areas where vegetation has been removed provides erosion, sediment and runoff control by reducing slope length and disrupting surface flow paths.

Managing Runoff and Controlling Sediment Adjacent to Watercourses

Every effort will be given to ensuring that surface runoff generated from access trails and roads is conveyed away from any watercourses and unstable terrain and to stable, well vegetated areas where suspended sediments can settle out. Direct connections between road ditches and watercourses will be avoided wherever possible. Site-specific BMPs for on-site and off-site haul roads will be developed to address erosion and sediment issues for the sections of roads that are located in through-cuts where it may be difficult to divert ditch drainage away from a watercourse. Armoured ditches, rock check dams, and sediment traps are common BMPs used in these situations. For disturbed areas in close proximity to stream channels, installation of sediment fence or sediment dykes will help to disrupt surface flow paths and help with the settlement of silt and sand sized suspended sediments before input into a watercourse occurs.

5.5.2.4 Maintenance

Maintaining erosion and sediment control and runoff management structures is critical to their effective function over time. As part of a commitment to contingency planning and monitoring (see Section 5.5.2.1.1: Contingency Planning and Plan Implementation), PRC will monitor and maintain sediment control and runoff management structures by ensuring drainage structures are functioning effectively and sediment captured in traps is removed in a timely manner. Revegetated areas will be monitored for evidence of wind and water erosion and additional seed and erosion measures (see Section 5.5.1.1) applied if necessary.

5.5.3 Site-specific Best Management Practices

5.5.3.1 Project Site

The development plan for the Project is discussed in detail in Section 4: Project Description. Section 4.4: Construction Phase Activities provides an overview of construction phase activities. A brief synopsis of elements with relevance to the SESC Plan is provided below.

Mine Development Plan

The Project lies on the northwest side of the Gordon Creek running along strike to Babcock Creek. Current mine operations at the Trend Coal Mine are located directly to the north of the Project. The operations phase is delineated into three phases which outline the progression of the active faces of mining. Waste stripping will occur concurrently with coal extraction and waste will be trucked to adjacent waste rock dumps. Progressive reclamation will be conducted throughout the life of the mine as areas become available to be reclaimed.

During Phase 1 of mining all mine-affected drainage will be collected by a series of collector ditches which run parallel to the toes of the North and South dump. The water collected by collector ditch RDN1-4 which captures run off from the North dump and the northern flank of the Phase 1 Gates pit and North Gething pit will be directed to an existing Trend sedimentation pond SP2 which will drain into the Roman sedimentation pond known as RP2 which in turn drains to Babcock Creek. RDS1-4 will capture all mine-affected drainage from the southern flank of the Gates pit and South Gething pit and will direct it to sedimentation pond RP1 which in turn drains into Babcock Creek.

In the fourth quarter of Year 2, mining will progress into Phase 2. Phase 2 will consist of a 750 m extension of the Gates and Gething pits to the east and will continue through Year 6. During Phase 2 waste rock will mainly be placed in the North Dump, with a small amount of material taken to the South Dump.

Early in Phase 2 the Phase 1 Gates pit void will be established as the tailings management facility and sedimentation pond, known as RP3. RP3 will receive tailings from the coal processing plant via a direct pipeline Once RP3 is commissioned RP1 will be abandoned and the RDS complex of ditches will be joined and extended to discharge to the tailings pond. The RP3 pond will also capture all surface run-off collected by the Gates and Gething pits.

The upper portion of Phase 3 will start development in the fourth quarter of Year 4 and be mined concurrently with Phase 2 until the first quarter of Year 6 when Phase 2 will be mined out.

This phase of mining will take development into the Gordon Creek watershed. In order to minimize effects on Gordon Creek, pit grade will be maintained to ensure all mine-affected effluent drains to Babcock Creek. Effluent will continue to be directed to RP3 from the pits and South dump via the RDS ditch. Surface run-off from the North dump will continue to report to SP2-RP2 ponds via the RDN ditch. Runoff from the Northeast Dump will be directed towards the existing Trend Coal Mine sedimentation pond SP4 prior to release to Gordon Creek.

Construction activities associated with each phase and associated catchments will consist of the following activities:

- vegetation removal and trail building to construct a system of diversion and collection ditches and a permanent sediment pond within each catchment
- grubbing, prestripping and stockpiling of soils
- pit, dump, and haul road construction

As development of the Project proceeds through the different phases, emphasis will be on constructing the water management system before significant disturbance of vegetation and pre-stripping of soils begins.

Gates Pit Erosion Protection Measures

The current mine plan does not propose a containment ditch between the Gates Pit and Gordon Creek. To assure that water quality is maintained in the Gordon Creek, the following mitigative actions will be undertaken by mine operations:

- mining benches will be designed to direct all runoff toward Babcock Creek with no surface water draining towards Gordon Creek
- blasting above Gordon Creek will be designed to limit material moving beyond the pit limit towards Gordon Creek.
- In Phase 3, clearing and grubbing will not be conducted ahead of the mining operation. Where possible organic material will be mined with the waste rock to reduce the disturbed area in Gordon Creek drainage.

- In Phase 3, to keep material from being pushed into the Gordon Creek watershed, a backhoe will be used—with a dozer assisting—to remove material from the exposed face

As an additional measure to prevent any problems with the sediment entering Gordon Creek, silt fences, and coir logs will be installed ahead of the mining operations. Mine engineering will use the mine plan to determine areas that will be mined in the coming year so that silt fences may be installed in the preceding summer months. The silt fences will be installed annually to cover the predicted next year's mining activity and maintained regularly.

PRC will conduct regular monitoring of the water quality in the Gordon Creek watershed; if these mitigation measures are not able to maintain adequate water quality further mitigation will be considered. Further mitigations may include creating local sumps to collect the surface runoff, which may be pumped back to the pit for treatment by the water management system.

5.5.3.2 Soil Erosion Potential

The mechanisms for erosion are wind, water and gravity. Wind erosion is at high risk in the mine sites due to both soil type and geographic location. Water erosion is also high and is evidenced by a high density of water courses. Gravity is primarily dealt with through terrain stability. Areas where erosion from gravity is at high risk are areas of potentially unstable terrain.

Section 8.2 (Terrain, Surficial Geology and Soils) describes the baseline condition and effects of construction activities on the soils present. Section 8 (Terrain and Soil) provides details on baseline conditions and further details on mitigation related to erosion control.

Overall, the dominant soil texture for the mine sites are a high proportions of silt followed by sand with only a small component of clay. These soils are prone to wind erosion when exposed. Aggregation is reduced by machinery traffic and handling. Water erosion risk is naturally high in the area due to slopes and soil textures. Potentially unstable terrain has been identified in the proposed clearing areas where vegetation is removed and soil is disturbed.

Wind Erosion Measures

Wind erosion is more of a concern for soil loss rather than concerns for water quality. Soil losses from wind that are related to mine development occur when topsoil is exposed and left in place; is replaced for reclamation; and is salvaged and placed in stockpiles. The best way to avoid soil loss from wind erosion is salvaging under appropriate weather conditions where extreme winds (100km/hr +) and dry conditions are avoided.

Exposed bare soils that are left in place or are recently reclaimed should be managed as outlined in Section 5.5.1.1 and promptly reseeded. Stockpile location and orientation should reduce soil erosion and the use of wind fences around stockpiles can be used if necessary. Stockpiles will be seeded to reduce soil erosion (see Reclamation Plan, Section 4.10).

Water Erosion Measures

Development activities occurring prior to soil salvage consist of vegetation removal and grubbing that expose soils to erosion. The critical BMP for reducing erosion and controlling sediment is a functioning water management system in place prior to significant land disturbance. This minimizes the potential for soil loss and reduces the likelihood of a release of sediment-laden runoff to the aquatic receiving environment downstream of the mine. Combining a water management system for each catchment with site specific BMPs to provide erosion and sediment control as close to the source of disturbance as possible will ensure the potential for significant sediment delivery to the downstream aquatic receiving environment is minimized.

Soils information for each catchment and development phase for the Project will be used when developing more detailed erosion and sediment control plans. This will enable the site specific BMPs provided in this SESC Plan to be adapted to the site conditions present at the time of development.

Gravity Erosion Measures

The most effective management of erosion by gravity is avoidance of unstable or potentially unstable terrain. Where avoidance is not possible or practical, terrain stability hazards can be reduced or eliminated using engineering solutions such as stripping and excavating of unstable materials, grading to reducing slope gradients, scaling off overhanging rock, and working under appropriate weather conditions. Drainage control measures may also reduce gravity erosion that originate from activities within the mine site, such as:

- Stabilizing, restoring, and re-vegetating banks and slopes to increase stability and minimize the rates of surface water run-off or ground-water infiltration.
- Installing toe drains to direct surface and groundwater away from terrain stability hazards.
- Dewatering and draining a slide mass.
- Protect down slope areas from the effects of mass wasting by design of structures such as sediment ponds and catchment structures engineered to contain debris flows and other mass movements, protective structures such as walls and embankments, or diverting the flow away from the down slope areas using diversion barriers or channels.

5.5.3.3 Construction of Water Management System

Section 4.11: Site Water Management, provides an overview of the water management system for the mine site. Construction of the water management system will require building access trails and constructing diversion channels, collection ditches and permanent sediment ponds.

Access Trails

BMPs for construction of temporary access trails will aim to convey surface runoff to stable, well vegetated areas and away from existing watercourses. Temporary ditching and small, temporary sediment basins will be used as necessary to manage runoff and control sediment. Where a temporary access trail crosses an existing watercourse, the

following BMPs for sediment control will be implemented to prevent the release of sediment to the downstream aquatic receiving environment:

- installing appropriately sized temporary culverts at all such crossings and armouring the inlets and outlets to prevent erosion
- installing sediment fence as necessary
- applying mulch and revegetating areas that will remain disturbed for a significant length of time or over the winter

In some instances, it may be necessary to develop permanent access to a sediment pond. BMPs for constructing haul roads will be used to manage runoff and control sediment for access trails developed into permanent roads.

BMPs for temporary access trail deactivation will aim to restore the natural hydrology of the site and provide permanent erosion control through application of an appropriate grass and legume seed mixture developed for PRC.

Diversion Channels, Collection Ditches, Sumps, and Construction of Permanent Sediment Ponds

Ditch, sump and sediment pond construction can occur simultaneously where collection ditches do not bisect existing watercourses. Collection ditches that intercept existing watercourses will not be constructed until construction of the permanent sediment pond is complete.

Diversion channels constructed to divert non-contact water away from the mine site will be constructed in an upslope direction. Connection to an existing watercourse will not occur until construction of the diversion channel to the engineering standard specified in the design is complete.

Soil excavated to construct the diversion channels, collection ditches and sediment ponds will be cast downslope if a sufficiently wide vegetated buffer exists between the ditch and the nearest watercourse. A second option will be to cast material far enough upslope to a point where risk of this material eroding back into the diversion channel or ditch is low. Sidecast material will be revegetated as soon as possible using an appropriate erosion control grass and legume seed mixture developed for PRC.

5.5.3.4 Project Site Preparation

Development of the Project site will require that the forest cover be harvested or cleared, followed by grubbing activities, soil salvage and overburden removal in certain areas. Development will progress in order through the different phases on a catchment by catchment basis as mining operations for each phase are completed.

Development activities will be scheduled so that catchment areas remain vegetated or covered with an undisturbed shrub and root layer for as long as possible. Conventional forest harvesting practices (i.e., harvesting in the winter when there is a protective cover of snow over the ground) typically minimize disturbance of the shrub and root layer. Initiating forest harvesting prior to construction of the water management system is possible because there will be little increased potential for significant erosion and sediment generation.

Commencement of grubbing activities, soil salvage and overburden removal in each catchment will expose underlying soils to erosion and thus sediment generation.

Construction of the water management system before significant disturbance of upslope areas will ensure the means to manage runoff and control sediment at the catchment scale are in place prior to or in conjunction with these activities.

Implementing BMPs for managing runoff, protecting against erosion, and controlling sediment during activities that disturb the shrub and root layer will increase the efficiency of the permanent sediment ponds by decreasing the overall sediment load conveyed to the ponds. The specific BMPs that will be adapted to the conditions present during land disturbance activities within each catchment are provided below.

- Temporary ditching and temporary sediment basins will be used to manage runoff and control sediment as close to its source as possible. Temporary ditches will be used to convey sediment-laden runoff to stable, well vegetated areas, or to temporary sediment traps or basins designed to exfiltrate collected water into the ground.
- Surface roughening and constructing vegetation windrows will be used to disrupt surface flow paths over disturbed areas.

5.5.3.5 Soil Stockpiles

Soil stockpiles will be constructed as soil is salvaged during each phase of development. The BMPs listed below will be adapted to this activity.

- Soil stockpiles will not be placed in areas where wind, water and gravity erosion risks are high.
- Soil stockpiles will be constructed with a shallow grade (i.e., 2:1 slope or less) or a stepped or terraced slope.
- Roughening the surface of the soil stockpile using tracked heavy equipment will provide erosion control and create optimal conditions for vegetation establishment.
- Soil stockpiles will be vegetated by applying an appropriate seed mixture developed for PRC.

5.5.3.6 Road Construction

Mine roads will be constructed as Project development proceeds. New roads will tie into existing roads which access the Trend Coal Mine South Block. Managing runoff, minimizing erosion, and controlling sediment from roads is important for reducing the total sediment load input into the water management system during the construction and operations phases of the mine.

A suite of BMPs for minimizing erosion from road ditches and road surfaces, and controlling sediment as close to the source as possible will be used to augment the function of the water management system in each catchment. These BMPs may include:

- rock check dams to reduce the slope length of ditches and slow runoff velocities
- sediment traps installed in the ditches to settle some suspended sediments
- rolling dips and waterbars to convey surface runoff generated on road surfaces to ditches or existing vegetation
- energy dissipaters to minimize erosion at the outfall of cross drainage culverts

- rock lined ditches in selected areas (i.e., ditches with steeper gradients or ditches in road through-cuts near water courses) to minimize erosion during large runoff events
- installation of sediment fence or silt dykes for areas where surface (sheet flow) runoff has the potential to erode exposed soils adjacent to watercourses

The applicability of each BMP will be determined when completing more detailed planning for specific road segments. This planning will consider the proposed location of the roads and the soil conditions present in order to develop effective site level prescriptions that use a combination of these BMPs. Additional BMPs listed in Section 5.5.1.1 (Erosion Control Management) will also be considered when developing site-level prescriptions.

5.5.4 Construction Phase Surface Erosion Protection and Sediment Control

Construction phase BMPs for constructing the new road segments and upgrading the existing one will focus on managing surface drainage patterns altered by construction so that sediment-laden runoff is collected and conveyed to stable, well-vegetated areas where it can seep into the ground. Temporary erosion and sediment control BMPs will be applied to minimize the potential to adversely affect water quality in adjacent streams and drainages located down slope of the road during construction. Runoff, erosion and sediment control BMPs for use during road construction are described below.

- Temporary ditches will be installed in conjunction with construction of any new road approaches leading to watercourse crossings. A system of temporary ditches will collect and divert surface runoff away from the watercourse to stable, well-vegetated areas where sediment-laden runoff can seep into the ground. To minimize erosion during the construction period, structures such as a rolling dip and water bars will be constructed to convey surface runoff from the road running surface to the temporary ditch system. The location of temporary ditching will approximate as closely as possible the location of permanent runoff management structures.
- Prior to beginning construction adjacent to a stream, the footprint for the new road or area of construction will be clearly marked in the field to prevent unnecessary disturbance of riparian vegetation.
- Construction activities occurring adjacent to a stream will be halted in the event of heavy rain. Sediment fence or silt dykes will be installed as appropriate along the edges of disturbed areas to manage sheet flow runoff and minimize sediment delivery to the watercourse.
- Newly exposed cut, fill and side slopes will be stabilized and revegetated as soon as possible by applying an appropriate grass and legume seed mixture developed for PRC.
- Excavated soils will not be stockpiled adjacent to a watercourse, height of land or exposed to prevailing winds, and will avoid unstable terrain. Where there is potential for erosion of a temporary soil stockpile and delivery of sediment to a watercourse, a sediment fence or silt dyke will be installed on the downslope side.
- Geotextile sediment traps consisting of non-woven geotextile with the leading end wrapped around a log that is placed perpendicular to the ditch are also effective for settling suspended sediments and slowing runoff velocities. This technique will be used where necessary for road segments in steeper terrain.

5.5.5 Permanent Erosion Protection and Sediment Control

Permanent surface erosion protection will consist of maintaining permanent vegetation cover on soils exposed on cut, fill and side slopes, and directing surface drainage collected in ditches away from watercourses to stabilize well vegetated areas or rock armoured discharge points wherever possible. Revegetation effectiveness will be monitored and additional applications of an appropriate erosion control grass seed mixture will be completed as needed. Runoff control measures will be installed in a manner that utilizes natural drainage patterns as much as possible. Where road through-cuts exist, sediment traps will be constructed and maintained in each ditch to impound water and allow settling of some suspended sediments before discharge.

Long term surface erosion protection and sediment control for the upgraded road segment will consist of reestablishing ditches to manage surface runoff immediately and ensuring collected runoff is conveyed away from watercourses to stable, well vegetated areas whenever possible. Disturbed soils will be stabilized and revegetated by applying an appropriate erosion control grass seed mixture.

5.5.6 Road Management in Erosive Soils and Sensitive Terrain

A number of additional permanent erosion and sediment control BMPs will be considered for areas with erosive soils and sensitive terrain and associated higher risk for sediment mobilization. The utility of these measures will be determined through more detailed planning to develop site-specific erosion and sediment control prescriptions. If appropriate, the prescriptions developed will consist of a combination of the BMPs described below.

For cut and fill slopes characterized by steeper grades, options for providing temporary erosion control will include straw mulch applied manually, erosion control blankets, or a hydraulically applied mulch and tackifier grass seed mixture. These measures provide temporary protection from surface erosion until permanent vegetation cover is established.

Armouring lengths of ditches with rock and installing rock check dams will also be considered where ditches are located in erosive soils and sensitive terrain and or have direct connectivity to a watercourse (for example, in a road through-cut situation). Rock armour and rock check dams minimize erosion by protecting the ditch surface and slowing runoff velocities.

Sediment control measures such as permanent sediment traps or temporary geotextile sediment traps will also be used where necessary to provide additional sediment controls.

5.5.7 Flocculant Management Plan

5.5.7.1 Introduction

This Flocculant Management Plan has been developed to ensure water quality discharge meets the BC Ministry of Environment guidelines. The plan addresses the use of a combination of anionic and cationic granular flocculants at the Trend Coal Mine and the Project. This plan includes relevant information on:

- the type of flocculants proposed for use, including the 96 Hour LD 50 Toxicity tests
- details on how the flocculants are applied and mixed
- how toxicity in the discharge will be prevented
- the proposed sampling program for determining when flocculants are required

The Water Management Plan (presented in Section 4.9) includes sediment ponds designed in accordance with the BC Guidelines to remove non-filterable residue or TSS from disturbed area runoff. Over the life of the mine and Project, sediment pond water will be discharged to Babcock, Gordon and Hambler creeks. On occasions when the water from the sedimentation pond system is at risk of not meeting water quality objectives for total suspended solids (TSS), source erosion control measures and settling aids, including flocculants, will be used to insure that water quality objectives are met. The BC Guidelines "clear flowing stream" designation applies for TSS and turbidity at the Trend Coal Mine Site. Induced TSS may not exceed 5 mg/L over a 30-day period or 25 mg/L over a 24-hour period. This guideline applies to the receiving waters downstream of the mine site, which are measured for compliance at water monitoring stations, at Trend B-5 and B-3 on Babcock Creek, G-2 and G-3 on Gordon Creek, and HAB-1 on Hambler Creek Tributary.

Discharge limits from a sediment pond are a function of sediment pond flow and corresponding downstream receptor flow. Due to the lag between sampling and receipt of lab TSS results, this Plan relies on field turbidity measurements. TSS values (mg/L) will be calibrated to field turbidity measurements over time. Turbidity measurements are dependent on variables such as particle size, shape, and colour, as well as concentrations of suspended solids, which lead to variations in field turbidity and laboratory TSS relationship. A comparison of 167 samples with TSS and turbidity results taken at the Trend Coal Mine site in 2005 and 2006 has shown that the relationship is:

$$\text{TSS (mg/L)} = 0.479\ (\text{turbidity (NTU)}) + 5.45$$

Data collected in 2007 at the three sediment ponds SP1-B, SP2, and SP3 indicate that the TSS and turbidity relationship is different for each catchment. The following table summarizes the relationships.

Table 5.5-1 TSS and Turbidity Relationships by Pond

Sediment Pond	TSS and Turbidity Relationship (2007 data)
SP1-B	TSS (mg/L) = 0.7294 (turbidity [NTU])
SP2	TSS (mg/L) = 0.6486 (turbidity [NTU])
SP3	TSS (mg/L) = 0.5268 (turbidity [NTU])

Therefore, it is proposed that the above formulas be used to convert a measured turbidity value to an equivalent TSS value. As new data become available, this relationship will be updated for increased accuracy. Data collected from Roman sedimentation ponds will be used to develop a similar relationship. The limits for TSS and turbidity that are incorporated in this Plan shall be consistent with the limits in the operational permits.

Site specific control BMPs are the preferred mitigation strategy at the Trend Coal Mine site and it is understood that a flocculation program will be implemented only when control BMPs and sediment ponds are insufficient to meet British Columbia water quality standards, notably at the compliance points on Babcock, Gordon and Hambler creeks and at sediment pond discharge points. The SESC Plan addresses both the short-term mitigation measures to control the TSS levels in the existing channels and constructed ditches through on-going development and the long-term measures to control the TSS levels leaving the site during the operations period. Flocculant products and doses have been recommended based on their effectiveness and toxicity. The flocculants are effective in attaining the specified TSS limits, yet will not be present in concentrations that may be toxic to aquatic biota in the receiving streams.

5.5.7.2 Recommended Flocculant Product and Dosage

A combination of anionic and cationic granular flocculant is in use at the Trend Coal Mine site. The flocculants proposed are based on jar and field testing at the mine site, in conjunction with proven reliability at the Kemess mine site in British Columbia. CIBA Specialty Chemicals Canada Inc. (CIBA) manufactures Magnafloc® 156 (anionic) and Magnafloc® 368 (cationic) flocculants which, used in combination, are very effective at reducing the suspended particle concentrations present in the Trend sediment ponds. The Magnafloc® 156 flocculant is a high molecular weight, fully anionic polyacrylamide flocculant supplied as a free flowing micro bead and the Magnafloc® 368 is a low molecular weight, highly cationic flocculant supplied as a free flowing bead. The flocculants are combined and mixed in hoppers situated in outbuildings situated at the inflows into the Trend Coal Mine site sediment ponds. A similar set up will be used at the Roman sedimentation ponds. Current dosage rates of the Magnafloc® 156 and Magnafloc® 368 are 4 and 8 ppm respectively. This is a 50 percent reduction from the dosage used in 2007, and testing is underway to further reduce the floc dosage. The aim is to find the minimum dosage that will still achieve adequate treatment.

Electric screw feeders feed the flocculant mixture contained within the hopper through an opening in the floor of each outbuilding and into the pond inflows. The rate of application of each screw feeder is matched to the volume of water measured at the outflow of each sediment pond. The feeder dose rate is calibrated by running it for a standard time period at a given setting and weighing the amount discharged. Each screw feeder flocculant feed rate and pond inflow is inspected periodically to ensure proper dosage is occurring. The flocculant outbuildings are located at sufficient distance “upstream” within the pond inflows to ensure the flocculant has a minimum continuous mixing time of 20–30 seconds prior to entering the ponds. A mixing system consisting of a pump and water jet discharge is proving effective at providing further mixing. A similar set up will be used at the Roman sedimentation ponds.

Flocculant Toxicity

Table 5.5-2 summarizes the results of the toxicity assessment obtained from the Magnafloc® 156 and Magnafloc® 368 MSDS sheet information.

Table 5.5-2 MSDS Toxicity of Magnafloc® 156 and Magnafloc® 368

Toxicity Parameter	Polymer Concentration (mg/L)	
	Magnafloc® 156	Magnafloc® 368
96-hour LC50 rainbow trout	230	4.0
48-hour LC50 *Ceriodaphnia dubia*	110	1.6
7 days EC50 *Ceriodaphnia dubia*	3.6	0.96
NOTE: 96-hour LC50 rainbow trout data and 48-hour LC50 Ceriodaphnia dubia data are measured under static conditions in the presence of humic acid. 7 day EC50 Ceriodaphnia dubia data are measured under static-renewal conditions in the presence of humic acid.		

5.5.7.3 Mine Operational Phase Flocculant Use Plan

Water from undisturbed areas is managed by diverting water around the mine operation to the extent practicable. Surface runoff from the disturbed and reclaimed areas and from undisturbed areas that cannot be diverted is managed through the mine drainage and sediment pond treatment systems. During mine operations, the focus of TSS and turbidity control and monitoring is at the outlet of the sediment ponds. At a frequency outlined in the operational permits, operational phase monitoring is performed at the outlets of sedimentation ponds.

During the operational phase, if a pond's discharge turbidity reading shows that an equivalent average TSS reading exceeds the ponds discharge limit, and is not the result of precipitation in excess of the 10-year, 24-hour event, a review of site activities is performed in an effort to apply BMPs to control the sediment source leading to the elevated TSS from the pond. Flocculant application at the pond inflows will be used in order to maintain compliance with the Operational Phase turbidity and TSS objectives.

The sedimentation ponds have been sized to settle suspended sediment down to fine to medium fine silt sizes for flows up to the 10-year return period 24-hour event, as per guidelines used by the BC Ministry of Environment. If flocculant application is needed to control turbidity levels in the effluent from the ponds, the flocculant stations will be activated. A flocculant station has been set up at the inflows into each of the Trend Coal Mine site sediment ponds. Electric screw feeders release the flocculant mixture contained within the hopper through an opening in the floor of each outbuilding and into the pond inflows. The rate of application of each screw feeder will be calibrated to the volume of water through the respective inflow into each sediment pond. Each screw feeder flocculant feed rate and pond inflow volume will be monitored periodically to ensure proper dosage is occurring. The flocculant outbuildings will be located at sufficient distance upstream within each pond inflow channel to ensure the flocculant has a minimum continuous mixing time of 20–30 seconds prior to entering the ponds.

For new sediment ponds, significant turbidity can be generated as the pond fills and mobilizes clay and silt particles from the excavated walls and floor of the pond. If this increased turbidity is high enough to contribute to a likely exceedance of discharge turbidity and TSS, the pond water may be pumped, circulated through a half culvert channel beside the pond, and dosed with flocculant. The water would then be reintroduced to the pond. This method was very effective at reducing the turbidity and TSS in the newly constructed SP2 pond in 2006.

Furthermore, if the induced turbidity at the compliance point in Babcock, Gordon or Hambler creeks exceeds the site-specific 30-day limits of approximately 7.4 mg/L for total suspended solids or 8.2 NTU for turbidity, then a reconnaissance of upstream conditions will be conducted to identify the source of the turbidity. If the source is a result of mining activities, then BMPs will be applied to control the sediment source leading to the elevated turbidity. BMPs may include the use of flocculant application in order to remove the very fine-grained sediment from channel or ditch flow.

Flocculants are only intended to be used when required to insure that water quality criteria are attained; typically during freshet and storm events. Flocculation and settling are strongly influenced by temperature; hence flocculant application may not be needed when water temperatures rise during the summer.

5.5.7.4 How Toxicity in the Discharge Will Be Prevented

During periods of flocculation each active flocculant station is monitored several times daily. A PRC Environmental Assistant is assigned to the monitoring and maintenance of the flocculant stations. The field set-up of the flocculant stations allows for a minimum continuous mixing period of 20–30 seconds, which allows the floc-structures to grow prior to entering the sediment ponds. The rate of flocculant application will be calibrated in association with sediment pond inflow water volumes to ensure appropriate dosage occurs. In addition to the stringent monitoring and strategic placement of the flocculant stations, the placement of several floating silt curtains within the sediment ponds will also assist in controlling the toxicity of pond discharges. Similar to a baffle system, the floating silt curtains will increase the retention time within the ponds allowing the flocculant polymers to bind with the suspended particles thereby gaining mass and settling within the pond rather than discharging. The floating silt curtains also act to curtail surface agitation of the ponds during windy periods.

Flocculant application will cease when the sediment pond discharge TSS is sufficiently low to meet turbidity and TSS objectives. Determining when the flocculant application is no longer needed is a judgment based on the flow rates discharging from the sediment ponds and at downstream compliance points. Turbidity levels will continue to be measured in pond discharge after the flocculant application has ceased to insure that the discharge objectives are met.

Toxicity results obtained from the MSDS sheets of the CIBA Magnafloc® 156 and Magnafloc® 368 are shown in Table 5.5-2. The concentration of flocculants in water discharging from the pond is anticipated to be minimal as the flocculants bind to the sediment particles and settle in the ponds. Settling tests without the addition of flocculants indicate about a 95 percent reduction in TSS levels in the Trend Coal Mine site sediment ponds. Further TSS reductions would occur when the CIBA Magnafloc® 156 and Magnafloc® 368 flocculants are applied to the ponds. To be conservative, if it is assumed that in the field a 95 percent reduction in TSS will be obtained and that in turn 95 percent of the flocculation product will settle in this process. As a result, flocculant product concentrations leaving the sediments ponds would be minimal. Furthermore, due to the long travel paths to fish bearing streams, and dilution provided in downstream receptors, flocculant concentrations reaching sensitive habitat are expected to be undetectable.

5.5.7.5 Sampling of the Pond Discharge for Toxicity Testing

Sampling of the pond discharges for 96 hour LC50 rainbow trout toxicity tests will be done to ensure that pond discharge water is non-toxic. Results from the testing will be compared to the laboratory controls. Discharge samples will be expected to meet the pass or fail (50 percent survival) criterion. Sampling interval is set out in the operational permits and currently one sample within 24 hours of initiating flocculant use at a given pond, and weekly during flocculant use. It is intended that this interval may be reduced once a sufficient database of results is compiled demonstrating the non-toxic nature of the discharges.

Flocculated suspended solids will be settled in the sedimentation ponds. When suitable nearby reclamation areas become available, sediments contained in the ponds will be emptied to both restore capacity and reduce the discharge of any flocculant polymers to the receiving waters. During ongoing mining, sediment levels in the ponds will be checked during the low flow period in the fall of each year, and sediment will be removed as required so that there is a minimum of 1.2 m of effective water depth, as per the Effluent Permit.

Once the flocculant polymers have reacted with the suspended particles and the flocculated sediments have settled in the ponds and stilling basins, they become inactive and the polymers are irreversibly bound to the settled particles. Furthermore, pond sediments containing these polymers are not as susceptible to erosion as pond sediments without polymer. As well, metals present in the floc structures are bound to the polymer and are not available to plants or aquatic organisms. Therefore, pond sediments containing these polymers do not have special management requirements and may be disposed in locations suitable for disposal of any pond sediments. Pond sediments may also be used as reclamation soil.

5.6 Receiving Water Quality Monitoring Plan

The management tools, which PRC is employing to predict, prevent, treat and control effluent are set out in Sections 5.5, 5.7, 5.8 5.12 and 5.13 of this EMP. This section describes the monitoring commitments, which PRC will undertake to ensure that site water quality management actions are adequate to protect receiving water.

PRC has developed a regular water quality-monitoring program which encompasses all stages of the Trend Coal Mine Project (i.e., construction, operation and closure) and which will apply directly to the Project. The main objectives of the monitoring regime are to quantify the potential effects to water quality and ensure compliance with permitted discharge limits.

Regular monitoring will allow PRC to make informed decisions on the requirements for any additional mitigation measures to minimize the effect of the mine activities on water quality. Additionally, an environmental effects monitoring (EEM) program will be devised with input and guidance from the BC Ministry of Environment. It is envisaged that the EEM will include chemical residue sampling and biological monitoring to be conducted every two years. Program results will be submitted to the Regional Environmental Protection Office in Prince George with terms of reference, developed by a qualified professional, for the scheduled residue and biological programs of the successive EEM cycle.

Management Commitments and Responsibilities

Table 5.6-1 details the monitoring regime that will be implemented during construction, operation and closure of the Project.

Table 5.6-1 Water Quality Monitoring Commitments

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Construction			
Construction Phase water quality monitoring program	Construction Phase monitoring program for receiving waters and pond effluents as agreed to with MOE: • Daily turbidity sampling • Weekly lab turbidity and TSS • Monthly or quarterly sampling for conductivity, hardness, TSS, pH, turbidity, major anions, nutrients, organics and metals	Environmental Coordinator	Weekly and monthly reports to MOE
Operations			
Sediment Ponds RP1, RP2, RP3 (TMF), SP-3, SP-4, LSP-1 and receiving waters (Bu/sBT-9, BT-8, B-2, B-5, B-3, Gu/sGT-16, G-2, G-3, MT100-1, MT100-2, F-3)	• Permit PE-17762 monitoring program for receiving waters and pond effluents as agreed to with MOE • Daily turbidity sampling • Weekly lab turbidity and TSS • Monthly or quarterly sampling for conductivity, hardness, total suspended solids (TSS), pH, turbidity, major anions, nutrients, organics and metals • Sampling triggers if turbidity values exceed the BC Water Quality Guidelines • Source control Best Management Practices are the preferred mitigation strategy, however if additional mitigation is required a flocculation program will be implemented at one or all of the ponds • Annual sediment sampling from sediment ponds • One sample shall be taken from each pond annually for determination of selenium species (selenate and selenite) • Toxicity testwork is conducted on sediment pond effluent when/if flocculants are used, as required by permitting • Environmental effects monitoring (chemical residue, biological monitoring, etc) will be conducted every two years, as required by the permit	Environmental Coordinator	Weekly, monthly, and annual reports to MOE
Pit Sump	• If a pit sump is constructed, water quality will be monitored on a monthly basis during open water season • Water quality analyses shall include pH, conductivity, alkalinity/acidity, redox potential, sulphate, dissolved major cations and dissolved trace elements. Detection limits shall be sufficient to compare to provincial water quality guidelines and MOE permitted water quality objectives • One sample shall be taken annually for determination of selenium species (selenate and selenite)	Environmental Coordinator	Results will be reported in the Annual Reclamation Report to MEMPR

Table 5.6-1 Water Quality Monitoring Commitments (cont'd)

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Seepage from waste rock dumps	• Seepage shall be collected and analyzed bi-annually, during freshet and late summer early fall • Analyses shall include pH, conductivity, alkalinity/acidity, redox potential, sulphate, dissolved major cations and dissolved trace elements. Detection limits shall be sufficient to compare to provincial water quality guidelines and MOE permitted water quality objectives	Environmental Coordinator	Results will be reported in the Annual Reclamation Report to MEMPR
Closure			
All sites	• Monitoring will continue through the closure period at all sites, but at a reduced frequency based on the data record and commensurate with the level of risk (detailed monitoring plans will be compiled and approved prior to closure)	Environmental Coordinator	Monthly and annual reports to MOE, Annual Reclamation Report to MEMPR

5.7 Selenium Management Plan

Selenium (Se) is an element that is commonly present in the Earth's crust and can be elevated in rocks associated with coal-bearing formations. Selenium can be associated with sulphides and organic material due to a high correlation with sulphur. Accelerated weathering of mine wastes due to the increased surface area exposed can release excess Se into the environment. Excess Se, if concentrated through the aquatic food chain, has the potential to have adverse effects on egg-laying vertebrates (i.e., fish, water birds and amphibians).

In the past decade, Se has been identified as a parameter of concern for many coal mining operations. PRC is taking a proactive approach to addressing potential effects of Se leaching from the Project and Trend Project sites with this Selenium Management Plan (SeMP), which describes those elements specific to the unique pathways and concerns of potential Project-related Se increases in the environment. Because of their proximity to one another, Se is most effectively managed if the Trend Coal Mine and Roman Project are treated together. Therefore, this plan takes into consideration Se contributions from both sites post-construction and following initiation of mining resulting in waste rock exposure to leaching.

The objectives of this SeMP, which will be adapted in future as relevant new information on site-specific Se releases and on management and treatment technologies is obtained, are to:

- protect the receiving environment from excess Se loading that could result in adverse effects to populations of fish, water birds or amphibians
- provide sound scientific data for effects assessment, including predictive studies of the potential for Se leaching at the Project site and documentation of receiving environment conditions before and during Project development
- set environmental effects monitoring objectives related to Se
- set risk-based adaptive management strategies during operations

- ensure that a range of management options is considered and appropriate measures and contingencies are adopted
- ensure that potential issues are proactively managed to avoid environmental liabilities
- develop public and regulatory confidence that the Se issue can be successfully managed

5.7.1 Organization

This SeMP is organized as follows:

- background information on Se toxicity and risk of Project-related effects, baseline data collection and review
- predictions of Se leaching at the Project and Trend sites
- identification of management measures throughout the life of the mine including mine waste management, water management and reclamation
- environmental monitoring specific to Se concerns
- identification of progressive, site-specific contingencies for implementation in the event that Se levels in the areas of concern begin to rise (adaptive management)

5.7.2 Background

Selenium is a group VIa element and is a chemical analogue to sulphur. Not only do both elements share oxidation states (-2, 0, +4 and +6), but their speciation in each oxidation state is similar. In general, selenate (Se^{6+}: the most oxidized species, and the species most likely to be present in oxic waste rock drainage waters) exists primarily as a dissolved oxyanion having a weak affinity for solid surfaces. Selenium occurs naturally and has been associated with coal deposits in western Canada.

The major concern related to Se is its accumulation in the organic form in food items eaten by fish, water birds, and amphibians such that elevated organo-Se concentrations are passed to their eggs, which can result in juvenile abnormalities or embryo death. Under certain environmental conditions, Se is capable of making a transformation from the inorganic oxyanion (the predominant species in oxygenated surface waters) to organo-selenides within the proteinaceous material of the food chain. Potential for bioaccumulation and toxicity will depend on the food-chain pathway, which will in turn be dependent on the physical, biological and chemical characteristics of the waterbody (Hoffman et al. 2003; Chapman et al. 2009).

Site-specific differences in Se toxicity can be significant, relating to the forms of Se present, conditions of the aquatic environment (e.g., flow rates, water depth, substrate), and the types of biological communities present. Different organisms not only exhibit greatly varying sensitivities to Se exposure, but the youngest life stages of fish, water birds and amphibians tend to be more susceptible.

Monitoring for amphibians is not presently recommended because: there are no effects thresholds for amphibians and thus no basis for comparison; amphibians are subject to a wide variety of other stressors that can affect their populations, both natural and anthropogenic (e.g., climate variation, eutrophication, pesticides), thus confounding such monitoring even in reference areas (Minnow Environmental 2006; EVSTF 2007); their typically patchy distribution renders field collections difficult and possibly damaging to

resident populations. Thus, monitoring will focus on fish and water bird populations with the assumption being made that protection of these populations from Se toxicity will also protect amphibian populations.

It is widely recognized that lentic systems (e.g., lakes, wetlands, back waters) are more at risk to Se inputs than lotic systems (flowing water) (Simmons and Wallschläger 2005; Chapman et al. 2009). Anaerobic zones in organic-rich sediments common to lentic systems favour the formation of the more toxic organic Se by bacteria, algae and phytoplankton. Rates of Se transformation are also predicted to be higher in lentic environments. The longer residence time and storage potential in lentic environments also provide an optimum medium for the cycling of organic Se.

The contrasting nature of Se behaviour in lentic versus lotic systems has relevance to both the Trend and Roman mines. There are limited lentic environments in Babcock and Gordon creeks, thus the potential for near-field Se toxicity in these lotic waterbodies is low. Lentic environments do occur in Hambler Creek (which will be affected in approximately 2011 when Trend mining first occurs in the Hambler Creek watershed) and in Flatbed Creek downstream of the confluence with Babcock Creek. Although there is potential for elevated concentrations of Se in these environments, it is unlikely that population-level effects on the larger aquatic ecosystem will occur as a result.

A lentic areas survey of Flatbed Creek (BC Watershed Code 234-323900-50900) was conducted from its confluence with the Murray River upstream to its confluence with Hambler Creek (234-323900-50900-62600), to identify potential lentic depositional habitats in the creek downstream from planned mining activities (Golder 2008). Small ponds were relatively common in the non-wetted portion of the Flatbed Creek channel. However, during the survey no ponds in which the substrate consisted of organic material deposited by the creek's flow over multiple years were observed. Ponds in which the substrate had accumulated over multiple years were isolated from the creek's surface flow, and were situated either in abandoned side channels or at the bases of landslides. In contrast, ponds within the channel portion subject to inundation during freshet flows lacked organic depositional matter because of scouring by those flows. While these ponds would provide habitat for fish while wetted, the potential for Se uptake is lower than in areas considered depositional habitats. The value of the scoured ponds as water bird habitat is relatively low because they lack emergent vegetation. The channel of Hambler Creek consists mainly of a series of beaver ponds connected by a low-gradient meandering channel. Because the flow is relatively sluggish, the substrate is largely composed of fines, and emergent sedges and rushes are common. The entire dammed section of the creek probably provides nesting and rearing habitat for water birds, although none were observed during the mid-July aerial survey.

Numerous variables affect the expression of Se in the environment. Concentrations of Se in water have been shown to be a poor predictor of Se toxicity via dietary exposure (Chapman et al. 2009). Accordingly, it is proposed that a tissue-based guideline for Se be adopted for this Project, with application primarily to fish tissue and water bird eggs.

Both the Province of British Columbia and the USEPA have proposed draft chronic guidelines and criteria for Se based on whole body fish-tissue concentrations (see Table 5.7-1). However, baseline studies conducted by a variety of proponents and by the BC MOE indicate that the BC guidelines are too low and are overly protective (e.g., Carmichael and Chapman 2006).

Table 5.7-1 BC and USEPA Guidelines[1] for Selenium

Water Use	Guideline for Total Selenium
BC Drinking Water	10 µg/L
BC Aquatic Life (freshwater)	2 µg/L
BC Aquatic Life (fish-tissue)	1 mg/kg body weight (wet weight) mean
BC Sediment	2 mg/kg (dry weight)
BC Wildlife	4 µg/L
BC Irrigation	1 µg/L
BC Livestock watering	30 µg/L
USEPA (chronic fish-tissue)	[1]7.9 mg/kg dry weight
USEPA (acute fish-tissue)	[1]258/417 µg/L

NOTES:
[1]Draft November 12, 2004 interim chronic value applies to fish whole bodies; if selenium concentrations in whole body samples approach 5.85 µg Se/g dry weight during the summer or fall months, then additional fish sampling during winter is recommended to determine if they exceed 7.91 µg Se/g dry weight. Acute values apply to all aquatic fauna and are now sulphate dependent for selenate. The 258 µg/L applies to selenite over a 24 h period which, when converted to selenate, would be 417 µg/L at 100 mg/L sulphate. Note that USEPA will be issuing revised draft guidelines in 2010.

5.7.3 Project-Related Effects

The primary issue associated with Se leaching from mining activities is the potential for introduction of Se to aquatic habitat downstream of mining. Specifically, the potential for Se leaching will relate to the weathering of rock surfaces in the major mine facilities.

The approach used to estimate Se concentrations in discharges from the waste rock dumps is described in Section 3.3 of this EA application. In brief, data from other mines in the region were reviewed to identify potential upper limits on Se concentrations. A value of 150 µg/L Se, representing the highest historic concentration observed from the Elkview Mine, was used to represent source concentrations for seepage emanating from the Project's waste rock dumps. This concentration (150 µg/L) was imposed on all waters coming into contact with waste rock during all flow periods. As an indication of the conservatism inherent in the value, a summary of regional and site-specific Se database information are provided below:

- maximum observed Se in mine waste seepage from Bullmoose Mine ranged from 15 to 95 µg/L
- maximum measured Se from relatively small Trend PAG test pads is 120 µg/L
- maximum recorded Se in Trend coal stockpile seepage is 80 µg/L
- maximum observed Se in Trend mine waste seepage is 60 µg/L
- maximum documented Se in Mesa Dump (Quintette Mine) seepage is 38 µg/L (n = 15 samples)

The Mesa dump contains similar waste rock to that which will be produced from the Project. Estimated concentrations of Se in the mine seepage from the Project, and therefore at the downstream water quality stations, are considered to be conservative.

Estimates of Se concentrations in receiving water stations are presented in Sections 12.5 and 12.6. During construction and initial operations, Se loadings to receiving flows will be relatively minor due to the low volumes of waste material generated. Selenium concentrations will increase during the operational period as the volume and footprint of the waste dumps increase and will reach a maximum concentration after the waste dumps have reached their full footprint. It is anticipated that loadings of Se will likely peak during the post-closure period after waste rock dumps have reached hydraulic equilibrium and seepage flow rates have stabilized. Water quality predictions assume that metal transport from the Project site to the LSA and RSA is conserved, and that no losses or attenuation occurs in the sediment ponds, along seepage and groundwater flow paths, or in the receiving environment itself. These assumptions inherently lend toward the conservative nature of the predictions.

Residual Project effects on Se concentrations were predicted for the LSA (see Section 12.5). Maximum predicted concentrations from the Project are provided in Table 5.7-2. A wide range of flow periods were considered in the water quality predictions (see Section 12.4). The one-in-ten year, seven-day low-flow period in summer (7Q10s) was consistently the flow period that showed the highest Se concentrations. Water quality degradation is predicted to be worst during this period due to a disproportionate release of lagged waste rock seepage. The seepage lag is a delay of maximum snowmelt infiltration during freshet and coincides with low-flow events in late summer where dilution is relatively low. Maximum predicted concentrations of Se in Babcock Creek (B-5) are 33 µg/L and exceed the BC guideline of 2 µg/L. Lower concentrations are predicted for Gordon and Flatbed Creeks; however, Se concentrations are predicted to exceed the water quality guideline at all stations.

Table 5.7-2 Maximum Predicted Residual Project Effects on Selenium Concentrations (µg/L) in the LSA

Station	Concentration (µg/L)	Flow Period
Babcock Creek		
B-5	33	7Q10s*
B-3	19	7Q10s*
Gordon Creek		
G-2	12	7Q10s*
G-3	8	7Q10s*
Flatbed Creek		
F-3	16	7Q10s*
NOTE: *7Q10s is the 1 in 10 year, seven-day low-flow summer event.		

Cumulative effects on water quality in the LSA were evaluated in Section 12.6 and include the potential effects from the Project. Maximum predicted cumulative effects on Se concentrations in the LSA are provided in Table 5.7-3 and include effects from the Project and the Trend Coal Mine.

Table 5.7-3 Maximum Predicted Cumulative Effects on Selenium Concentrations (µg/L) in the LSA

Station	Concentration (µg/L)	Flow Period
Babcock Creek		
B-5	54	7Q10s*
B-3	46	7Q10s*
Gordon Creek		
G-2	96	7Q10s*
G-3	75	7Q10s*
Flatbed Creek		
F-3	40	7Q10s*
NOTE: *7Q10s is the 1 in 10 year, seven-day low-flow summer event.		

The same methodology was used to evaluate both the Trend and Roman Coal Mine projects, including the range of flow conditions (see Section 12.6). As a result, the one-in-ten year, seven-day low-flow period in summer (7Q10s) was again found to consistently be the flow period that showed the highest Se concentrations, as described above. Maximum predicted concentrations of Se were predicted to occur in Gordon Creek (G-2) at 96 µg/L. Lower concentrations are predicted for Gordon Creek Station G-3, Babcock Creek, and Flatbed Creek; however, Se concentrations are predicted to exceed the water quality guideline at all stations.

As demonstrated by the residual Project effects water quality predictions (see Table 5.7-2), the majority of cumulative Se loading to Gordon Creek (see Table 5.7-3) will originate from the Trend Coal Mine (see Section 12.6).

Mining-related loadings from the Project are expected to have negligible influence on surface water quality in the Murray River, with predictions for all flow conditions producing Se concentrations of negligible difference from the current base case (pre-Project) conditions, including inputs from historic Quintette operations (see Section 12.6). The total disturbed area from mine development within the RSA for the base case or current condition is approximately 5732 ha. The total disturbed area of the Project is approximately 810 ha, which contributes an increase in disturbed area of approximately 14 percent. Water quality predictions reflect the high dilution of source flows within the Murray River and argue against cumulative effects in the RSA. This SeMP is therefore focused on the LSA and aquatic resources in Babcock, Gordon and Flatbed creeks and will be extended to Hambler Creek in the future as mining progresses in that direction (scheduled to begin in 2011).

Predicted residual effects associated with loadings of Se to the receiving waterbodies take into account mitigation measures that will be implemented including:

- Surface Erosion Prevention and Sediment Control Plan
- Water Management Plan
- Receiving Water Quality Monitoring Plan
- Metal Leaching and Acid Rock Drainage Management Plan

- Air Quality and Dust Control Plan
- Mine Waste Management Plan
- Tailings Management Plan

5.7.4 Predictive Studies

5.7.4.1 Overview

Predictive studies for this Project have included acid-base accounting (ABA), solid phase Se analysis of Project rock lithologies, mineralogical studies, kinetic laboratory leaching tests (humidity cells, columns), kinetic field leaching experiments (field barrels), field-scale waste rock test pads (lysimeters), and evaluation of monitoring data from full-scale operating and closed mines. These studies have been designed to evaluate the potential for leaching of contaminants in general, with a specific focus on ensuring that Se leaching at different time and spatial scales is evaluated and understood.

5.7.4.2 Selenium Leaching

Based on the kinetic tests and regional water quality sampling completed to date, the contaminant that has the highest potential to be elevated above provincial water quality objectives is Se. Elevated levels of selenate and sulphate are commonly associated with neutral pH coalmine drainages in which both ionic forms are liberated by oxidation of sulphide minerals (primarily pyrite).

Analysis of rock samples (see Section 3.3) indicated that coarser-grained samples tended to have lower trace element concentrations than claystone samples and than samples adjacent to coal seams, including CCR. However, the range in Se concentrations was narrow, with concentrations typically between 0.5 and 2 mg/kg dry weight (dw). Kinetic leaching studies have shown that Se leaching is closely correlated with the Se content of rock, but not with the sulphide content of the solids or sulphate concentrations of the leachate.

Comparison of full scale monitoring results, field scale tests, and laboratory data from the Trend mine and other projects in the area have demonstrated a “reverse scale effect”, with the highest concentrations observed in the smaller scale tests. This suggests there are beneficial reactions occurring within the full-scale dumps that help to control selenium concentrations. Longer contact times and increased opportunities for attenuation reactions are factors that may lead to enhanced control.

Comparison of full-scale monitoring results from mines in the Tumbler Ridge area to data from the Elkview Mine in the Southeast Coal District suggests that source concentrations may not be as high as those observed in the southeast. This is consistent with lower solid phase selenium concentrations in the Tumbler Ridge area.

ABA, solid phase Se analyses, and seepage monitoring will be included in the routine geochemical monitoring programs to continue to refine these conclusions. The primary purpose of monitoring will be to confirm the characteristics of wastes as they are mined and to evaluate Se concentrations in waters originating from contact with different sources in the mine. Source monitoring will include periodic sampling of waste rock, sampling of pit floor rock, and monitoring of seeps, pit sump waters, and groundwater seeps below the waste rock dumps.

5.7.5 Receiving Environment Conditions

5.7.5.1 Surface Water Quality

Baseline surface water quality conditions associated with the mine site area (i.e., Babcock, Gordon, and Flatbed creeks and the Murray River) are described in Section 12.3. The full suite of water quality data, including results for quality assurance and quality control, are presented in Appendix 12A. Nearly half of the total Se values in the creeks were near or below the detection limit of 0.5 µg/L; total Se values in the Murray River downstream of the Wolverine River presently exceed the provincial water quality guideline of 2 µg/L, resulting largely from inputs from historic Quintette operations.

5.7.5.2 Groundwater Flows and Quality

Groundwater recharge and discharge areas as well as groundwater flow directions have been interpreted from hydraulic heads measured in piezometers and open exploration holes in addition to examining topographic mapping and air photographs. Baseline groundwater quality is relatively good in relation to receiving water objectives, and generally displays a similar chemistry to the local surface waters. Effects to groundwater immediately down-gradient of the mine are predicted to be similar to those predicted for surface water (i.e., elevated concentrations of nitrate during operations and the early post-closure period), elevated concentrations of Se, sulphate, and other metals in the late operations, closure and post-closure periods. Effects associated with groundwater that discharges directly to creeks downstream of the mine are not significant, and were incorporated into the modeled surface water predictions.

5.7.5.3 Sediment Quality

Background sediment quality conditions associated with the mine site area (i.e., Babcock, Gordon, and Flatbed creeks) are described in Section 12.3. The full suite of sediment quality data, including results for quality assurance and quality control, is presented in Appendix 12A.

Baseline sediment Se concentrations range from 0.50 to 1.10 mg/kg dw and are below the British Columbia draft interim sediment quality guideline value of 2 mg/kg dw.

5.7.5.4 Periphyton and Benthic Invertebrates

Samples of periphyton and benthic invertebrates were collected from Babcock and Gordon creeks in September 2004 and 2005 as detailed in Section 15.3.3 of the Application (see Table 15.3-1).

Unfortunately, insufficient benthic invertebrate tissue was available in 2004 for Se analyses, thus no data are available from this sampling period. Sufficient tissue was available for analysis of both total Se concentration and moisture content in riffle benthic invertebrates collected from Babcock Creek and Gordon Creek in 2005. Total Se ranged from 0.80 mg/kg wet weight (ww) in benthos from station B-3 to 1.85 mg/kg ww in benthos from station G_{US}. On a dry weight basis, total Se ranged from 5.84 mg/kg dw at station G-2 to 8.98 mg/kg dw at station B-2.

Analysis of total Se in periphyton in 2004 was only possible for stations G_{US}, B-3 and B-2 due to lack of biomass at the other stations. Selenium concentrations ranged from 0.155 to 0.291 mg/kg ww. Tissue volumes were insufficient for percent moisture analysis at all

stations. In 2005, sufficient tissue was available for analysis of total Se and moisture content from all stations except G_{US}, at which no periphyton was found. Two periphyton communities were sampled from station B-3. Total Se concentrations in 2005 ranged from 0.51 mg/kg ww at station B-1A to 1.35 mg/kg ww at station B-2. The Se content of the two different communities sampled at station B-3 was also variable; the dominant community (primarily the blue-green alga *Nostoc pruniforme*) had a Se concentration of 1.18 mg/kg ww, whereas Se in the sub-dominant community (primarily the green alga *Spirogyra sp.*) was 0.68 mg/kg ww. On a dry weight basis, total Se ranged from 6.40 mg/kg dw at station B-1A to 22.81 mg/kg dw at station G-2.

5.7.5.5 Fish

Babcock and Gordon creeks upstream and Flatbed Creek downstream will initially be affected by runoff from the Roman and Trend mine sites. Hambler Creek will not be affected until approximately 2011 (from Trend runoff only). The focus of initial baseline investigations was thus Babcock and Gordon creeks, which will directly receive mine runoff. Flatbed Creek flows into the much larger Murray River, where changes in concentrations of Se are not expected to be measurable due to dilution. Subsequently baseline investigations were conducted in Hambler Creek.

Fish populations downstream of mining activities are one of two primary receptors of potential concern (ROPC). As previously noted and explained, monitoring will focus on fish and water birds. Fish are expected to be more immediately affected by Se uptake via the food chain compared to water birds, and were thus the focus of baseline data collection.

Baseline Results

As detailed in Section 14.3.2.2 of the Application, baseline fish tissue sampling was conducted in 2004 and 2006, and additional samples were collected in 2008 (fish from Babcock Creek represented post-construction samples while fish from Gordon and Hambler Creeks were considered baseline samples because mine discharges to these waterbodies had not yet commenced). Whole body Se concentrations were measured in 2004 in slimy sculpin from three distinct areas: G (Gordon Creek near the road); BAB1 (lower Babcock Creek, downstream of the twin 2.5 m falls); and BAB2 (upper Babcock Creek, upstream of the confluence with Gordon Creek and downstream of the upper 5-m falls). In addition, three bulltrout were collected above the 2.5 m falls in upper Babcock Creek and used for whole body Se analyses. In 2006, slimy sculpin were again collected and analyzed from Gordon Creek and lower and upper Babcock Creek. Slimy sculpin were also collected and analyzed from an unnamed tributary of Hambler Creek. Sampling at these same sites was repeated in 2008.

Detailed results of the Se analyses are provided in Appendices B2 and B3. Baseline (2004–2006) mean $\pm$SD whole body Se concentrations are summarized in Table 5.7-4 with proposed $\pm$2SD values (conduct investigative studies) and $\pm$3SD values (assess need for other actions) derived as detailed in Appendix 5B.2. Exceedance of the 2SD levels would lead to investigations to determine whether or not these exceedances were resulting in adverse effects and, where appropriate, a focus on management efforts to reduce Se loadings to the system.

Table 5.7-4 Summary of Measured Slimy Sculpin and Bull Trout Baseline Selenium Concentrations (2004–2006)

Fish Species	Measured (mean ± SD, n =10 for sculpin except for Hambler Creek n = 5, n = 3 for bull trout)	+2SD	+3SD
Sculpin, Gordon Creek	5.86 ± 0.57	6.99	7.56
Sculpin, lower Babcock Creek	5.95 ± 0.64	7.24	7.88
Sculpin, upper Babcock Creek	7.05 ± 0.76.	8.58	9.34
Sculpin, Hambler Creek	2.90 ± 0.17	3.24	3.41
Bull Trout	4.19 ± 0.92	N/A	

NOTE:
Values in mg/kg dry weight
NA: insufficient data to derive

Table 5.7-4 shows the variability in Se background levels in slimy sculpin. Highest whole body Se levels in sculpin occurred in upper Babcock Creek, which is the only area that exceeds the USEPA (2004) draft criterion, presumably due to natural Se releases. Lowest whole body Se levels occur in Hambler Creek, well below baseline levels observed elsewhere and well below the USEPA (2004) draft criterion.

For Gordon Creek, lower Babcock Creek and Hambler Creek, the USEPA (2004) 7.91 mg/kg dry weight draft Se criterion in whole bodies of sculpins will be used as a "not to exceed" value without further investigation. This value is below Babcock Creek baseline levels and thus can be considered protective of fish in this stream system. For Babcock Creek actual baseline values will be used for this purpose.

Comparison of 2008 Selenium Concentrations to Defined Baseline Levels

Selenium mean dry weight tissue concentrations in sculpin were significantly higher in Gordon Creek in 2008 compared to the three other sites sampled that year (approximately 1 to 2 times higher; Appendix 5B.3). Selenium concentrations in fish collected from Gordon Creek in 2008 were also significantly higher than baseline concentrations measured in 2004 and 2006 even though Gordon Creek has not yet received mine-related discharges. The concentration of Se in all the Gordon Creek samples exceeded the MWLAP guideline, and four of six samples exceeded the USEPA draft criterion.

In comparison, the Se concentrations measured in fish collected from Babcock (exposed to mine water) and Hambler (not yet exposed to mine water) creeks in 2008 were not significantly higher than those measured in fish in 2004 and 2006. All the Babcock Creek samples exceeded the MWLAP guideline and two Lower Babcock Creek samples exceeded the USEPA draft criterion. Selenium concentrations in sculpin collected from Hambler Creek in 2004, 2006 and 2008 were below the USEPA draft criterion, and below or equal to the draft MWLAP guideline.

The control chart analysis was applied to the 2008 post-construction data (except for Gordon and Hambler creeks which had not at the time of sampling received mine water discharges). Selenium concentrations from Gordon Creek exceeded the baseline mean + 3 SD threshold in two samples and the baseline mean + 2 SD threshold in four of the five samples (see Figure 5.7-1). This result indicated that some fish in Gordon Creek had Se concentrations significantly elevated above background concentrations for the study area. Exceedance of these site-specific thresholds indicates that the 2008 post-construction data

were not consistent with baseline conditions, but does not in itself provide any indication of the potential for adverse effects. Rather, further investigation is warranted to confirm and assess these exceedances.

5.7.5.6 Water Birds

Water bird populations downstream of mining activities are the second ROPC. Water bird surveys relevant to the Trend and Roman Projects conducted in 2004 by Keystone Environmental (WCC 2004) noted the following water birds: mallard, bufflehead, green and blue-winged teal, common merganser, common goldeneye, ring-necked duck, sora, common snipe, spotted sandpiper and red-winged blackbird. American dippers may be present, although none were noted in the 2004 surveys. Studies in the Elk Valley have indicated that population-level effects do not occur for either American dippers or spotted sandpipers exposed to Se in lotic areas of the Valley; Se effects to red-winged blackbirds are also not occurring in lentic areas of the Elk Valley (EVSTF 2007).

To date there has been no attempt to collect water bird eggs to measure Se concentrations. In 2010 attempts will be made to collect representative samples of eggs from red-winged blackbirds and either spotted sandpipers or American dippers. Mean egg Se concentrations will be compared to data for these species from the Elk Valley both in reference areas and in areas downstream of present and planned mining activities.

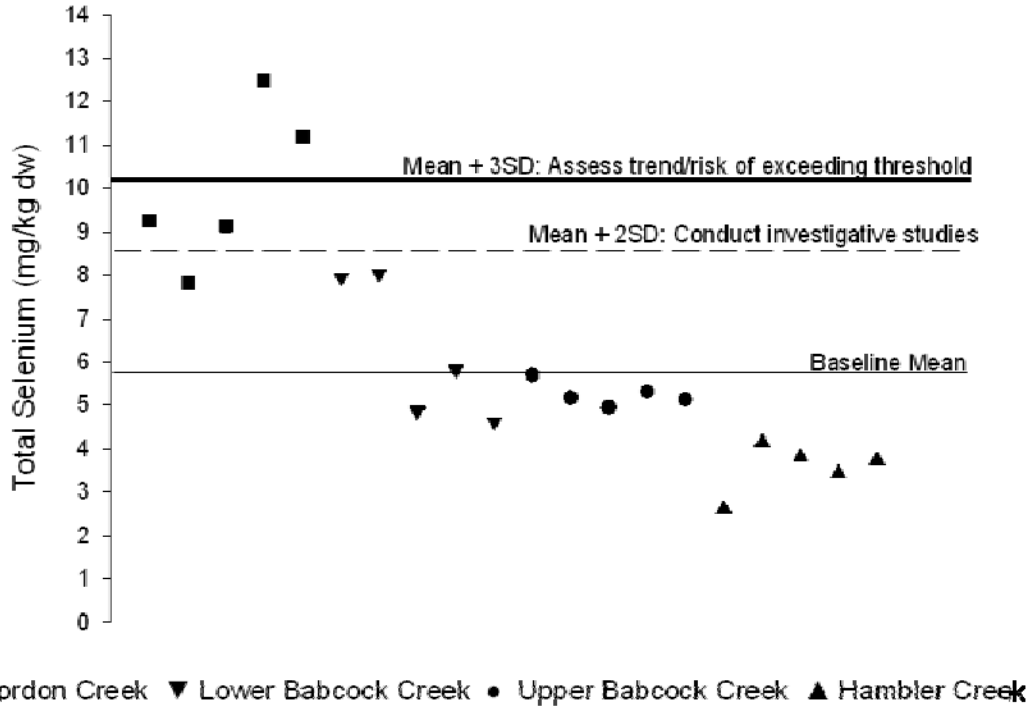

Figure 5.7-1 Comparison of Se Tissue Concentrations in Slimy Sculpin Collected in Fall 2008 with Proposed Baseline Limits for Sculpins

As previously noted, lentic environments are of most concern related to organo-Se production and its movement up the food chain. In this regard, because the water in the sedimentation ponds will have higher concentrations of Se than the receiving environments, the ponds will be managed to minimize the development of littoral environments and the attractiveness to water birds.

Water bird use of the sedimentation ponds during operation will depend upon the presence of littoral areas with vegetation on the edges and the amount of disturbance (regular or irregular). Establishment of emergent vegetation along the sedimentation ponds will be discouraged. The ponds will be subject to operational fluctuations in level and sediment loading that will discourage development of aquatic habitats supporting food for water birds. Water level may also need to be drawn down during operations to dredge sediments from the ponds in order to maintain satisfactory operating conditions.

Selenium concentrations will be measured regularly in the sedimentation ponds. If there is an increase in Se concentrations in these ponds and if water birds are using these ponds, PRC will take measures to discourage water bird use of these ponds (i.e., drawing down the water or using air cannons to discourage use). The sedimentation ponds will be reclaimed to eliminate ponded water at closure. Thus, they will not pose a Se hazard following closure. Overall, use of the managed sedimentation ponds by water birds is expected to be relatively low, with commensurately low risks.

5.7.5.7 Vegetation

Information on the levels of trace metals in vegetation is required for mine reclamation planning at the Mine permitting stage. Terrestrial vegetation samples were taken for the Trend Coal Mine maximum disturbance limit (MDL) in 2004 and from in and around the Project MDL in 2007(Vegetation Appendix 9I: Vegetation Metals Analysis) to establish baseline metal levels. Sampled species included grasses and willows, which ungulates use, and native legumes. These plant species or species groups are also expected to be abundant on the mine site, post-closure. CE Jones studied vegetation metals uptake on reclaimed mine spoil at the Bullmoose Mine, and found no evidence of vegetation uptake of Se in reclaimed vegetation. Similar findings are reported for the Elk Valley mines (EVSTF 2007).

5.7.6 Mine Waste Management

A detailed description of the mine waste management plan is provided in Sections 4.7, and 4.8. In brief, potentially acid-generating waste rock from above the D-seam and potentially acid generating CCR will be placed in layers alternating with non-acid generating rock from the Middle Gates formation. No specific measures are proposed for management of Se because the distribution of Se in the waste rock is relatively uniform. However, the horizontal or end-dumped layers may enhance Se removal through sorption to iron oxides that will develop in the neutralized PAG layers within the dumps and compaction of each dump lift.

The placement of soil covers over the layered dumps should further reduce infiltration. Operational monitoring of sedimentation ponds and environmental monitoring (e.g., fish tissue, water bird eggs) will provide an indication of the effectiveness of these measures.

5.7.7 Water Management

The waste rock dumps will be compacted and sloped to encourage water to runoff rather than infiltrate. Clean water diversions will be constructed to divert runoff around the pits and waste rock dumps. All mine site runoff will be collected by drainage ditches and directed to sediment control ponds before release to receiving waters, as described in the Water Management Plan (see Section 4.9). Reduced attractiveness of the sediment ponds as habitat for water birds is discussed in Section 5.7.5.6.

5.7.8 Reclamation and Decommissioning

Replacement of topsoil and establishment of a vegetated cover on the dumps and backfill will reduce water infiltration to, and contact with, waste rock, due to storage in soils and evapo-transpiration. The sedimentation ponds will be breached and re-graded to the extent possible to prevent surface ponding and the development of lentic habitats along the primary drainage paths from the site.

Portions of the mined out pits will not be backfilled. Under the current reclamation plan, a permanent pit pond will remain at the western end of the Gates Pit, which will also serve as the tailings management facility. Detailed closure planning is conducted near the end of the mine life. If, at that time, concentrations of Se in the pit pond are predicted to be of ecological concern (based on predicted Se concentrations and an enhanced understanding of biologic effects), then PRC will evaluate options for mitigating this issue, including removal of the ponded area by draining or backfilling. Ongoing studies of potential effects of Se, as well as monitoring of Se in seepages from the Trend Coal Mine and the Project, will allow appropriate mitigation plans, if required, to be developed prior to closure.

5.7.9 Monitoring and Contingency Plans

5.7.9.1 Monitoring Framework

To assess the effectiveness of Se management and determine the need for further contingency management measures (adaptive management), the focus will be on Se concentrations in water, fish tissue and water bird eggs. The approach proposed incorporates the most current information available from detailed Se studies in British Columbia, Alberta, and elsewhere (e.g., Chapman et al. 2009). For example, although the sediment-detrital pathway can be of importance with respect to dietary exposure of higher trophic levels, a Selenium Science Workshop held September 5–6, 2000 in Hinton (Alberta) concluded that measuring Se concentrations in sediments is not a reliable indicator of Se effects on aquatic biota. Similar conclusions were reached by a June 2005 Selenium Science Panel (Klaverkamp et al. 2005).

Verification monitoring of water quality in the pit sumps, sedimentation ponds, and dump toe seeps will define Se leaching from waste rock. The magnitude of Se loading to the receiving waterbodies will increase slowly over time as the footprint of waste rock increases and as the waste rock dumps become hydraulically active; therefore, monitoring of sedimentation ponds and toe seeps will provide an effective early indicator of Se release and will allow predictions of maximum expected concentrations to be refined.

Monitoring will be conducted to provide early warning of any potential for Se effects on affect fish. Monitoring will not be restricted to water Se concentrations in the receiving waterbodies, although such monitoring will be conducted regularly (monthly) to

determine whether or not increases are occurring, and the extent of any such increases. In the Elk River Valley, Se water concentrations in lotic areas (e.g., Line Creek) and in some lentic areas that are greater than an order of magnitude higher than the provincial water quality guideline have not resulted in population-level effects to fish or water bird populations. This prediction will be tested via monitoring.

Monitoring of whole body fish tissue levels has been conducted in 2004, 2006 and 2008, and will continue in 2009. Monitoring of water bird egg Se concentrations will begin in 2010. Initial monitoring of both whole body fish tissue levels and water bird egg Se concentrations will occur annually; however, this frequency may be reduced in future (e.g., to every two years) if warranted (adaptive management). Conservation of both fish and water bird populations will be considered prior to each sampling event.

Monitoring of benthos and periphyton for Se body burdens is not recommended for three reasons: 1) data are highly variable, thus they do not provide a high level of discrimination between areas or over time; 2) it is not currently possible to relate changes in Se in either benthos or periphyton to changes in Se body burdens in fish or water birds; and 3) sufficient tissue for analyses to reasonable detection limits let alone for replication cannot reliably be collected for either periphyton or benthos. However, should monitoring of fish tissue or water bird eggs indicate potential risks to those organisms, then investigative studies of inorganic Se transformation and accumulation through the food chain may be initiated (cf. Chapman et al. 2009).

The primary focus of monitoring will be on the fish (slimy sculpins) in the watercourses and either red-winged blackbirds, spotted sandpipers or American dipper, depending on the results of 2010 investigations into the feasibility of regularly collecting eggs for Se analyses. Water is not the exposure route of concern, but it is the primary avenue by which Se from coal mining enters the aquatic environment. Significant increases in water column Se concentrations above baseline can indicate potential for additional food chain exposures. Accordingly, water quality monitoring will be conducted to determine any trends. Regularly scheduled monthly water quality monitoring will be conducted including Babcock, Gordon and Flatbed creeks. Groundwater seeps will be monitored twice per annum below the waste dumps. Proposed groundwater monitoring programs are presented in Section 13: Groundwater.

Resident fish whole body samples will be collected for Se analyses from Babcock (upper and lower), Gordon, and Hambler creeks and these results will be compared to both baseline data and the USEPA (2004) draft criterion. Fish tissue data will be analyzed per the control chart approach outlined by Chapman and de Bruyn (2007). Depending on the concentrations measured and any differences from baseline, the following will occur:

- If Se slimy sculpin tissue levels do not exceed either the USEPA (2004) draft criterion value or baseline +2SD (whichever is higher), monitoring programs for water and fish will continue, at a frequency dictated by the monitoring results.
- If Se fish tissue levels exceed these levels, PRC will conduct investigative studies to determine whether or not Se is effecting fish reproduction. These studies could take the form of laboratory studies (raising fertilized eggs) but are more likely to be field studies (assessing recruitment), given that immigration and emigration are not possible within the creeks being assessed. Investigative studies into the transformation of inorganic Se into organo-Se and its accumulation up the food chain may also be initiated to help determine appropriate mitigative strategies.

Water bird egg Se concentrations will be similarly analyzed to determine both trends and any exceedances of background and threshold concentrations (the latter based on data from the Elk Valley). If exceedances occur, nests will be assessed for any abnormalities or mortalities that could be associated with increased Se concentrations in eggs. Similar to fish, investigative studies into Se transformation and accumulation up the food chain may also be initiated.

Detailed steps in the adaptive management monitoring program for the Roman and Trend Projects are:

1. Collect appropriate water bird eggs for Se analyses downstream of planned or present mining activities to determine baseline and current concentrations compared to existing thresholds from the Elk Valley.
2. Conduct additional reconnaissance and baseline studies in Hambler Creek in advance of mining in this area to determine lentic areas and resources and develop a monitoring plan to complement that for Babcock and Gordon creeks.
3. Monitor groundwater seeps on a twice per annum basis. Groundwater seep monitoring down-gradient of dumps will be used to confirm the leaching and water quality effects projections, and will provide early warning regarding the potential for loadings to surface waters from groundwater Se inputs.
4. Monitor water, fish tissue and water bird eggs in Babcock, Gordon, and Flatbed creeks during operations, and assess increases in Se concentrations compared to baseline and thresholds. Conduct monthly monitoring of water quality in the sedimentation ponds.
5. If concentrations of Se in fish tissue or water bird eggs exceed either background concentrations or thresholds (whichever is appropriate, e.g., see Sections 5.7.5.5 and 5.7.5.6), conduct further investigations to determine the biological significance of these exceedances (exceedances indicate a potential risk, not a realized risk). As appropriate, also investigate the transformation and accumulation of Se up the food chain to these higher level predators relative to possible mitigative actions.
6. If population-level (not just individual-level) Se-related effects could or may be occurring to fish or water birds, take additional necessary measures to reduce Se loadings to obviate or eliminate the possibility of such effects.

5.7.9.2 Contingency Measures

A number of contingency measures have been defined to address the situation where Se levels in receiving waterbodies exceed acceptable values for protection of fish and water birds.

Gates Pit Pond—Closure

The Gates Pit will be used as a sub-aqueous storage facility for PAG material; including tailings, PAG CCR, and PAG waste rock. These materials will require permanent water cover to minimize potential leaching of metals and ARD. A permanent, ponded water cover is the current management plan for this facility. If Se levels in the pit lake exceed acceptable values for protection of fish and water birds, PRC will investigate options to ensuring that development of a permanent pit pond, which could have negative effects on water birds, is avoided. The most likely solution is backfilling with non-acid generative material (e.g., waste rock). On the other hand, if habitat for water birds were limiting in

the area, and if projected potential effects on water birds were insignificant or low (e.g., limited to increases in egg Se levels with little or no population effect), retaining the pond may be beneficial for overall water bird productivity. Further, the pond may afford opportunities for passive bioremediation of selenium from the water column. A final decision will be made in conjunction with closure planning.

Protection of Water Birds in Sedimentation Ponds

The sedimentation ponds will be managed to the extent practical to reduce attractiveness to water birds. As a general operating procedure, emergent vegetation will not be allowed to become established at the pond edges. Measures could be taken to further discourage water bird use of these ponds for feedings (i.e., selective draw-downs, which would limit the formation of attractive littoral habitat) and physical measures could be implemented to inhibit exposure (i.e., scaring birds away). Since the sedimentation ponds are temporary structures, and will be decommissioned at closure, no long-term effects on water birds are expected from the sedimentation ponds.

Enhanced Soil Cover Application

If Se leaching levels from specific waste dumps exceed predictions and if aquatic resources are predicted to be negatively affected, additional cover material to act as infiltration barriers on the waste rock dumps could be considered. Such mitigation measures may reduce Se loadings to receiving waterbodies through reduced contact of water with waste dump materials and increased runoff away from waste dump surfaces.

5.7.10 Closure

If required, post-closure monitoring of Se will be implemented. Methods will follow the same biological monitoring criteria and recommendations outlined above for the operations phase of the Project. Following closure, monitoring will be conducted to verify that Se does not affect fish and water birds.

5.8 Metal Leaching and Acid Rock Drainage Management Plan

5.8.1 Overview

Geochemical characterization results presented in Section 3.3 indicate that there is potential for acidity and metal leaching in waste rock from the above D-seam units, some of the waste rock adjacent to coal seams, and some of the CCR, tailings, and coal at the Roman property. The following sections provide a summary of the management plans for identifying and managing of these materials during operations, contingency plans for addressing potential water quality issues, and monitoring plans for verifying the geochemical properties of these materials and the predicted source concentrations for the waste rock dumps, pit exposures, and tailings areas.

5.8.2 Identification and Management of Waste Materials

5.8.2.1 Waste Rock Dumps

General Strategy

Specific strategies are required to prevent the development of acidity and metal leaching from the PAG waste rock above D-seam and for PAG CCR and tailings that will be placed in the dumps during the first two years of mining. Blending and layering options have been recommended for this site due to the high proportion of non-PAG to PAG waste rock, the high NP content of the non-PAG rock and the relatively low sulphur content of the PAG rock. Data from the layered test pads at the geochemically analogous Trend Coal Mine has shown that the layering approach has been successful at controlling ARD and metal leaching.

Blending and layering options can perform in two different ways (MEND1998):

> An "ideal" blend is one in which the overlying non-PAG layer provides enough alkalinity to maintain neutral conditions in underlying PAG rock. This type of blend is considered to be more ideal because consistently neutral pH conditions would ensure maximum control of metal leaching from the dumps. Calculations using humidity test results showed that this type of blending can be achieved in most of the waste rock dumps using 1 m thick PAG layers.
>
> A "less-ideal blend" is one in which an underlying non-PAG layer neutralizes the acidity produced in an overlying PAG layer. While this approach is effective at controlling ARD, it may not be as ideal for controlling metal leaching due to the development of locally acidic material within the dump. Calculations for this scenario suggest that the acidity produced in a 1 m thick layer of PAG rock would be neutralized within a few to tens of labelled layers of an underlying layer of typical NP non-PAG rock. Therefore, layered or end-dumped waste rock should be placed on a minimum 1 m thick base layer of non-PAG rock to neutralize any acidic leachate that could form should locally acid conditions develop in the dump.

A combination of controlled end-dumping and layering methods will be implemented at the Project to ensure that the PAG material is well distributed throughout the dumps, and that there is sufficient non-PAG rock surrounding the PAG rock to maintain neutral pH conditions in the dump as a whole. During the first two years of the mine life, small quantities of CCR and tailings with a mixed potential for ARD will also be incorporated in the dumps using controlled end-dumping and layering methods. For the remainder of the mine life, non-PAG CCR will continue to be incorporated into the dumps. Specific details of the placement methods are outlined in the following section.

Operational controls will be required to ensure that the PAG materials are correctly identified and placed in the dumps. The specific procedures and responsibilities for implementing the waste rock management plans are detailed in a section titled "Operating Procedures and Responsibilities".

For the very small amounts of PAG adjacent to coal seams in the Middle and Lower Gates, Moosebar, and Gething, non-deliberate mixing resulting from normal blasting and hauling practices, as described in Section 4.2 (Mine plan), will ensure that they are well

distributed in the non-PAG lifts of the dumps. The blending will occur by three different mechanisms: when the material is blasted, when the material is loaded into haul trucks and when material is dumped into end waste dumps. The steep dip of the beds is also a positive factor in ensuring the success of these non-deliberate methods.

Placement Methods

Controlled End Dumping

A schematic of a dump constructed using controlled end dumping methods in shown in Figure 5.8-1. The dump will be constructed on top of a minimum 3 m base layer of non-PAG waste rock from the Middle Gates Formation to ensure that groundwater seepage along the base of the pile will not be in contact with the PAG material. This base layer will also provide a source of additional buffering to neutralize any acidity that may develop within the PAG layers.

The dump will advance outwards on this base, with alternating layers of PAG and non-PAG waste placed on the face of the dump. The PAG layers will be constructed such that they have a maximum vertical thickness of 1 m (0.3 m for the high sulphur PAG). The thickness of the PAG layer will be controlled by spacing the haul trucks an appropriate distance along the face of the dump. A spotting dozer will be used to ensure the spacing is adequate. The spacing will depend on the desired layer thickness, the height of the dump face and the size of the haul trucks. The spacing requirements for different face heights for the 178 t Komatsu 730E haul trucks currently used at Trend, and proposed for use at the Project are shown in Figure 5.8-2. The figure shows that it would be necessary to space the trucks approximately 3 m apart to achieve a 1-m thick layer on a dump with a typical 22-m high dump face, or 10 m apart to achieve the desired thickness on a 7-m high dump face.

The Komatsu 730E haul trucks are approximately 7.3 m wide. The rock is likely to spread out over a somewhat wider area as it is dumped, but there would be gaps between the loads if the spacing was much greater than the truck width. As shown in Figure 5.8-2, the working face would need to be at least 8 to 10 m high to achieve a less than 1-m thick layer of PAG rock, and at least 30 m high to achieve a less than 0.3-m thick layer of PAG rock. Therefore, some of the shorter dumps may be constructed using the horizontal layering approach that is currently used at the Trend Coal Mine. A description of that method is presented in the following section.

Horizontal Layering

Horizontal layering is currently used to ensure adequate distribution of the PAG and non-PAG materials at the Trend Coal Mine Figure 5.8-3. This methodology will continue to be used where the proposed end dumping procedure is not practical.

As in the end dumping method, a minimum 3 m base layer of the non-PAG waste rock is placed on the original ground surface to ensure that groundwater seepage along the base of the pile does not come into contact with any PAG material and to provide a source of added buffering to neutralize any acidity that may develop within the PAG layers.

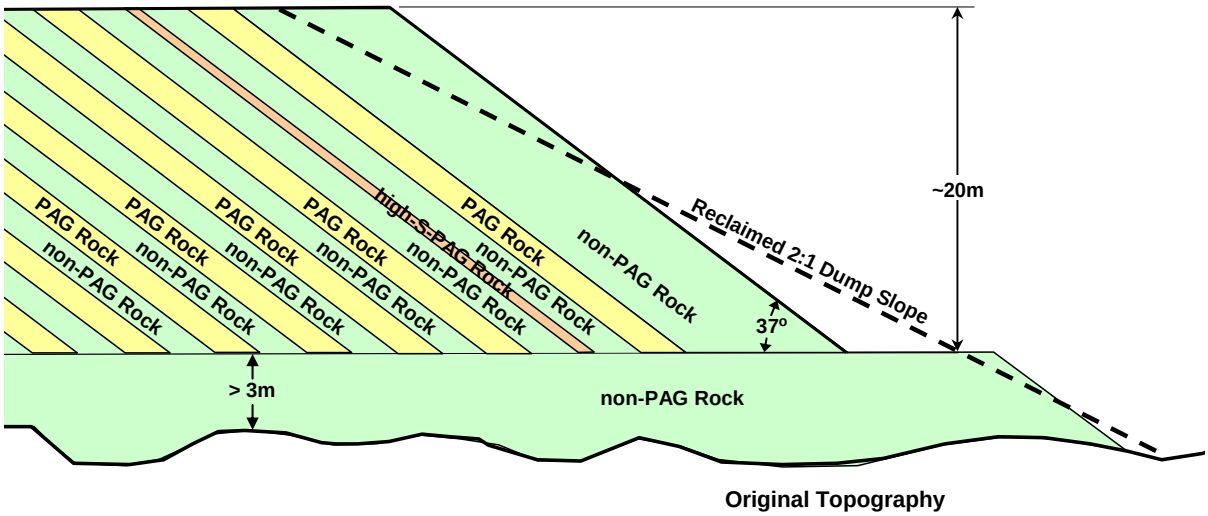

Figure 5.8-1 Typical Section of Waste Dump Constructed using Controlled End Dumping Approach

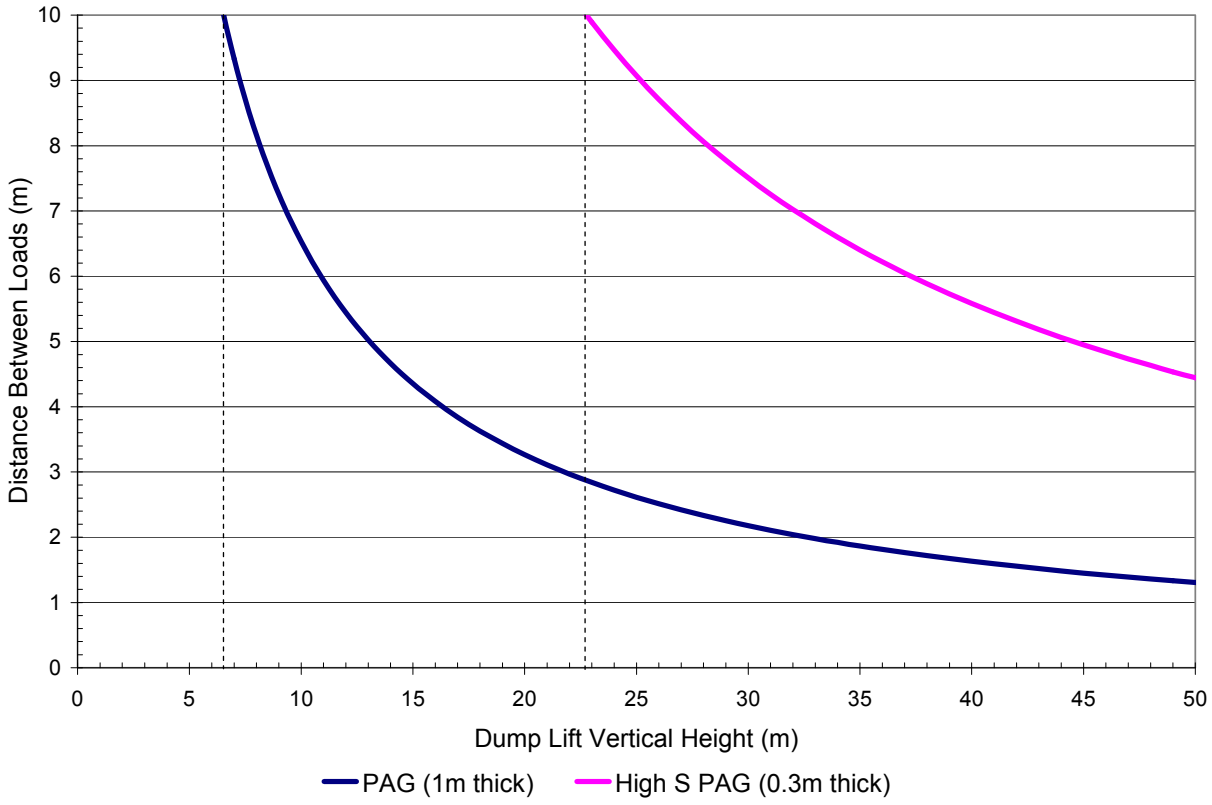

Figure 5.8-2 Spacing Distances between Loads (based on 178 t Komatsu 730E Haul Truck)

Figure 5.8-3 Placement of Horizontal Layers at the Trend Coal Mine

Alternating layers of PAG and non-PAG rock are then placed on the base layer and spread to the desired thickness using a dozer. The segregated PAG lift is spread to a thickness of approximately one meter. PAG rock located above D-seam has a relatively coarse grain size distribution. To minimize the generation of reactive fines, this material is handled as little as possible before placement into a designated PAG lift. A minimum of 1 m of non-PAG rock from the Middle Gates waste is placed over each PAG lift. This material provides a source of alkalinity, helping to maintain neutral pH conditions in the underlying rock. It also ensures that runoff from the surface of the pile is not in contact with the PAG material.

For PAG layers with greater than 0.5 percent total sulphur, known as high sulphur PAG (high-S-PAG), the same procedure is followed, but the lifts are 30 cm thick.

Final Surface

Regardless of the method used to layer the PAG materials, the outer surface of the dumps will be built from non-PAG material such that the PAG material is not exposed during recontouring for reclamation. The thickness of the outer surface non-PAG layer will depend on the dump height as shown in Figure 5.8-4. On a typical 20-m high lift, the outer 8 m of the dump will be built of non-PAG rock. If sufficient non-PAG waste is not

available, then a non-PAG layer can be added after the dump has been resloped for reclamation.

Operating Procedures and Responsibilities

PCRI has set up operating and monitoring procedures for identifying and handling the PAG material above D-seam, as follows:

- As required, the Geology department will sample each discrete lithological unit above D-seam and submit these for ABA tests, gradually building up a more detailed understanding of PAG and non-PAG units within this zone. From these tests, the PAG zones will be identified in the geology model on a bench-by-bench basis, and this information will be communicated to the Engineering and Mine Operations departments.
- The Mine Planning engineers will produce "dig plans" (see Figure 5.8-5) to guide shift supervisors and operators in the field in determining where the PAG material is located. They will also be responsible for designing and sequencing dumps and scheduling preparatory work, for example the construction of the non-PAG base layer.
- Based on the dumping plan, the engineers will issue instructions on the spacing of haul truck loads based on the dump height and material type (PAG or high S PAG). The engineers will present the waste dumping strategy to the surveyors who will delineate the materials, and the shift supervisors who will be responsible for its implementation.
- Following a blast, the Mine Surveyor will stake the PAG layer hanging wall contact at the top of bench elevation. The Surveyors will also perform weekly dump surveys to monitor the dump development. This will confirm that the actual placement of PAG material coincides with planned placement.
- The shift supervisor will instruct the shovel operator to follow the weekly dig plan and use the PAG stakes for guidance. The shovel operator will follow the direction of the shift supervisor, referring to the dig face plan and stakes to identify the non-PAG and PAG waste. If the operator is unsure about the boundary between the non-PAG and PAG rock he or she must not mine the material in question until its composition is known. The shovel operator will also be responsible to track the total number of truck loads of non-PAG and PAG material mined in a shift.
- The shift supervisor will also manage material placement on the waste dumps, advising the truck and spotting dozer operators of the dumping plan. The truck operator will follow the direction of the shift supervisor and transport the non-PAG and PAG to areas designated on the dumping plan. If the operator is unsure about where to place the material they will contact the shift supervisor for direction. The truck operator will also be responsible to track the total number of truck loads of non-PAG and PAG material mined in a shift.
- The dozer operator will follow the direction of the shift supervisor and direct the trucks to dump in the correct locations. If the operator is unsure about the locations for non-PAG, PAG, or high-S-PAG rock placement he or she must contact the shift supervisor. Before leaving the dump the operator must mark where the end of the current layer is located.

- The shift supervisor will be responsible to monitor that the operators are following the plan and take expedient action to correct any deviation from the plan. At the end of each shift the shift supervisors will be responsible for reconciling their shift's load counts. The waste blending will be tracked on a shift by shift basis by tracking layer development and counting the number of PAG and non-PAG loads. Computerized tracking methods may be used to simplify this process.
- The shift by shift waste blending will be recorded by the Geology department and archived for future reference and for inclusion in the annual report. A weekly blending report will be produced and distributed to the Mine Planning Engineers to monitor the blending performance. The monthly dump surveys will also be archived to aid in determining where the material is located.
- The mining engineers will monitor the placement of the PAG waste and, in co-ordination with mine operations, develop any remedial designs if required. The engineers will also be responsible for the storage of survey information in a computer model for future reference on the location of PAG material.

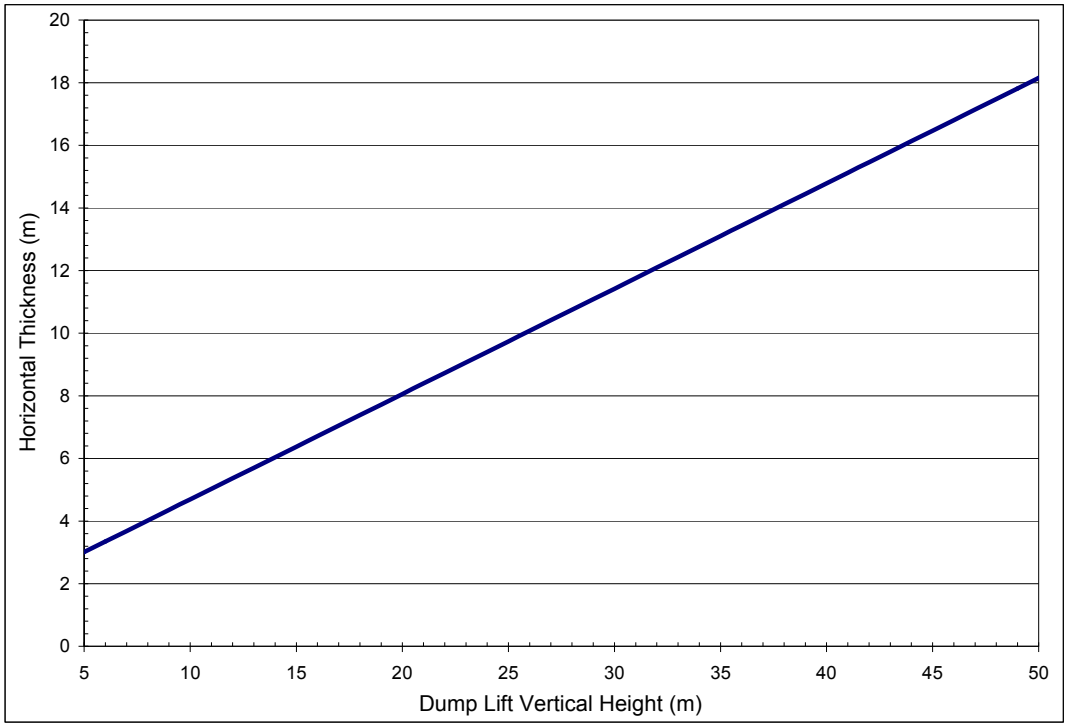

Figure 5.8-4 Thickness of non-PAG materials required to construct the Outer Layer of the Dumps

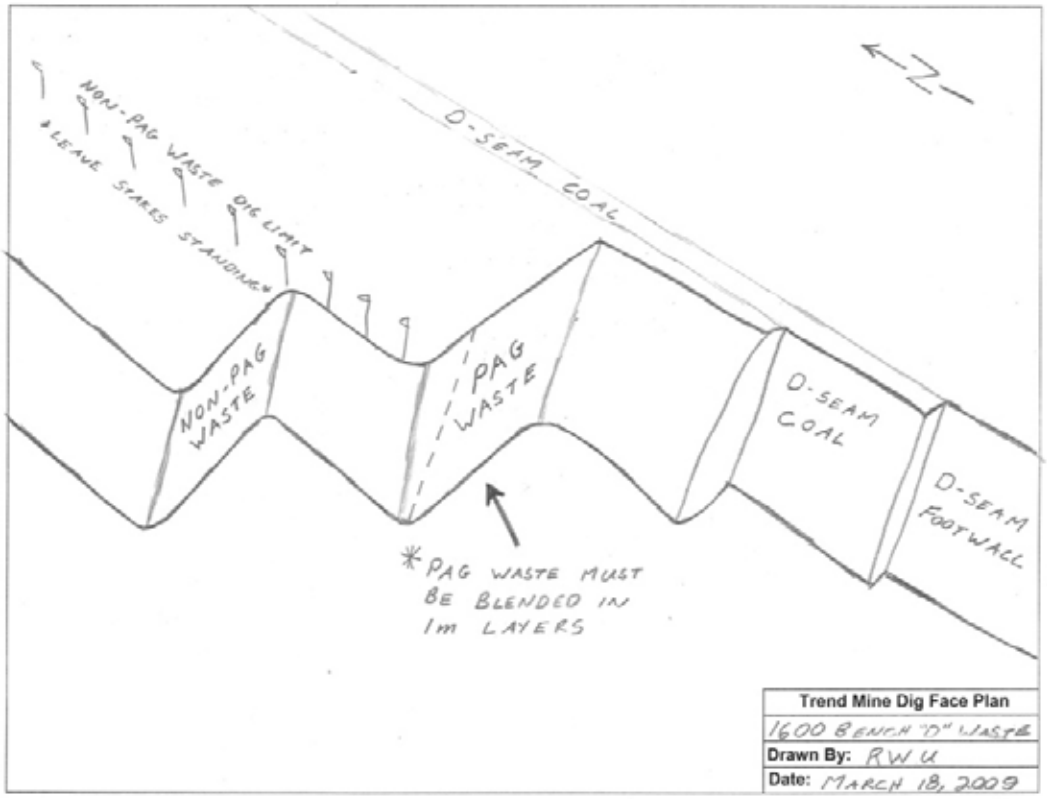

Figure 5.8-5 Example Dig Plan

5.8.2.2 Open Pits (Excluding Roman In-Pit TMF)

In the Gates Pit, all of the above D-seam material is expected to be mined out of the syncline. Thin hanging wall and footwall layers adjacent to coal seams (less than 1 m) may be locally acid generating, resulting in the generation of local acidic seams. However, since the portion of such materials will be very minor (less than 5 percent) relative to the alkaline units, it is expected that any acid generating seeps would be neutralized in-situ.

In the Gething Pit, the complete sequence of Moosebar and Gething units will be left exposed in the pit walls, including the Bird and GT seams, which will be exposed near the base of the pits. Thin (less than 1 m) hanging wall and footwall layers adjacent to these coal seams may be locally acid generating, particularly those associated with the Bird Seam. Also, the lower-most 1 to 2 m of the Moosebar formations and two metre interval above the third Gething coal zone may be locally acid generating. These thin PAG units may comprise up to 10 percent of the pit walls and may result in the development of local acidic seeps. However, the rest of the exposed rock in this pit is predominantly alkaline and should neutralize these seeps in-situ.

No special management strategies are required.

5.8.2.3 Coal, CCR and Tailings Disposal Area

Geochemical testing on coal, CCR, and tailings samples indicated a variable potential for ARD, with some seams (F, G, J, K and GT seams) classified as not potentially acid generating and some as potentially acid generating (D, E, and Bird seams). The geochemical evaluation of CCR and tailings were based on a small dataset, generally consisting of no more than 2 samples per seam per waste type. As such, the acid base accounting potential of CCR and tailings will be monitored regularly during the first several months of operations to determine the variability in ARD potential of these materials and to establish a correlation between the coal seams processed and the geochemical properties of the CCR and tailings.

As discussed previously, during the first two years of operation, all CCR (0.20 Mt) and filter pressed tailings (0.27 Mt) will be disposed of in the PAG lifts of the waste dumps, and will be treated in a similar manner as the PAG waste rock.

After the first two years of operations, non-PAG CCR will continue to be placed in the waste rock dumps and all of the tailings and PAG CCR will be deposited in the Gates In-Pit tailings facility (see Figure 5.8-6). The Gates Pit has a total flooded volume of 7.3 Mm^3, of which 6.2 Mm^3 is available for underwater storage. The estimated volume of tailings is approximately 2.1 Mm^3, and the estimated volume of PAG CCR is approximately 0.8 Mm^3; therefore, there is also 3.1 Mm^3 of space available for storage of PAG waste rock (see Figure 5.8-7). Priority will be given to using this area for storage of PAG waste rock with the highest sulphur content. Further work to delineate the distribution of the sulphur content in the above D-seam unit will be completed for the Mine Permit Application, and some refinement of this is likely to be completed during operations. Removal of the high sulphur PAG rock from the other waste rock piles was conservatively neglected in the assessment of overall NP/AP ratios in the waste rock dumps, and in the water quality predictions for the waste rock dumps.

Water balance calculations indicate that the pit will reach its maximum operating level approximately 15 months after the start of waste deposition, and that the rate of water infill will far exceed the rate of waste deposition. If it is assumed that deposition of waste rock would start during a winter low flow period (for example in January), some of the waste rock may be exposed for a few months (see Figure 5.8-8), but throughout most of the operations, there will be sufficient water cover to allow the CCR, tailings and waste rock to be placed directly underwater. Underwater placement is expected to prevent oxidation and metal leaching from these materials. At closure, there is a strongly positive water balance, ensuring that both the tailings and the PAG CCR will continue to remain submerged in the Gates Pit.

Details of how the tailings, waste rock and CCR will be deposited in the pit will be presented in the Mine Permit Application.

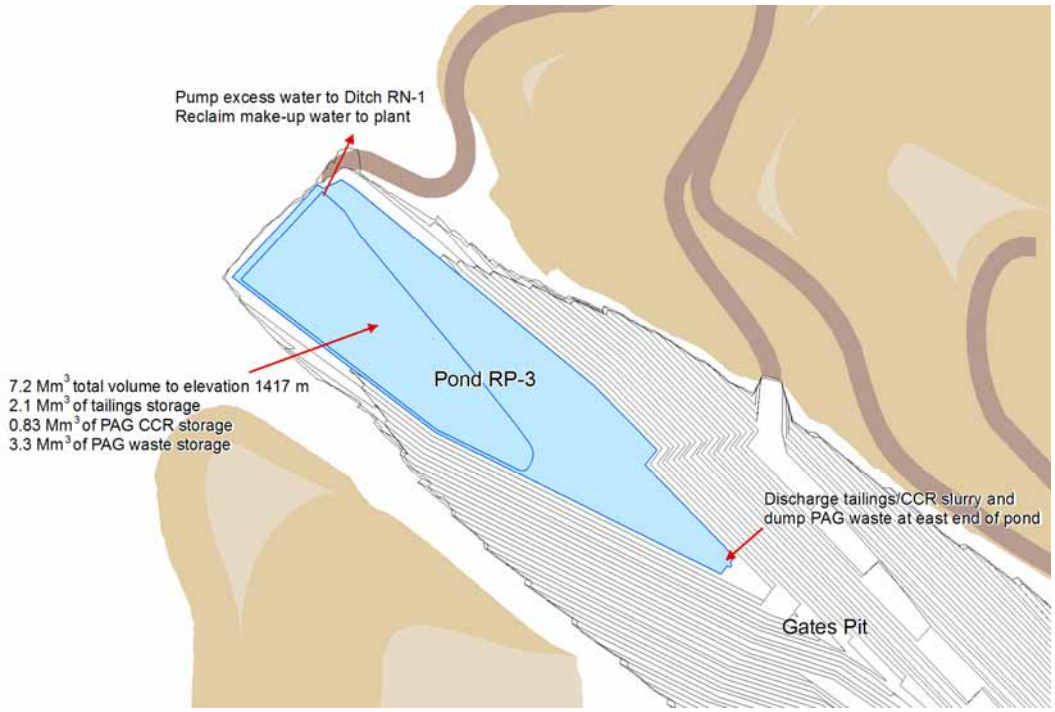

Figure 5.8-6 Schematic of the Roman In-pit Tailings Facility

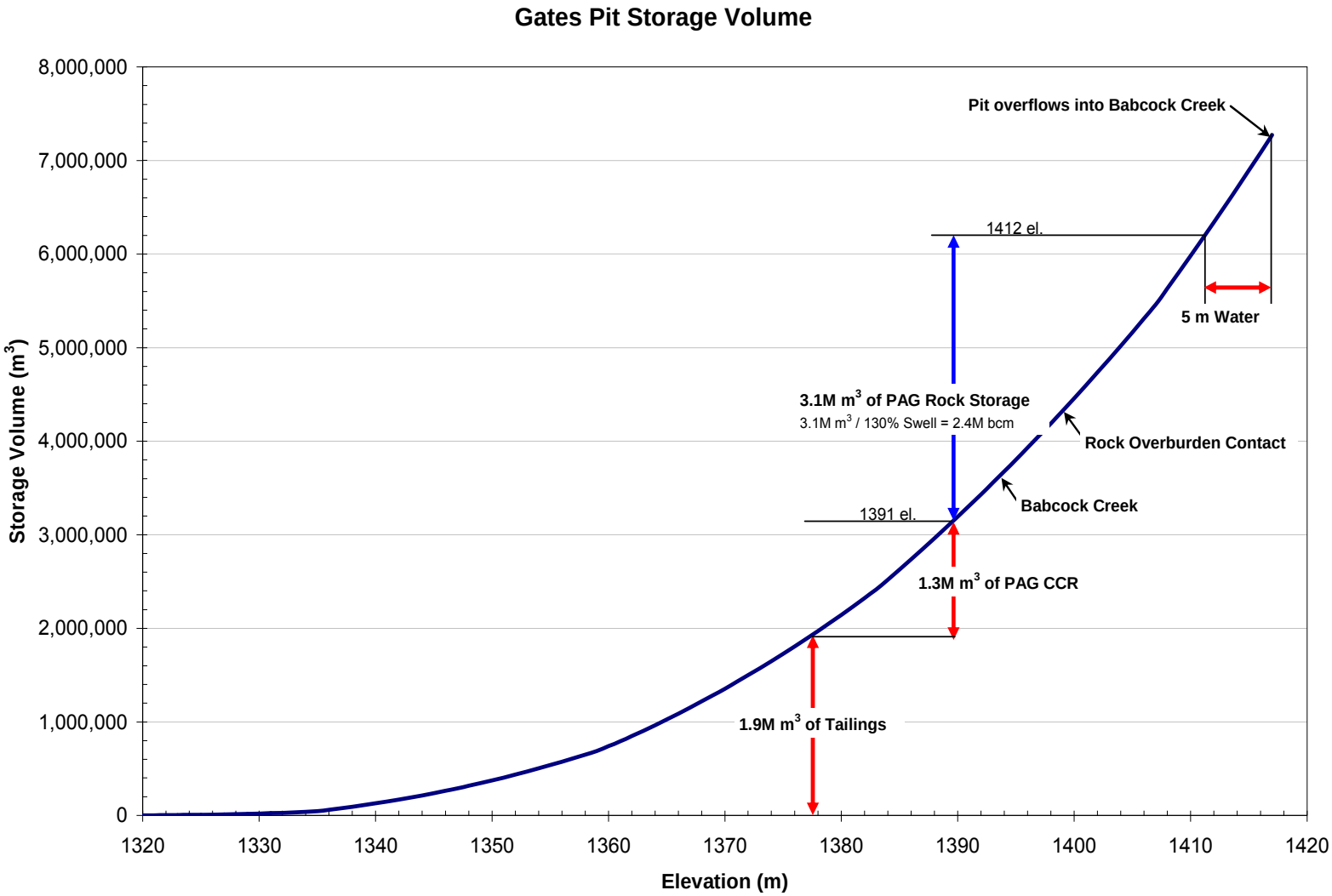

Figure 5.8-7 Height Capacity Curve for the Roman In-Pit Tailings Facility

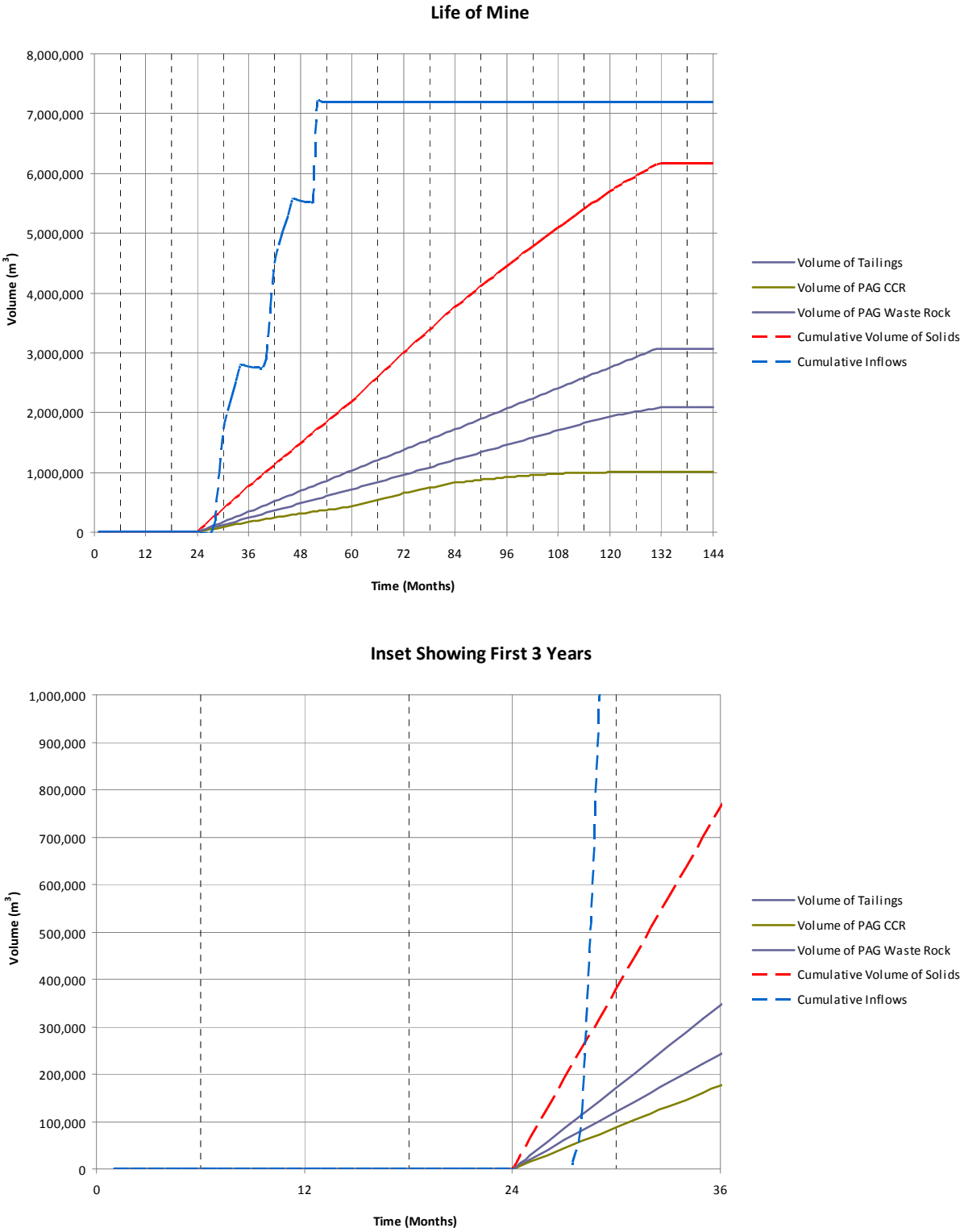

Figure 5.8-8 Filling Rates for Tailings, CCR, Waste Rock, and Water Inflow to the Gates In-pit Tailings Facility

5.8.3 Contingency Planning

Seepage from the waste rock dumps and water from the pit sumps will be directed to a series of sediment ponds to allow settling of suspended solids (see Section 4.9: Water Management Plan). The settling ponds will act as a final point of control for ensuring that water quality meets the applicable discharge criteria.

5.8.4 Geochemical Monitoring Plans

During mine construction and operation of the Project, PCRI will monitor the waste rock, CCR, tailings and coal to determine the metal leaching (ML) and acid rock drainage (ARD) potential. The monitoring program will be used to validate the pre-mining predictions, guide general management decisions, confirm the effectiveness of waste management procedures and identify any additional requirements for mitigation measures to ensure environmental protection.

Monitoring plans are outlined in Table 5.8-1. The Chief Geologist and Environmental Scientist will be responsible for ensuring that these activities are carried out. The results will be reported in the annual reclamation report. Details on sampling frequency and analytical parameters will be presented in the Mine Permit Application.

Table 5.8-1 Monitoring of Waste Materials

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring) Monitoring
Materials Inventory	• A materials inventory shall be maintained which will include: composition, mass, volume, surface area, storage locations, history and timing of excavation and monitoring data
Waste Rock	• ABA tests and elemental analyses will be completed on samples of from each major interburden unit below D-seam (i.e., D-seam to F-seam, F-seam to G-seam, G-seam to J-seam, J-seam to K-seam (including K-seam partings), below K-seam, Moosebar, and Gething. The testing will be to verify that these materials are consistently non-PAG • Additional monitoring will be completed to delineate the spatial extent of the PAG and non-PAG/low NP rock from above D-seam • Waste rock dump seepage surveys
Coarse Coal Refuse	• Periodic ABA tests and elemental analyses
Tailings	• Periodic ABA tests and elemental analyses
Coal	• Periodic ABA tests and elemental analyses
Sediment pond and pit sump monitoring	• Periodic monitoring during the open water season
Tailing pond samples	• Periodic monitoring during the open water season

5.9 Fish and Fish Habitat Protection Plan

5.9.1 Introduction

The Project will be situated at the headwaters of fish-bearing Babcock Creek, and its major tributary, Gordon Creek. These creeks together support resident populations of bull trout (*Salvelinus confluentus*) and slimy sculpin (*Cottus cognatus*). Consequently, the fish

populations and habitats present in these watercourses are potential receptors of environmental effects due to mine development and operation.

Although the mine footprint will not directly affect fish-bearing habitats, the mine's potential effects on downstream fish-bearing habitats during construction and operation of the site are of concern. PRC is required to protect the downstream fish habitats from harmful alterations, disruption or destruction (HADD) under Section 35(2) of the federal *Fisheries Act*, and to avoid deposition of deleterious substances into downstream fish-frequented waters under Section 36(3) of the *Fisheries Act*. The provincial *Environmental Management Act* prohibits the introduction of waste to the environment unless the introduction of that waste is conducted in accordance with a permit, approval, order, or regulation.

The following measures are therefore recommended to protect fish and fish habitat in the context of the proposed mine:

1. provision of leave strips to protect the riparian habitats of watercourses around the mine site, and maintain the existing natural functions of these habitats
2. application of sediment and erosion control measures to minimize the amount of sediment and coarse material introduced into fish-bearing waters
3. control of the release of "deleterious substances" into receiving waters
4. timing of instream works
5. notification of Fisheries and Oceans Canada regarding the commencement of work

These recommendations should be revisited on a regular basis during mine construction and operation, and updated or added to as appropriate. Before work commences, the roles and responsibilities of the various parties involved in the work (e.g., PRC, contractors, environmental monitors) and the organizational lines of reporting and communication should be documented.

5.9.2 Leave Strips

5.9.2.1 Importance of Leave Strips

The objective of providing "leave strips" adjacent to watercourses in the vicinity of the mine is to protect the riparian zones of these watercourses. Leave strips are areas of land and vegetation adjacent to watercourses that should remain in an undisturbed state, during and after the mine development.

An intact, undisturbed area of riparian vegetation along a watercourse is important to providing the watercourse with shading, leaf litter and insect drop, infiltration, and channel stability, all of which benefit downstream fish. Leave strips should be provided on watercourses around the mine, including small ephemeral streams that may not flow throughout the entire year. The joint federal and provincial *Land Development Guidelines* (DFO and MOE, 1992) recommend that, for watercourses with well-defined high water marks in low density development areas, the minimum leave strip width on each side of the watercourse should be 15 m from the high water mark.

5.9.2.2 Measures to Protect Leave Strips

Application of the following general principles will aid in protecting leave strips and maintaining a functional riparian zone:

- During development, there should be no unauthorized work or disturbance in the leave strip.
- Where encroachment into a leave strip is required (e.g., for a bridge or culvert), specific plans should be prepared in advance of the work. These plans should include the extent of work areas, plans for the control of water discharged from the work area, the timing of work; and the details for restoration after construction. These plans may need to be provided (well in advance) to the Department of Fisheries and Oceans (DFO) or Ministry of Environment (MOE) for review.
- Access points to the streambank through the riparian zone should be carefully selected, the size and duration of disturbance minimized, and the streamside vegetation and undergrowth preserved wherever possible.
- Machinery and equipment access and direct disturbance to streambank areas should be limited.
- Physical stabilization of eroding or eroded banks may be required to promote bank stability and regeneration of riparian vegetation.
- Remove disturbed, unstable debris from the riparian zone to prevent it from being swept away during high water.
- Retain stable large organic debris (e.g., logs) which does not impede flows and fish migration, or promote bank erosion.
- Revegetate disturbed areas immediately following completion of work in riparian zones.

5.9.3 Erosion and Sediment Control

Mine-related activities such as land clearing, grading slopes, road building, excavation, and stockpiling of materials can lead to the erosion of material into nearby watercourses. This material can be carried downstream into fish-bearing waters. Increased surface runoff as a result of the development, due to lack of vegetation, infiltration and ponding, and the loose condition of disturbed soils also leads to increased downslope transport of soils by the runoff. Even after the replacement and compaction of slopes and surfaces, soil erosion, gully and channel formation can occur.

Sediments are composed of undissolved organic and inorganic materials that range in size from microscopic particles to boulders, transported by flowing water. The finer material is carried suspended in the volume of water and is known as suspended sediment or suspended load. Larger material, generally consisting of coarse sand, gravels, and boulders, is carried along the channel bottom by the flow of water and is known as bedload.

On and offsite runoff management is a key factor in erosion and sediment control. By preparing and covering disturbed soils, revegetating slopes and lining runoff channels, the amount of soil available to be eroded can be reduced. The objective of erosion and sediment control measures is to minimize sediment inputs into fish habitat by reducing

the potential for erosion, by stabilizing disturbed soils and intercepting sediment-laden runoff. Erosion and sediment control is extremely important because sediment can have severe negative effects on all life stages of fish and their habitats. Examples of sediment effects on fish and fish habitat include:

- suspended sediment can settle on spawning areas, smothering eggs and juvenile fish
- bedload and settled sediments can infill pools and riffles, reducing the availability and quality of rearing habitat
- suspended sediment can clog and abrade fish gills, causing suffocation or injury
- suspended sediments can reduce water clarity and visibility in the stream, impairing the ability of juvenile fish to find food items
- settled sediments can smother and displace aquatic organisms (e.g., benthic invertebrates), reducing the amount of food available for fish
- increased levels of sediment can displace fish out of prime habitat into less suitable areas

According to the *Land Development Guidelines*, runoff water from the mine site should contain less than 25 mg/L of suspended solids (or non-filterable residue, NFR) above the background suspended solids levels of the receiving waters during normal dry weather operation, and less than 75 mg/L of suspended solids above background levels during design storm events.

Sediment and erosion control measures relevant to the Project are provided in the Sediment and Erosion Control Plan (see Section 5.5). Other measures for sediment and erosion control may be found in the *Land Development Guidelines* (DFO and MOE, 1992) and in Appendix 5B: Erosion and Sediment Control BMPs. Key considerations in designing and applying sediment and erosion control measures include:

- planning the development to match the existing terrain and site conditions, and minimizing soil disturbance to the extent possible
- scheduling the development to minimize risk of potential erosion (e.g., minimize clearing work during the wet season)
- retaining existing vegetation where possible
- re-vegetating or protecting denuded areas and bare soils
- diversion of runoff away from denuded areas
- minimizing the length and steepness of slopes where possible
- minimizing runoff velocities and erosive energy
- retention of eroded sediments onsite with erosion and sediment control structures
- planning, inspection, and ongoing maintenance of erosion and sediment control structures

5.9.4 Control of Deleterious Substances on the Mine Site

Common deleterious substances include raw and uncured concrete, mortar, glues, paints, lubricants, organic and inorganic contaminants, fuels and oils. These substances can have negative or toxic effects on downstream fish if they are allowed to enter the watercourses

that drain the mine site. In most instances, the control of these substances can be dealt with through an awareness of their detrimental effects, good housekeeping (e.g., daily site clean-ups, use of disposal bins) on the mine site, and the proper use, storage and disposal of such substances and their containers.

The following control measures should be implemented to prevent the release of deleterious substances into fish habitat:

- Raw or uncured waste concrete and grouts should be disposed of by removal from the development site or by burial on the site in a location and in a manner that will not have an effect on a watercourse.
- Wash-down waters from exposed aggregate surfaces, cast-in-place concrete and from concrete trucks should be trapped onsite to allow sediment to settle out and reach neutral pH before the clarified water is released or allowed to percolate into the ground (approximately 48 hours).
- Fuels, lubricants and hydraulic fluids for equipment used on the development site should be carefully handled to avoid spillage, properly secured against unauthorized access or vandalism and provided with spill containment according to applicable statues (e.g., the provincial *Occupational Health and Safety Regulation*, local fire protection bylaws). Handling procedures for these materials are discussed in Section 5.11 Solid and Hazardous Waste Management Plan and 5.12 Chemical Management Plan.
- Fuelling and lubricating of equipment onsite should only be done after the equipment to be serviced is moved to a constructed service pad with a separate drainage collection system, as far as possible from detention or sedimentation facilities and leave strips.
- Any spillage of fuels, lubricants or hydraulic oils should be immediately contained and the contaminated soil removed from the site and properly disposed of in accordance with the federal and provincial requirements. In accordance with the *Spill Reporting Regulation*, any spills of oil, fuels must be reported to 1-800-663-3456 (Spill Reporting Centre of the Provincial Emergency Program). Handling and spill response procedures for these materials are discussed in Section 5.11 Solid and Hazardous Waste Management Plan and 5.12 Chemical Management Plan.
- Waste oils and hydraulic fluids should be collected in leak-proof containers and removed from the site for proper disposal or recycling. Storage and handling procedures for these materials are discussed in Section 5.11 Solid and Hazardous Waste Management Plan and 5.12 Chemical Management Plan.
- The rinse and cleaning water or solvents for glues, paints, wood preservatives and other potentially harmful or toxic substances on the development site should be controlled so as to prevent leakage, loss or discharge into the storm drain system.

5.9.5 Timing Windows

Section 42(1) of the *Water Regulation* under the British Columbia *Water Act* requires that, unless otherwise authorized, any change made “in and about a stream” must take place during the periods of the year during which the change can proceed without causing harm to fish, wildlife or habitat. Because the resident bull trout are fall spawners, the “window of least risk” for Gordon and Babcock creeks is June 15 to August 15.

However, work may also take place if the stream channel is naturally dry or frozen to the bottom and the instream activity will not result in the introduction of sediment into fish habitat, or if construction of a winter crossing is proposed and such works does not adversely affect the stream channel (including stream banks), fish habitat or fish passage.

5.9.6 Notification of Agencies

Fisheries and Oceans Canada (DFO), in their May 12, 2009 letter of advice to PRC, has indicated that they wish to be notified at least 10 days before work at the mine is begun. Pat Lim's contact number at DFO is (604) 666-6529, her fax is (604) 666-7907, and her email is pat.lim@dfo-mpo.gc.ca. DFO has also indicated that a copy of the letter of advice should be kept on-site while the work is in progress.

5.10 Archaeology Site Protection Plan

Through the construction of the Project, as identified in the original Project description the proposed footprint illustrated in Figure 4.2-26, will effect known and recorded archaeological sites GfRf-013, 014, 015, 016, 017, 018, 019, 020, and 021. Following the 2008 Prefeasibility Study, the mine footprint was reduced by approximately 20 percent. This reduction was achieved in part by increasing the overlap of Roman waste dumps onto areas previously disturbed by the Trend Coal Mine. Due to this reduction in the footprint, GfRf-017, 018, now lie outside of the currently proposed mine footprint described here. These sites will not be subject to impact. Site specific mitigation measures are presented in Section 17.6: Summary of Mitigations in the Archaeology Effects Assessment (see Section 17).

The archaeological site protection plan will employ the following general mitigation measures:

1. all known archaeological sites will be avoided whenever practical in mine planning
2. appropriate environmentally-stable signage or barriers will be placed around recorded archaeological sites that lie within 100 m of construction or decommissioning and reclamation work, but are not directly subject to these activities
3. all staff and contractors will be informed of the importance of avoiding these sites
    - all construction activity in or within 25 m of a recorded archaeological site will be completed under the auspices of an active, relevant *HCA* S12 SAP
    - general access to recorded site areas will be restricted, except where they may be subject to impacts and effects approved under an active, relevant *HCA* S12 SAP
    - PRC staff and its contractors will be made aware of the presence or absence of recorded and unrecorded archaeological remains in areas subject to development
    - grading or other maintenance activities related to the upkeep of access trails and roads will be restricted to designated trails and roads
    - a process will be developed by which archaeological remains observed by PRC staff and its contractors are reported in a timely manner to an archaeologist or the Archaeology Branch

In the unlikely event that buried archaeological sites or remains are discovered during construction or decommissioning and reclamation, work will be halted and a qualified archaeologist will examine the find(s) and report to the British Columbia Archaeology

Branch. Mitigation measures required by the British Columbia Archaeology Branch will include documentation of the site (if not previous recorded), and the collection and removal of cultural material remains. PRC will follow the instructions from the British Columbia Archaeology Branch to mitigate the effect, and will not continue activities at the (newly) discovered site until permission to do so is granted.

5.11 Solid and Hazardous Waste Management Plan

5.11.1 General Waste Management

It is the objective of PRC to control the handling and disposal of all wastes generated at the Trend and Roman Coal Mine sites during construction, operation and closure in a safe, efficient and environment sensitive manner. The purpose of the Solid and Hazardous Waste Management Plan is to ensure that all materials classified as waste are collected, stored, handled and disposed of in compliance with all legal requirements and company Policy. All contractors and employees of PRC will be required to comply with applicable regulations for the containment, handling and disposal of wastes and potentially hazardous materials.

Management Commitments and Responsibilities

Table 5.11-1 provides employees and contractors with guidance on company Policy and Standards, Procedures and Methods to be established for the collection and disposal of waste materials generated during the construction phase.

Table 5.11-1 General Waste Management

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Non Hazardous Wastes[1]	• all non hazardous waste will be segregated on site for recycling purposes • all waste will be stored in covered, secured and clearly labelled containers • all recyclable waste will be transported to offsite recycling facilities • all non recyclable waste will landfilled on site under a Refuse Permit • waste for offsite disposal will be transported from site by a licensed waste contractor • all waste trucks will be covered to avoid accidental littering • as far as practicable the storage of waste will be kept to a minimum	Contractor, Environmental Coordinator	any non-conformances to be reported to the Chief Environmental Scientist and Operations Manager
Hazardous Waste[2]	• all waste will be stored in covered, secured and clearly labelled containers • all waste will be identified with the appropriate WHIMS labels	Contractor, Environmental Coordinator, Operations Manager	any non-conformances to be reported to the Chief Environmental Scientist and Operations Manager

[1] Non Hazardous wastes include: wood, plastic, card and paper, scrap metal
[2] Hazardous wastes include: oily absorbents and rags, used oils, used batteries, paints, solvents, waste chemicals

Table 5.11-1 General Waste Management (cont'd)

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
	• only one category of hazardous waste will be placed in any one container • hazardous liquid wastes will be stored within containment • waste will be transported from site by a licensed waste contractor for specialist disposal, and copies of the manifests will be provided to the Operations Manager		any spill or leakage of hazardous waste to be reported to the Provincial Emergency Program (PEP), see Table 2.2 Incident Response and Reporting for details
Food Waste	• food wastes will be stored in covered secure containers to deter foraging animals • food waste will landfilled on site under a Refuse Permit	Contractor, Environmental Coordinator	any non-conformances to be reported to the Operations Manager
Sewage	• underground storage tanks will be installed for the office facilities. The sewage will be pumped from the tanks to a modular sewage treatment plant for onsite treatment	Contractor, Environmental Coordinator	any non-conformances to be reported to the Operations Manager

5.12 Chemical Management Plan

5.12.1 Overview

The Chemical Management Plan focuses on the handling and storage of chemicals and materials that are generated from construction and mine actives associated with the Trend and Roman Coal Mines.

Employees will be trained in to use the WHIMS labelling system. All chemicals on site will have WHIMS labels. All chemicals on site will have a Material Safety Data Sheet and this information will be made available to all employees.

5.12.2 Fuel Management

5.12.2.1 Fuel Storage, Handling and Transportation

The fuel management plan has been developed to minimize the potential for fuel spillage into the environment during the construction and operation of the Trend and Roman Coal Mines. The construction and operation of the Project will require the construction or expansion of a fuel handling facility (Fuel Island). Fuel storage and handling will be conducted in accordance with the *CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum* and *Allied Petroleum Products and the British Columbia Fire Code*.

Management Commitments and Responsibilities

Table 5.12-1 details the commitments done by PRC to address the management and monitoring of fuel storage, handling and transportation at the mine site.

Table 5.12-1 Fuel Storage, Handling and Transportation

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Fuel Island Construction	• fuel island will be located away from any waterbodies or sensitive areas • fuel tank will be double walled Envirotank • fuel tank will be fitted with a cam-lock coupling system for loading and unloading of fuel	Operations Manager	
Storage and Handling	• tanks will be clearly labelled • one designated fuelling area for light vehicles with an impermeable layer to prevent soil contamination, and a low berm or sloping pad to contain spills will be established • fuelling will be supervised at all times • fuel hoses will be stored above a drip tray when not in use • a spill cleanup kit will be located at the fuel island and operators will be trained in its use • fuel hoses will be fitted with 'break away' connectors to ensure no spillage in the event of a hose break • fire extinguishers will be placed at appropriate locations around the fuel island	Operations Manager	
Fuel Transportation	• fuel supplies will be transported to site by a licensed contractor who meets all conditions of the 'Transportation of Dangerous Goods' requirements • the contractor will supply trained and appropriately qualified personnel • all fuel truck drivers will have current Transportation of Dangerous Goods (TDG) certification • tank refuelling operations will be supervised at all times • all refuelling of the tank will use the 'contained coupling method' • the tank will be inspected prior to each refuelling for potential leaks	Operations Manager Contractor	
Maintenance and Inspection	• regular inspection and monitoring will be undertaken • equipment cleaning will be undertaken, whenever possible, at the maintenance shop which will be equipped with a steam bay and oil/water separator • if repairs are made in field, barrels and absorbent pads will be on hand in the event of incidental spillage • any used oils and absorbent pads will be disposed of appropriately	Environmental Coordinator	• Environmental Coordinator will report results of the inspections to the Operations Manager during construction or Mine Manager during operation • any regulatory non compliance will be reported to the appropriate regulatory body

5.12.3 Explosive Handling Procedure

The on-site explosives factory currently used for the Trend Coal Mine will be used for the Project as well. A third-party contractor will be responsible for the handling of explosives on site. PRC will be responsible for the following:

- ensuring employees have required training and blasting certificates in accordance with the *Mines Act*
- procedures are followed in transporting explosives on site
- patterns are designed to account for bootlegs in accordance with the *Mines Act*
- explosives are loaded and primed in accordance with the *Mines Act*
- procedures are developed for carrying out blasts
- misfires are accounted for and dealt with in a safe manner in accordance with the *Mines Act*
- explosives and Explosive Agents are disposed of in accordance with the manufacturers' requirements

5.13 Emergency Response Plan

5.13.1 Incident Response and Reporting

PRC has compiled the following management plan to clearly define the response and reporting requirements in the event of an environmental incident, including the commonly used chemicals in Table 5.13-1, water management control structure incidents and any other incident with the potential to affect the environment.

Management Commitments and Responsibilities

Table 5.13-1 and 5.13–2 detail the commitments undertaken by PRC to address incident response and reporting at the mine sites.

Table 5.13-1 Reportable Levels of Hazardous Materials Spills

Hazardous Material	PEP Reportable Level	Incident Report Required
Explosives	any	any
Flammable Gasses	10 kg	2.5 kg
Diesel Fuel	100 L	1 L
Gasoline	100 L	1 L
Greases/Lubricating Oils	100 L	1 L
Solvents	100 L	1 L
Anti Freeze	5 kg	5 kg
Pesticides	1 kg	1 kg

Table 5.13-2 Incident Response and Reporting

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Incident Occurrence	• Immediately inform supervisor upon discovery of incident	Individual discovering incident	
	• If safe to do so initiate spill containment procedures (i.e., shut off source of spill)	Individual discovering incident	
	• Determine whether spill can be contained or controlled with equipment on hand or if Emergency Response Procedure must be implemented	Supervisor	Supervisor, Environmental Coordinator, Operations Manager
	• Once spill contained initiate clean up procedures	Supervisor under advice from the Environmental Coordinator	
Thresholds for Spill Quantity	• All spills are to be reported to supervisor and Environmental Coordinator	Individual discovering incident	Supervisor, Environmental Coordinator,
	• For spills under incident report levels, no incident report required	Supervisor	Chief Environmental Scientist,
	• For spills between incident report levels and PEP report levels: clean up, incident report required	Environmental Coordinator	Operations Manager
	• Greater than or equal to PEP levels: clean up, incident report required, report to PEP required • Any amount to waterway (water filled ditch,	Environmental Coordinator,	
	• pond, or natural stream): clean up, incident report required, report to PEP required	Chief Environmental Scientist	
Spill or Permit /Approval Condition Exceedance Reporting and Investigation	• Submit report to PEP. Report to contain the following: • Reporting person's name and contact number • Location and time of spill/exceedance • Type and quantity of substance spilled • Cause and effect of spill/exceedance • Details of actions taken to stop, contain and clean up spill • Description of affected and surrounding area • Details of any further actions required/anticipated	Environmental Coordinator or Chief Environmental Scientist	Submit Report immediately to the Provincial Emergency Program (PEP) at 1-800-663-3456
	• Names of any agencies on the scene • Names of other persons advised of spill • Complete Incident Investigation Report containing details of: • Cause of spill/exceedance • Effect of spill/exceedance • Corrective action to be taken to prevent reoccurrence incident: including responsibility and time frame for action	Contractor, Environmental Coordinator	Submit Incident Investigation Report to: Operations Manager, Chief Environmental Scientist

5.14 Access and Traffic Management Plan

Access to the Trend and Roman Coal Mine is via the Heritage Highway, to PDR-46, to a non-status road known as the Talisman Road. The haul route for both mines will be via PDR-46, to the Bypass Road to PRC Rail Load-out Facility.

PRC is developing a traffic management plan for the PDR-46, Heritage Highway and Bypass Road to ensure the safety of general public, contractors and employees. This plan will be incorporated into ongoing training of employees and contractors.

Road Signage

Road signage has been positioned along the PDR-46 and along the bypass. Signs will be added as required to enforce the rules and procedures of the road systems.

General Public

Given the PDR-46 road is used to access popular recreational areas, this traffic is expected to continue through. The PDR-46 road is radio controlled and the general public is expected to adhere to this policy.

The Bypass Road is a private road and traffic will be restricted to coal haul traffic only. Signage indicating restricted access will be posted at both ends of the bypass road.

Traffic Procedure

- PDR-46 and the bypass roads are radio controlled. The frequency is posted at the turnoff to the PDR-46 and will be posted on both ends of the bypass road. All traffic is required to monitor the posted frequency.
- Traffic traveling in both directions is required to call each posted kilometre.
- Unnecessary radio chatter should be avoided; channel will be reserved for calling in kilometre postings and emergency purposes.
- Posted speed limits and traffic signs must be obeyed by all users.
- No passing will be permitted except in the following case:
    - Maintenance equipment should be given adequate space. Contact either visual or over the radio must be made with the operator. Operator will signal when and call over the radio when it is safe to pass.

Access Management

Entry to the mine site area will be controlled by means of a staffed site access security gate located at 14.25 km. Site access will restrict access to the mine site to coal haul traffic and authorized personnel. All vehicles will be required to meet vehicle standards defined by PRC policies. All industrial traffic users will be expected to read and sign acknowledgement of the written road rules, and will be expected to abide by the posted traffic signs.

There is currently some public use of roads in the mine site area to access alpine viewpoints and recreational areas. During mine construction and operation, public traffic will be controlled around the mine site. A formal sign in and out procedure will be followed. Additionally as some blasting activities associated with operations will infringe

on some public access areas surrounding the mine site, PRC will periodically restrict access to these areas.

A more detailed access and traffic management plan will be developed during feasibility planning and will be presented in the Mine Permit Application.

5.15 Routine Environmental Site Inspections

The Environmental Coordinator will conduct regular environmental inspections of the mine during construction and operations. Inspections will include recommendations for corrective action where required including who is to complete the action and a time frame for completion. Corrective actions will then be inspected during subsequent inspections.

Management Commitments and Responsibilities

Table 5.15-1 details those areas to be inspected and the reporting requirements and responsibilities.

Table 5.15-1 Routine Environmental Site Inspections

Issue	Commitments/Mitigation (incl. any monitoring and frequency of monitoring)	Responsibility	Reporting Requirements (if applicable)
Fuel Island(s)	Inspections to be undertaken weekly	Environmental Coordinator	Inspection results will be reported to the Chief Environmental Scientist, Operations Manager and Mine Manager to complete any required corrective action
Maintenance Shop(s)	Inspections to be undertaken weekly	Maintenance Manager	Inspection results will be reported to the Chief Environmental Scientist, Operations Manager and Mine Manager to complete any required corrective action
General Site Inspection	Inspections to be undertaken weekly	All Managers	Inspection results will be reported to the Chief Environmental Scientist, Operations Manager and Mine Manager to complete any required corrective action
Settling Ponds and Ditches	Inspections to be undertaken monthly (non-winter)	Environmental Coordinator	Inspection results will be reported to the Chief Environmental Scientist, Operations Manager and Mine Manager to complete any required corrective action

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Roman Coal Mine Project

ENVIRONMENTAL ASSESSMENT REPORT

VOLUME 1, SECTION 6: EFFECTS ASSESSMENT APPROACH

Prepared for:
BC Environmental Assessment Office
Victoria, British Columbia

Prepared by:
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March 2010

6 Effects Assessment Approach

6.1 Introduction

This environmental assessment has been completed using a standard methodological framework to meet the requirements of British Columbia *Environmental Assessment Act* (BCEAA) The environmental effects assessment methodology is based on a structured approach, which:

- focuses on issues of greatest concern
- considers provincial regulatory requirements for the assessment of environmental effects
- considers issues raised by the public, Aboriginal people and Project stakeholders
- integrates engineering design and programs for mitigation and monitoring into a comprehensive environmental planning process

For the purpose of this assessment, "environment" refers broadly to the combined biophysical and human environment and encompasses the following definition of environment from the Canadian *Environmental Assessment Act* (CEAA).

> *"Environment" means the components of the Earth, and includes:*
>
> *a) land, water and air, including all layers of the atmosphere*
> *b) all organic and inorganic matter and living organisms*
> *c) the interacting natural systems that include components referred to in paragraphs (a) and (b)*

The environmental assessment focuses on valued environmental components (VECs), which are of value or interest to government regulators, the public, Aboriginal people and stakeholders. VECs are typically identified through consideration of regulatory issues and guidelines, consultation with regulators and stakeholders, field reconnaissance, and professional judgment.

VECs can encompass a variety of components that might interact differently with the Project; therefore, the environmental assessment may consider effects on certain key indicators (KIs), as well as VECs.

An environmental effect broadly refers to a change in the environment in response to a Project effect. The Canadian *Environmental Assessment Act* (CEAA) definition is as follows:

> *"environmental effect" means, in respect of a project,*
>
> *a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the Species at Risk Act*
> *b) any effect of any change referred to in paragraph (a) on*
>
> *i. health and socio-economic conditions*
> *ii. physical and cultural heritage*

iii. the current use of lands and resources for traditional purposes by Aboriginal persons

iv. any structure, site or thing that is of historical, archaeological, paleontological or architectural significance

c) any change to the project that may be caused by the environment whether any such change or effect occurs within or outside Canada

The environmental assessment approach used in this Application addresses Project–related environmental effects as they pertain to the biophysical and human environment and cumulative environmental effects as they pertain to the biophysical environment. Project-related environmental effects are changes to the biophysical or human environment that are caused by a project or activity arising solely as a result of the proposed principal works and activities, as defined by the scope of the Project. Cumulative environmental effects are changes to the biophysical environment that are caused by an action associated with the Project under review, in combination with other past, present and future projects and activities.

The environmental assessment process proceeds sequentially through identification and characterization of Project-specific effects, identification of practicable mitigation measures, characterization of Project residual environmental effects, screening for potential cumulative effects for biophysical VECs, and cumulative effects assessment where required. Once residual environmental effects have been characterized a determination of significance is made.

The environmental effects assessment approach used in this assessment is organized into the following sections (see also Sections 6.2 to 6.7 for details):

- Scope of Assessment
- Baseline Conditions
- Assessment of Residual Environmental Effects (after consideration of mitigation)
- Identification and Assessment of Cumulative Environmental Effects (where required)
- Determination of Significance
- Monitoring

6.2 Scope of Assessment

Scoping of the overall assessment includes:

- selection of VECs and KIs
- selection of measurable parameters
- identification of temporal, spatial, administrative and technical boundaries
- definition of the parameters that will be used to characterize the Project-related environmental effects and cumulative environmental effects
- identification of the standards or thresholds that will be used to determine the significance of residual environmental effects

6.2.1 Selection of Valued Environmental Components and Key Indicators

As indicated above, VECs are broad components of the biophysical and human environments that, if altered by the Project, would be of concern to government regulators, the public, Aboriginal people and stakeholders.

The following general criteria have been used to facilitate the selection of VECs:

- Does it represent a broad biophysical or human environment component that may be affected by the Project?
- Was it identified as an issue during working group meetings or preliminary Project planning?
- Is it vulnerable to the environmental effects of the Project and other activities in the region?
- Has it been identified as important issue of concern by stakeholders, regulators or in other effects assessments in the region?

For some VECs, key indicators were selected to focus the assessment on elements that are likely to be most sensitive to Project environmental effects or elements that are representative of the VEC as a whole (e.g., "umbrella species"), and where sufficient information was available or attainable through field study to support the assessment.

For each VEC or KI, measurable parameters were selected to quantify or qualify the potential environmental effects. Measurable parameters provide a means to determine the level or amount of change to a VEC or KI as a result of an environmental effect.

The degree of change in measurable parameters can be used to characterize environmental effects, and evaluate the significance of the potential environmental effects. Thresholds or standards have been identified for each measurable parameter to assist, where possible, in determining the significance of a predicted environmental effect.

6.2.2 Project Interactions with the Environment

Interactions between Project activities and the environment have been ranked according to the potential for an activity to interact with VECs. The following rankings were assigned:

- 0 = No interaction.
- 1 = Interaction occurs; however, based on past experience and professional judgment the interaction would not result in a significant environmental effect, even without mitigation; or interaction would not be significant due to application of codified environmental protection practices that are known to effectively mitigate the predicted environmental effects.
- 2 = Interaction could result in an environmental effect of concern; the potential environmental effects have been considered further in the environmental assessment.

Justification for the interaction rankings are provided for each VEC

6.2.3 Temporal Boundaries

The temporal boundaries for the assessment were defined based on the timing and duration of Project environmental effects in relation to each VEC or KI. The purpose of a temporal boundary is to identify when an environmental effect may occur in relation to specific Project phases and activities. Temporal boundaries for most projects typically include:

- baseline (pre-Project conditions)
- pre-construction
- construction
- operations
- closure
- post-closure

In some instances, construction, operations and closure have been combined into a maximum (worst case) disturbance scenario.

6.2.4 Spatial Boundaries

Spatial boundaries were primarily established based on the estimated zone of Project influence, beyond which the potential environmental, cultural and socio-economic effects of the Project are expected to be non-detectable. Boundaries typically include a local study area (LSA) for Project-specific effects and a regional study area (RSA) to provide regional context. LSA and RSA boundaries vary among VECs and, in some cases, KIs. For most biophysical components of the environmental assessment, the LSA consists of the Project footprint and an associated buffer within which the direct effects of the Project on the environment are expected to be detectable.

RSAs for cumulative effects assessment have been defined by the furthest extent that measurable or demonstrable Project-specific effects may act in combination with similar effects from other projects on VECs.

6.2.5 Administrative and Technical Boundaries

Administrative and technical boundaries were identified as appropriate for VECs and KIs. Administrative boundaries include specific aspects of provincial and federal regulatory requirements, as well as regional planning initiatives that are relevant to the assessment of the Project's environmental effects on the VEC. Administrative boundaries often influence spatial boundaries.

Technical boundaries include limitations in scientific and social information, data analyses and data interpretation, as well as time limitations.

6.2.6 Characterizing Residual Environmental Effects

Characteristics of residual environmental effects were defined and used to assist in the assessment. Where the characteristics of residual environmental effects could not be expressed quantitatively, they were described using qualitative terms (e.g., low, moderate, high). Where qualitative descriptions were used, definitions for these qualitative terms have been provided for each VEC or KI, as appropriate, in the

associated section of the environmental assessment. The characteristics used to describe residual environmental effects include:

- Direction—the ultimate long-term trend of the environmental effect (i.e., positive or adverse).
- Magnitude—the amount of change in a measurable parameter or variable relative to baseline case (i.e., low, moderate, high).
- Geographical Extent—the geographic area within which an environmental effect of a defined magnitude occurs (i.e., site-specific, local, regional, provincial, national, international).
- Frequency—the number of times during a project or a specific project phase that an environmental effect may occur (i.e., once, sporadically, regular, continuous).
- Duration—typically defined in terms of the period of time that is required until the VEC or KI returns to its baseline condition or the environmental effect can no longer be measured or otherwise perceived (i.e., short-term, medium-term, long-term, permanent).
- Reversibility—the likelihood that a measurable parameter or KI will recover from an environmental effect (i.e., reversible, irreversible).
- Ecological or Socio-economic Context—the general characteristics of the area in which the project is located (i.e., undisturbed, disturbed, urban setting).

6.2.7 Standards or Thresholds for Determining the Significance of Environmental Effects

Determination of the significance of residual environmental effects is supported by reference to threshold criteria or standards wherever possible.

Standards are recognized government or industry regulations or objectives for physical aspects of the environment (e.g., air quality, water quality, effluent release or in-stream flows). Thresholds reflect the limits of an acceptable state for an environmental component based on resource management objectives, community standards, scientific literature or ecological processes (e.g., desired states for fish or wildlife habitats or populations). In the absence of prescribed thresholds and standards, determination of the significance of a project environmental effect was qualitative and based on logical reasoning and professional judgment.

Potential changes in a measurable parameter, KI or VEC resulting from the Project or cumulative environmental effects were evaluated against these standards or thresholds wherever possible.

6.3 Baseline Conditions

The baseline conditions sections are intended to summarize available baseline information and characterize pre-development conditions in a manner that supports the identification of Project-environment interactions and the assessment of environmental effects. Baseline conditions sections for each VEC include:

- a summary of existing information
- identification of important data gaps for the effects assessment

- methodologies for baseline information collection
- a brief summary of the results of field surveys and additional data analyses (if applicable)
- description of the environment and selected KIs before Project development (i.e., the baseline conditions)

6.4 Assessment of Environmental Effects

6.4.1 Assessment of Project-Related Environmental Effects

The assessment of Project-related environmental effects includes descriptions of how an environmental effect might occur, planned mitigation and environmental protection measures proposed to reduce or eliminate the environmental effect. The assessment also includes evaluation and characterization of the residual environmental effects of the Project (i.e., environmental effects remaining after application of mitigation measures) for each development phase.

6.4.1.1 Description of Project Environmental Effects

The assessment of each Project environmental effect begins with a description of the Project effect mechanism including a detailed account of how specific Project activities and actions could result in an environmental effect. Where possible, the spatial and temporal extent of these changes is also described to define where and when an effect is expected to occur. As the environmental assessment focuses on evaluation of residual environmental effects, environmental effects before mitigation were not quantified or characterized, and no determination of significance has been made at this stage of the assessment.

6.4.1.2 Mitigation of Project Environmental Effects

Mitigation measures can include changes to the Project that result in reduction of predicted Project environmental effects, such as changes in temporal or spatial aspects of the Project or changes in Project construction, operation or closure, over and above aspects of the Project design. Mitigation measures can also include best management practices or environmental management plans that are implemented to reduce or avoid potential project environmental effects, thereby focusing the assessment on the residual Project environmental effects.

6.4.1.3 Characterization of Project Residual Environmental Effects

Residual Project environmental effects (following application of mitigation measures) were characterized in terms of some of all (depending on the VEC or KI) of the following: direction, magnitude, geographic extent, frequency, duration, reversibility and ecological or socio-economic context. Where possible, these characteristics were described quantitatively for each residual environmental effect. Where these characteristics could not be expressed quantitatively, at minimum, they were described using qualitative terms that were defined specifically for the VEC- or KI-specific environmental effect.

6.5 Assessment of Cumulative Environmental Effects

In the case of biophysical VECs, where there a potential interaction between the predicted residual Project environmental effect and other projects or activities was anticipated within a regional context, a screening of these potential interactions was undertaken to determine if an assessment of cumulative effects was required.

Where required, the residual cumulative environmental effect of the Project in combination with other past and future projects and activities were then evaluated and the Project contribution to overall cumulative effects was characterized.

6.5.1 Project Inclusion List

In order to facilitate the assessment of cumulative environmental effects, known (planned) and reasonably foreseeable projects, activities and actions were identified and evaluated with respect to potential spatial and temporal overlap with residual Project environmental effects. This "project inclusion list" was created for a 495.5 km^2 RSA[1]. Existing projects (e.g., Quintette Mine) have not been included in the project inclusion list as they are implicit in baseline data.

The Project inclusion list (Table 6.5-1) was developed by consulting a wide variety of information sources, including guidance from the British Columbia Environmental Assessment Office (BC EAO). Projects currently listed with the BCEAA electronic Project Information Centre and the CEAA public registry were evaluated for relevance to the Project, and where the potential existed for these projects to overlap and interact with the Roman Coal Mine Project, they were included in the Project inclusion list.

The Project Inclusion List summarizes information about the Project, the Proponent, the proposed timeline and current status based on available information. For information about the location of these projects see Figure 6.5-1. This list does not imply that there is an interaction with these other projects; that determination has been made in the environmental effects assessment sections for each of the biophysical VECs.

[1] Identical to the RSA used for the wildlife and vegetation assessments

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Table 6.5-1 Project Inclusion List

Company Name	Project Name	Type	Category	Status	Application Interest Date (M-D-Y)	As-Built Date (M-D-Y)	Area (ha)	Comments
Reasonably Foreseeable								
Suncor Energy Inc.		Pipeline	OGC	Application Submitted		NA		OGC File #9701293
Suncor Energy Inc.		Facility	OGC	Application Approved		NA		OGC File #9702791
Suncor Energy Inc.		Temporary Permit	OGC	Application Submitted		NA		OGC File #9630897
West Fraser Mills		Logging	MOF	Harvesting	1/1/2009			
West Fraser Mills		Logging	MOF	Harvesting	1/1/2012			
West Fraser Mills		Logging	MOF	Harvesting	NA			
Peace River Coal Inc.	Horizon Mine Coal Project	Typical EA Process (active and complete)	Mining	Pre-Application	9/20/2005		1,512.00	Formally known as Five Cabin Coal Project. Several open pit coal mines with an estimated production capacity of 1.6 Mt per year. Mine life expectancy is 20 years
Certified / Complete Projects								
Canadian Natural Resources Ltd.		Pipeline	OGC	Completed / Certified	2/21/2005	8/16/2005	4.22	OGC File #9619375
Canadian Natural Resources Ltd.		Petroleum Development Road	OGC	Completed / Certified	6/13/2008	NA	35.14	OGC File #9629425
Canadian Natural Resources Ltd.		Well Authority–well site	OGC	Completed / Certified	10/24/2007	NA	1.41	OGC File #9628139
Canadian Natural Resources Ltd.		Pipeline	OGC	Completed / Certified	11/1/2006	NA	34.53	OGC File #9624643
Canadian Natural Resources Ltd.		Pipeline	OGC	Completed / Certified	6/2/2006	NA	25.64	OGC File #9624120
Canadian Natural Resources Ltd.		Meter Station and Dehydrator	OGC	Completed / Certified	NA	NA	NA	NA
Canadian Natural Resources Ltd.		Compressor Station and Dehydrator	OGC	Completed / Certified	NA	NA	NA	NA
Canadian Natural Resources Ltd.		Gathering Point	OGC	Completed / Certified	NA	NA	NA	NA
Canadian Natural Resources Ltd.		Dehydrator	OGC	Completed / Certified	NA	NA	NA	NA
Devon Canada Corporation		Pipeline	OGC	Completed / Certified	NA	NA	NA	NA
Devon Canada Corporation		Meter Station	OGC	Completed / Certified	NA	NA	NA	NA
Devon Canada Corporation		Well Authorization Granted	OGC	Completed / Certified	NA	NA	NA	NA
Husky Oil Operations Limited		Well Authority–well site	OGC	Completed / Certified	12/18/2008	NA	5.10	OGC File #9630618
Husky Oil Operations Limited		Well Authority–well site	OGC	Completed / Certified	4/23/2007	NA	11.71	OGC File #9627406
Husky Oil Operations Limited		Pipeline	OGC	Completed / Certified	11/10/2008	NA	8.12	OGC File #9701988
Husky Oil Operations Limited		Pipeline	OGC	Completed / Certified	NA	NA	NA	OGC File #9702776
Shell Canada Limited		Petroleum Development Road	OGC	Completed / Certified	5/8/2007	NA	16.4339	OGC File #9626840
Shell Canada Limited		Well Authority–well site	OGC	Completed / Certified	12/29/2006	NA	27.21	OGC File #9626407
Spectra Energy		Pipeline	OGC	Completed / Certified	NA	NA	NA	NA
Suncor Energy Inc		Temporary Permit–Permanent Access Road	OGC	Completed / Certified	2/18/2008	NA	0.12	OGC File #9628956
Suncor Energy Inc		Temporary Permit–Staging Area	OGC	Completed / Certified	2/19/2007	NA	0.24	OGC File #9627027
Suncor Energy Inc		Well Authority–well site	OGC	Completed / Certified	10/16/2008	NA	6.41	OGC File #9629585
Talisman Energy		Well Authorization Granted	OGC	Completed / Certified	NA	NA	NA	NA
Peace River Coal Inc.	Trend Coal Mine	Mine site	Mining	Operating/ Certified	5/18/2005	NA	1,281.45	NA

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Figure 6.5-1 Projects Selected for Inclusion

6.5.2 Screening for Cumulative Environmental Effects

A set of three questions was used to screen for potential cumulative environmental effects for biophysical VECs. Cumulative environmental effects were assessed only if all three of the following conditions were met for the environmental effect under consideration:

- Will the Project result in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the biophysical environment?
- Is the Project-specific residual environmental effect on that component likely to act in a cumulative fashion with the environmental effects of other past or reasonably foreseeable future projects?
- Is there a reasonable expectation that the Project's contribution to cumulative environmental effects will affect the viability or sustainability of the VEC or KI?

6.5.3 Description of Cumulative Environmental Effects

The assessment of each cumulative environmental effect began with a description of the environmental effect and the mechanisms through which the Project environmental effects could interact with other projects and activities in the RSA. Where possible, the cumulative environmental effect was quantified in terms of the degree of change in one or more measurable parameters and the spatial and temporal extent of these changes. As the assessment focuses specifically on residual environmental effects, cumulative environmental effects before mitigation were not characterized.

6.5.3.1 Use of Temporal Cases

The assessment of cumulative environmental effects uses three temporal scenarios:

- Base Case—the current status of the measurable parameters for the environmental effect before Project initiation, including all appropriate past and present projects and activities. Present projects and activities include all projects or actions that currently exist, as well as projects that have been approved under some form of regulatory permitting. The base case is normally presented in the existing conditions of the VEC or KI with explicit reference to the fact that the base case reflects the contributions of past and present projects and activities.
- Project Case—the status of the measurable parameters for the environmental effect with the Project in place, over and above the base case. This is usually assessed using the peak environmental effect of the Project or the maximum active footprint for the Project.
- Future Case—the status of the measurable parameters for the environmental effect as a result of the Project case in combination with all reasonably foreseeable projects, activities and actions. Reasonably foreseeable projects are defined as future projects, activities or actions that are expected to occur with a high degree of certainty, including projects that have entered into a formal regulatory approval process and may also include projects for which a public announcement to seek regulatory approval has been made.

The comparison of the Project case with the future case allows the Project's incremental contribution to the cumulative effects of all past, present and reasonably-foreseeable projects and activities (i.e., future case) to be determined.

6.5.3.2 Mitigation of Residual Cumulative Environmental Effects

Mitigation measures designed to reduce the cumulative environmental effect were described. There are three types of mitigation measures that can be implemented:

- solely by the Project Proponent
- by the Project Proponent in cooperation with other Project Proponents, government, Aboriginal organizations or public stakeholders
- independently by other Project Proponents, government, Aboriginal organizations or public stakeholders

For the latter two types of measures, the degree to which the Project Proponent can or cannot influence the implementation of these measures has been noted.

6.5.3.3 Characterization of Residual Cumulative Environmental Effects

Residual cumulative environmental effects were described, taking into account the degree to which the proposed mitigation measures are expected to reduce or avoid the environmental effect. Two aspects of cumulative environmental effects to a VEC or KI were described: 1) the overall cumulative environmental effect (i.e., the environmental effect of all past, present and reasonably foreseeable projects and activities in combination with the environmental effect of the Project); and 2) the incremental contribution of the Project to overall cumulative effects. Where possible, cumulative environmental effects have been characterized in terms of: direction, magnitude, geographic extent, frequency, duration, reversibility and ecological context.

6.6 Determination of the Significance of Residual Environmental Effects

6.6.1 Determination of Significance of Project Environmental Effects

A determination of the significance of residual Project environmental effects was made using standards or thresholds that were specific to the VEC or KI or the measurable parameters used to assess the environmental effect.

The determinations also included a discussion of the prediction confidence based on:

- scientific certainty relative to quantifying or estimating the residual environmental effect, including the quality or quantity of data and the understanding of the effect mechanisms
- scientific certainty relative to the effectiveness of the proposed mitigation measures

6.6.2 Determination of Significance of Residual Cumulative Environmental Effects

A determination of the significance of residual cumulative environmental effects was made using standards or thresholds that were specific to the VEC or the measurable

parameters used to assess the environmental effect. A determination of significance was made for:

- the overall cumulative environmental effect (i.e., the environmental effect of all past, present and reasonably foreseeable projects and activities in combination with the residual environmental effect of the Project)
- the contribution of the Project to overall cumulative effect

As described above for residual Project residual environmental effects, the determination of significance for cumulative environmental effects also included a discussion of prediction confidence.

6.7 Monitoring

Monitoring programs have been identified and described as appropriate for each VEC or KI. Some sections may also include identification of follow up measures to verify the accuracy of effect predictions or to determine the effectiveness of prescribed mitigation measures.

6.8 References

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