HILLSBOROUGH
RESOURCES LIMITED

ECHO HILL

ECHO HILL COAL PROJECT
Project Description
British Columbia

Submitted to:

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Acronyms and Abbreviations

µm	Micrometer (one millionth of a metre)
µg/m^3	micrograms/cubic metre
AIA	Archaeological Impact Assessment
AIR	Application Information Requirements
AOA	Archaeological Overview Assessment
amsl	above mean sea level
AP	acid potential
ARD	acid rock drainage
BCEAA	British Columbia Environmental Assessment Act
BCEAO	British Columbia Environmental Assessment Office
BEC	Biogeoclimatic Ecosystem Classification
BCM	Bank cubic metre
°C	degrees Celsius
CDC	Conservation Data Centre
CEA	Cumulative Effects Assessment
CEA Act	Canadian Environmental Assessment Act, 2012
CEAA	Canadian Environmental Assessment Agency
EA	Environmental Assessment
EAC	Environmental Assessment Certificate
EBM	ecosystem based management
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
FSR	Forest Service Road
GWh	Gigawatt hours
HADD	harmful alteration disruption or destruction (of fish habitat)
HCA	Heritage Conservation Act
HIA	Health Impact Assessment
IPP	Independent Power Producer (in BC not BC Hydro)
km	Kilometers
kv	Kilovolt
lbs	Pounds
LOM	Life of Mine
LRMP	Land and Resource Management Plan
LSA	Local Study Area
m	Metres
m^3	cubic metre
m^3/s	cubic metres per second
MEM	Ministry of Energy and Mines
mg/L	milligrams/litre
Mm	Millimetres

Mlb	million pounds
Mt	million tones
MW	Megawatt
MX	Mineral Exploration (Permit)
NOW	Notice of Work
NP	neutralizing potential
Non-PAG	Non-potentially acid generating
NPV	net present value
NTS	National Topographic System
PAG	potentially acid generating
PEA	Preliminary Economic Assessment
PFS	Pre-feasibility Study
PM	particulate matter
PRRD	Peace River Regional District
Project	Echo Hill Coal Project
Reg	Regulation
RMDRC	Regional Mine Development Review Committees
ROMt	Run-of-Mine tonnes
RSA	Regional Study Area
SRSA	Socio-economic Regional Study Area
T	Time
tonnes	metric ton (equivalent to 2205 lbs)
TMF	Tailings Management Facility
US	United States
VCs	Valued Components (biophysical and socio-economic)
WMU	Wildlife Management Unit

EXECUTIVE SUMMARY

Project Name: **Echo Hill**, a proposed coal mine in northeastern British Columbia (Figure ES-1)

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The Echo Hill Project ("Project") is located about 44 highway kilometres north of Tumbler Ridge, British Columbia near Highway 52 (the Heritage Highway) between Tumbler Ridge and Dawson Creek (Figure ES-2). The Project site is located within National Topographic System (NTS) map 93P/37, at approximately latitude 55° 22′ 01″ N and longitude 120° 48′ 10″ W and at about 1000 to 1100 metres elevation above mean sea level.

The proponent for the Project is Hillsborough Resources Limited ("Hillsborough"). Hillsborough is a wholly-owned subsidiary of the Vitol group of companies, a private energy trading company.

Exploration of the deposit dates from 1978 when the property was staked and drilled by Gulf Canada Resources. Gulf Canada subsequently let the claims lapse and the property was re-staked by Hillsborough which carried out further exploration and drilling continuing up to the present time.

A project at this location was submitted into the BC environmental assessment process by AES Wapiti Energy Corporation (a joint venture between Hillsborough and AES Power Corporation) in 2006. At that time the project was presented as a 700,000 tonne per year surface coal mine with a thermal electric power plant. A terms-of-reference (now Application Information Requirements [AIR]) was submitted and Section 11 order was received from the British Columbia Environmental Assessment Office ("BCEAO"), but the project was cancelled in 2007 following passage of legislation in British Columbia requiring net zero greenhouse gas emissions from power facilities. In June 2012 Hillsborough requested that that application be withdrawn from the British Columbia environmental assessment process pending submission of this Project Description.

The Echo Hill Project will produce between 1.0 and 1.5 million tonnes of product coal per annum via the combination of contour mining and highwall auger mining; as such, it is expected that an environmental impact assessment could be required. Physical works related to the Project (Figure ES-6) are proposed to consist of:

- *Contour and highwall auger mine: coal will be sequentially exposed (and the area will be progressively reclaimed) along approximately 42km of subcrop (325 hectare surface area) and to a depth of 15 to 20 metres. Highwall augering will extract additional reserves up to 220 metres in from the exposed coal face. Mining is proposed at a rate of 2,700 to 4,000 tonnes per day (1.0 to 1.5 million tonnes per annum), with a mine life of approximately 10 to 14 years. The opportunity to extend the mine life exists through exploration on Coal Licences held adjacent the Project region.*
- *An office, mine dry and maintenance facilities: associated facilities and infrastructure needed for the life of the project are expected to include a maintenance shop, warehouse and administration complex, generator, fuel storage, and storage and laydown areas. These facilities will be supported by related water and power infrastructure.*
- *Mine access and haul roads: access to the site facilities noted above will be by existing roads. Access to the mine working areas will be by temporary haul roads.*
- *A coal handling and storage site: coal will be stockpiled, crushed and screened onsite to provide a thermal coal product for sale.*
- *Water management structures: where possible water diversions will direct runoff water away from the mine workings and mine impacted water will be directed to water management structures for treatment prior to be being released to the environment.*
- *Use of existing highway roads to a train load-out: product coal from the mine will be hauled to an existing train loading facility on existing roads and highway.*

Primary construction phase activities will include:

- *Completion of engineering studies and environmental approvals processes*
- *Procurement and movement of construction materials and mining equipment to identified laydown areas*
- *Establishment of site drainage and water management structures*
- *Construction of associated buildings, facilities and access roads*
- *Initiation of contour mine development: timber clearing, cover soil salvage and overburden removal*

Operations phase activities are anticipated to include:

- *Overburden removal to expose the coal seam and coal mining from the contour mine and highwall augering*
- *Coal stockpiling, crushing, screening and hauling to the train loadout facility*
- *Progressive mine reclamation*
- *Ongoing environmental management*

Decommissioning phase activities will include reclamation of the remaining mine disturbances and closure and removal of mine infrastructure. Ongoing environmental monitoring and site management will occur as needed after decommissioning activities are complete.

A preliminary schedule for the Project has the construction phase commencing in the second quarter of 2015 (after completion of the Federal and Provincial EA processes). The operation and production phases are planned to start in the end of the second quarter of 2015 and continue for the 10 to 14 year mine life. Closure and decommissioning is anticipated to begin in 2025 at the earliest.

Several aspects of the Project are anticipated to require completion of the British Columbia provincial EA process coordinated by the British Columbia Environmental Assessment Office ("BCEAO"). Part 3 of the *Reviewable Projects Regulation* under the *BC Environmental Assessment Act* identifies new coal mining facilities with a production capacity ≥250,000 tonnes/year (clean coal or raw coal) as requiring an environmental assessment certificate. The project proposes a production level of 1.0 to 1.5 million tonnes of raw coal per year and is therefore expected to be subject to a BC environmental assessment.

The project may require completion of a Federal Environmental Assessment ("EA"), pursuant to the Canadian Environmental Assessment Act, 2012 ("CEAA"). Under the CEAA (paragraph *84(3)*) the *Regulations Designating Physical Activities* identifies "*the construction, operation, decommissioning and abandonment of a coal mine with a coal production capacity of 3,000 tonne per day or more"* as a type of project that may be subject to a federal environmental assessment. The proposed Project will produce between 2,700 and 4,000 tonne per day and have an estimated annual groundwater extraction rate of 30,000 to 50,000 m^3. If the CEAA determines that a Federal EA is required, the Project Description will be used to develop Environmental Impact Statement Guidelines, which defines the scope of the Federal EA. The proposed Project is not within a region that has been the subject of federal regional environmental studies.

It is fully expected that the same body of information will be used to inform both the Provincial and Federal EA processes. Where possible, consultation activities pursuant to both processes will be coordinated and used to inform both EA processes.

Local Communities Proximate to the Project (Figure ES-3)

Aboriginal Groups

Although the proposed Project footprint does not overlap with any Indian Reserves, there are five Aboriginal groups in the Project region which are expected to have an interest in the Project going forward. The proposed Project site falls within the Treaty 8 Region. Initial consultation efforts have commenced with the four identified First Nations, including discussion on draft Protocol Agreements.

- Halfway River First Nation – community located 160km northwest of the Project

- Saulteau First Nations – community located 80km northwest of the Project
- West Moberly First Nations – community located 80km northwest of the Project
- McLeod Lake Indian Band – community located 150km southwest of the Project

Municipalities

There are a number of local municipalities which are expected to have an interest in the Project, including:

- Tumbler Ridge – located 35km south of the Project
- Dawson Creek – located 55km north of the Project
- Kelly Lake – located 50km east of the Project
- Chetwynd – located 60km northwest of the Project

Permanent residences associated with agricultural activity are located 25 kilometres north of the Project area.

Mineral Title and Land

The Project property includes a total of 31 Coal Licences - 30 are currently held by Hillsborough (owner number 137113) and one is under application by Hillsborough. Together, the 31 Coal Licences cover a total of 22,512 hectares (Figure ES-2).

Project Rationale

The Project will involve the development and operation of a thermal coal mine. Demand for thermal coal is growing to support industrialization and power generation in countries such as China, Korea, Japan and India. Meanwhile new technologies are providing more cost-effective solutions for cleaner emissions from coal-fired power plants, which could expand markets for this coal. The expected market for the Project coal will be export markets in Asia, shipped through the Ridley Terminal in Prince Rupert, B.C.

Resource Estimate

The measured plus indicated reserves total 80,108,000 tonnes with an additional inferred resource of 35,246,000 tonnes.

Capital Cost and Taxation

The Pre-Feasibility Study completed in 2012 estimated the initial capital cost for the Project at CAN $35 million. The Project will contribute to the BC and Federal Government by way of corporate taxes, provincial net proceeds and net revenue taxes, mineral taxes, sales taxes, income taxes and employment taxes.

Mining Method

The proposed mining method for the Project is a combination of contour mining and highwall auger mining. The contour mining involves mining to either an economic cut-off based on the thicknesses of the coal seam and overlying overburden and mining costs or to a minimum bench width of 30m (to allow sufficient room for the highwall-augering equipment). The coal reserve for the contour mining portion of the plan is 6.4 million tonnes. The mining reserves for the highwall-auger portion of the plan is a function of the depth that the auger will operate to and the spacing of the auger holes to provide a stable roof. The coal reserve for the highwall-auger portion of the plan is 6.6 million tonnes.

The contour mining operation has a total footprint of about 325 hectares over the planned 10 to 14 year life of the mining operation. The surface disturbance from the contour mining will be temporary, with reclamation advancing with the mining as it progresses along the contour. The active mining area will have a footprint of about 20 hectares at any one time. An additional temporary disturbance of 80 ha for surface facilities and temporary site roads will be required.

Explosives are not expected to be required either for removal of overburden or coal mining.

The proposed plan is to produce a raw coal product, with the only beneficiation being crushing and screening to remove oversize parting and dilution from mining. This eliminates the production of tailings (typically associated with wet processing) and the need for a tailings management plan. Parting and coal rejects from the crushing and screening operation will be backfilled in mine out contour benches as part of the reclamation.

Reclamation and Closure

The proposed mining method lends itself to progressive reclamation due to the progression of the contour bench development and associated backfilling following the highwall-augering coal removal. Once backfilled and recontoured the completed benches will be planted. Progressive reclamation will minimize the active mining footprint, limiting the area exposed to possible erosion and impact on water quality.

The projected end land use is forage and shelter for wildlife and commercial forestry with potential for recreation and traditional and cultural use. End land use objectives will be discussed through consultation as the Project moves through the environmental certificate application process.

Access

The existing Provincial Highway 52 and the Moore Forest Service Road (FSR) will serve as the access to and from the mine for personnel, supplies and coal product transport. These roads will be used for all phases of the project (construction, operation, decommissioning and abandonment) and are permanent structures.

Water Management

Water management structures for the mining operations, coal handling and storage site and shop, warehouse and office site will be engineered containment structures designed to collect and treat runoff affected by the disturbance areas. Combined, these structures will cover an area of about 1 hectare and will be reclaimed following mining activity. A water balance (natural inputs, mine use and outputs) and water management plan will be developed for the Environmental Assessment application based on the project design. With the contour mining located at the height of land and well above and away from the major drainages (Salt Creek and Jackpine Creek), it is expected that there will be minimal groundwater and surface water to manage. To the extent practical, surface water not impacted by mining activity will be diverted around active workings through ditches, culverts and pipes. Mining impacted waters will be routed to engineered sediment ponds prior to discharge into the natural drainage system. Minimal, if any, groundwater is expected to seep onto the contour bench from the highwall or coal seam.

Water Supply

Water demands for the mine (potable water, dust suppression, equipment cleaning and fire protection) will be met with well(s) drilled near the site facilities area. The estimated annual groundwater extraction rate is 30,000 to 50,000 m^3. Bottled potable water will be supplied if well water is not suitable or adequate.

Fuel and Liquid Storage and Handling

Requirements for fuel and lubricant storage and handling will include diesel for generators and mine equipment, oil, lubricants, antifreeze and coolants for mine equipment. All storage and dispensing locations will be designed and constructed with secondary containment and in accordance with applicable regulations.

Waste Generation

Anticipated management plans for the gaseous, liquid, solid, or hazardous wastes that will be generated by the proposed Project are tabulated below.

Waste Type	Management Plan
Dust generated by mining activity and vehicle movement	• Watering unsurfaced roads and coal stockpiles. • Covers on highway coal trucks
Exhaust (GHG) from diesel fuel consumption	• Diesel equipment will meet required emission standards (currently Canadian Tier 4 standard)
Mine site water	• Water in contact with mine workings will be collected and directed to a settling pond
Domestic sewage	• Treated on site with a rotating biological reactor
Mine solid waste (topsoil and overburden)	• Through the progressive reclamation plan will be placed back into the mined out areas.
Domestic solid waste	• Evaluate potential for reuse or recycling • Incinerate if suitable • Landfill bulk inert waste
Hazardous wastes (waste petroleum products, glycol, batteries)	• Store in appropriate temporary storage areas and remove from site for recycling or disposal as per regulations

Power

Power will be supplied by diesel generators as there is no power transmission line within reasonable distance to the Project site. Alternate, economically viable means of power supply will be investigated.

Offsite Facilities

Offsite facilities will include shared use of a coal storage and train load-out facility with another coal producer in the area. Discussions are underway towards reaching such an agreement.

Staff Accommodations

Staff needed for construction and operations are expected to live in Tumbler Ridge or Dawson Creek.

Project Alternatives

Potential Project alternatives at this early planning stage include:

- mining method: contour, open pit and dragline mining with contour mining being the base case
- highwall mining: auger and surface highwall mining with auger mining being the base case
- coal processing: non-washed and washed or partially washed thermal coal with non-washed product being the base case
- offsite rail load out: Peace River Coal Trend mine load out and Teck Coal Bullmoose load out with either being the base case at the time of writing of this document

Assessment of alternatives will involve discussion with First Nations, provincial and federal regulators and interested third parties.

Geology

The region is underlain by Upper Cretaceous rock formations hosting what is referred to as the Wapiti Coal Seam. All of the overburden mined to expose the coal seam on the contour benches is non-marine in origin and generally sandstone. An erosion-resistant sandstone forms the floor of the contour bench. The Wapiti Coal Seam consists of an upper ply and lower ply of coal separated by a parting of variable thickness.

Coal Quality

The Wapiti Coal Seam is classified as a sub-bituminous A to high volatile C bituminous coal (beyond the oxidation limit). The coal sampling and quality analysis work done in conjunction with the exploration drilling indicates this coal to be suitable for thermal power generation. Coal sampling was also done for washability. The results of these tests indicate that the coal has difficult washability characteristics and significant yield losses could be expected from a wet process coal preparation plant. For this reason the coal is being considered for use as a raw, run of mine product. Production of a raw, run of mine product eliminates the production of fine tailings and coarse rejects.

Geochemistry

The geochemistry and potential for acid rock drainage (ARD) and metal leaching (ML) has been characterized for the strata found at the Project coal deposit. Static testing, laboratory kinetic tests and field leaching studies were conducted on samples collected from the exploration drill holes. Samples were collected from the overlying rock formation, the coal seam and the rock that lies immediately below the coal seam (although little to no mining of this rock is anticipated). Generally, the relative position to the coal seam appears to be the most important factor regarding the acid generating potential of the strata.

The strata overlying the coal seam, which represents most of the material to be mined, are predominately non-PAG. In contrast, 90% and 100% of the samples from the footwall rock and coal seam respectively were found to be PAG. Due to its greater stratigraphic thickness, the majority of the waste rock (>98%) from mining activity is expected to be derived from the non-PAG overburden.

Terrain, Soils and Surficial Geology

The Project leases occur on two headlands (Figures ES-4 and ES-5) which are characterized by slightly undulating topography composed primarily of variable thickness cordilleran till capping the local carbonaceous sandstones and shales. A discontinuous thin veneer of eolian material commonly overlies the local till on these headlands. U-shaped valleys with steep slopes separate the headlands; valley bottoms are level to very gently sloping with evidence of preserved post-glacial lacustrine deposits and widespread accumulation of organic material. Jackpine East and Jackpine West Creeks drain from the upland headlands into the valley bottoms where they form shallow misfit floodplains.

Climate

The climate of the Project site area is continental subhumid, characterized by dry summers and cold winters and fairly low annual precipitation. Throughout the area, the mean annual temperature is 3°C, varying from -10.7°C in January to 15.5°C in July. Monthly average precipitation varies throughout the year with the wettest month being July while the driest month is February. The annual precipitation totals about 44.7 cm and snowfall is 169.6 cm. Monthly average wind speeds stay relatively constant around 8.2 km/h blowing from the southwest.

An automated UT30 Weather Station supplied by Campbell Scientific (Canada) Corp. was established in late August 2010 at the Project site; siting, construction and operation of the station follow relevant guidelines and regulations.

Air Quality

The Project area has no long-term publically available air quality monitoring data other than for the city of Fort St. John and Taylor which are not representative of undeveloped areas. Spot data collected over a short time period provides an order of magnitude estimate of background concentrations of criteria air contaminants (CACs), as defined by Environment

Canada and BC Ministry of Environment. Of interest for the Project are particulate matter (TSP, PM_{10}, $PM_{2.5}$), nitrogen gases (NOx), sulphur gases (SOx), and carbon monoxide.

Site investigation involved direct, real-time continuous measurement of particulate matter concentrations in two 36-hour sessions in August 2011 using DustTrak Aerosol Monitor 8533 DRX. The monitoring site was by the Project weather station located within the boundaries of the Project. Baseline sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO) concentrations for the proposed mine site are expected to be similar to those from a relatively uncontaminated and remote undisturbed location in northern Canada. Regional averages of gaseous CACs were assumed to apply to the Project site.

Concentrations of particulates measured were all very low:

- $PM_{2.5}$: 2 µg/m^3
- PM_{10}: 4 µg/m^3
- TSP: 5 µg/m^3

No nearby background published data for NOx or SOx was available. Environment Canada's range for CO in unpolluted air is 29 to 115 µg/m^3.

Noise

Baseline noise surveys were conducted in the Project area in August 2011. Daytime sound pressure level averaged 28 dBA and night time 26.6 dBA.

Vegetation

Vegetation surveys were conducted on the Project site during June through to August 2011. Activities included terrestrial ecosystem mapping (TEM) field vegetation typing, rare plant and invasive plant surveys and plant tissue collections for background metals levels. Rare plant surveys confirmed the presence of one provincially Blue-Listed Species, western Jacob's ladder. No invasive plant species were recorded. TEM and plant metals results will be discussed in the baseline report prepared for the environmental certificate application (EIA).

Wildlife

Wildlife surveys included: amphibians and reptiles, raptors, terrestrial birds, mammals including bats, furbearers, and ungulates.

The amphibian and reptile surveys focused on the western toad, however, any amphibian and reptiles identified were recorded. Amphibians located were well away from any areas that will be directly disturbed by mining. Mining activities will be on hillsides and to a limited extend on the plateau above Jackpine Creek.

Raptor information for the 2011 field season was collected through call playback surveys and incidental observations. Objectives were to assess the presence and distribution of raptor species in the project footprint and buffer. No nests of any raptors were confirmed in

the project footprint and buffer. Raptors recorded included Barred Owl, Red-tailed Hawk, Cooper's Hawk, Sharp-shinned Hawk and American Kestrel.

Thirty-seven point counts were established through the LSA during the 2011 field season and a diversity of terrestrial bird species recorded. A total of 302 detections of 47 species were made. One hundred thirty five detections of 27 species were recorded during the July surveys. Four species of conservation concern were recorded during the 2011 season. These included Olive-side Flycatcher, Black-throated Green Warbler, and Barn Swallow.

Bird feathers were collected to assess metals accumulation; many metals were undetectable due to low sample sizes. Selenium was below detectable levels in all specimens.

Acoustic bat surveys utilized an Anabat™ detector to record bat calls within the area surrounding the bat detector. During the July surveys, five detections occurred on each of the two nights.

The purposes of the ungulate overview assessment were to identify important wildlife values in the proposed mine site RSA along the branches of the LSA and around Muskeg Creek. Specifically, the overview was conducted to identify any winter wildlife use of the study area by ungulate species (i.e., deer and moose), furbearers and to identify any critical wintering habitats that may be impacted by the Project. The study confirmed five species using the area that consist of Moose, Black-tailed Deer, Lynx, Snowshoe Hare and Wolf. The most frequently encountered ungulate species was moose.

Hydrology

The Project site is located just east of the drainage divide between the Murray River on the west and the Kiskatinaw River on the east (Figure ES-4). Both rivers drain to the Arctic. Six continuously recording water level stations were established at various times commencing mid-July 2010 on Jackpine and Salt creeks and the West Kiskatinaw River. One atmospheric pressure recorder was established near one of the stations. Spot discharges were obtained from monthly discharge measurements obtained by wading a cross section of streams at the hydrology stations. This will allow establishment of a relationship between continuous water levels recorded by the dataloggers and stream flows. These hydrology data will be used to assist in interpreting water quality and aquatic habitat data and for predicting possible effects of mining on both quality and quantity of water in potentially affected water bodies.

Hydrogeology

Nine monitoring wells were installed by CH2M Hill in 2006. In 2010 and 2011 Hillsborough installed 20 additional wells. Three of the CH2M Hill wells were reactivated and the ground water monitoring network now consists of 23 wells. Monitoring includes levels and quality.

Groundwater levels mimic topographic relief. Hydraulic conductivity was found to decrease with depth, i.e., groundwater moved more slowly the deeper the readings were taken. Groundwater flow is dominated by downward vertical gradients through the block.

Recharge generally occurs on the upper surface of the blocks with discharge occurring either as springs along the edges or at the base of the blocks where artesian conditions were observed. Ultimately groundwater from the three resource blocks will report to Jackpine Creek, Muskeg Creek or Salt Creek, contributing to the base flow component of these streams.

Groundwater sampled from wells screened in the coal seam and overlying rock formation on both the Heritage and Centre blocks (recharge zones) are dominantly Calcium – Bicarbonate type water. Groundwater sampled from wells screened in the underlying rock formations and associated with artesian flow are dominantly Calcium – Sulfate type water. Groundwater from the lower Chungo lying below the coal seam is intermediary between Calcium-Bicarbonate type water and Calcium – Sulfate type water. Cadmium, cobalt, iron, manganese, sulphate, and zinc were measured to be above BC water quality guidelines for the protection of aquatic life. Selenium slightly exceeded the 2 µg/L aquatic life guideline in two wells.

Surface Water Quality

Surface water runoff from the Project area reports primarily to Jackpine Creek. Muskeg Lake is located 2 km west of the southern tip of the Heritage Block, and also receives runoff from the southern end of the Heritage Block. Surface water quality monitoring was carried out in 2005 and 2006 in support of the proposed Wapiti Power Development by AESWapiti Energy. Monitoring was initiated in support of the Project in July 2010 and is ongoing. The locations provide baseline information for Jackpine Creek from its headwaters just downstream of the Centre Block to its mouth at the Kiskatinaw River, Salt Creek upstream and downstream of the Project area, Muskeg Creek, the West Kiskatinaw River, as well as the Teepee Creek reference stream. Samples were collected monthly, as well as weekly during spring freshet seasons of 2011 and 2012.

Water quality in Jackpine Creek is highly influenced by spring freshet and storm events. During winter low flow periods, Jackpine Creek is characterized by a high level of total dissolved solids (TDS) and related parameters such as conductivity and hardness. All dissolved metals in Jackpine Creek, Muskeg Creek, and West Kiskatinaw River were below WQGs, which apply to total metals. Many total metal levels were above their WQG during turbid flow conditions (As, Cd, Cr, Cu, Fe, Hg, and Zn). This is related to metals associated with suspended sediments, which are elevated during high flow periods. During clear flow periods all metals are below their WQGs.

Sediment Quality

Depositional zones, where fine grain sediments accumulate, are created by the numerous beaver dams on Jackpine, Salt, and Teepee Creek. The location of these change as dams get washed away during floods, as occurred in 2011, and rebuilt. Jackpine Creek, below the Project area, is a low gradient stream with muddy stream bed and relatively little gravel and cobble size material. The West Kiskatinaw River bed is primarily composed of gravel/cobble/boulder sized material, with few depositional zones. Salt Creek stream bed is similar to the West Kiskatinaw, with primarily rock substrate. Sediment quality samples were

collected in August 2010 and August 2011 at the same locations as water quality samples. Fine grained sediments were collected from depositional zones. Metals were analyzed on the <63 µm fraction.

Fish and Fish Habitat

Fish, fish habitat, tissue metal burdens and lower trophic work have been conducted for a variety of purposes since the 1970s. Rationale for studies has been associated with forestry, oil and gas and since 2005 for the Project. A multi-season, multi-year collection of aquatic data has been compiled to characterize baseline conditions. Fish habitat for sport fish and other species in Jackpine Creek progressively declines upstream.

Lake chub and suckers were the only fish captured upstream of Muskeg Creek; the stream is low gradient (<1%) and high in fine sediment and organics. The upper reaches of Jackpine Creek (Figure ES-4) where it branches into two tributaries were found to be non-fish-bearing. Highest species diversity over multiple years of sampling is in the lower reaches of Jackpine Creek (beyond the Project footprint), and includes Arctic grayling and rainbow trout.

Salt Creek, situated west and south of the Project footprint, contains a 20 m high waterfall which constitutes a fish barrier 5 km upstream of the Murray River. Fish present in the lower reaches are potentially a combination of resident and migratory fish from the Murray River. Below the barrier (approximately 8km from the project site) to fish passage in Salt Creek bull trout, burbot, mountain whitefish, slimy sculpin, white sucker, brook trout, lake chub, longnose sucker and rainbow trout have been captured. Upstream of the barrier only white sucker have been captured across all years of sampling.

Lower trophic communities, benthic macro invertebrates (BMI) and periphyton, were sampled in 2006 and 2011. Sampling was limited by substrate variances and suitability sampling methods were modified accordingly.

Selenium in fish tissue sampled in 2006 exceeded the BC interim guideline for total selenium in tissue of 1ug/g wwt at Salt Creek reach 1 and Jackpine Creek reach 5. Slimy sculpin and lake chub were sampled at these sites respectively with the maximum recorded concentration of 1.36 µg/g wwt. White sucker sampled in Salt Creek in reach 4 and 7 did not have total selenium concentrations above 0.6 µg/g wwt. No other exceedances were observed in algae or BMI although BMI tissue from Salt Creek reach 5 did have a selenium concentration of 0.92 µg/g wwt. Selenium concentrations from fish sampled in 2011 indicated similar patterns to the 2006 results.

Socio-Economics

The Project site is situated in northeast British Columbia close to the Municipal District of Tumbler Ridge. This area is sparsely populated.

The socio-economic regional study area (SRSA) selected for this assessment consists of those urban and rural communities that are most likely to provide the manpower, goods and

services needed to construct and operate the mine and/or that will be directly or indirectly affected by mine construction or operation.

The boundary of the SRSA was also chosen to reflect the statistical reporting units used by Statistics Canada and the Government of British Columbia. The Statistics Canada reporting units in this region include only three communities and two RDEAs:

- Urban communities (City of Dawson Creek, District Municipality of Tumbler Ridge, District Municipality of Chetwynd);
- RDEAs (Peace River D, Peace River E).

There are two Aboriginal groups with interests in the SRSA (Saulteau First Nations, East Moberly Lake 169 reserve; and West Moberly First Nations, West Moberly Lake 168A reserve).

In 2006, the population of the SRSA was 25,187 people, which is an increase of 2.5% from 2001. About 64% of the regional population lived in the communities of Dawson Creek, Tumbler Ridge and Chetwynd, while 23% lived in rural areas and the balance in smaller communities. Dawson Creek is the largest community in the region, with a population of 10,995 in 2006. Next in size is Chetwynd (2,633 residents in 2006), followed by Tumbler Ridge (2,454 residents in 2006). The rural areas include Peace River, which had a combined population of 8,780 in 2006. In 2006 approximately 22% of the SRSA population was Aboriginal, with 325 living on reserves and 2,874 living off reserves. The reserves in the region include East Moberly Lake 169 and West Moberly Lake 168A.

In 2006, just over one-third of the regions workforce was employed in primary industries which include the agriculture and resource-based, manufacturing and construction industries. In recent years, the regional economy has been evolving through the development of more value-added processing of resources and the expansion of tourism and eco-tourism. The resource-based industry employs 18.6% of those working in the region. This includes extensive agriculture, forestry and mining as well as oil and gas exploration and development.

Approximately 75.6% of the homes in the SRSA were privately owned. In Dawson Creek, 34.2% of housing was rented. In Tumbler Ridge 81.3% of housing was owner occupied and 18.7% was rented. About 61.5% of the Aboriginal off-reserve population owned their homes. Housing has been an issue in the SRSA, especially in Tumbler Ridge.

In Dawson Creek, potable water is currently being drawn from the Kiskatinaw River, but the new proposed reclaimed water plant will treat effluent currently being released into the Dawson Creek and be reclaimed for industrial purposes, which may reduce the amount drawn from the Kiskatinaw. In Tumbler Ridge, potable water is drawn primarily from wells.

Dawson Creek is fully equipped with medical facilities, including a number of health centres and a hospital that serves Dawson Creek and the surrounding area. Tumbler Ridge has a health centre equipped with an emergency department and the facilities needed to stabilize patients before transfer to a hospital.

In the SRSA, the communities of Dawson Creek and Tumbler Ridge are governed by an elected council comprised of a mayor and six members. In the Peace River Regional District, there is a common board chairperson and each district has a director. In the Aboriginal community of West Moberly Lake 168A, a chief and four council members govern the community.

Land Use

The footprint of the proposed Project contains no water lots and does not overlap with any private or federal Crown land. The nearest Federal land area is Jasper National Park, approximately 300km to the southeast.

The area surrounding the Project study area is a combination of provincial Crown lands and private lands that are managed by a variety of land use policies, plans and regulations. They include the Dawson Creek Land and Resource Management Plan (LRMP), the Peace River Regional District Rural Official Community Plan and the *Agricultural Land Commission Act* relating to the Agricultural Land Reserve (ALR).

There are no parks or protected areas proximate to the Project area. The exact extent of recreational activity is not known in the areas within and adjacent to the Project Area because recreationists are not required to register their activities, but it is evident that recreational opportunities and areas are plentiful for summer, winter and water-related activities. Recreational areas in the LSA include the Paradise Valley trail that generally runs in a north-south direction primarily in the western half of the LSA, Muskeg Lake (privately

owned), Muskeg Creek, Murray River and Muskeg Lake Trail. In the RSA recreational areas include Murray River Canyon Overlook, Teepee Falls, Bearhole Lake Trail and Wasp Lake Trail. There are no designated trails that cross the Project deposit.

One guide-outfitter's territory (British Columbia *Wildlife Act* Management Unit) covers the Project deposit, but the territory is 533,672 ha and the projected mining area is a very small percentage of this territory. Forest harvesting has been actively carried out in the general area, including the portions of the planned mining footprint and thus industrial disturbance pre-dates the Project. Hunting for large mammals (moose, deer, bears, carnivores) and birds is allowed in the general area of the project under BC hunting regulations. The extent of hunting in the Project area is not known.

There are no natural gas or oil wells directly on the Heritage or Centre Blocks. However a natural gas pipeline constructed by Encana Corporation crosses the northern part of the Heritage Block.

There are four operating coal mines in the northeast BC region and several projects that have active extensive exploration ($1 to $3 million based on Ministry of Energy and Mines [MEM] statistics). Teck has two closed mines, one of which has potential to reopen (Quintette).

There are no Federal lands within the proximity of the Project and the Project will not change the environment on Federal lands outside of British Columbia.

Archaeology

An archaeological overview assessment (AOA) was completed in 2006 (CH2M Hill 2006). Nearly all of the commercially valuable timber has been logged from the immediate Project area and there are consequently few undisturbed areas. The AOA identified two sites well away from the proposed mine footprint: a culturally modified tree 4.9 km southeast, and surface lithics 5.4 km southeast.

An archaeological impact assessment (AIA) of the proposed surface disturbance area for contour mining was conducted in 2011 and no artefacts were found. Upon finalizing the precise location for additional infrastructure, a further assessment will be undertaken.

Effects Assessment

Comprehensive environmental, social and economic effects assessments will be conducted as part of the Application process. This Project Description document provides an overview of potential effects that could result from Project development.

Particulate Matter

It is anticipated that the Project will generate a small amount of particulate matter from surface operations. Generation of suspended particulate matter is not expected to be significant from transport of coal by truck since transport will be largely on paved roads and coal trucks will be covered or coal sprayed with a tackifier. Air quality modelling will be

conducted to predict levels of air contaminants and to identify where mitigation will be required. Gaseous pollutants will be generated by fixed and mobile internal combustion engines both on the mine property and in transporting the coal to rail loadout south or west of Tumbler Ridge. The main sources on the mine site will be diesel powered generators (assuming alternate sources such as wind power are not available or are not cost competitive).

Noise

During construction, there will be heightened activity at the mine site and access road corridors from heavy machinery and vehicle movements, diesel generators, erection of plant building, and process equipment installation. During operations noise generation will be reduced; the principal sources will be earth moving equipment during construction and reclamation of contour benches, limited noise from the highwall-auger miner (whose moving parts will be mostly underground and therefore muffled), and raw and finished coal haul trucks.

An inventory of noise sources by type and location will be made and noise levels modelled to predict impacts on human and wildlife receptors. Mitigation will be in the form of best management practices and engineered sound reduction devices such as mufflers, baffles, etc. to the extent practical.

ARD/ML

Disturbance of geologic materials during mine activities will result in increased exposure of rock surfaces, which increases the ML/ARD potential post mining relative to the present undisturbed condition. Possible sources of ML/ARD include runoff and seepage from the contour bench floor, waste rock and coarse reject. Mitigation of acid rock drainage will be undertaken during operations to prevent acidic waters from emanating from the major mine facilities. The primary mitigation method is the overall design of the mine that limits the volume of waste rock produced and progressive reclamation that limits the extent of exposed highwall surfaces at any one point in time.

Terrain, Soils and Surficial Geology

Till and overburden will be removed in creating the contour benches for operation of the highwall-auger miner. Soils will be stockpiled for reclamation purposes and redistributed once a bench segment is reclaimed. Soil rehandling will be minimized to mitigate soil degradation from that source.

Soil contamination is a potential at industrial sites including mines. A diesel fuel spill is seen as the mostly likely cause of soil contamination. Storage of fuel and fuelling of vehicles will be localized to reduce the areas where soil contamination could occur. The fuel farm will be bermed and any tanks outside the fuel farm will be double walled with leak detection.

Vegetation

Construction and operation of the mine will require removal of vegetation. However, the proposed mine site is an area of active logging and thus much disturbance has occurred and will continue to occur in the area. The mining method (previously described) will minimize disturbance and vegetation removal and shorten the length of time before reclamation and revegetation of bench areas can commence.

Wildlife

Changes to wildlife (including migratory birds) habitat and its associated use by wildlife may result from the removal of habitat during construction and the reclamation of habitat during post-closure. Direct effects occur in areas where habitat is lost, and indirectly in areas immediately adjacent, where wildlife use patterns may change in response to a habitat edge, and greater proximity to disturbance. Reclamation will restore habitat as much as possible.

Specific changes to migratory bird habitat could include the direct loss of nesting areas resulting from site logging and clearing or indirect physical and biological changes to habitat (noise, surface water flow or level changes, and air, water, sediment and soil quality) resulting from the proposed project. Mitigations and windows for clearing and construction activities will follow the protection of migratory birds as per the *Migratory Birds Convention Act 1994*. Potential effects associated with altered habitat will be investigated and addressed in the environmental impact assessment.

The project is off the migratory path of caribou so disruption of movement is not expected to be a concern.

Hydrology

Neither Jackpine Creek nor Salt Creek will require diversion as a result of mining. Runoff from contact areas will need to be treated, at least by removal of suspended sediment, before discharge. A certain amount of this water will be lost due to evaporation or be used as a water source for mining and/or processing operations. Groundwater that could otherwise recharge in Jackpine Creek could be intersected by mine workings and require treatment prior to discharge to the creek. As part of the effects assessment and for water management purposes a detailed water balance will be developed as part of mine design engineering. The water balance model outputs will be used to predict effects on water quantity through the various phases of mining and suggest possible design changes to minimize identified potential impacts. This information will identify the amount of water required and suggest possible practical sources, be they ground or surface water.

Surface Water Quality

Water that is in contact with mine components, including the contour bench floor, waste rock, and coarse reject, has the potential to carry elevated levels of contaminants to receiving environment streams. Mine contact water may potentially affect receiving water quality due to ML/ARD. Water quality may also be affected by increased sediment loads from roads and cleared areas leading to elevated total suspended sediment (TSS) levels.

Settling ponds will be constructed to reduce TSS levels in water prior to discharging to the receiving environment. A water quality monitoring program during construction and operation will be implemented in order to identify changes to water quality due to mining activities. A selenium monitoring program will be implemented that includes monitoring selenium levels in tissues of biota in contact with water in the LSA. The monitoring program will allow additional mitigation measures, such as water management or treatment, to be triggered if necessary.

Hydrogeology

Potential effects on groundwater in the project area may be produced by both contour mine operations and coal coring. Groundwater quality may also be affected by the influence of ML/ARD on waters seeping through the mine area. Mining operations will likely result in increased drainage from the perched aquifer in the sandstone overlying the coal seam. Mitigation through design is planned by limiting subsidence over the augered coal, thus limiting the potential for enhanced seepage.

Fisheries and Aquatics

Potential effects on fisheries and aquatics would be limited to changes in water quality caused by contact with mined materials and mine impacted water and flow reductions caused by use of water for mining activities and loss of ground water recharge.

The effect of water quality changes will be mitigated by water management plans that intercept and routes clean water around active areas and collects contact water to control

sediment release. The effect of flow reduction will be mitigated by not having a wet process for coal beneficiation.

The potential for and estimated magnitude of these possible changes will be the objective of hydrology, hydrogeology, water quality and aquatic effects assessments.

Land Use

The Project site has been actively logged. During mining certain areas will remain open which will affect tree rotation times on forest tenure managed licenses that overlap the proposed facilities.

One pipeline crosses the northern part of the Heritage Block and there are no gas wells on either the Heritage or Centre blocks. A number of oil and gas and/or forestry access roads cross the Project deposit. Consultation has occurred or is planned with other land users in the Project area.

There will be no land use conflicts with other mines since Hillsborough, by way of its extensive mineral claims and a mining lease once the mine is approved and permitted, will essentially preclude others mining in the immediate area.

The footprint of the proposed mine has limited recreational potential. There are no organized trails nor are there fish-bearing water bodies. Given the large size of the trapping and guiding territories that encompass the Project deposit and previous forestry and natural gas activities at the site, no issues are expected.

Visual Aesthetics

No facilities should be visible from the Heritage Highway (Highway 52). The area east of Highway 52 parallel to the Project deposit is classified as a scenic area and thus any changes in the viewscape from the highway may result in concerns and need to be addressed.

Archaeology

No artefacts were found on the contour mine area; an additional survey will be carried out on the other proposed surface facilities areas once selected.

Social, Health and Community Issues

There are a number of positive economic benefits, as well as some social impacts associated with the proposed Project. Overall, the Project is but one of several proposed and operating industrial activities in the Peace region and therefore in the context of regional development will not be the dominant factor in any issues that may arise as a result, except on a local scale. The Project will provide employment, training and business opportunities, pay royalties and taxes to government. However, there will be an influx of people to the area and housing is relatively short in Tumbler Ridge. The cumulative effect of the Project in

combination with other mining and oil and gas projects may pose challenges for municipal health and public safety services.

Sustainability

The underlying sustainability goal and Hillsborough corporate policy is to leave a legacy of trained people in the employment catchment area of the mine who will be able to shift to other mining or heavy industrial professions and trades once the Echo Hill Mine closes at the end of its 10 to 12 year mine life.

Cumulative Effects

A cumulative effects assessment will be carried out to include other past, present and reasonably foreseeable future projects that could reasonably be expected to interact temporarily or spatially with the proposed Echo Hill Project. The assessment will follow guidelines provided by both the federal and provincial environmental assessment agencies.

Aboriginal Group Engagement and Public Consultation

During the preparation of this Project Description document, the following Aboriginal groups were consulted with:

- *McLeod Lake Indian Band*
- *West Moberly First Nations*
- *Halfway River First Nation*
- *Saulteau First Nations*

Discussions with the First Nations to date have indicated the existence of environmental values of interest that are important considerations for the Project. Historical issues include archaeology, traditional use, and aboriginal rights and title related to environmental resources and quality (including water, land, vegetation and wildlife). Socio-economic considerations include topics such as employment and business opportunities. A summary of the potential effects on Aboriginal peoples of any changes to the environment resulting from the proposed Project are presented below.

Possible Impact	Potential Effect on Aboriginal Rights	Possible Mitigation
Changes to the environment: Potential impact to downstream aquatic habitat and water quality from sediment and effluent discharge and from the use of water resources for Project operation.	Could affect FN treaty rights to traditional food harvesting practices, including fishing and plant food harvesting.	Project design (including producing a non-washed product) will insure that a very limited amount of water will be used for operations. The Proponent is committed to developing a water management and monitoring plan for the Project prior to construction and

		operation,
Changes to the environment: Potential impacts to vegetation and wildlife that support subsistence hunting and traditional use caused by physical disturbances (logging, overburden and coal removal, road construction) on the Project footprint.	Could affect FN treaty rights to traditional food harvesting practices, including hunting, trapping and plant food harvesting. Could also result in the loss of structures or sites of historical, archaeological, paleontological, architectural or spiritual significance.	Impacts to wildlife and habitat on the Project footprint are reversible, with the significance of the impact mitigated by: • Highwall auger mining minimizes the overall disturbance footprint • Progressive reclamation will minimize the area of productive habitat lost at any given time during the life of the Project The Proponent is committed to developing a wildlife management and monitoring plan for the Project prior to construction and operation. No artifacts have been discovered in the archaeology impact assessment work done to-date.
Changes to the environment: Continued development in the area (coal mining, oil and gas activity and timber harvesting) having a cumulative impact on water, habitat, wildlife and terrain.	Could affect FN treaty rights to traditional food harvesting practices, including fishing, hunting, trapping, plant food harvesting and non-subsistence harvesting.	The Project design will minimize impacts and the progressive plan will insure the site is returned to productive habitat after decommissioning.
Social impacts: Training, employment and contracting opportunities during construction and operations		During the EA phase discussions will be held with Aboriginal groups to develop strategies for training and employment and contracting opportunities.
Traditional use: Loss of access to the Project area for hunting	Could affect FN treaty rights to traditional food harvesting practices, including hunting and trapping.	Through site visits and discussion on the final mine plan efforts will be made to minimize effects on access for traditional uses

Additional engagement, including TK/TLU studies, with Aboriginal groups will take place throughout the pre-application and application phases of the environmental assessment.

Hillsborough has initiated meetings with the Ministry of Environment and Fisheries and Oceans Canada, Prince George offices and with both BCEAO and CEAA offices to introduce the project and scope of baseline studies. A summary of consultations to date with public, regional government and municipal government stakeholders is tabulated below.

Stakeholder	Nature of Consultation	Results of Consultation
British Columbia Ministry of Environment	Meetings at the ministry office in Prince George and at the Project site	Recommendations relating to the baseline studies for the EIA: location of hydrometric stations, scope of aquatic studies
District of Tumbler Ridge	Meeting with the Mayor and administration to provide a Project overview	Points of interest noted as possible Project effects included truck traffic (in the vicinity of the community) associated with the coal haul to the train loadout, workforce size and sourcing and housing.
City of Dawson Creek	Meeting with the Mayor and administration to provide a Project overview	Points of interest noted as possible Project effects include impacts to water quality and quantity in the Kiskatinaw River (the cities drinking water source), workforce size and sourcing and housing.
Peace River Regional District	Meeting with District administration to provide a Project overview	Points of interest noted as possible Project effects included the possibility of having a campsite to house workers (there are no plans for a campsite).
Encana Corporation – holder of overlapping oil and gas tenures	Meeting to provide a Project overview and discuss possible development conflicts	Communications regarding development activities will be maintained, including mining activity in the vicinity of a pipeline and sharing baseline information.
West Fraser Mills Limited – holder of timber harvesting rights over portions of the Project area	Meeting to provide a Project overview and discuss possible development conflicts	Communications regarding development activities will be maintained.
Private woodlot owner - holder of timber harvesting rights over portions of the Project area	Meeting to provide a Project overview and discuss possible development conflicts	Communications regarding development activities will be maintained.

The general public and stakeholders will be consulted as the Project moves forward through the assessment process.

Reclamation Security

Section 10 of the provincial *Mines Act* stipulates that the Chief Inspector of Mines may, as a condition of issuing a permit, require that the mine owner provide monetary security for mine reclamation and to provide for protection of, and mitigation of damage to, watercourses and cultural heritage resources affected by the mine. Security will remain in effect until such time as the Chief Inspector of Mines determines that all reclamation obligations have been met and the Company can be indemnified.

Permits

A *Mines Act* permit will be required to commence construction. Any effluent discharge or point emissions will require *Environmental Management Act* permits. Under the one project one process guidelines, all major permit applications will be reviewed together and coordinated through the Prince George office of Ministry of Forests, Lands and Natural Resource Operations, although responsible ministries will issue permits and licenses.

Potential Federal permits, licences and authorizations required for the proposed project include:

- *Canadian Environmental Assessment Act* – CEA Act Approval
- *Radio Communications Act* – Radio Licence

There are no Federal lands that will be used for the purpose of carrying out the Project and no federal authorities will be providing financial support.

Summary

The Project will provide jobs and business opportunities to Aboriginal groups as well as other British Columbians and Canadians, and will provide royalties to the provincial government. The initial capital cost of the Project is estimated at CAN $35 million and the Project is anticipated to create 80 full time jobs during operations. The coal deposit can be mined in an environmentally responsible manner and, with proper closure (which is planned) will not leave a negative environmental legacy. The Project is unique in several key aspects and will result in a comparatively low environmental impact.

A mining method and mine plan has been developed that minimizes the disturbance footprint and allows for progressive reclamation. The mining method is referred to as contour mining with highwall augering. The contour mining takes advantage of the natural slope of the hillside and flat orientation of the coal seam to develop a bench along the contour of the hill (at the elevation of the coal subcrop) from which about 50% of the coal is released. The highwall-augering then recovers the balance of the mineable reserve by extracting coal from beyond the contour bench highwall without any further disturbance to the overlying ground surface. Once the highwall-auger mining is complete along a section

of highwall, the area is immediately backfilled to the approximate original ground surface, cover soil replaced and re-vegetation started.

1. There is no requirement for permanent overburden dumps for the mining method and plan described above.

2. No in-stream works or stream diversion will be required.

3. The mine will produce a non-washed coal product. By not having a wet-process coal preparation plant, water and electrical power requirements are reduced and the need for a tailings pond and coarse coal rejects dump is eliminated.

4. The mining area is outside of present day maps delineating core-caribou habitat.

The Project will contribute to the sustainability of the region by facilitating acquisition of job skills that can be used outside of mining or at other mining projects in the future. Project planning will focus on minimizing environmental impacts and returning the project area to pre-mining land form and use.

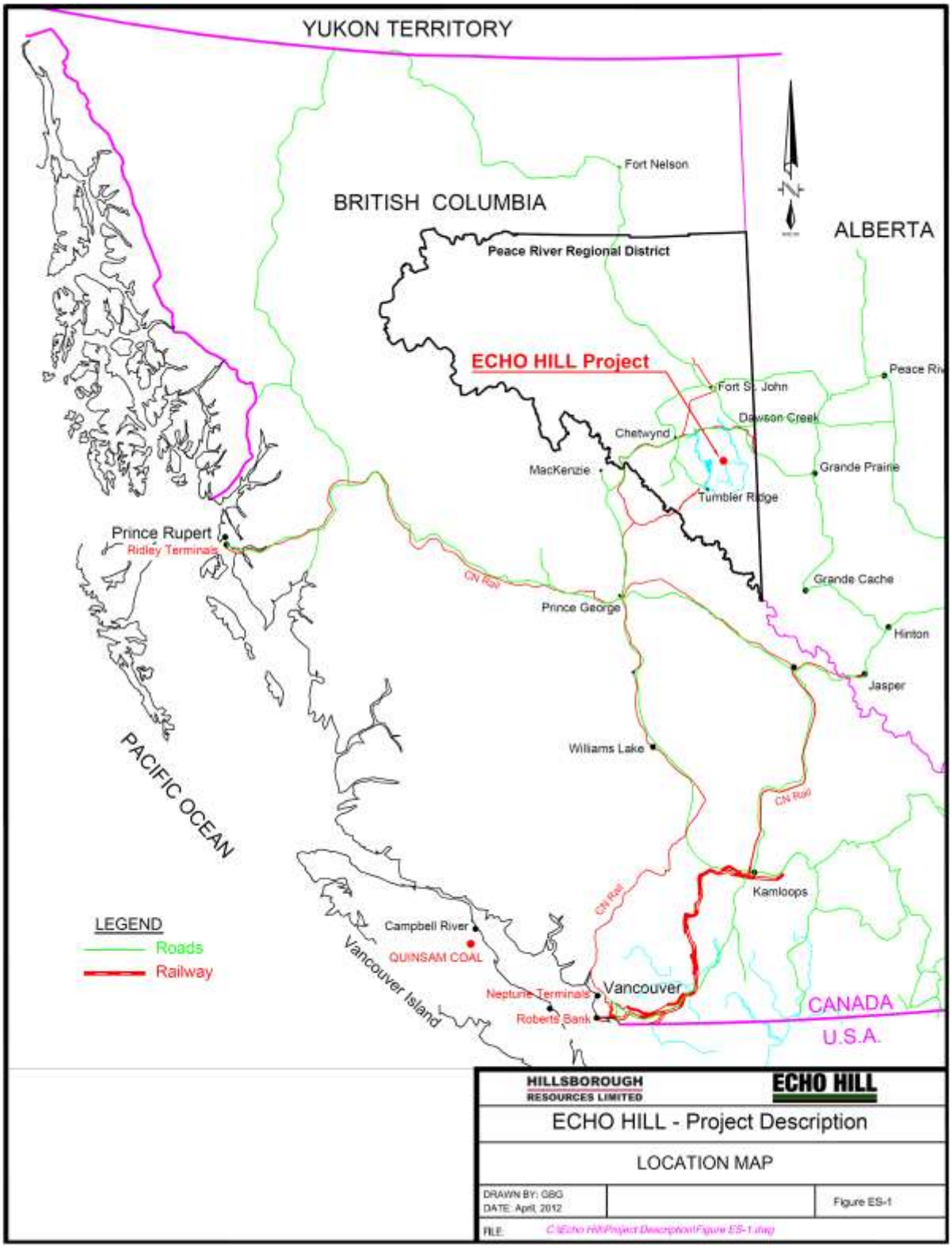

Figure ES-1: **ECHO HILL Location Map**

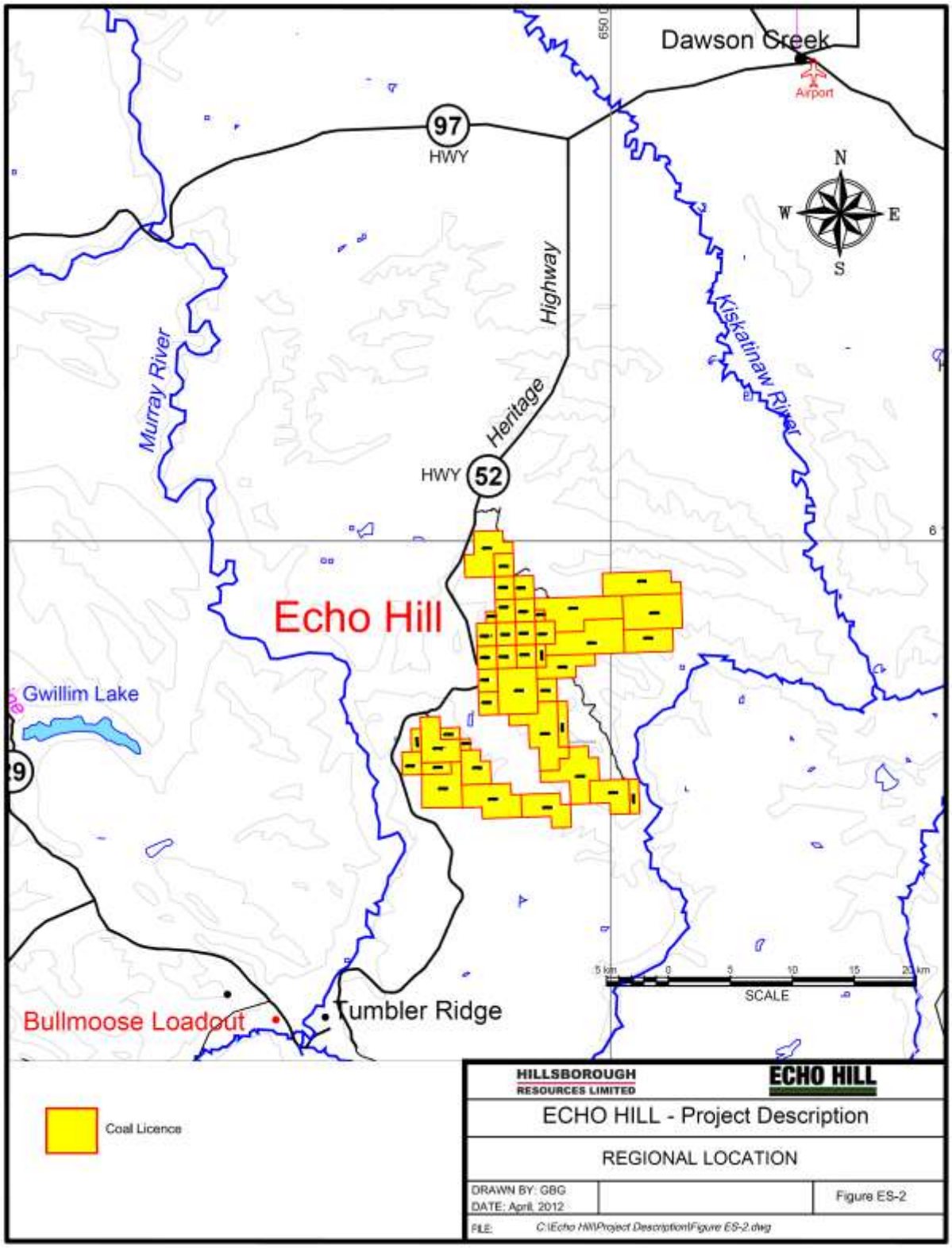

Figure ES-2: **ECHO HILL Regional Location**

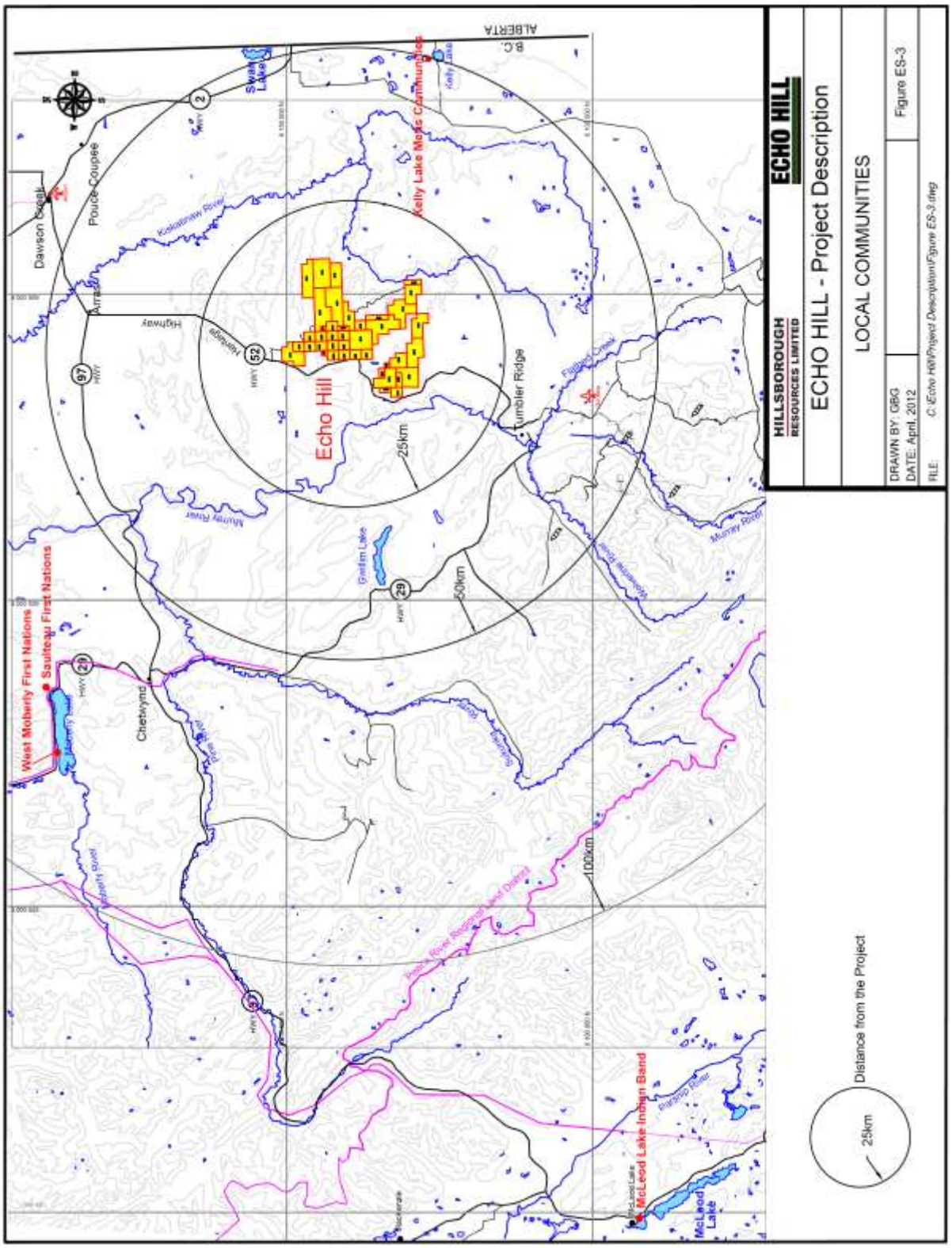

Figure ES-3: **ECHO HILL Local Communities**

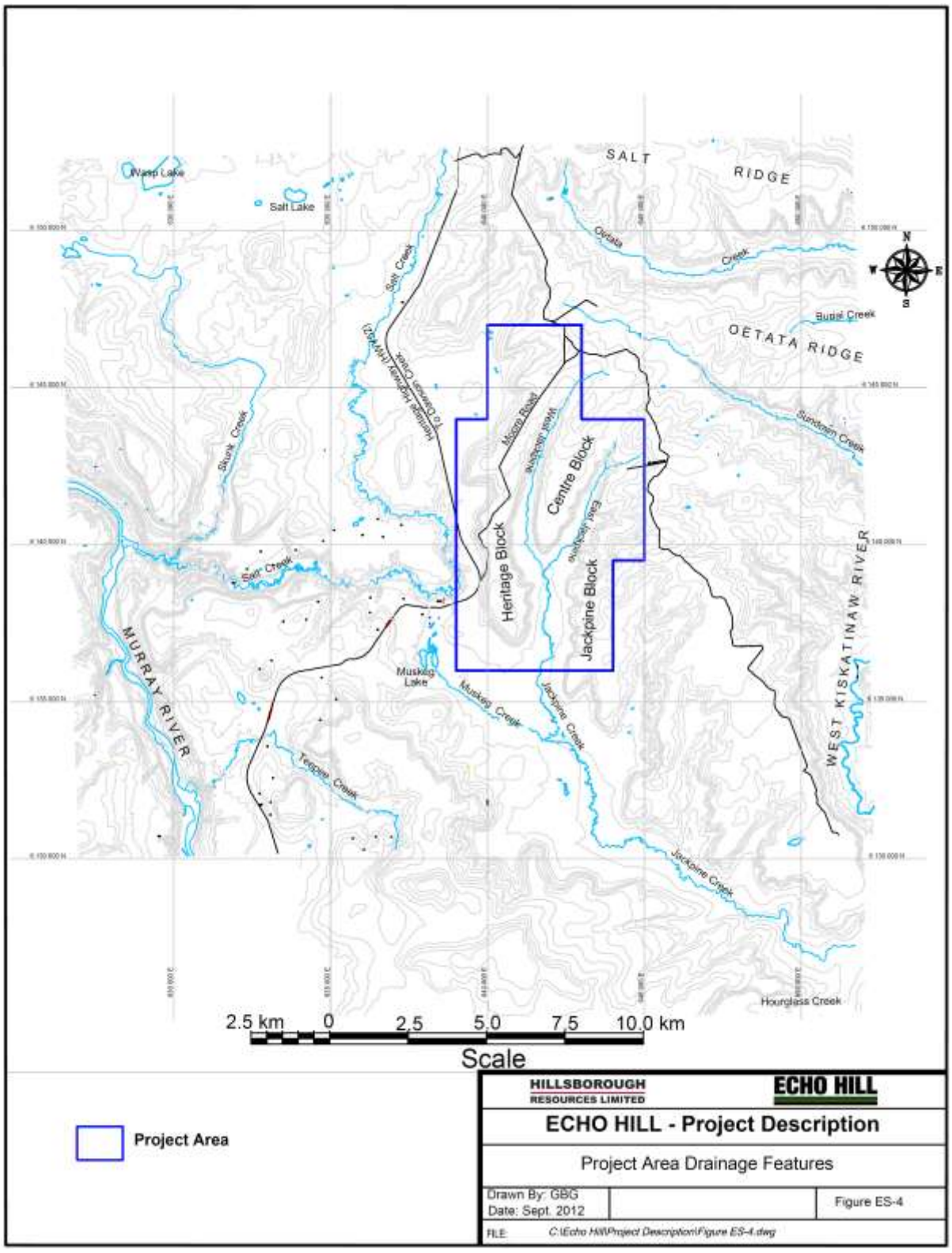

Figure ES-4: **ECHO HILL Drainage Features**

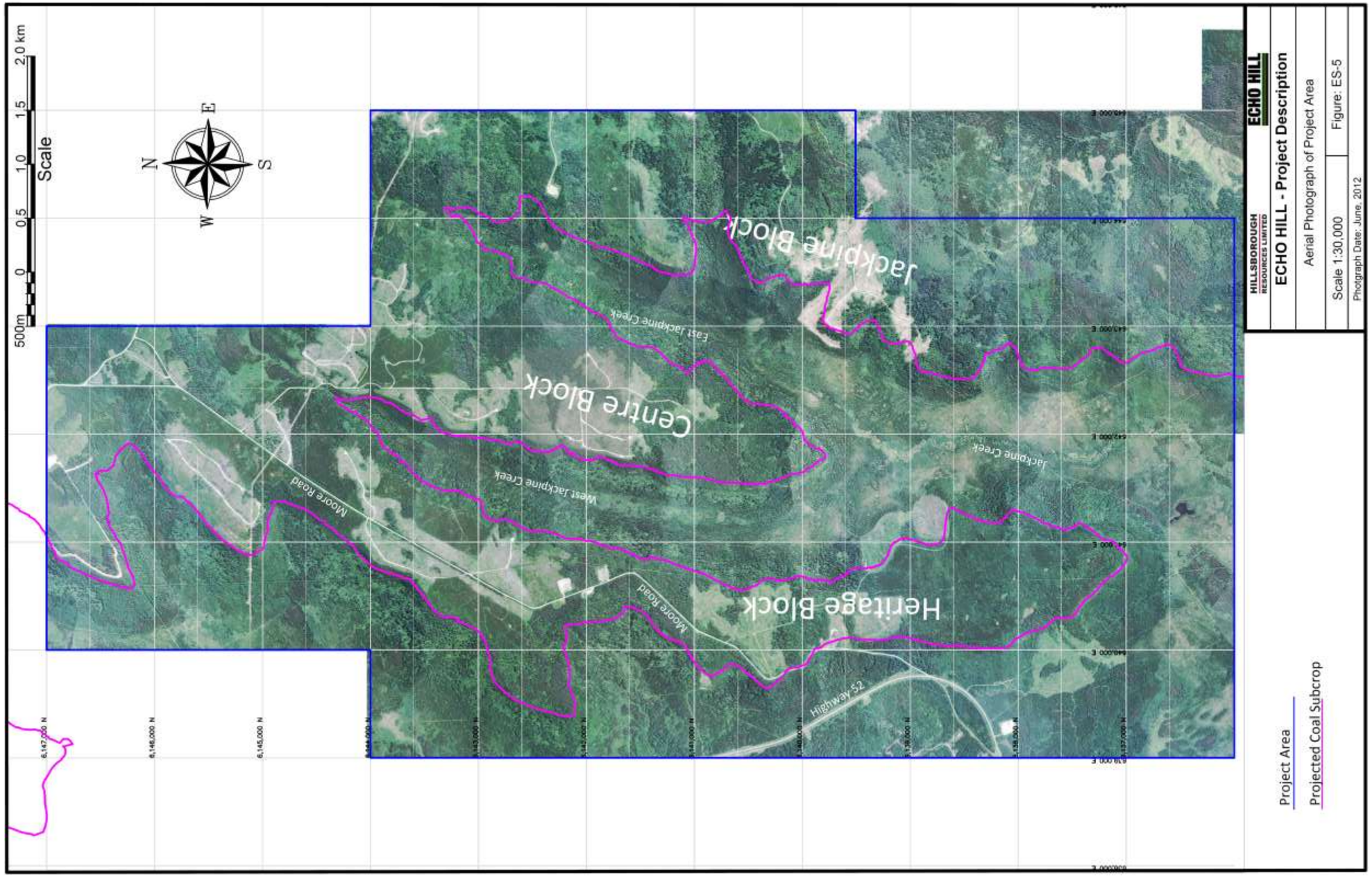

Figure ES-5: ECHO HILL – Aerial Photograph of Project Area

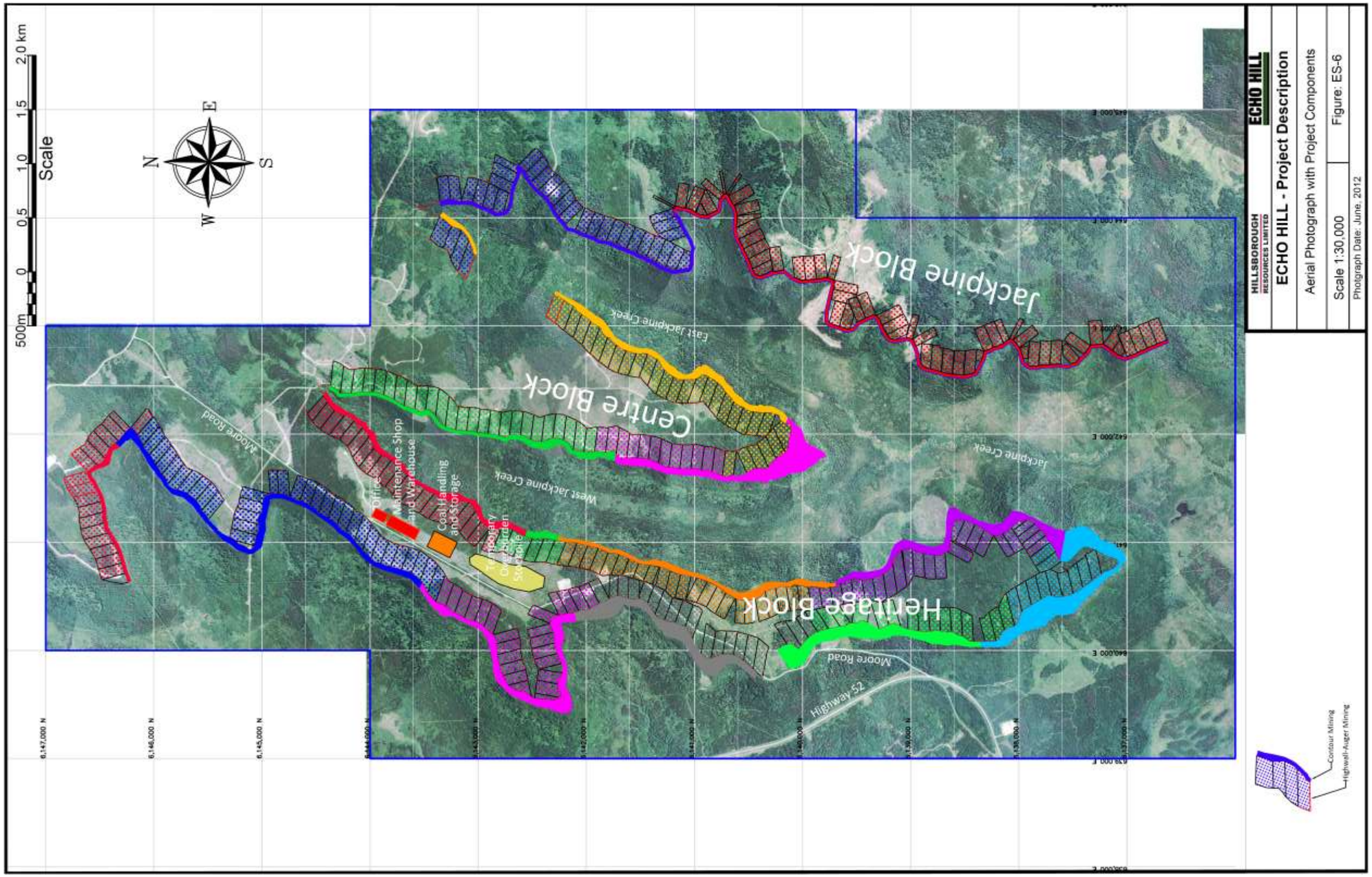

Figure ES-6: ECHO HILL – Aerial Photograph with Project Components

1.0 INTRODUCTION

1.1 Hillsborough Resources Limited – Corporate Overview

The proponent for the Project is Hillsborough Resources Limited. Hillsborough is a wholly-owned subsidiary of Vitol, a privately owned global energy trading company. Hillsborough also owns and operates the Quinsam Coal Mine, an underground coal mine near Campbell River, British Columbia and owns Crossville Coal, a coal mine property in central Tennessee that is currently being reclaimed. Echo Hill would be Hillsborough's second wholly-owned coal mine in British Columbia.

1.2 Project Contacts

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2.0 PROJECT AND REVIEW HISTORY

2.1 Project History

Coal exploration of the Echo Hill property dates back to 1978. Gulf Canada Resources Inc. identified the potential of the Echo Hill coal deposit through initial studies of regional geological maps and natural gas well records available at the time. In 1979, Gulf Canada staked the first coal licenses on the property and conducted drilling programs to confirm the resource. The initial coal assessment reports submitted to the BC government identified the Echo Hill coal resource as sub-bituminous A to High Volatile C bituminous coal, with low sulphur content, a low washery yield, and a calorific value suitable for thermal power generation. The initial reports identified the Echo Hill coal as most suited to a run-of-mine production to supply resource for a mine mouth power plant with no value as a metallurgical coal.

Without further development of the resource, Gulf forfeited the coal licenses in the 1980s when large oil and gas companies were abandoning coal development. The coal licenses were re-staked in 2004 and transferred to Hillsborough in 2005. Further exploration drilling was undertaken in 2004 and 2006 and investigation of the coal deposit by Hillsborough confirmed earlier findings; the total coal resource has been estimated as 80.1 million tonnes measured and indicated within the entire property holding and 48 million tonnes measured within the project area of interest.

At approximately the same time that Hillsborough obtained the coal licences for the Echo Hill property, BC Hydro was designing the Fiscal 2006 Open Call for Power. This call for tenders to Independent Power Producers ("IPPs") was for the development of new energy sources that would include a mix of resource options to supply both firm and non-firm energy. Firm energy is defined as energy from large projects connected directly to the existing transmission system providing an on demand contracted amount of electricity over a long period of time. Non-firm energy suppliers do not have any contractual commitments with respect to timing or minimum energy delivery requirements. BC Hydro's 2006 Open Call for Power was seeking up to 800 gigawatt hours ("GWh") of firm energy supply from large IPPs. In response to the 2006 Open Call for Power, AES and Hillsborough formed the joint venture company AESWapiti Energy Corporation to develop the Echo Hill coal deposit in the Peace River Regional District ("PRRD"), near Tumbler Ridge, BC.

Section 10 and Section 11 Orders were issued by BCEAO and worked undertaken on the Application for an Environmental Certificate. However, the project was halted in 2007 when the BC government announced net zero greenhouse gas for the production of electricity.

3.0 PROJECT LOCATION AND MAPPING

3.1 Location

The Echo Hill project site (the Project) is within the Peace River Regional District and the territories of Treaty 8 First Nations in northeastern British Columbia. The main town sites within the area include Tumbler Ridge, Dawson Creek and Chetwynd.

The Project is centred on 55° 22′ 01″ north latitude and 120° 48′ 10″ west longitude and is approximately 1000 to 1100 m above mean sea level. Figure 3.1-2 shows the property location with respect to Tumbler Ridge, as well as the Trend and Bullmoose Mine rail load outs which have both been identified as options for rail shipment of coal to market.

Dawson Creek (approximately 75 highway kilometres northeast of the Project site) is the largest community in the region, with a population of 10,994 (2006 Canadian census). Tumbler Ridge (approximately 44 highway kilometers south) is the nearest community to the Project site and has a population of 2,454 (2006 Canadian census; from a peak of 4,794 in 1991 and a low of 1,932 in 2001).

Highway access to the site is by Highway 52 which connects the communities of Tumbler Ridge and Dawson Creek. Access to the Project site from Highway 52 is via the Moore Forest Service Road.

The current mineral property boundaries are shown on Figure 3.1-2, below. The Heritage and Centre Blocks and a portion of the Jackpine Block are proposed for development. Figure 3.1-3, below, shows the coal licenses in the area of interest of the Project.

Figure 3.1-4 describes the proximity of the Project to Aboriginal groups and residential areas.

Although the proposed Project footprint does not overlap with any Indian Reserves or aboriginal settlements; there are five Aboriginal groups in the Project region, these being the:

- Kelly Lake Metis Communities – Kelly Lake is located approximately 50km east of the Project area. The Metis Nation of British Columbia (“MNBC”) will be consulted with on development activities and opportunities related to the Project. There are approximately 160 people that reside in the community.

- Halfway River First Nations – The Halfway River First Nations (“HRFN”) community and Reserve #06956 (3,989 hectares) is located approximately 160km northwest of the Project area. The community population is approximately 240. HRFH is affiliated with the Treaty 8 Tribal Association (“T8TA”).

- Saulteau First Nations – The Saulteau First Nations (“SFN) community and Reserve #06949 (3,026 hectares) is located at the east end of Moberly Lake and is approximately 80km northwest of the Project. The band population is approximately 840. SFN is affiliated with the T8TA.

- West Moberly First Nations – the West Moberly First Nations ("WMFN") community and Reserve #06955 (2,034 hectares) is located at the northwest end of Moberly Lake and is approximately 85km northwest of the Project. The band population is approximately 234. WMFN is affiliated with the T8TA.

- McLeod Lake Indian Band – the main community of the McLeod Lake Indian Band ("MLIB") is located on Reserve Lands (19,810 hectares) near McLeod Lake, BC and is approximately 150km southwest of the Project. Band membership totals about 500. MLIB is a signatory of Treaty 8.

The West Moberly and Saulteau First Nations settlements are the closest to the Project area.

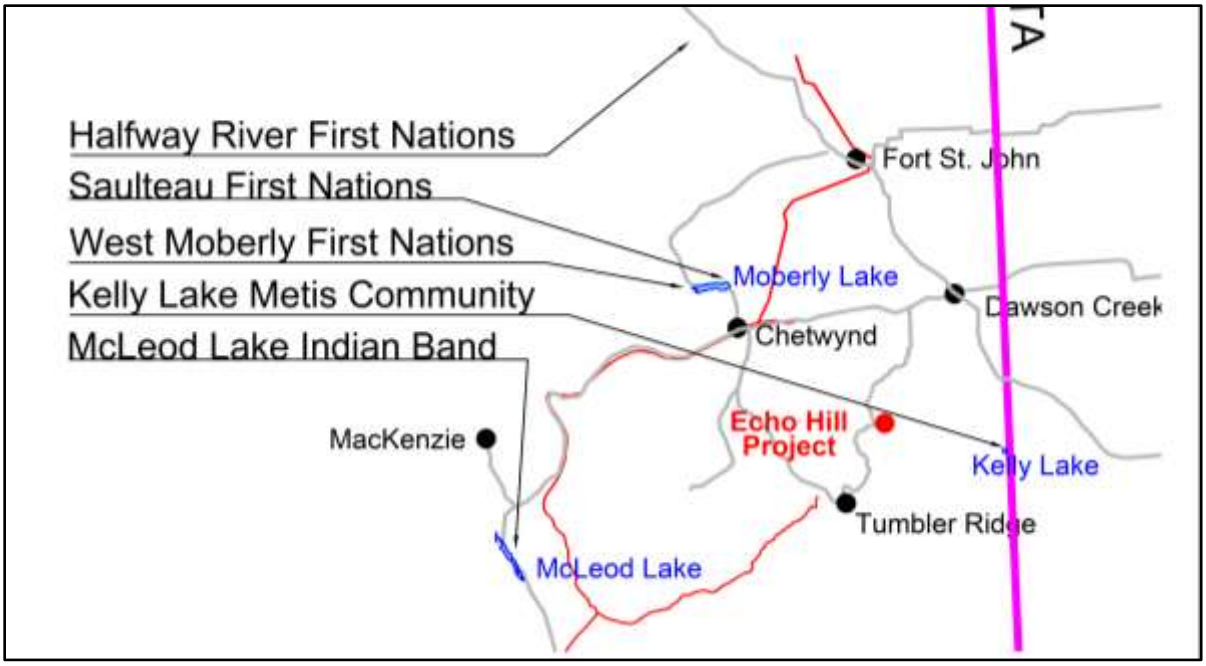


Figure 3.1-4: Project Proximity to Aboriginal Groups and Residences

The two nearest residential communities to the Project, and communities with permanent residents are Tumbler Ridge and Dawson Creek. Tumbler Ridge is located 44 kilometers south of the project and Dawson Creek 75 kilometres to the north.

There are no Federal lands within the proximity of the Project (the nearest Federal land area is Jasper National Park, approximately 300km to the southeast) and the Project will not change the environment on Federal lands that are either outside British Columbia or Canada.

The proposed Project is not located in a region that has been the subject of a regional environmental study as defined by the CEAA 2012.

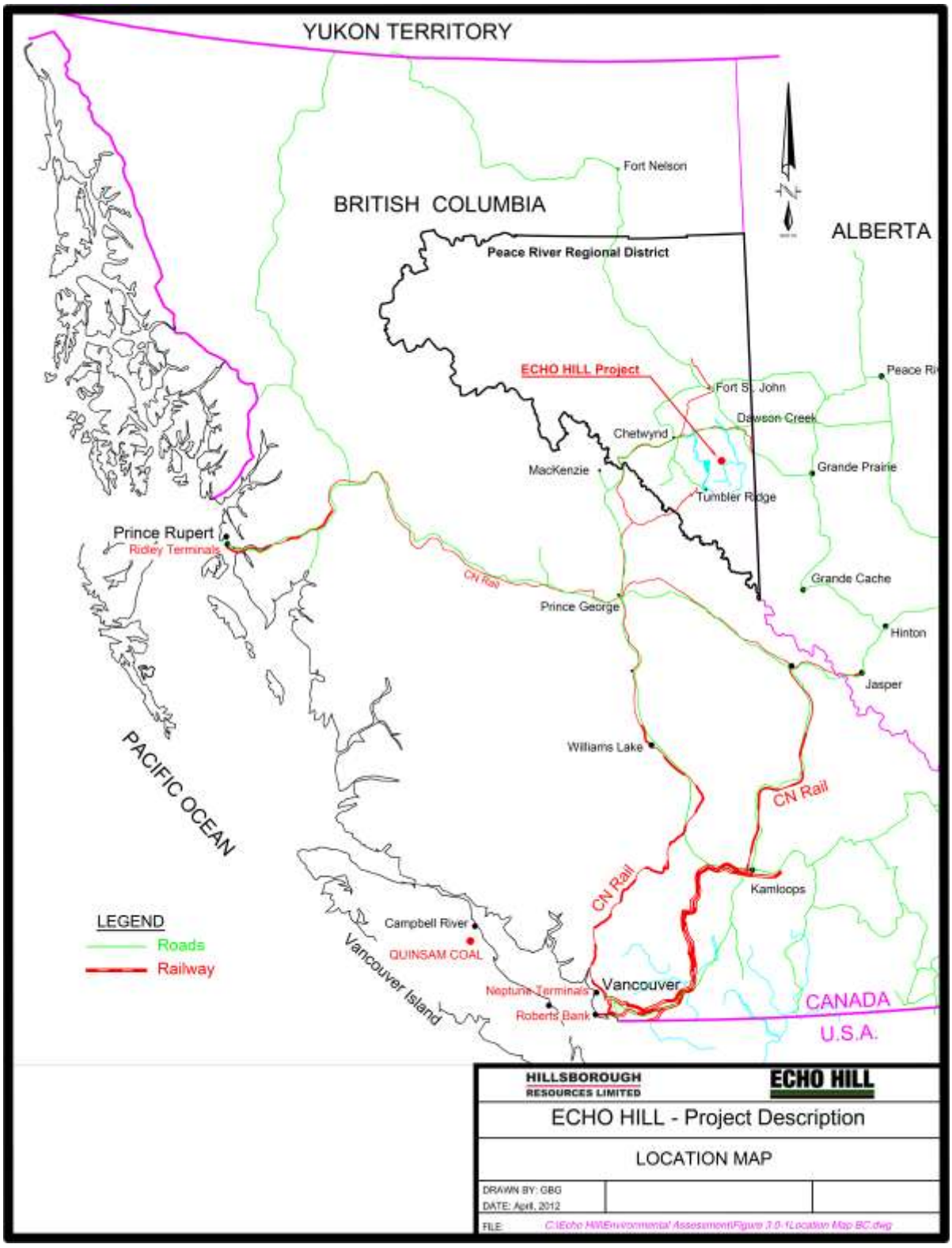


Figure 3.1-1: Echo Hill Property Location

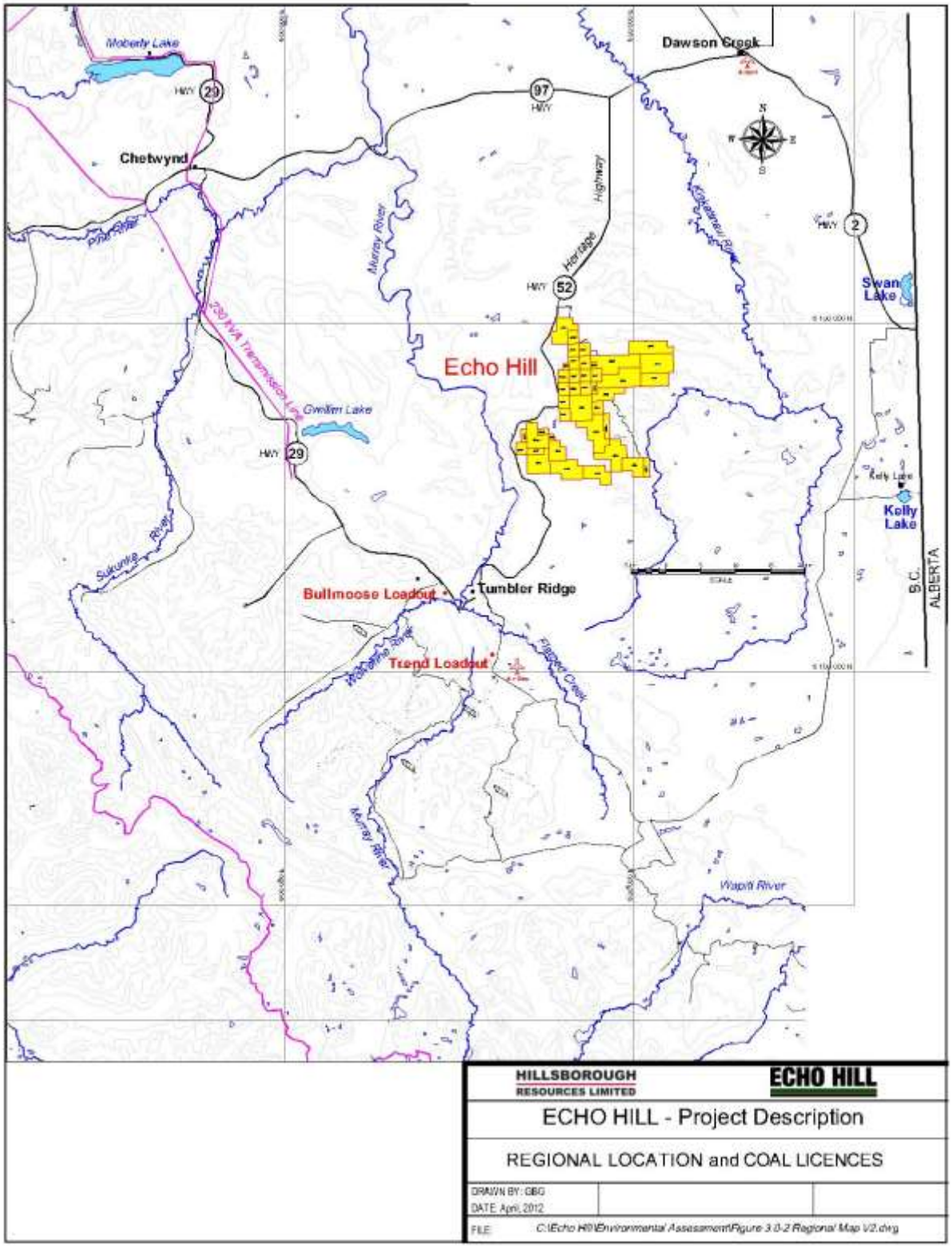


Figure 3.1-2: Echo Hill Property Boundaries

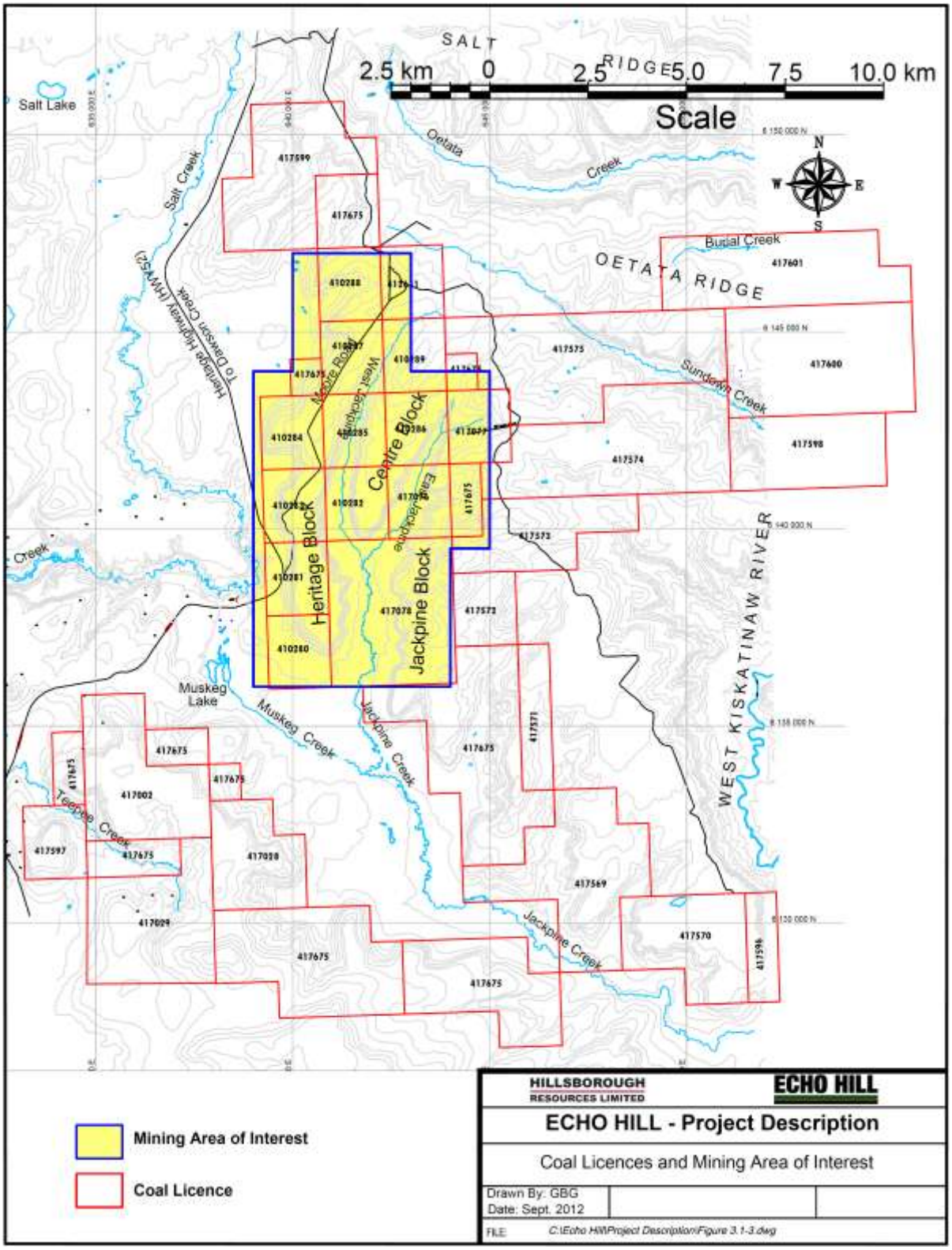


Figure 3.1-3: Echo Hill Coal Licenses and Mining Area of Interest

3.2 Mineral Title

The Project property includes a total of 31 provincially issued Coal Licences - 30 are currently held by Hillsborough (owner number 137113) and one is under application by Hillsborough. Together, the 31 Coal Licences cover a total of 22,512 hectares which is all provincial Crown land (and on BCGS map sheets 093P037 and 093P047). The following table summarizes the Coal Licence details.

Table 3.2-1: Coal Licence Details

Licence	Area (ha)	Date Issued
410280	295	May, 2004
410281	295	May, 2004
410282	294	May, 2004
410283	294	May, 2004
410284	294	May, 2004
410285	294	May, 2004
410286	294	May, 2004
410287	294	May, 2004
410288	294	May, 2004
410289	294	May, 2004
412651	294	July, 2004
417002	883	July, 2005
417028	589	August, 2005
417029	958	August, 2005
417076	294	October, 2005
417077	294	October, 2005
417078	1,176	October, 2005
417569	1,179	February, 2007
417570	737	February, 2007
417571	295	February, 2007
417572	295	February, 2007
417573	662	February, 2007
417574	1,396	February, 2007
417575	1,469	February, 2007
417596	221	March, 2007
417597	295	March, 2007
417598	735	March, 2007
417599	954	March, 2007
417600	1,322	March, 2007
417601	1,101	March, 2007
417675	4,421	Application
Total	**22,512**	

4.0 PROJECT PURPOSE AND RATIONALE

4.1 Project Justification

The Project will involve the development and operation of a thermal coal mine. Demand for thermal coal is growing to support industrialization and power generation in countries such as China, Korea, Japan and India. Meanwhile new technologies are providing more cost-effective solutions for cleaner emissions from coal-fired power plants, which could expand markets for this coal. The expected market for Project coal will be export markets in Asia, shipped through the Ridley Terminal in Prince Rupert, B.C.

The long term outlook for thermal coal is around $100 to $110/tonne in 2012 dollars.

4.2 Estimated Resource

4.2.1 Coal Resource Estimate

Table 4.2-1: Echo Hill Resource Estimate (full property)

	In-Place Surface Mineable Coal Resources (ktonnes)			In-Place Underground Mineable Coal Resources (ktonnes)		
	Measured	Indicated	Inferred	Measured	Indicated	Inferred
Subbituminous A to High Volatile C Bituminous	38,882	11,594	22,739	9,092	20,540	12,507
Total	**50,476**		**22,739**	**29,632**		**12,507**
Combined Surface and Underground Mineable Resources						
Deposit Type	Measured plus Indicated			Inferred		
Surface Mineable	50,476			22,739		
Underground Mineable	29,632			12,507		
Combined Total	**80,108**			**35,246**		

Table 4.2-2: Echo Hill Resource Estimate for the Project Area-of-Interest

Deposit Type	Measured and Indicated (ktonnes)	Inferred (ktonnes)
Combined (Surface and Underground Mineable	47.9	1.0

4.2.2 Coal Reserves and Quality

The proposed mining method for the Project is a combination of contour and highwall-auger mining. The contour mining involves mining to either an economic cut-off based on the thicknesses of the coal seam and overlying overburden and mining costs or to a minimum

bench width of 30m (to allow sufficient room for the highwall-augering equipment). The coal reserve for the contour mining portion of the plan is 6.4 million tonnes. The mining reserves for the highwall-auger portion of the plan is a function of the depth that the auger will operate to and the spacing of the auger holes to provide a stable roof. The coal reserve for the highwall-auger portion of the plan is 6.6 million tonnes.

Under the ASTM coal classification system the coal is ranked as sub-bituminous to high-volatile bituminous and is suitable for thermal and industrial markets.

4.3 Capital Cost and Taxation

The Pre-feasibility Study completed in 2012 estimated the initial capital cost for the Project at CAN $35 million. The Project will contribute to the BC and Federal Government by way of corporate taxes, provincial net proceeds and net revenue taxes, mineral taxes, sales taxes, income taxes and employment taxes. The estimated breakdown on taxes will be provided as part of the economic effects assessment in the EIA submitted for an Environmental Certificate.

5.0 PROJECT OVERVIEW

5.1 Project Components

The Project involves the planned production of 1.0 to 1.5 million tonnes per year of coal over an estimated mine life of 10 to 14 years. The main components of the proposed project include:

- Access roads: existing Provincial Highway (52) and Forestry Service Road and roads constructed to support mining activity
- Contour Mining – Highwall-Auger mining operation, followed by progressive reclamation
- Coal crushing and screening site with a raw coal stockpile
- Shop, warehouse, office and support facilities (generator, fuel storage)
- Water management structures

Refer to Figure 5.2-1 for the proposed mine layout and mining sequence and location of mine related facilities.

5.1.1 Access Roads

The existing Provincial Highway 52 and the Moore Forest Service Road (FSR) will serve as the access to and from the mine for personnel, supplies and coal product transport. These roads will be used for all phases of the project (construction, operation, decommissioning and abandonment) and are permanent structures.

Approximately 30 kilometres (75 hectare surface area) of road will be constructed to support the operation phase of the mining. These roads will be used to access the work areas and for overburden and coal haulage. These roads are regarded as temporary, as they will be reclaimed as part of the progressive reclamation plan as mining advances.

5.1.2 Contour Mining and Highwall Auger Mining Operation

The contour mining operation has a total footprint of about 325 hectares over the planned 10 to 14 year life of the mining operation. The surface disturbance from the contour mining will be temporary, with reclamation advancing with the mining, as it progresses along the contour. The active mining area will have a footprint of about 20 hectares.

No additional surface disturbance is created by the highwall auger mining.

5.1.3 Coal Handling and Storage Site

The coal handling and storage site will be located along the Moore FSR, about 6 km from the intersection with Highway 52. The site covers an area of approximately 5 hectares and will accommodate the raw coal and product coal stockpiles and the

crushing and screening system. This disturbance is temporary as the site will be reclaimed at closure. Refer to Figure 5.3-1.

5.1.4 Shop, Warehouse, Office and Support Facilities

This infrastructure will be located on a site along the Moore FSR and adjacent the coal handling and storage site. The site covers an area of 2 hectares. The complex will consist of a pre-engineered metal structure on a concrete pad. Services to the complex will include a diesel powered electric generator, water well and distribution and a sewage treatment plant. This disturbance is temporary as the site will be reclaimed at closure. Refer to Figure 5.3-1.

5.1.5 Water Management Structures

Water management structures for the mining operations, coal handling and storage site and shop, warehouse and office site will be engineered containment structures to collect and treat runoff affected by the disturbances. Combined, these structures will cover an area of about 1 hectare and will be temporary.

5.2 Mining Method

The proposed mining method is referred to as contour – highwall mining, with the highwall portion being done using an augering system.

The contour mining will be carried out with a small fleet of surface mining equipment including backhoe excavators and front-end-loaders, rock and coal haul trucks, dozers and support equipment. This equipment will progress along the sub-crop, exposing a bench of coal. The contour bench, depending on terrain, will vary in width from 30m up to 80m and expose a 10m to 15m highwall. In addition to exposing coal, this bench provides the room required for haul roads and the subsequent auger operation. As the mining (both contour mining and auger mining) progresses along the sub-crop, reclamation will follow immediately behind, with the overburden from the contour bench being used to backfill the zone where the auger mining is complete.

Once the coal from the contour bench has been removed the auger mining operation will advance into the area. The auger will drill holes up to 1.8m in diameter and 220m in length to recover coal from behind the contour mine highwall. A pillar is left between each hole to prevent the overlying ground from caving on to the auger and to prevent long-term subsidence of the ground above the auger-mined area. Large diameter auger mining is a long-established, proven method of coal extraction.

All earthworks structures including the contour bench highwall, temporary overburden dumps, backfill slopes and highwall-auger holes will be designed to be structurally stable.

The contour operation will involve annual mining of about 2.3 million BCM of overburden per year, or about 31 million BCM over the project life. The contour mining and auger mining would each release about 500,000 ROMt of coal per year.

Coal from the contour and highwall-auger operations will be trucked to a centrally located stockpile for crushing and screening prior to being hauled to an off-site train load-out facility.

Refer to Figure 5.2-2 for a cross-section of the proposed mining method and Figure 5.2-3 for a plan of the contour mining-auger mining-progressive reclamation sequence. This mining sequence, at any time, would extend about 1,500m along the sub-crop and present an active mining footprint of about 20 hectares.

The proposed mining method along with the progressive reclamation results in no permanent (end of mine-life) overburden dumps. A small temporary dump is required to handle the overburden mined from the opening contour bench in the Heritage Block, but will be rehandled to backfill the final contour benches, resulting in closure plan contours that will approximate original ground surface. Overburden is expected to be non-potentially acid generating (non-PAG).

Vegetation and surface soils removal will precede mining, with these materials being placed directly onto the backfilled and recontoured contour bench once the progressive reclamation sequence has been established.

As noted on Figure 5.2-1, the mining area of interest is sub-divided into blocks which are delineated by the areas topographic features. Salt Creek and the west branch of Jackpine Creek delineate the Heritage Block where mining will start and be active through to about the end of Year 9. The west and east branches of Jackpine Creek delineate the Centre Block and the Jackpine Block (situated east of the east branch of Jackpine Creek) where mining will continue through to about year 13. The annual mining quantities are shown in Table 5.2-1.

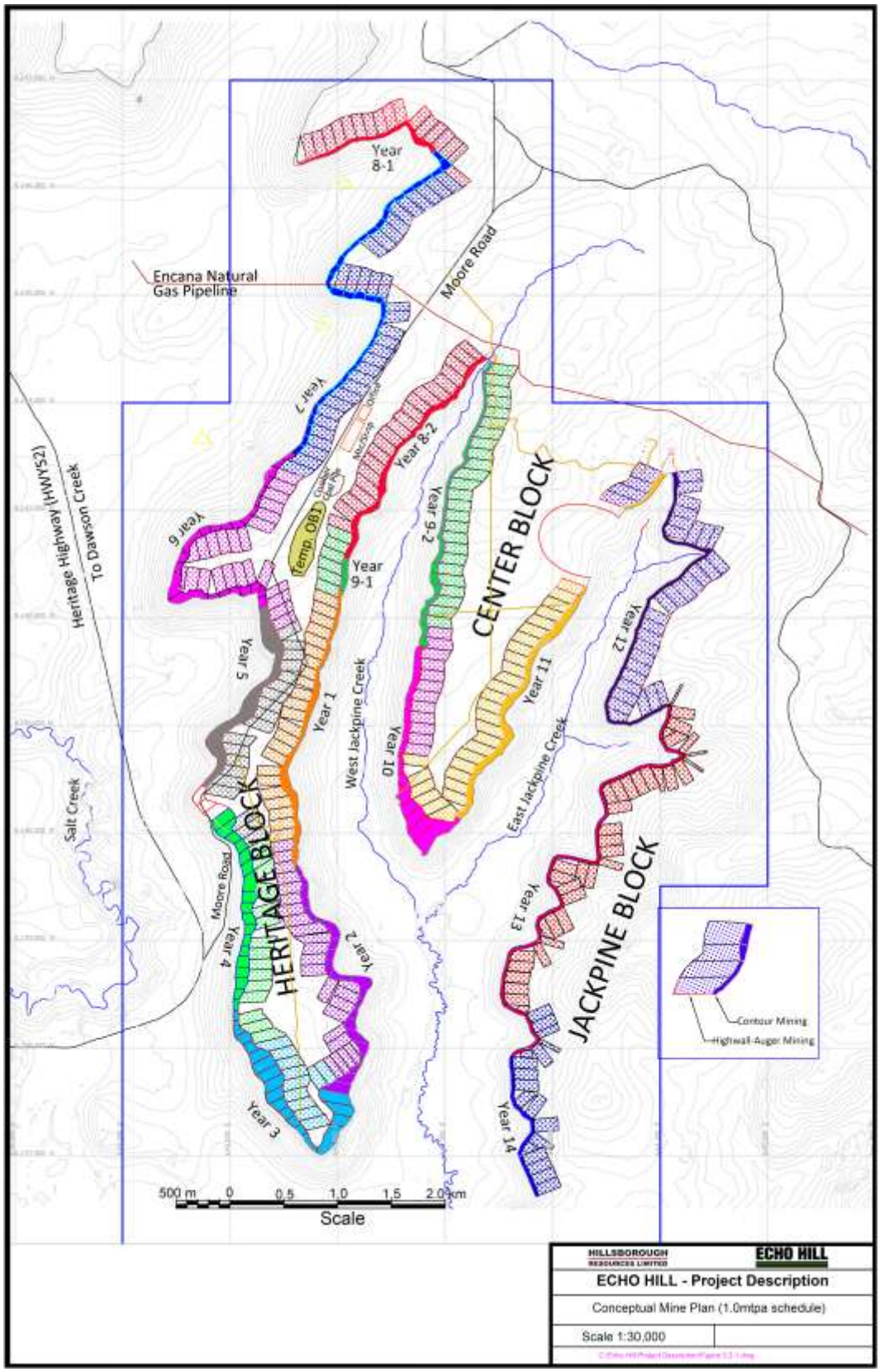


Figure 5.2-1: Echo Hill Mine Project General Layout

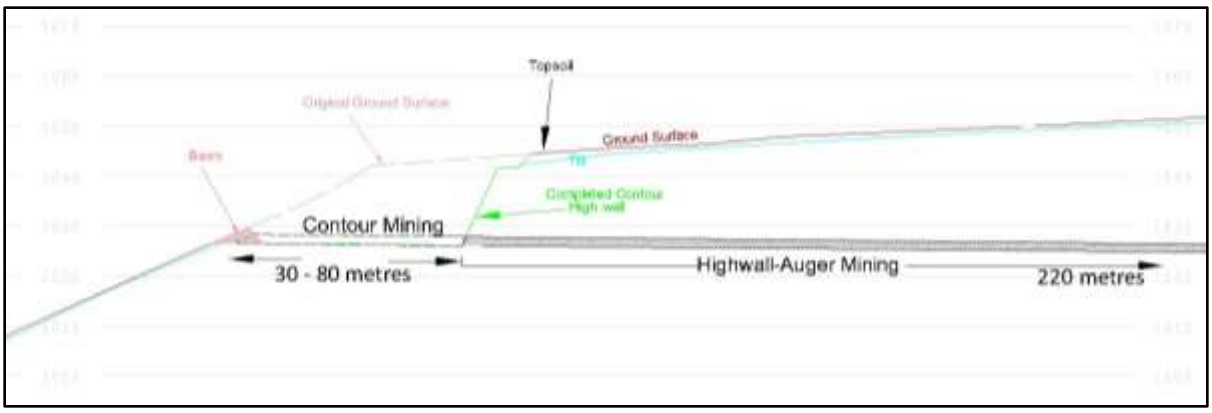


Figure 5.2-2: Echo Hill Mining Method Cross Section

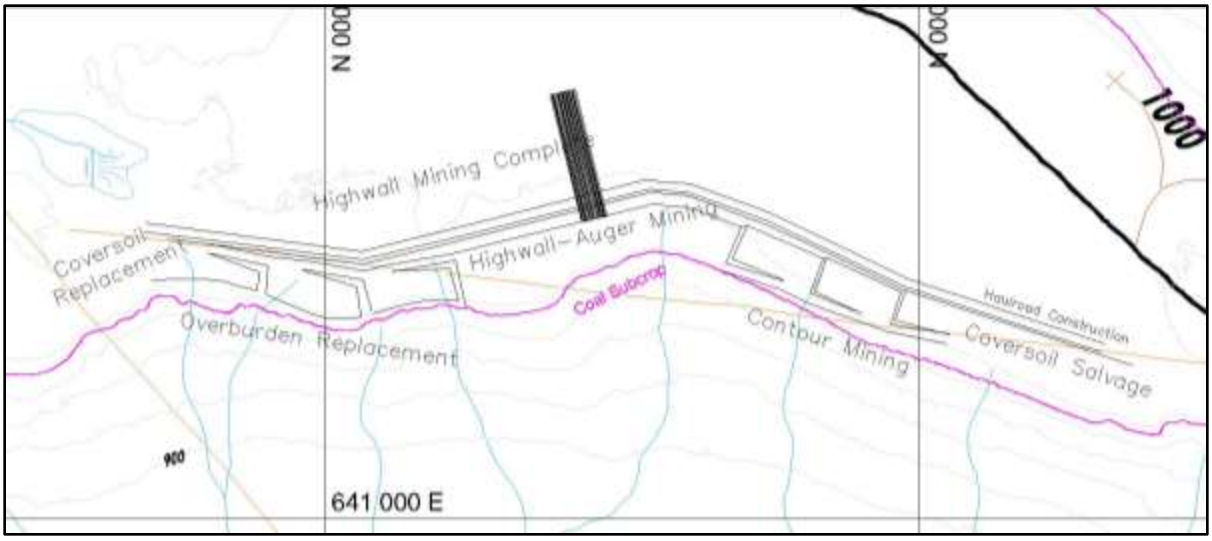


Figure 5.2-3: Echo Hill Mining Sequence Schematic

Table 5.2-1: ***Summarized Mine Production Schedule for the Echo Hill Mine Project***
(1.0 million tonne per year schedule)

Mining Period Year	Contour Waste (BCM)	Contour Coal (ROMt)	Contour S.R.	Auger Coal (ROMt)	Total Coal (ROMt)	Overall S.R.	Product Tonnes
-1	0						
1	1,410,000	256,000	5.51	235,000	491,000	2.87	486,000
2	2,459,000	617,000	3.99	403,000	1,020,000	2.41	1,012,000
3	3,251,000	705,000	4.61	315,000	1,020,000	3.19	1,014,000
4	2,747,000	664,000	4.13	347,000	1,011,000	2.72	1,004,000
5	2,835,000	626,000	4.53	400,000	1,026,000	2.76	1,018,000
6	2,635,000	535,000	4.93	477,000	1,012,000	2.60	1,002,000
7	1,829,000	408,000	4.48	601,000	1,009,000	1.81	1,000,000
8	2,013,000	392,000	5.14	633,000	1,025,000	1.96	1,008,000
9	1,931,000	371,000	5.21	650,000	1,021,000	1.89	1,009,000
10	2,500,000	656,000	3.81	365,000	1,021,000	2.45	1,013,000
11	2,008,000	424,000	4.74	595,000	1,019,000	1.97	1,012,000
12	2,018,000	305,000	6.62	648,000	953,000	2.12	944,000
13	2,018,000	305,000	6.62	648,000	953,000	2.12	944,000
14	1,009,000	153,000	6.62	325,000	478,000	2.11	472,000
Total	**30,663,000**	**6,417,000**	**4.78**	**6,641,000**	**13,058,000**	**2.35**	**12,938,000**

Note: S.R. = Strip Ratio

5.3 Site Layout and Facilities

The site support facilities and infra-structure for the Project will consist of a maintenance shop, a warehouse, a mine office, a change house, a supply yard, a coal storage and handling area (stockpiles, crushing and screening unit and truck load-out) and water (fresh water, mine water and sewage) handling and treatment facilities.

Offsite facilities will include that shared use of a coal storage and train load-out facility with another coal producer in the area. Discussions are underway towards reaching such an agreement.

Refer to Figure 5.3-1 for the conceptual plan of the site facilities, which have an approximate footprint of 5.0 hectares.

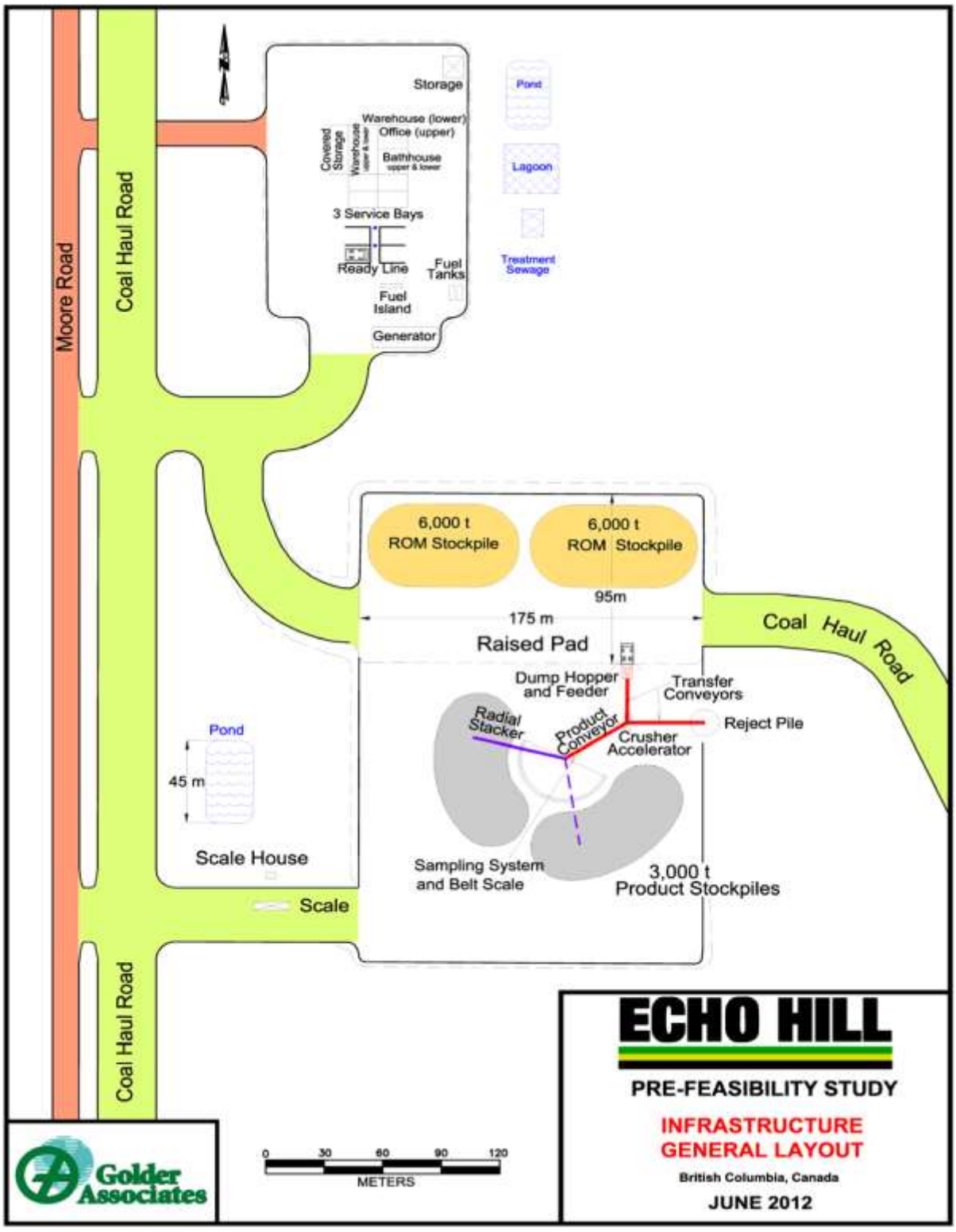


Figure 5.3-1: Echo Hill Site Facilities (Conceptual)

5.3.1 Contour Mine

As described in section 5.2, the proposed mining method is a combination of contour mining and high-wall auger mining, with only the contour mining resulting in ground disturbance. The contour mining will follow the coal sub-crop which also coincides with the height of land at the edge of the hillsides above the valley. The total footprint of the contour mining covers approximately 325 hectares, with mining activity on only about 20 hectares at any time.

5.3.2 Coal Storage and Handling

Coal from the contour mining and highwall-auger mining operations will be hauled directly to the coal storage and handling area and placed in one of two temporary raw coal stockpiles. These stockpiles are sized at 6,000 tonne capacity each. From this stockpile coal will be fed by a front-end-loader into a crushing and screening unit. The function of this unit is to remove oversize dilution rock and parting from the coal and produce a 50 mm minus sized product. Coal from the crushing and screening unit will be conveyed to the coal product stockpile. This stockpile is sized at 6,000 tonne capacity. From this stockpile coal will be loaded by a front-end-loader into 40-tonne highway trucks for transport to the train load-out facility.

The oversized dilution rock and parting removed by the crushing and screening unit (estimated to be 120,000 tonnes over the mine life) will be hauled back to the mining area and backfilled, with the overburden, into the mined out contour bench.

Limiting the scope of coal processing to simply screening and crushing (versus a wet cleaning process) provides the following benefits to the project:

- Eliminates the production of fine tailings and reduces the production of coarse rejects to the oversize produced from the first stage of the screening operation
- Maintains the mining footprint in upland areas away from Jack Pine Creek and Salt Creek
- Reduces capital expenditure and project start-up time
- Reduces water and electrical energy requirements.

5.3.3 Process and Potable Water

Water demands for the mine (potable water, dust suppression, equipment cleaning and fire protection) will be met with well(s) drilled near the site facilities area. It is estimated that groundwater extraction will be in the range of 30,000 to 50,000m^3 per year. Bottled potable water will be supplied if well water is not suitable or adequate.

A water balance (natural inputs, mine use and outputs) and water management plan will be developed for the Environmental Assessment application based on the project design. This will consider:

- Requirements for water quality protection and conservation
- Seasonal variation and climate extremes
- Appropriate methods for waste water disposal
    - Domestic sewage consisting of grey and black water from the warehouse/office facility treated onsite using a rotating biological reactor

5.3.4 Fuel, Lubricant and Liquid Storage and Handling

Requirements for fuel and lubricant storage and handling are expected to include:

- Diesel fuel storage and dispensing for mine equipment and generators
- Oil and lubricants for mine equipment
- Antifreeze/coolant for mine equipment

All storage and dispensing locations will be designed and constructed with secondary containment and needed statutory permits and authorizations applied for.

5.3.5 Domestic Solid Waste and Hazardous Waste

Suitable nonhazardous wastes will be incinerated and bulk inert waste placed in a landfill. Potential for reuse and recycling will be evaluated and included as part of the domestic waste management plan where appropriate.

Hazardous wastes generated at the proposed Project will be stored in appropriate temporary storage areas and removed from site for recycling or disposal as per applicable regulations.

5.3.6 Power Supply and Distribution

Power for the site will be supplied by diesel powered generator(s) in the base case. An evaluation will be undertaken to determine if electrical power can be supplied to the mine by a power line tie-in to a nearby wind power facility.

5.3.7 Staff Accommodations

It is anticipated that both construction and operations staff will live in Tumbler Ridge or Dawson Creek and commute to the Project site. Available information (CMHC, 2012) shows that there were 149 housing starts in Dawson Creek in 2010, but this dropped to 89 in 2011, and there were no housing starts during the first quarter of 2012. During 2011, nearly half of the housing starts (49.3%) consisted of semi-detached housing, 46.4% consisted of single dwellings and the balance (4.3%) was row housing. Nearly all of the new housing starts in 2011 (95.6%). The other 4.3% was consisted rental housing (53.3%) and there was no condominium development during this period. As of May 2012 there were 23 vacant residential units in Tumbler Ridge and 41 residential lots available for sale. Additional residential units are available in Dawson Creek. Hotel accommodation in Tumbler Ridge and Dawson Creek is expected to be adequate for construction crews.

5.3.8 Explosives Manufacturing Facility and Explosives Magazines

It is anticipated that explosives will not be required either for removal of overburden for construction of the contour benches nor for highwall-auger mining in the coal. As such there will be no need for explosives facilities or explosives licenses.

5.3.9 Surface Water and Groundwater Management

With the contour mining located at the height of land and well above and away from the major drainages (Salt Creek and Jackpine Creek), it is expected that there will be minimal groundwater and surface water to manage. To the extent practical, surface water not impacted by mining activity will be diverted around active workings through ditches, culverts and pipes. Mining impacted waters will be routed to engineered sediment ponds prior to discharge into the natural drainage system. Minimal, if any, groundwater is expected to seep onto the contour bench from the highwall or coal seam.

Objectives of the surface and groundwater management plan in the Environmental Assessment (EA) will include:

- Minimizing erosion, sedimentation and degradation of natural drainage systems
- Progressive reclamation, including re-vegetation, as a water management strategy

5.4 Coal Processing

The Project Pre-Feasibility assessment included the option of producing either a non-washed thermal coal product or washed thermal coal product from the Echo Hill mine. As a result of the assessment, the non-washed scenario has been selected, thereby precluding the need for a wet coal cleaning process.

As described in section 5.3.2, the only beneficiation done on the raw coal from the contour and highwall-auger mining will be screening and crushing to remove oversize rock dilution and parting material and to provide product sizing.

5.5 Mixed Coarse and Fine Coal Rejects Management Facilities

The only waste materials management from the coal beneficiation process (i.e., screening and crushing) will be hauling the oversized rock dilution and parting materials back to the mined out contour bench as backfill.

5.6 Access Roads

The Project area is immediately adjacent Highway 52 (the Heritage Highway), which provides access from the nearest residential communities: Tumbler Ridge which is 44 highway km to the south and Dawson Creek which is 75 highway km to the north.

Primary access on the Heritage Block will be on the Moore Forest Service Road. Encana Corporation is currently the primary user of this road and as a result, a Road Use and Maintenance Agreement will be entered into respecting Hillsborough's use of this road. This road will provide access to the site support facilities and the coal handling and storage area. Upgrades will be made as needed to handle the mine traffic.

Primary access to and on the Center Block will be on an upgraded existing logging road. This road was developed by the Woodlot Owner having timber harvest rights on portions of the Centre Block area. A Road Use and Maintenance Agreement will be entered into respecting Hillsborough's use of this road.

Mine exploration, forestry and oil and gas exploration activities have established multiple other roads and trails on the property. Where possible, access to the mining areas will be done through upgrades to these roads.

Similar to other operations in northeastern British Columbia, coal from the mine will be transported by highway truck to either one of two rail load out facilities: Peace River Coal's Trend load out south of Tumbler Ridge or Teck Coal's Bullmoose load out west of Tumbler Ridge. These two load outs are both located about 55 highway km from the mine.

Figure 5.2-1 shows the primary site access.

5.7 Project Phases

The table below describes the timeline and activities expected for each phase of the project.

Phase	2015	2015 - 2025	2026
Construction	Access Roads Coal handling and storage site Shop, warehouse and office site	Access Roads	
Operations	Clearing Topsoil Salvage Contour Mining Highwall Mining	Clearing Topsoil Salvage Contour Mining Highwall Mining	
Decommissioning	Progressive Reclamation	Progressive Reclamation	Progressive Reclamation Remove Infrastructure
Abandonment			Final Reclamation of all disturbances

5.8 Alternatives Assessment

Hillsborough has considered and is currently considering a number of project alternatives to ensure the best project is put forward for review. Options that have been considered in the past or are currently under consideration include:

- Mining Method
    - Area surface mining
        - **Contour Mining**
            - **Minimizes disturbance footprint**
            - **Lower capital and operating cost**
        - Open Pit Mining
        - Dragline Mining
    - Highwall Mining
        - **Auger mining**
            - **Less dilution from roof material falling**
            - **Lower capital cost**
        - Surface Highwall Miner

- Coal Processing and Product
    - **Non-washed thermal product**
        - **Negates need for coarse coal rejects and tailings management**
        - **Lower capital and operating cost**
    - Washed or partial-washed thermal product
- Offsite rail load out
    - Peace River Coal – Trend mine load out
    - Teck Coal – Bullmoose load out

Hillsborough has commenced engagement and will continue to engage First Nations and Provincial and Federal regulators during the assessment of alternatives.

5.8.1 Power

The proposed plan is to use diesel powered generators to provide the electrical power needed for the shop, warehouse, office, coal handling and support facilities.

At present, the closet power line tie-in to the mine site would be from a recently constructed line about 20km away and servicing a wind power facility located between the project site and Tumbler Ridge. The possibility and economics of this line servicing the mine site will be explored as an option.

5.9 Reclamation and Closure

The reclamation and closure plan for the Project will be based on the pre-mining uses such as wildlife habitat, commercial forest and access for traditional and cultural, recreational and other industrial uses.

The Project area is forested, with large areas that have been previously harvested and are at some stage of reforestation. Reclamation towards a forest cover is seen as the primary reclamation objective, as it is the forest cover and related under-story that provides:

- Forage and shelter for wildlife
- Commercial forestry opportunities
- Recreation and traditional and cultural use potential

Current access within the property is used for other industrial activities. This access will be maintained, both during mining and at closure.

On-going research, maintenance and monitoring programs will be an integral part of the reclamation plan.

5.9.1 Contour Mining

The proposed contour mining method and sequence lends itself to progressive reclamation featuring:

- Direct placement of cover soil, and native vegetation species salvaged with the cover soil, onto areas that have been backfilled
- Direct placement of overburden into areas where the contour and highwall-auger mining is complete (eliminating the need for end-of mine overburden dumps)
- Early annual re-vegetation programs, which also serve as an erosion control measure

The first step to the mining process will be timber salvage and clearing, followed by cover soil salvage. All the merchantable timber will be harvested and the non-merchantable timber will be included in the cover soil salvage operation. The cover soil salvage plan will be support by soil studies presented in the EA, identifying suitability and quantity of soil to be salvaged.

The contour bench will be backfilled once the highwall-auger coal removal is completed. Backfilling and re-grading will approximate the original ground surface contours.

The initial step of the re-vegetation program will be seeding of grasses and legumes for erosion control followed by the planting of tree seedlings suited to the commercial forest end-land use objective. Native species of grasses, legumes and shrubs will be incorporated into the re-vegetation program.

5.9.2 Site Facilities Area

All site facilities not required beyond closure will be decommissioned and their footprint reclaimed to the end-land use objective.

5.9.3 Access Roads

Currently existing access roads within the proposed mining area will be left in-place at closure. New roads built to serve the mining activity and those remaining from exploration drilling will be reclaimed to the end-land use objective.

6.0 PROJECT SETTING

The Project area lies along the western side of the Western Canadian Sedimentary Basin, which extends through the eastern foothills of the Canadian Rocky Mountains and adjoins the Alberta Plateau. This area is a transition between the relatively gently-dipping, non-deformed formations of the Alberta Plateau to the east and the highly-deformed Rocky Mountain trend to the west.

The topography of the region consists of a series of north-south trending low ridge-edged plateaus incised by southerly flowing creeks. This series of plateaus and creek valleys defines the mining blocks at the Project, which from west to east area referred to as the Heritage Block, Centre Block and Jackpine Block.

The West Kiskatinaw River is the principal drainage in the area and receives seasonal flows via Jackpine Creek from the eastern half of Heritage Block, Centre Block and Jackpine Block. The West Kiskatinaw River flows into the Kiskatinaw River which supplies drinking water for Dawson Creek. The Murray River is the other major drainage in the area and receives seasonal flows via Salt Creek from the western half of Heritage Block. Both drainages empty into the Peace River which flows to the Arctic.

The plateau regions are typically forested, with large areas having previously been harvested. The valley regions are characterized by wetlands.

Elevations within the Project area range from 860m (Jackpine Creek downstream of the Muskeg Creek confluence) to 1,080m (height of land on Centre Block) above sea elevation.

6.1 Existing Conditions

Currently the project area, with the Moore Forest Service Road providing primary access, is used for both industrial and recreational activities. Timber harvesting has been undertaken throughout large areas of the site with recently logged and second growth forest covering large portions of the project area. More recently the Moore Road has served as access for natural gas exploration and production in the area. While there are no wells within the project footprint, a recently placed natural gas pipeline runs though the northern end of the property.

The primary recreational activity within the project area is hunting with some evidence of random camp sites.

Other than recent coal exploration programs, with the most recent being in November 2011, there are no areas of previous underground or surface mining in the Project area.

6.1.1 Regional Geology

The region is underlain by Upper Cretaceous rocks of the Wapiti and Puskwaskau Formations, with the upper part of the Puskwaskau Formation hosting the Wapiti coal seam.

Formations and formation members (Figure 6.2-1) of importance to the Project, and which contribute to the coal resource base, include:

Wapiti Formation

The Wapiti Formation forms the youngest bedrock within the Project property, capping the hills and ridges. The sediments of the Wapiti Formation, which are non-marine, are generally sandstone with minor beds of conglomerate, shale and siltstone. The sandstone is medium to coarse-grained, friable to moderately well-cemented, feldspathic and variably calcareous. The shale and siltstone are brownish-grey and exhibit platy- to rubbly weathering.

All of the overburden mined to expose the contour bench will be material from the Wapiti Formation.

Nomad Member

The Nomad Member is a thin marker layer of grey rusty-weathering mudstone inter-bedded with carbonaceous sandstone and siltstone indicating the top of the marine sediments of the Puskwaskau Formation and the approximate location of the underlying Wapiti Seam. Within the Project coal property, the Nomad Member ranges in thickness from a few decimeters to a few metres.

The Nomad Member and, depending on the thickness of the Nomad Member, the Wapiti Formation, are the roof rocks of the Wapiti Seam (and the hanging wall of the highwall-auger openings). The roof rock lithology is variable, being sandstone, siltstones, shales and mudstone.

Chungo Member

The Chungo Member consists of a clean, coarsening-upward, quartz-lithic sandstone. Within the Project area of interest, the Chungo Member ranges from 5 to 13 metres thick. The contact between the Wapiti Seam and underlying Chungo Member is a hard, weakly carbonaceous sandstone horizon that will form the floor of the contour bench.

In comparison to the Wapiti Formation and Nomad Member which overly the coal seam, the Chungo Member is seen as an erosionally-resistant sandstone resulting in a steepening of the hill slope below the coal sub-crop. In contrast, the relatively soft Nomad Member and Wapiti Formation strata produce a gradual slope above the Wapiti Seam creating a favourable geometry for contour mining.

Structural disturbance in the Project area is minimal. Generally, there is a series of open folds that trend roughly northwest to southeast and plunge gently to the southeast. The overall regional dip is gentle (less than 3 degrees) and no major faulting has been encountered during exploration drilling.

6.1.1.1 Local Geology

The local geology of the Project area has been defined with stratigraphic and structural data from exploration programs.

The first known coal exploration work within the Project area was undertaken by Gulf Canada Resources, with geologic mapping, exploration drilling and bulk sampling undertaken in 1979 and 1980. This work identified potential surface mineable and underground mineable coal reserves, with the seam of economic interest being the Wapiti No. 1 Coal Zone ("Wapiti Seam").

No further exploration work was done until 2004 and 2006, with the later program being conducted by Hillsborough. Following the 2006 drilling a Technical Report (in compliance with the requirements of National Instrument 43-101) was completed on the property that indicated an in-place surface mineable coal quantity of 50.5 million tonnes (measured plus indicated) and an in-place underground mineable coal quantity of 29.6 million tonnes.

Since that report, two additional exploration programs have been completed; one in 2010 with a focus on coal bulk samples for washability work and one in 2011 with a focus on characterizing groundwater.

The following table summarizes the exploration work completed on the Project area to date.

Table 6.1-1: **Summary of Exploration Drilling**

Year	Coal License Holder	Exploration Activity
1979	Gulf Canada Resources	45 exploration holes (6,787 metres)
1980	Gulf Canada Resources	30 exploration holes (1,975 metres), two adits
2004	Wapiti Coal Limited	29 exploration holes (844 metres)
2006	Hillsborough	31 exploration holes (1,5179 metres)
2010	Hillsborough	7 exploration holes (174 metres) and a test trench and adit for coal bulk samples
2011	Hillsborough	3 exploration holes (107 metres) and 6 groundwater well holes

All of the exploration holes were collared in the Wapiti Formation which has been eroded across the Project property leaving from 0m to 60m of cover over the Wapiti Seam. From surface the top three metres of the formation are generally weathered, followed by the inter-bedded sequence of sandstone, siltstone and shale.

On a local scale the Wapiti Seam is gently folded with dips ranging from 1 to 5 degrees, but within most of the area at less than 2.5 degrees. The seam thins from approximately 2.2m near the centre of the mine area to about 1.4m at the north end of the Heritage Block.

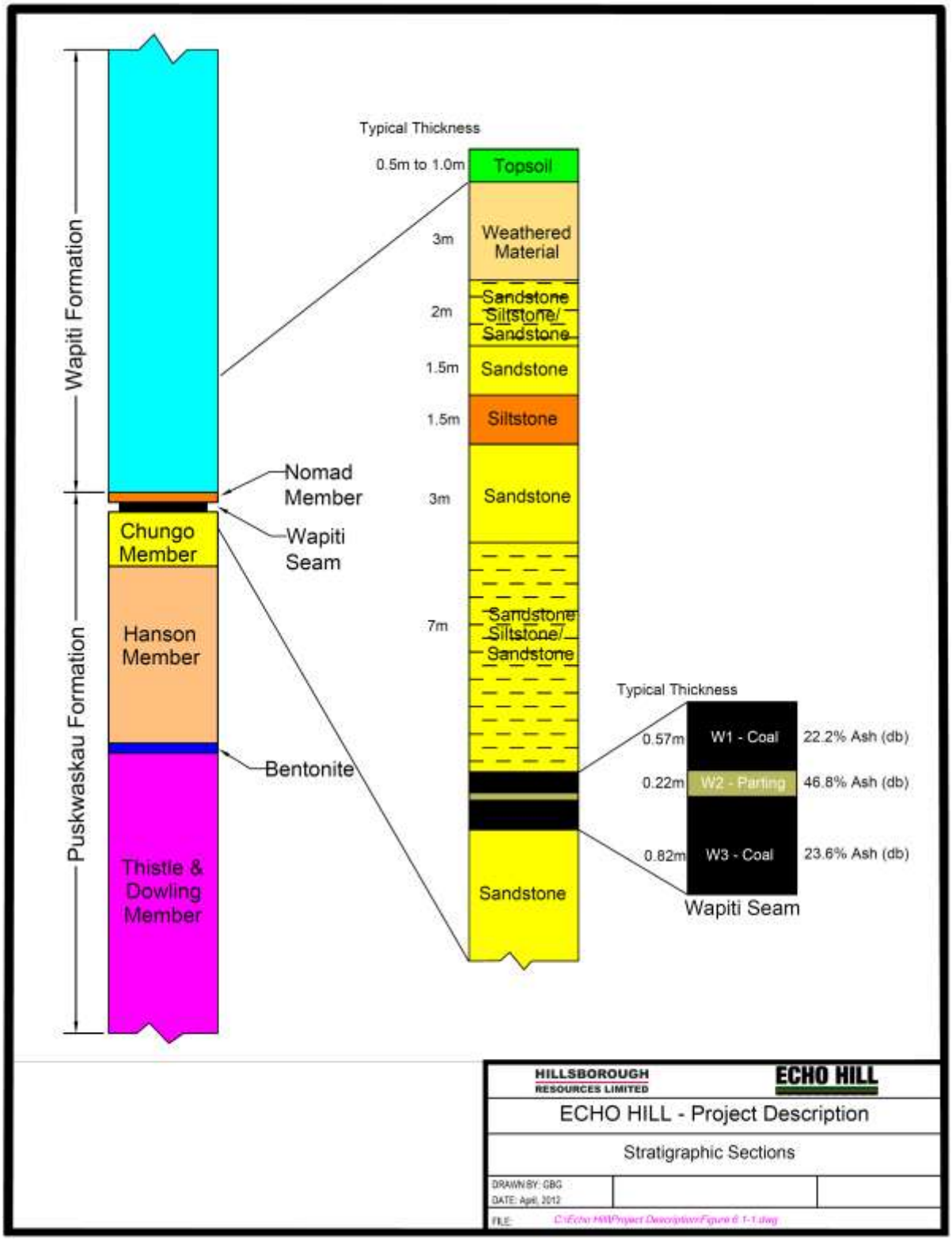


Figure 6.1-1: Geology of the Echo Hill Property

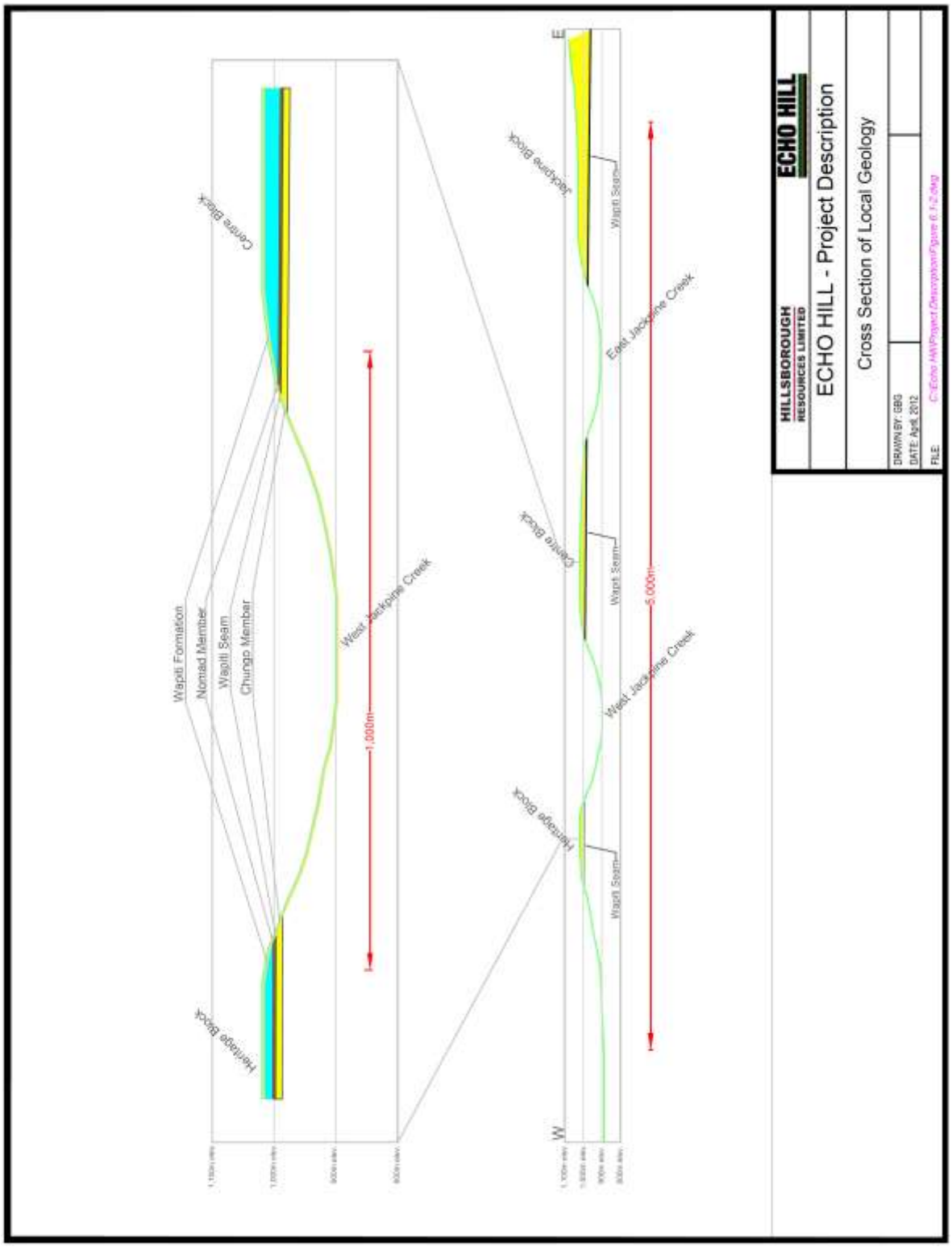


Figure 6.1-2: Geology of the Heritage and Centre Blocks

6.1.1.2 Echo Hill Deposit Geology

Within the eroded sequence of the Wapiti Formation overlying the Project property there is only one coal zone, referred to as the Wapiti Seam. The Wapiti Seam consists of an upper ply and lower ply of coal separated by a parting of variable thickness. There has been enough exploration drilling done within the current area of interest on the Project property to understand the thickness and lateral extent of the two coal plys and the parting that make up the seam.

The upper coal ply (referred to as W1 in the geologic model) varies in thickness from 0.2m to 1.0m with a general trend of thinning to the north. Both coal plys consist of moderately-bright, banded humic coal, with visual contrast between dull and bright layers. The upper ply includes a thin band of light brown, silty mudstone, possibly representing a volcanic ash band.

The middle parting (referred to as W2 in the geologic model) varies in thickness from 0.1m to 0.3m with a general trend of thickening to the east, although there is local variability. The parting typically is described as a coal shale or high ash coal (greater than 40%).

The lower coal ply (referred to as W3 in the geologic model) varies in thickness from 0.5m to 1.2m with local variability.

6.1.2 Coal Quality

The Project coal-measures are of Upper Cretaceous in age (100 to 65 Ma) and are part of a thick accumulation of post-Precambrian sedimentary rocks which cover the western side of the ancient Canadian Shield.

The Wapiti Seam is classified as a sub-bituminous A (along the subcrop where there has been oxidation) to high volatile C bituminous coal (beyond the oxidation limit). The coal sampling and quality analysis work done in conjunction with the exploration drilling indicates this coal to be suitable for thermal power generation. Results from the drill hole quality data are summarized in the Table below.

***Table 6.1-2*: Summary of Coal Quality**

	Dry Basis (db)					As-Received Basis (arb)
	Ash %	Volatile Matter %	Fixed Carbon %	Sulphur %	Calorific Value	Moisture %
W1 – upper ply	22.7	31.9	45.4	0.52	5,844	7.90
W2 – parting	42.1	24.5	33.4	0.33	4,092	4.69
W3 – lower ply	23.9	31.0	45.1	0.48	5,687	7.97
W1+W2+W3	25.7	30.5	43.8	0.47	5,585	7.39

Other quality testing done on the coal provides the following highlights:

- Hardgrove Grindability Index between 49 and 55 (a hard coal)
- Low sulphur content; between 0.45% and 0.60%
- Average in situ ash content of about 27% due in part to a carbonaceous rock parting that makes up between 10% to 20% of the full seam thickness
- Low CaO content; generally less than 4.5%
- Low in arsenic, bromine and chlorine
- Excellent ash chemistry
- High ash fusion temperature

Coal sampling was also done for sink-float testing (washability). The results of these tests indicate that the coal has difficult washability characteristics and significant yield losses could be expected from a wet process coal preparation plant. For this reason the coal is being considered for use as a raw, run of mine product.

6.2 Geochemistry

The geochemistry and potential for acid rock drainage (ARD) and metal leaching (ML) was characterized for the strata found at the Project coal deposit. Static testing, laboratory kinetic tests and field leaching studies were conducted on samples collected from the drill holes illustrated in Figure 6.2-1. Samples were collected from the Wapiti Formation and Nomad Member that overlie the coal seam, the coal seam and the Chungo Member that lies immediately below the coal seam. Generally, the relative position to the coal seam appears to be the most important factor regarding the acid generating potential of the strata.

Total sulphur contents are generally low with median values ranging from 0.03% (Wapiti Formation) to 0.23% (coal seam). The majority of measured sulphur resides in sulphide minerals, with median sulphate sulphur content generally falling below the detection limit (0.01%).

Neutralization potential in the form of carbonate minerals is abundant in the strata overlying the coal seam and relatively rare in the immediate footwall and the coal seam itself. The carbonate mineral assemblage includes calcite ($CaCO_3$), dolomite / ankerite ($Ca(Fe^{2+},Mg,Mn)(CO_3)_2$) and siderite ($FeCO_3$), with siderite occurrence being relatively independent of lithology or stratigraphic position.

The net potential ratio (NP/AP) is used to assess the likelihood of a given sample to generate acidity. Values of less than two are considered to represent potentially acid generating (PAG) samples, while a NPR of greater than 2 is classified as non-potentially acid generating (non-PAG). Based on these criteria, PAG strata have been identified in and immediately around the coal seam. For example, 90% and 100% of collected samples were found to be PAG in the footwall pavement sandstone (Chungo Member) and the coal seam, respectively. In contrast, the strata overlying the coal seam are predominately non-PAG. The proportion of PAG samples in the Nomad Member directly overlying the coal seam is approximately 20% and less than 5% in the stratigraphically higher Wapiti Formation. Due to

its greater stratigraphic thickness, the majority of the waste rock from mining activity is expected to be derived from the non-PAG Wapiti Formation. If a wet process coal preparation plant were to be used to beneficiate the coal, coal rejects would be expected to be PAG.

Kinetic test results confirm that the footwall sandstone (Chungo Member) produced slightly acidic leachate (pH 5.9), consistent with the general lack of neutralization potential in this stratigraphic unit. A preliminary qualitative assessment indicates that relatively low metal leaching rates can be expected at neutral pH from most strata. Parameters with the highest leaching potential with respect to aquatic life guidelines include sulphate, aluminum, and selenium. Other parameters that are under consideration include arsenic, cadmium and chromium.

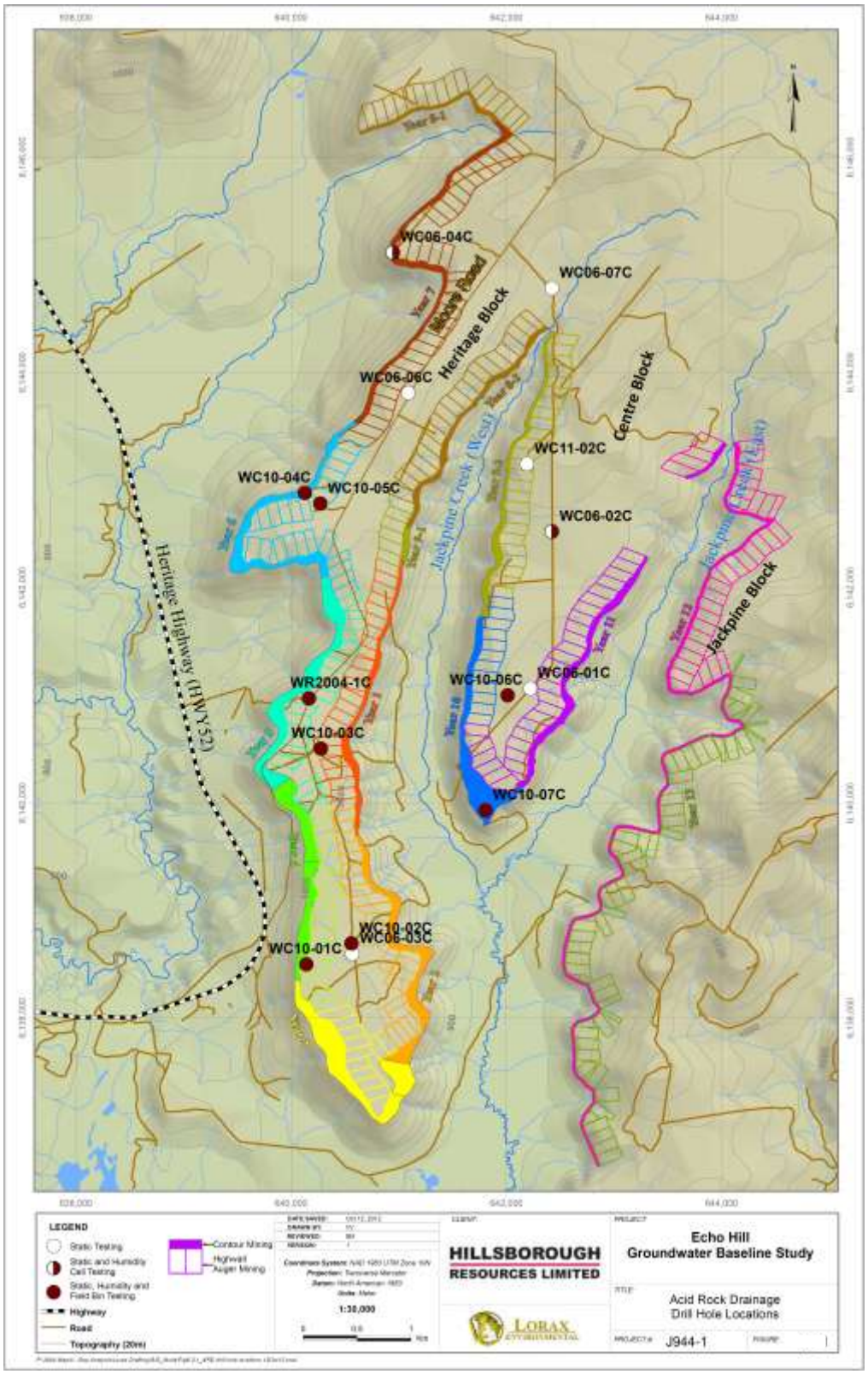


***Figure 6.2-1*: Echo Hill ARD Drill Hole Locations**

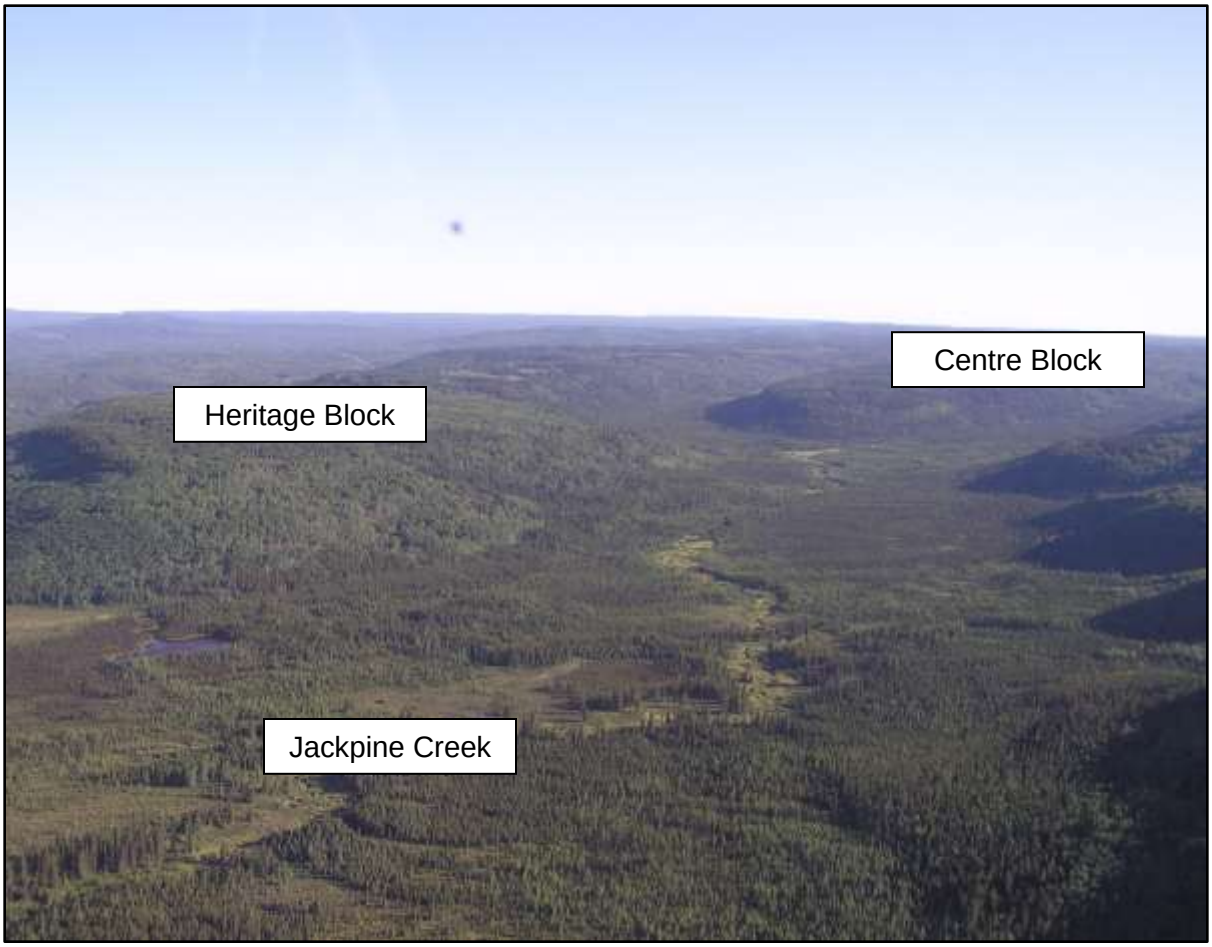
6.3 Terrain, Soils and Surficial Geology

The Project leases occur on two headlands which extend in a south-east direction. The western headland (Heritage Block Leases) extends approximately 2 kilometres further south than the eastern headland (Centre Block Leases). These headlands consist of slightly undulating topography composed primarily of variable thickness cordilleran till capping the local carbonaceous sandstones and shales. A discontinuous thin veneer of eolian material commonly overlies the local till on these headlands.

U-shaped valleys separate the headlands recording a strong development influence from the Cordilleran ice. Valley bottoms are level to very gently sloping with evidence of preserved post-glacial lacustrine deposits and widespread accumulation of organic material. Localized terraces of glaciolacustrine sediments are noted within the valley bottom positions. Jackpine East and Jackpine West Creeks drain from the upland headlands into the valley bottoms where they form shallow misfit floodplains.

The valley walls and headland slopes are generally over-steepened ranging from moderately to very steep. These slopes contain areas of steep bedrock outcropping and coarse textured colluviated till derived from local bedrock. Areas of moderate slope contain moderately fine textured colluviated till deposits. Large landslide scars are clearly visible on the east facing valley wall of the western headland (Heritage Block).

Figure 6.3-1 provides an aerial oblique view looking north.



Source: Hillsborough Resources Limited

Figure 6.3-1: Echo Hill Deposit with Jackpine Creek in Foreground

6.4 Climate

Baseline climatic conditions in the Project area can be characterized by Climate Normals[1] data for the most representative climate stations available for the region. The two closest regional stations operated by Environment Canada with Climate Normals are Chetwynd and Dawson Creek.

For comparison, pertinent data of the Project weather station is also included.

Analysis of both Climate Normals confirmed that meteorological parameters for the Chetwynd station are more detailed than for the Dawson Creek station, which is missing average wind data. Therefore the Chetwynd Climate Normals has been adopted as being representative of the Project climate data.

[1] Climate Normals for a station are 30 year average values of climate parameters such as temperature and precipitation, and are updated every ten years.

The Project lies to the east of the Rocky Mountains and is situated in North Central / West Area on terrain that slopes gradually towards the east. The climate of the Project site area is continental subhumid, characterized by dry summers and cold winters and fairly low annual precipitation. Throughout the area, the mean annual temperature is 3°C varying from minus 10.7°C in January to 15.5°C in July. Monthly average precipitation varies throughout the year with the wettest month being July while the driest month February. The annual precipitation totals about 44.7 cm and snowfall is 169.6 cm. Monthly average wind speeds stay relatively constant around 8.2 km/h blowing from southwest. Most of the sunshine days occur during the long summer days.

An automated UT30 Weather Station supplied by Campbell Scientific (Canada) Corp. was established in late August 2010 at the proposed mine site with UTM coordinates 640120 mE 6140440 mN Zone 10. Siting, construction and operation of the station follow relevant guidelines and regulations (EPA 2006, WHO 2006, The State Climatologist 1985).

A 10-metre tower raises measurement heights above low-lying obstruction such as grass and shrubs allowing temperature gradient monitoring by the mean of two sensors installed at 2 m and 10 m heights.

The hourly data will be used as an input to AERMOD dispersion model in the AERMET meteorological preprocessor. Additional necessary meteorological parameters such as cloud cover and ceilings, mixing height, and upper atmosphere meteorological parameters will be generated by a mesoscale meteorological computer model MM5.

6.5 Air Quality

The Project area has no long-term publically available air quality monitoring data other than for the city of Fort St. John and Taylor which are not representative of undeveloped areas. Spot data collected over a short time period provides an order of magnitude estimate of background concentrations of criteria air contaminants (CACs), as defined by Environment Canada and BC Ministry of Environment. Of interest for the Project are particulate matter (TSP, PM_{10}, $PM_{2.5}$), nitrogen gases (NOx), sulphur gases (SOx), and carbon monoxide.

Site investigation involved direct, real-time continuous measurement of particulate matter concentrations in two 36-hour sessions in August 2011 using DustTrak Aerosol Monitor 8533 DRX. The monitoring site was by the Project weather station located within the boundaries of the Project. Baseline sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO) concentrations for the proposed mine site are expected to be similar to those from a relatively uncontaminated and remote undisturbed location in northern Canada. Regional averages of gaseous CACs were assumed to apply to the Project site.

6.5.1 PM

The results show very low concentrations for all suspended particulates, with the lowest values for $PM_{2.5}$ and the highest for TSP. This is as expected since TSP includes PM_{10} and $PM_{2.5}$. The measured average baseline concentration was 2 µg/m^3 for $PM_{2.5}$, 4 µg/m^3 for PM_{10} and 5 µg/m^3 for TSP. These values will be used for the cumulative impact assessment of particulate matter.

6.5.2 NOx

Taylor, BC has NO_2 data for 1997 with a daily average of 14.3 µg/m^3; Taylor has a pulp mill, both heavy truck and car traffic, and is subject to inversions which may have influenced the NO_2 concentrations recorded. Four small communities in the Dawson Creek area were monitored by MOE Mobile Air Monitoring Laboratory for one month periods in the summer and early fall of 2010. The MOE report (2011) provides graphical summaries from which very approximate averages can be obtained. Farmington and Rolla, both north of Dawson Creek, averaged about 20 µg/m^3 over the monitoring periods. Toms Lake, south of Dawson Creek, averaged about 10 µg/m^3 and Ground Birch, west of Dawson Creek, averaged about 5 µg/m^3. The baseline concentrations of NO_2 were monitored in 2005 and 2006 at Kitimat, BC. The monthly average concentration reported by Environment Canada (2008) was 5 µg/m^3. Given the lack of any background source at the Project site, 5 µg/m^3 will be used.

6.5.3 SOx

The baseline concentration of SO_2 is expected to be minimal because there are no significant nearby local or regional emissions. Based on the following reports, “Review of National Ambient Air Quality Objectives for Sulphur Dioxide, Desirable and Acceptable Levels” (Environment Canada (EC) 1987a) and “Application for Environmental Assessment Certificate” (Rescan 2006) for the proposed Galore Creek project by NovaGold Canada Inc., the baseline SO_2 concentrations are assumed to 4.0 µg/m^3 (1-hour and 24-hour averages) and 2.0 µg/m^3 (annual average), respectively. These data will be used as surrogate for the Project EA in the absence of site specific background data.

Data are available for 2010 to September 2012 for Taylor, BC, northeast of the Project site and much closer than Galore Creek. In Taylor the annual average SO_2 concentration for the period used was 2.8 µg/m^3; that for Taylor Hill 1.1 µg/m^3. Use of the Galore Creek data is considered to be conservative.

6.5.4 CO

For baseline concentrations of CO, Environment Canada (1987b) indicated that levels “in relatively unpolluted air of 29 to 115 µg/m^3 have been observed. As a conservative estimate for this air quality evaluation, a baseline level of 100 µg/m^3 of CO was assumed for all averaging time periods. The four small communities around Dawson Creek cited above had CO mean concentrations over the one month measured were 80 to100 µg/m^3.

6.5.5 Other Gaseous CACs

The less common air contaminants such as nitrogen oxides (NO_x), ozone (O_3) and sulphur oxides (SO_x) are unlikely to be of concern for the baseline studies because there are currently no identified significant anthropogenic sources near the proposed Project. Ozone levels are typically expressed in parts per billion by volume (ppbv, or ppb), which represent the fraction of air molecules represented by ozone. Typical background ozone levels at remote locations in the Northern Hemisphere are from 20 ppb to 40 ppb, varying by season and latitude (Sillman 2003).

6.6 Noise

Baseline noise assessment is a prerequisite to any noise impact assessment as the baseline noise will be added to the project-generated noise giving the cumulative environmental noise level.

An AMEC environmental scientist conducted baseline field noise surveys on 18-19, 19-20 and 25-26 August 2011 The sampling location was within the local study area at UTM Zone 10 coordinates 639252mE, 6138094mN. The site elevation was 889 m AMSL. The 24-hour average baseline sound pressure level (SPL) which is represented by L_{90} for the Project study area is 27.1 dBA. The daytime SPL is 28.0 dBA and the night time SPL is 26.6 dBA. These values will be used in predicting Project noise levels and in cumulative noise impact assessment.

6.7 Vegetation

AMEC vegetation ecologists conducted surveys on the Project site during June through to August 2011. Activities included terrestrial ecosystem mapping (TEM), field vegetation typing, rare plant and invasive plant surveys and plant tissue collections for background metals levels. The local study area was the project footprint plus a 500 m buffer. The terrestrial local and regional study areas are shown on Figure 6.8-1.

6.7.1 Plant Species at Risk

A rare plant survey was conducted June 29 to July 4, 2011 by AMEC vegetation specialists. A combination of BC and Alberta rare plant sampling protocols were followed. These include *Protocols for Rare Vascular Plant Surveys* (Penny and Klinkenberg 2010) and *Alberta Native Plant Council (ANPC) Rare Plant Survey Sampling Protocols* (Lancaster 2000). A list of regional species at risk was developed from the Conservation Data Centre website (BCSEE) and those listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

The results of the field work identified and confirmed the presence of one Blue-listed plant species, western Jacob's-ladder (*Polemonium occidentale* Greene subsp. *occidentale*) within the study area. The species was found in streamside wetland habitats along Jackpine Creek. Western Jacob's-ladder is not listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the *Species at Risk Act* (SARA).

6.7.2 Invasive Plant Species

No invasive plant species were recorded during the 2011 fieldwork but further analysis of invasive plant sites (IAP) is ongoing and will be reported in the EIA baseline.

6.7.3 Terrestrial Ecosystem Mapping Survey

The Terrestrial Ecosystem Mapping (TEM) survey was conducted following provincial guidelines outlined in *Standards for Terrestrial Ecosystem Mapping in BC* (RIC 1998) and the data was collected based on the *Field Manual for Describing Terrestrial Ecosystems*

(Luttmerding, et al. 1990). A sampling plan was prepared prior to conducting the TEM survey field work, identifying the biogeoclimatic units and potential ecosystem units expected in the area. Sampling sites were selected to provide a cross section of environmental and physical conditions in the study area.

TEM mapping results will be presented in the EIA baseline.

6.7.4 Biogeoclimatic Zones

The proposed Project occurs in the Kiskatinaw Plateau Ecosection (KIP) that falls within the Alberta Plateau Ecoregion (Demarchi 2011). The KIP is characterized by a continental climate with cold, dry winters and warm, moist summers. The KIP ecoregion contains various Biogeoclimatic (BGC) units based on the provincial ecosystem classification system (Meidinger and Pojar 1991). Two BGC units known as variants occur within the study area:

- Boreal White Black Spruce Moist Warm Peace variant between 1000 and 1050m
- Boreal White Black Spruce Wet Cool Murray variant above 1050 m

Most of the BGC units are geographic specific or elevational dependant.

6.7.5 Plant Tissue Analyses

During the TEM survey and at select plot locations plant foliage, humus, and soil samples were collected from upland (mesic/zonal) and plant foliage and organic samples were collected at wetland sites. From upland sites, the leaves of trailing raspberry (*Rubus pubescens*) plants were collected as a representation of edible berries that are important to First Nations and wildlife. The leaves of willow (*Salix* spp.), an important forage species for wildlife such as ungulates, were collected from wetland sites.

Plant tissue analyses will be reported in the EIA baseline.

6.8 Wildlife

6.8.1 Amphibian and Reptile Surveys

The amphibian and reptile surveys focused on the western toad, however, any amphibian and reptiles identified were recorded. Visual encounter surveys for amphibians and reptiles were conducted using modified provincial Resource Inventory Standard Committee (RISC) protocols of systematic searches. Shorelines of accessible wetlands and vernal pools were visually surveyed for egg masses, tadpoles and adult amphibians and reptiles. Field Sampling Dates were completed June 6-9 and July 23-26, 2011. Notable findings within the Local Study Area (LSA) (Figure 6.8-1), but away from areas within the planned mine disturbance footprint, are summarized below. A desktop study of the transportation corridor was also completed.

A large adult toad was located at the edge of the forest along an old trail east of Muskeg Lake during the bird survey in June. Western toad juveniles were detected along small

vernal pools in the eastern access road within the LSA and in small ponds near the junction of the gas pipeline as well as the western most access road. Columbia Spotted Frog (*Rana luteiventris*) tadpoles were found in one of the same pools. Wood Frogs (*Lithobates sylvaticus*) were located along the edges of the main access roads in July as well as the same ponds as the toad tadpoles. Boreal Chorus Frogs (*Pseudacris maculata*) were heard calling during the songbird surveys in forested wetlands throughout the LSA.

The areas where amphibians were located is well away from any areas that will be directly disturbed by mining. Mining activities will be on hillsides and to a limited extend on the plateau above Jackpine Creek.

6.8.2 Raptors

Raptor information for the 2011 field season was collected through call playback surveys and incidental observations. Objectives were to assess the presence and distribution of raptor species in the LSA (project footprint and buffer). Pre-recorded calls or call playbacks simulate the presence of an "intruder" in an already claimed territory elicits a defensive response in the target species. The response of the bird, whether it is a close approach, accompanied by an aggressive behaviour, or a distant vocalization, allows the observer to record the presence of the species. Call playbacks are used for inconspicuous, scarce (e.g., northern goshawk (*Accipiter gentilis*)) or nocturnal species known to respond to calls during the breeding season.

No nocturnal raptors or Northern Goshawks were recorded on CPS surveys. A total of five species of raptors have been observed as incidentals; Barred Owl (*Stix varia*), Red-tailed Hawk (*Buteo jamaicensis*), and Cooper's Hawk (*Accipiter cooperii*), Sharp-shinned Hawk (*Accipiter striatus*) and American Kestrel (*Falco sparverius*). During songbird transect surveys east of Muskeg Lake, the call of a Barred Owl (*Strix varia*) was recorded. In addition, during the June songbird point count surveys the alarm call of a young Red-tailed Hawk was heard. The bird was flying around the south end of the eastern arm of the property. Another Red-tailed Hawk, an uncommon sighting of Harlan's Hawk (*B. j. harlani*), a subspecies of Red-tailed Hawk, was observed in July perched beside Highway 52 near Muskeg Lake. During field surveys in June a Cooper's Hawk (*Accipiter cooperi*) flew across a road clearing and into the adjacent forest along the southern edge of the western arm. An American Kestrel (*Falco sparverius*) was recorded flying across a road and into the adjacent forest in the northern portion of the Project site. Finally, a Sharp-shinned Hawk (*Accipiter striatus*) was recorded during the breeding bird point count surveys in July. No nests of any raptors were confirmed in the LSA.

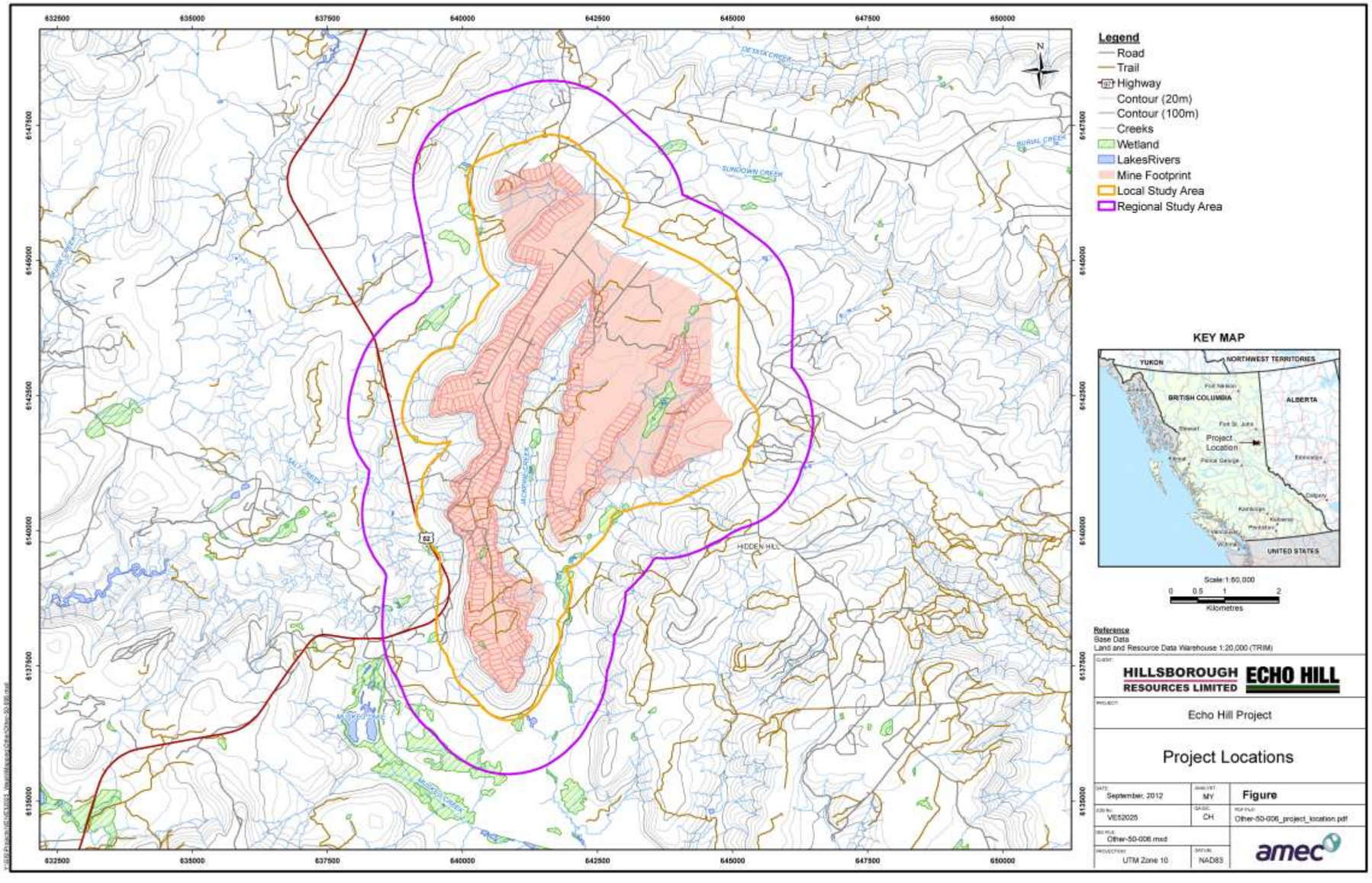


Figure 6.8-1: Terrestrial Local and Regional Study Area

6.8.3 Terrestrial Birds

Thirty-seven point counts were established through the LSA during the 2011 field season and a diversity of species recorded. A total of 302 detections of 47 species were made. 135 detections of 27 species were recorded during the July surveys. Four species of conservation concern were recorded during the 2011 season. These include the following:

- Olive-sided Flycatcher (*Contopus cooperi*) – provincially Blue-listed, COSEWIC-listed Threatened;
- Black-throated Green Warbler (*Dendroica virens*) - provincially Blue-listed;
- American Bittern (*Botaurus lentiginosus*) - provincially Blue-listed (incidental sighting in Muskeg Lake); and
- Barn Swallow (*Hirundo rustica*) - provincially Blue-listed COSEWIC-listed Threatened (incidental sighting over Muskeg Lake).

6.8.4 Metal Toxicity in Birds

As part of the baseline program for 2011, AMEC collected feathers from the HY birds born at the Project site and had them analyzed for total metal levels. Using standard mist net bird collection methods over a three day period in July when hatch year birds had fledged, feathers were collected and sent for laboratory metal analysis.

Preliminary analysis indicate that for many of the metals, levels were undetectable due to low sample sizes. Selenium levels for all specimens were below detectable levels. However, elements aluminum, calcium, copper were recorded in higher concentrations for HY (young of year) birds. Amphibian and aquatic bird eggs are planned to be sampled in the spring of 2013.

6.8.5 Mammals

6.8.5.1 Bat Survey

Acoustic bat surveys utilized an Anabat™ detector to record bat calls within the area surrounding the bat detector. The Anabat detector was placed in potential bat habitat (i.e., wetlands) before sunset. The machine was activated to record at sunset while sampling ended at sunrise.

During the July surveys, five detections occurred on each of the two nights. The detections occurred in the LSA along the west main access road. None of the detections have been identified to species due to the difficulty in separating bat calls. Further analysis of the data will take place in 2012 in an attempt to identify the recordings. Results will be discussed in the EIA baseline section.

6.8.5.2 Ungulate Surveys

The purposes of the ungulate overview assessment were to identify important wildlife values in the proposed mine site RSA along the branches of the LSA and around Muskeg Creek. Specifically, the overview was conducted to identify any winter wildlife use of the study area by ungulate species (i.e., deer and moose), furbearers and to identify any critical wintering habitats that may be impacted by the Project.

The field assessment used a modified encounter transects survey method of protocols developed by RISC. The encounter transects were conducted as a simple and direct means of recording the presence of wildlife and their distribution amongst habitat types in the LSA (proposed mine site). All encounter transects were surveyed using helicopter support. All significant groupings of ungulates and furbearers encountered during the overview flight were recorded.

The RSA was flown from the southeast section of the RSA at the West Kiskatinaw River northwest to Muskeg Creek searching for any ungulates. All sightings were recorded with a GPS. A total of eleven transects oriented from west to east were flown over the LSA starting from the south. The aerial transect survey recorded all groupings of ungulates. Furbearers were also noted. The study confirmed five species using the area that consist of Moose (*Alces alces*), Black-tailed Deer (*Odocoileus hemionus*), Lynx (*Lynx canadensis*), Snowshoe Hare (*Lepus americanus*) and Wolf (*Canus lupus*). The most frequently encountered ungulate species was moose. Numerous tracks and individuals were noted throughout the LSA low elevation areas.

A winter furbearer tracking survey was completed in early March 2012 and will be discussed in the EIA baseline report.

6.8.5.3 Transportation Corridor

The transportation route follows Highway 52 extending north of Tumbler Ridge for 44 km and south for approximately 16 km. The route is located within the foothills of the Rocky Mountains, at approximately 850 to 1,250 metres elevation a.s.l. The area is located in the BWBS Boreal White Black Spruce moist warm (BWBSmw) variant biogeoclimatic zone. Forests in this area are largely dominated by lodgepole pine (*Pinus contorta*), much of it heavily damaged historically by forest fire or mountain pine beetle (*Dendroctonus ponderosae*). As part of the background assessment of the transportation corridor, a 500 m buffer was assessed on either side of the corridor. Habitats of species of management concern were reviewed. The most significant habitats for the defined species of management concern are considered to be intact forested areas with streams and wetlands as well as open streams and wetlands; especially when they are adjacent to or transect the transportation corridor.

The most significant issue for the Echo Hills Project transportation route is the presence of an ungulate winter range (SPC-009). It has been designated for Caribou (*Rangifer tarandus*). The Quintette Caribou herd is associated with this area and it is considered by the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) as a sensitive zone. This Ungulate Winter Range (UWR) overlaps with the southern extent of the

proposed transportation route. It is located just north of Tumbler Ridge immediately south of the Project site.

Woodland caribou have been Red-listed provincially and designated as federally Threatened by *SARA* nationally. These caribou rely on mature forest to provide winter range. Their low elevation winter range has undergone significant changes in forest structure due to the mountain pine beetle outbreak. It is anticipated these changes in forest structure could alter habitat availability and cause a shift in the predator-prey dynamics in the caribou's winter range. An increase in the numbers of moose and deer may lead to an increase in the number of wolves, leading to further threats to the viability of this population. Locally, these caribou are known to spend time on the high elevation ranges, where they feed on arboreal (tree) lichens when snow conditions warrant, or terrestrial lichens on windswept ridges. It is possible that a combination of increased blowdown, and a reduction of available cover in low elevation pine-lichen habitats may make the intact high elevation habitat types more important over time.

6.9 Hydrology

6.9.1 Description of Regional Watersheds

The Project site is located just east of the drainage divide between the Murray River on the west and the Kiskatinaw River on the east; both rivers drain to the Arctic. Salt Creek, located west of the Project site and separated by the Heritage Highway, has primary tributaries which drain the far western perimeter of the Project site (see Figure 6.9-1). Jackpine Creek, a tributary of the West Kiskatinaw River (which in turn is a tributary of the Kiskatinaw River) drains the Project site and will potentially be most affected by construction and operation of the coal mine. Muskeg Lake is located southwest of the south end of the Heritage Block. It is a shallow eutrophic lake with a relatively extensive wetland border. It is drained to the south by Muskeg Creek, a low gradient stream bordered by wetlands which joins Jackpine Creek south of the Project site.

6.9.2 Current Program

A network of hydrology stations was established in 2005 by CH2M Hill to obtain stream flow data in support of an application for environmental approval for the coal mine - power plant project. The network was re-established and expanded in 2010 by AMEC. The locations of the current stream flow monitoring stations in the Project area are shown on Figure 6.9-1.

Six stations were established at various times commencing mid July 2010. Onset Hobo model U20-001-04 water level recorders were installed at each station by driving steel pipes into the stream bed and affixing the pressure transducers in stilling wells made of PVC pipe. At each station a staff gauge was also affixed to the steel pipe. One pressure sensor was mounted at stream side adjacent to H3 to record atmospheric pressure to allow correction of water level readings for changes in atmospheric pressure. All stations were located using hand held GPS.

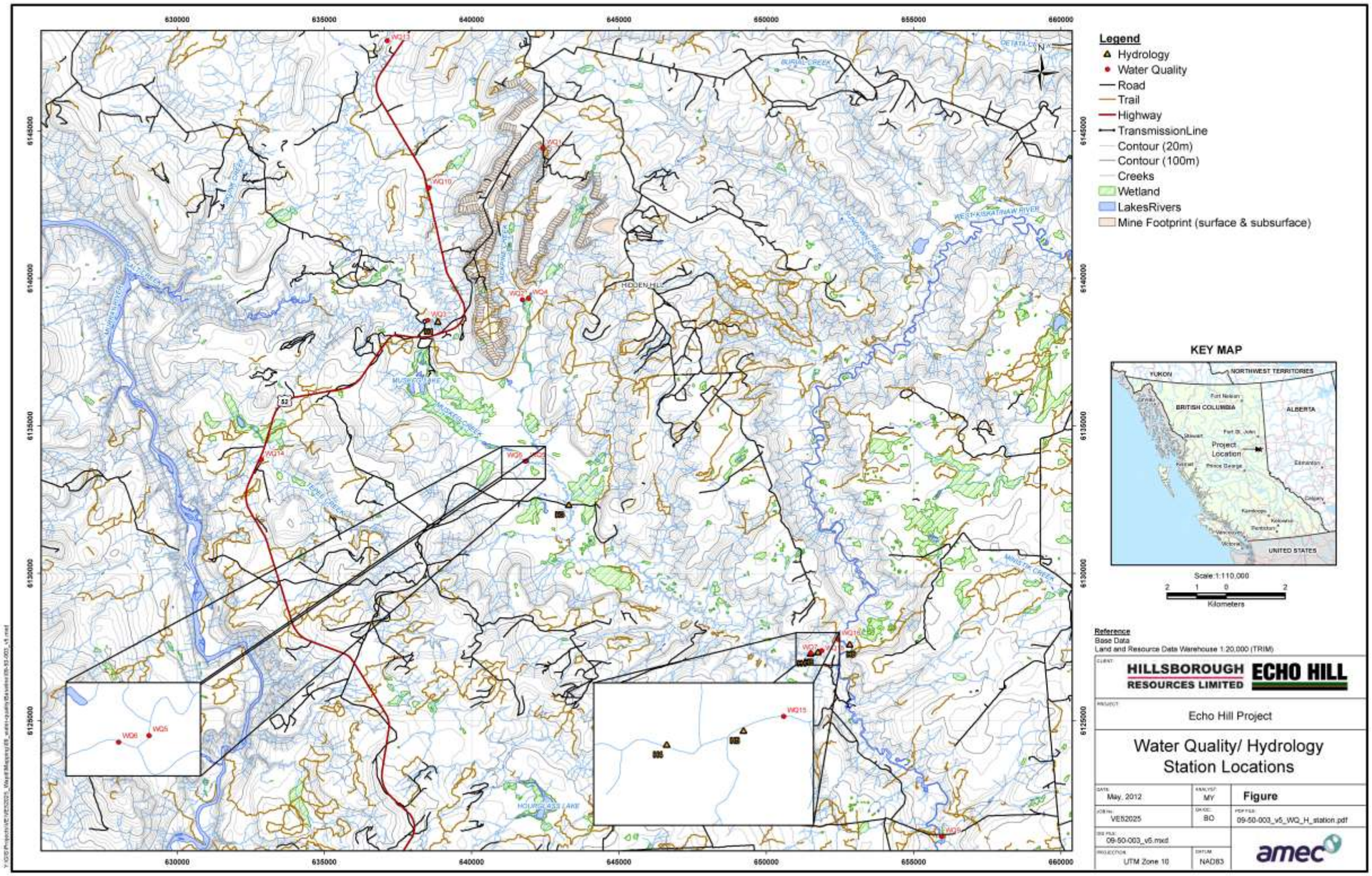


Figure 6.9-1: Echo Hill Coal Project Water Quality and Hydrology Station Locations

All station heights were determined relative to fixed bench marks so that should pressure transducers move the new staff gauge readings could be corrected to the old.

Dataloggers were removed each winter to prevent freezing in. As well, a number of stations were lost in July 2011 due to exceptionally high floods. Additional data is being collected in 2012. Spot discharges were obtained from monthly discharge measurements obtained by wading a cross section of the stream at the hydrology stations. This will allow establishment of a relationship between continuous water levels recorded by the dataloggers and stream flows.

Based on the data collected, peak flows (spring freshet) in upper Jackpine Creek and Salt Creek occurred around mid-May to early June and in mid-June in lower Jackpine Creek and the West Kiskatinaw River. The hydrology data will be used to assist in interpreting water quality and aquatic habitat data and for predicting possible effects of mining on both quality and quantity of water in potentially affected water bodies.

6.10 Hydrogeology

Groundwater monitoring was initiated in 2006 with the installation of nine (9) monitoring wells (DH06-series and MW06-series), in support of the Wapiti Power Development proposed by AESWapiti Energy at that time. Groundwater monitoring activities resumed in 2010 with the installation of four (4) additional monitoring wells (WC10-series). In November 2011, a drilling program saw the installation of an additional ten (10) monitoring wells (WC11-series) including eleven (11) packer tests conducted on six (6) boreholes. The existing groundwater monitoring network currently consists of 23 monitoring wells. The location of all installations is shown on Figure 6.10-1. Groundwater monitoring includes water level measurements and groundwater quality sampling. The groundwater quality analyses include: bulk chemical parameters, major groundwater anions, metals, nutrients and organic carbon. Specifics of the project area physical hydrogeology and groundwater quality are discussed below in Sections 6.10.1 and 6.10.2, respectively.

6.10.1 Physical Hydrogeology

In general, the water levels and thus the groundwater equi-potentials, mimic the surface topography which is typical for a British Columbia physiographic regime with moderate topographic relief and a temperate climate. Refer to Figure 6.10-1. The permeability of the overburden material was determined through grain size analyses of samples collected from split spoon sampling. The permeability of the underlying bedrock was determined using constant rate injection packer testing.

Table 6.10-1 summarizes the estimated hydraulic conductivity of the main lithology groups observed on the Heritage and Centre Blocks. The lithology groups in Table 6.10-1 are listed with increasing age and depth. The hydraulic conductivity decreases with increases in depth and rock competence.

Table 6.10-1: Hydraulic Conductivity Estimates

Lithology Group	Test Type	Count	Geometric Mean K (m/s)
Overburden - on blocks	Grain size analysis	11	1E-09 to 1E-05
Overburden - in valleys	Grain size analysis	14	1E-10 to 1E-04
Wapiti	Packer testing	3	2E-06
Nomad & Chungo (coal) [1,2]	Packer testing	2	7E-06
Chungo (sandstone) [3]	Packer testing	2	3E-06
Hanson	Packer testing	1	2E-07
Thistle/Dowling	Packer testing	3	3E-08
Marshybank	Packer testing	1	5E-09

Notes:
[1] Comprises the Nomad Member and the coal seam of economic importance which is found in the uppermost part of the Chungo Member
[2] Includes part of the lower Wapiti Formation
[3] Chungo Member sandstone (underlying the coal seam)

The most highly permeable units are localized areas of silty-sandy overburden and the fractured Wapiti Formation and Nomad and Upper Chungo members. Packer testing of the Nomad and Chungo Members indicated that the permeability of the coal seam and its hanging wall (Nomad Member) is slightly higher than that of its footwall (Chungo Member sandstone). An impermeable aquiclude layer is believed to exist adjacent to the coal seam. The aquiclude is believed to be thin (< 3 m thick) because packer testing did not identify its position.

Groundwater levels were measured in twenty-three (23) monitoring wells throughout the project area as shown on Figure 6.10-1. A hydrogeological section along transect A – A' is shown in Figure 6.10-2. The hydrogeological section illustrates the extent of the geologic formations and general groundwater flow patterns. Water levels indicate that a perched water table lies above the pavement layer and coal seam in the fractured Wapiti-sandstone. Below the coal seam, groundwater levels indicate the lower Chungo is dry and that the lower aquifer's piezometric surface lies within the Hanson siltstone.

Groundwater flow is dominated by downward vertical gradients through the block. Recharge generally occurs on the upper surface of the blocks with discharge occurring either as springs along the edges or at the base of the blocks where artesian conditions were observed. Ultimately groundwater from the three resource blocks will report to Jackpine Creek, Muskeg Creek or Salt Creek, contributing to the base flow component of these streams.

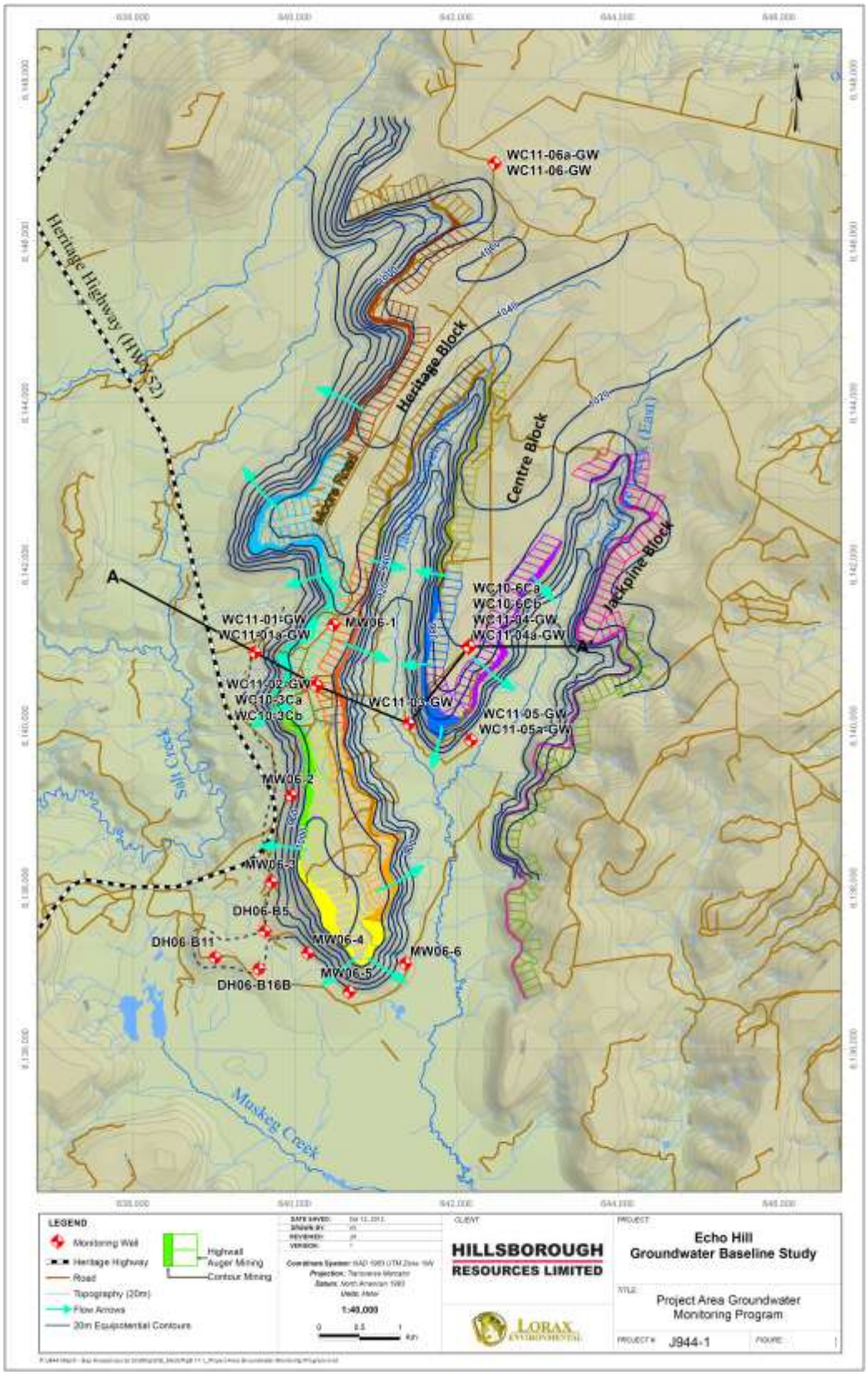


***Figure 6.10-1*: Groundwater Monitoring Program**

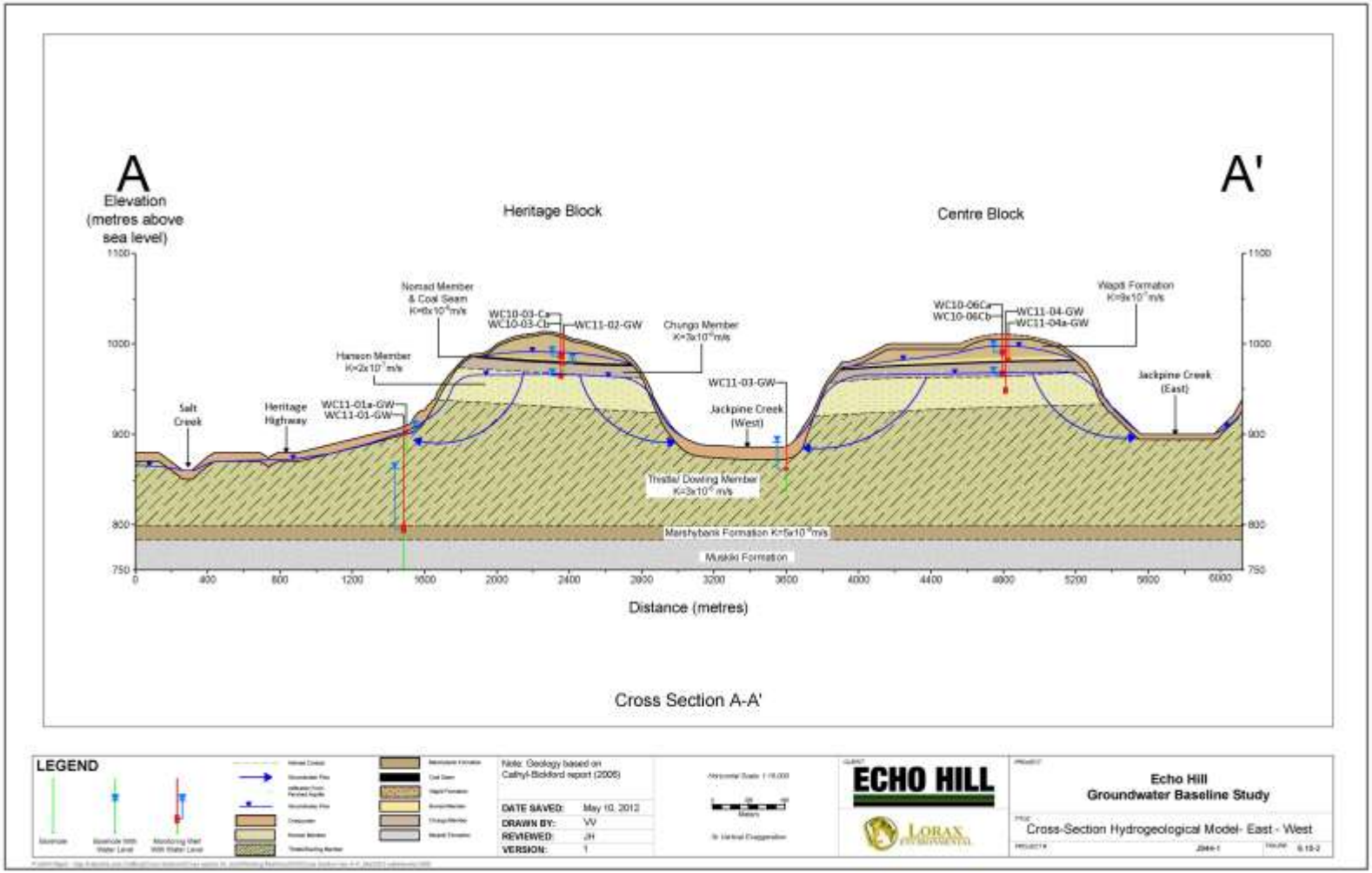


***Figure 6.10-2*: Groundwater Monitoring Program Cross-Section**

6.10.2 Groundwater Chemistry

Several rounds of groundwater samples have been collected from the MW-06-series and WC10-series wells since the winter of 2010. Sampling for the WC11-series wells was initiated more recently in November 2011. Groundwater sampled from wells screened in the Wapiti, Nomad and upper Chungo (coal seam) on both the Heritage and Centre blocks (recharge zones) are dominantly Calcium – Bicarbonate type water. Groundwater sampled from wells screened in the lower Puskwaskau or the Thistle and Dowling mudstone and associated with artesian flow are dominantly Calcium – Sulfate type water. Groundwater from the lower Chungo lying below the coal seam is intermediary between Calcium-Bicarbonate type water and Calcium – Sulfate type water.

Table 6.10-2 provides a summary of parameters that exceed the British Columbia Water Quality Guidelines (BC WQG) 30-day and chronic guideline levels. Selenium is exceeded in two groundwater samples with a concentration of 2.06 and 2.86 µg/L. Dissolved iron (Fe), cobalt (Co), manganese (Mg) and sulfate (SO4) increase in concentration with increasing groundwater age or flow path with the highest concentrations observed in groundwater discharge zones associated with the Thistle and Dowling mudstones.

***Table 6.10-2*: Summary of Groundwater Quality Exceedances**

	Exceedances			
Lithology Group	**Dissolved Metals BC WQG**		**Anions and Nutrients BC WQG**	
	Acute	**Chronic**	**Acute**	**Chronic**
Overburden	Cd, Fe		F, SO_4	
Wapiti	Fe		F	
Chungo (coal)			F	
Chungo (sandstone)	Fe		F	
Hanson	Cd, Se	Co, Mn	F, SO_4	
Thistle/Dowling	Fe	Co, Li, Zn	F, SO_4	

Note: groundwater is compared to surface water criteria only for comparison. Groundwater guidelines are set by the *Contaminated Sites Regulation, Schedule 6* and are generally a factor of 10 higher than surface aquatic life guidelines.

6.11 Water Quality

6.11.1 Description of Regional Watersheds

The Project area lies within the headwaters of Jackpine Creek, a tributary of the West Kiskatinaw River, approximately 20 km downstream from the southern extent of the Heritage Block (Figure 6.9-1).

Surface water runoff from the Project area reports primarily to Jackpine Creek. Muskeg Lake is located 2 km west of the southern tip of the Heritage Block, and may also receive runoff from the southern end of the Heritage Block. The open water portion of Muskeg Lake is less than 1 m deep. Outflow from Muskeg Lake is to Muskeg Creek, which flows into Jackpine Creek 4.5 km downstream of the lake. Muskeg Lake and all of Muskeg Creek are bordered by wetlands, as is Jackpine Creek between the southern end of the Heritage Block and the Muskeg Creek confluence. This portion of Jackpine Creek is very low gradient, slow moving water with deep pools and frequent beaver dams. Jackpine Creek spits into an east and west fork around the Centre Block. These forks, which are the headwaters of Jackpine Creek, are steeper gradient streams through forested areas. A small, unnamed pond is located at the southern tip of the Heritage Block. Teepee Creek, located 5 km south of Salt Creek, is a tributary of the Murray River that serves as a reference stream and is located outside the Project area catchment.

6.11.2 Monitoring Program

Surface water quality monitoring was carried out in 2005 and 2006 in support of the proposed Wapiti Power Development by AESWapiti Energy. Monitoring was initiated in support of the current Project in June 2010 and is ongoing. Monitoring locations on the Project area streams have changed between these two monitoring periods (Figure 6.9-1). Overall, the locations provide baseline information for Jackpine Creek from its headwaters just downstream of the Centre Block to its mouth at the Kiskatinaw River, Salt Creek upstream and downstream of the Project area, Muskeg Creek, the West Kiskatinaw River, as well as the Teepee Creek reference stream. Samples were collected monthly, as well as weekly during spring freshet seasons of 2011 and 2012. Samples were collected less frequently from Muskeg Lake and once from the unnamed lake near the Heritage Block.

Water quality samples were analyzed by ALS Environmental Laboratory in 2005 and 2006, and have been analyzed at AMEC Laboratory since 2010. The parameter list and detection limits meet the requirements for baseline monitoring provided in the MOE (2011) guidance document on baseline water monitoring for mine proponents. These include a full suite of physical parameters, major anions, nutrients, and total and dissolved metals. A general description of baseline water quality for Jackpine Creek and Salt Creek are provided below in Sections 6.11.3 and 6.11.4, respectively.

6.11.3 Jackpine Creek Watershed

Water quality in Jackpine Creek is highly influenced by spring freshet and storm events. During winter low flow periods, Jackpine Creek is characterized by a high level of total dissolved solids (TDS) and related parameters such as conductivity and hardness. Sulphate levels are generally <15 mg/L, well below the current BC water quality guideline

(WQG) of 100 mg/L. TDS levels during low flow months are typically higher on the east branch of the Jackpine than the west branch. TDS in the Jackpine increases with distance downstream and is consistently higher at the mouth than midstream. TDS levels are lower in the West Kiskatinaw River than Jackpine Creek. Muskeg Creek water quality is similar to that of Jackpine Creek.

All dissolved metals in Jackpine Creek, Muskeg Creek, and West Kiskatinaw River were below WQGs, which apply to total metals. Many total metal levels were above their WQG during turbid flow conditions (As, Cd, Cr, Cu, Fe, Hg, and Zn). This is related to metals associated with suspended sediments, which are elevated during high flow periods. During clear flow periods all metals are below their WQGs.

6.11.4 Salt Creek Watershed

Salt Creek has the same seasonal and flow related effects on water quality as occur in Jackpine Creek, with TDS related parameters diluted by snow melt during freshet, and total metals elevated by increased levels of suspended sediments during high flows. TDS levels in Salt Creek are generally higher than in Jackpine. There is a small but consistent increase in levels of TDS

6.12 Sediment Quality

6.12.1 Description of Regional Watersheds

Depositional zones, where fine grain sediments accumulate, are created by the numerous beaver dams on Jackpine, Salt, and Teepee Creek. The location of these change as dams get washed away during floods, as occurred in 2011, and are then rebuilt.

Jackpine Creek, below the Project area, is a low gradient stream with muddy stream bed and relatively little gravel and cobble size material. The West Kiskatinaw River bed is primarily composed of gravel/cobble/boulder sized material, with few depositional zones. Salt Creek stream bed is similar to the West Kiskatinaw, with primarily rock substrate.

6.12.2 Monitoring Program

Sediment quality samples were collected in August 2010 and August 2011 at the same locations as water quality samples (Figure 6.9-1). Fine grained sediments were collected from depositional zones. Metals were analyzed on the <63 µm fraction. The parameters analyzed and detection limits meet the requirements for baseline monitoring provided in the MOE (2011) guidance document on baseline water monitoring for mine proponents.

Results will be discussed in the baseline report submitted as part of EIA documents.

6.13 Fish and Fish Habitat

6.13.1 Overview of Studies

The Project sits at the top of the Jackpine Creek watershed and on the edge of the Salt Creek watershed. Centre Block sits between upper Jackpine Creek to the west and a tributary to Jackpine Creek to the east. Heritage Block sits between Jackpine Creek to the east and Salt Creek to the west. The Project is located up gradient from these water bodies and directly overlaps first or second order tributaries to both water bodies that are typically temporary (ephemeral) and steep (>20 % gradient) when mapped at a 1:20,000 scale.

Hydrology in both creeks is influenced by a snow melt freshet with stream flows declining through the summer months. Water levels can fluctuate by approximately 1.5 m in both creeks and fluctuate rapidly during high rainfall events. Particularly in Jackpine Creek the stream channel banks and valley have low stability and high levels of erosion resulting in high turbidity during most stream flows (DES, 2006). This was recorded up to 450 NTU during the 2011 freshet.

Fish, fish habitat, tissue metal burdens and lower trophic work have been conducted for a variety of purposes since the 1970s. Rationale for studies has been associated with forestry, oil and gas and since 2005 for the Project. A multi season, multiyear collection of aquatic data has been compiled to characterize baseline conditions. The following summarizes the sampling data available:

- 1976 provincial sampling captured burbot, slimy sculpin and longnose sucker near the mouth of Salt Creek,
- Forest Information Systems Ltd, 1995 reviewed watershed restoration opportunities and noted Jackpine Creek had a medium degree of impact from sediment contamination, channel stability and erosion with a low inherent sensitivity to mass wasting (Fisheries Information Summary System (FISS), accessed May 1, 2012),
- Hatfield 1997 sampled tributaries to Jackpine Creek in the middle and lower watershed capturing rainbow trout in a few of the tributaries. No fish were captured in the one sample site in Salt Creek,
- Columbia 2001 conducted reconnaissance level sampling at 12 sites in the Jackpine Watershed including three sites spread throughout Jackpine Creek itself capturing longnose dace and lake chub in the main stem and rainbow trout in some tributaries,
- 2004 and fall 2006 Diversified Environmental Services surveyed aquatic habitat in Salt, Jackpine and Teepee creeks as well as unnamed tributaries to the Murray River associated with the then proposed project. The objectives included reach break analysis, barrier assessment, fish presence / absence, fish distribution, fish population information, periphyton and benthic invertebrates community characterization and tissue metal burdens, and
- Spring, summer and fall 2011 and spring 2012 fisheries sampling was conducted throughout Salt and Jackpine Creeks for the Project. Sample objectives included fish presence / absence, relative abundance and distribution, fish habitat characterization, lower trophic studies, hydraulic habitat and tissue metal burdens.

A map of fish distribution by reach summarizing the results of multiple sampling events is provided in Figure 6.13-1.

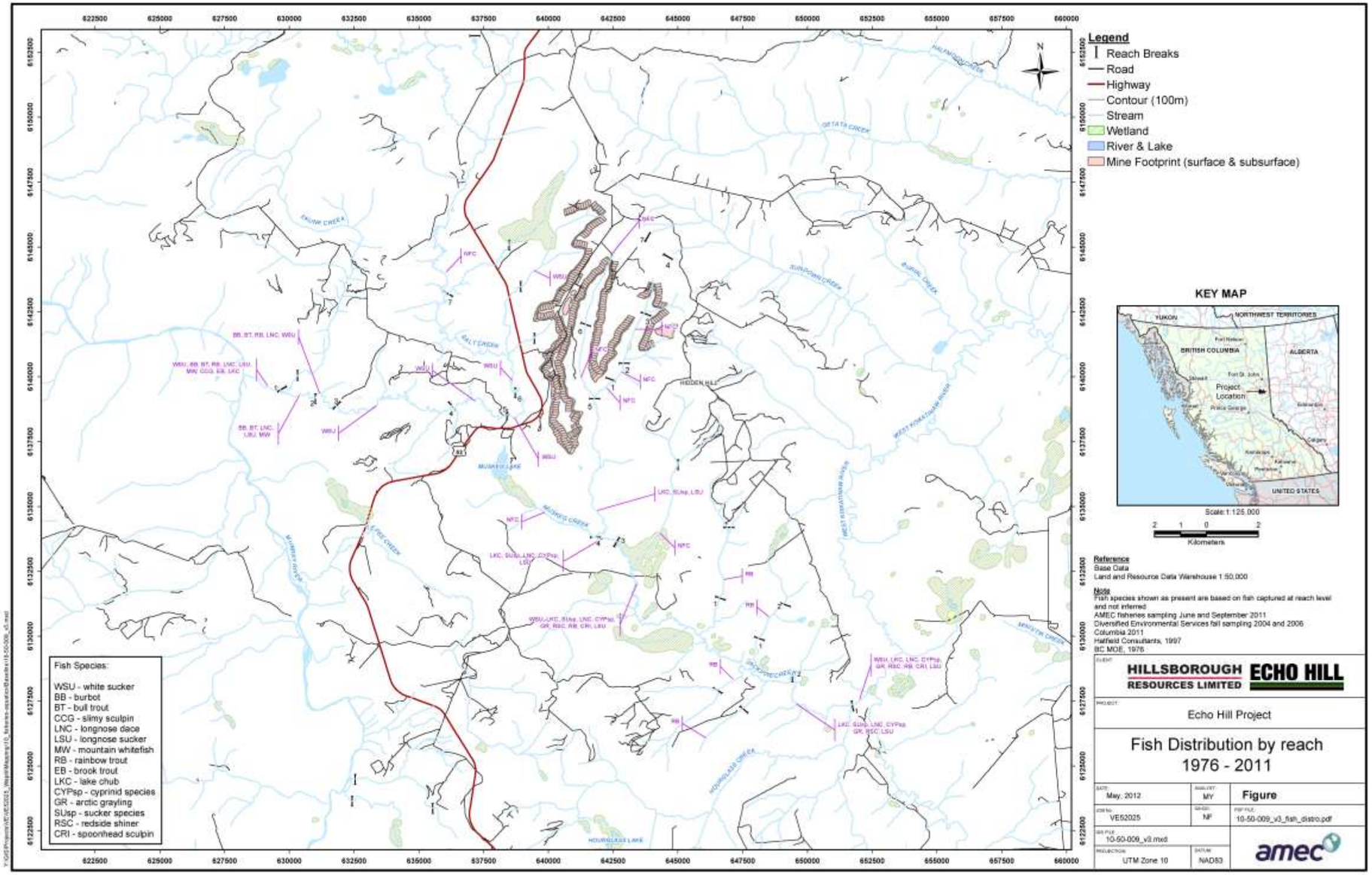


***Figure 6.13-1*:** **Echo Hill Local Study Area Fish Distribution**

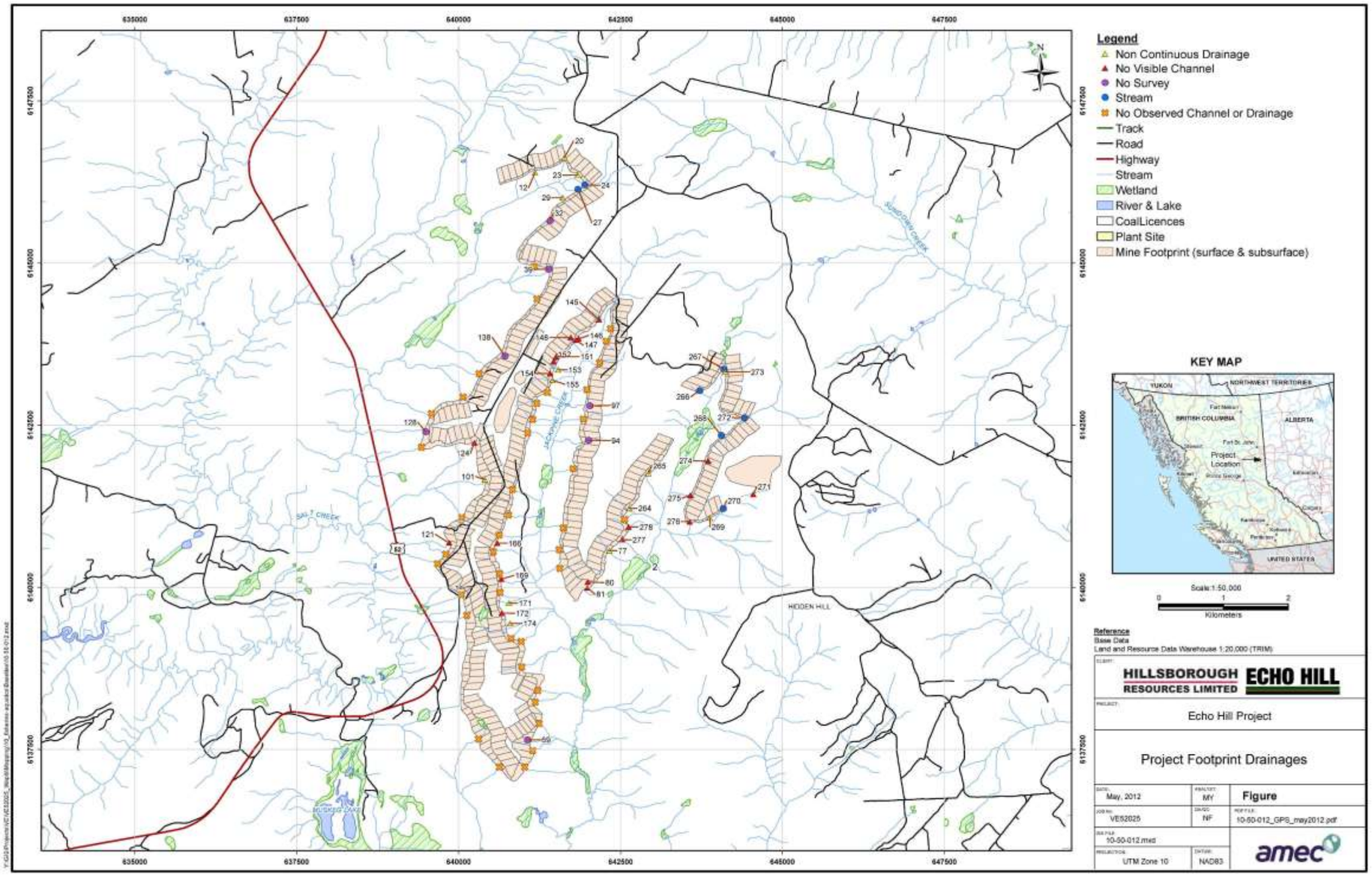


***Figure 6.13-2*: Echo Hill Project Footprint Drainages**

6.13.2 Jackpine Creek

Jackpine Creek (WSC 232-646800-48900) is a 4th order, 34 km long tributary to the West Kiskatinaw River (FISS). It drains southeast from Hidden Hill at 1035m above sea level (masl) into the West Kiskatinaw River at 805 masl (Columbia, 2001). It has two named tributaries, Hourglass Creek and Muskeg Creek both entering Jackpine Creek from the west. Hourglass Creek represents approximately one third of the drainage area in the Jackpine Creek watershed and enters Jackpine Creek approximately 1 km from its confluence with the West Kiskatinaw River. Fish habitat for sport fish and other species in Jackpine Creek progressively declines upstream. A summary of fish habitat information collected from a level 1 FHAP in summer/fall 2011 is presented in the table below.

Table 6.13-1: Fish Habitat by reach in Jackpine Creek as determined during a Level 1 Fish Habitat Assessment Procedure in Summer/fall 2011

Reach	Length sampled	Number of mesohabitats measured	Mean bankfull width (m)	Primary habitat unit (%)			Residual pool depth (m)	Gradient (%)	Dominant substrate	Subdom. substrate
				Riffle	Pool	Glide				
1	468	13	22.3	39	36	25	0.7	0.6	C	G
2	326	12	12.8	12	63	25	0.9	0.7	sand	C
3	817	28	10.3	0	12	88	0.4	0.3	sand	G
4	183	7	4.9	10	20	70	0.8	0.5	clay	G
5	251	20	5	7	77	16	0.4	0.3	sand	G
6	not sampled using level 1 FHAP due to lack of defined channel and beaver influence – 1:20K done									
7	104	16	2.4	24	0	76	0.2	2.9	C	G
East Fork	200	n/a	3.4	deep glide / pool			0.6	1.0	F	C

FHAP – fish habitat assessment procedure; C – cobble; R – bedrock; F – fines; G – gravel; B - boulder

Below Hourglass Creek in reach 1 the lower kilometer of Jackpine Creek, 24 km from the project, the habitat is cobble dominated with riffle-pool mesohabitats. Mean bankfull widths are around 20 m with residual pools over 1 m deep.

In reaches 2, 3 and 4, which covers the majority of Jackpine Creek, the dominant fish habitat is glide-pool with short (<5 m) and infrequent riffle sections with embedded gravel and cobble. The creek is partially confined with mass wasting events evident. Dominant cover is deep pool or large wooded debris (LWD). Bankfull widths are typically 8 - 12 m with gradient less than 1 %.

By reach 5 upstream of Muskeg Creek habitat suitability for sport fish is severely limited (DES, 2006). Bankfull widths are typically less than 5.0 m and gradient is < 1 % with deep pool and instream vegetation providing fish cover. Substrates are fine and organic with beaver activity presenting impediments to fish passage. Reach 5 is the maximum upstream distribution of fish with lake chub and suckers being captured in this reach based on sampling in 2001, 2004 and spring and fall 2011 (Columbia, 2001; DES, 2006 and AMEC, 2011).

Habitat in reaches 6 and 7 is dominated by a poorly defined channel, low gradient and fine or organic sediments. In sections the channel becomes non-continuous in reach 7 and a series of linear beaver ponds and flooded forest / fen sections in reach 6. Distinct mesohabitats in reach 6 were not identifiable during a level 1 FHAP habitat mapping in spring or summer 2011.

Fish distribution and species abundance is related to habitat complexity and quality decline up the Jackpine Creek watershed. Highest species diversity over multiple years of sampling are at reaches 1 and 3. The upper reaches of Jackpine Creek are considered non-fish bearing based on BC MOE, 2011.

In the lower three reaches, at least 5 km downstream of the Project, sport fish and forage fish species are present. Arctic grayling found in these reaches ranged from 135 – 250 mm fork length. Rainbow trout were found mostly in the tributaries to reach 3 where gravel substrates and lower turbidity would provide more suitable habitat than the main stem. Rainbow trout size in the main stem ranged from 65 – 212 mm. Habitat availability and seasonal sampling in 2011 suggests use of the main stem for movement and overwintering. Lake chub were the most numerous forage fish while long nose sucker, red side shiner, long nose dace and white sucker were also present.

In Jackpine Creek reaches 4 and 5 lake chub, longnose sucker and long nose dace were the only identified species captured. Similar cyprinid and sucker species were present but could not be identified to species level.

Upstream of reach 5 Jackpine Creek and a similar sized tributary to the east are considered non-fishing bearing. This is based on the absence of fish captured and the lack of continuous habitat. Fishing has been conducted in spring and fall 2011, 2006 and 2004 using electrofishing and minnow trapping. While no barrier has been identified to fish passage there are numerous impediments to fish movement from reach 5 including beaver dams, undefined channel, no visible channel and subsurface flow as well as the absence of overwintering habitat in reach 7.

6.13.3 Salt Creek

Salt Creek is a 4th order, 44 km long tributary to the Murray River that originates north of the project. It has one named tributary, Skunk Creek which joins Salt Creek close to the Murray River. The creek is incised in its lower reaches and of lower gradient in the upper watershed. In summer upper reaches are dry or intermittent with isolated or near isolated pools. A summary of fish habitat information collected from a level 1 FHAP in summer/fall 2011 is presented in the table below.

Table 6.13-2: Fish Habitat by reach in Salt Creek as determined during a Level 1 Fish Habitat Assessment Procedure in Summer/fall 2011

Reach	Length sampled	Number of mesohabitats measured	Mean bankfull width (m)	Primary habitat unit (%)			Residual pool depth (m)	Gradient (%)	Dominant substrate	Subdom. substrate
				Riffle	Pool	Glide				
1	450	3	14.4	83	17	0	0.6	0.7	C	G
2	434	8	13.1	68	17	15	0.8	1.0	C	G
3	532	7	10.7	0*	18*	0*	Plunge pool	2.7	R	C
4	497	11	17.8	44	66	0	0.8	0.8	F	C
5	338	7	18.7	6	94	0	>1.5	0.6	F	B
6	437	10	17.1	20	76	4	0.8	0.7	C	G
7	832	24	13.7	15	67	18	1.0	0.8	C	G
8	302	15	5.3	58	42	0	0.6	0.7	G	C

*other habitat 82 % as a result of rock chute; C – cobble; R – bedrock; F – fines; G – gravel; B - boulder

Fish habitat in the lower three reaches of Salt Creek is typically cobble substrate, riffle and shallow glide. Gradient steepens towards the top of reach 3 where after a series of bedrock falls and chutes the grade culminates in a 20 m waterfall, approximately 5 km from the Murray River. This falls presents a barrier to fish passage.

Upstream of the falls stream gradient declines below 1 % and is dominated by long pools punctuated with short riffles of sand or embedded cobble and gravel. Low summer stream flow leads to near isolated pools connected with shallow (<5 cm) riffles. Bank wasting and high sediment load is common. Reach 4 is occasionally confined with the active channel moving across its floodplain. Reach 5 is dominated by fine sediments, deep pools and high LWD recruitment from mass wasting of banks. Reach 6 and 7 have highly embedded substrates with dominant fish cover in deep pools where the stream bottom is obscured by suspended sediment.

Fish distribution in Salt Creek is defined about the barrier to fish passage 5 km from the Murray River. Fish present in the lower reaches are potentially a combination of resident and migratory fish from the Murray River.

Below the barrier to fish passage in Salt Creek bull trout, burbot, mountain whitefish, slimy sculpin, white sucker, brook trout, lake chub, longnose sucker and rainbow trout have been captured. Brook trout and rainbow trout are introduced species stocked into lakes in the Murray River watershed in the 1980s. Scale aging of bull trout and rainbow trout indicated these fish were 1 – 3 years old and ranged from 160 – 270 mm.

Upstream of the barrier only white sucker have been captured across all years of sampling. This is a geographically and genetically isolated dwarf population. The largest white sucker captured was 169 mm total length and through otolith aging determined to be 6 years old. On average (n = 134) captured white sucker were 70 mm.

6.13.4 Site Footprint Drainages

To characterize the drainages within the project footprint the project perimeter was walked in October, 2011 and May, 2012 when the site was clear of snow. A reconnaissance level habitat assessment was conducted in May 2012 during the 2012 freshet. The habitat inventory was conducted following 1:20,000 reconnaissance level procedures (BC RISC, 2001). The Forest Practices Code Fish Stream Identification Guidebook was used to further define and categorize the sites. Results are mapped on Figure 6.13-2 and summarized in the following list:

- 90 sites were identified by their intersection with the project footprint based on 1:20,000 TRIM mapping and field identification,
- 7 sites were not surveyed in May 2012 given their location and low likelihood for stream presence,
- 41 of the 1:20,000 mapped sites showed no sign of drainage within the project surface footprint (no 1:20,000 site card completed),
- 20 sites had no visible channel (NVC) where there was no sign of scour, deposition, bank definition and vegetation did not change from surrounding land use (forest),
- 14 sites were identified as non-continuous drainages (NCD) where channel scour, deposition and bank definition was not continuous over 100 m within the project footprint, and
- 8 of the sites were identified as streams with continuously (>100 m) of defined bank, scour and/or deposition with riparian vegetation.

Refer to Figure 6.13-2.

A summary of the habitat characteristics of the eight streams identified that intersect the project footprint are shown in the table below. Given the gradient or absence of fish presence downstream all streams but one are considered non fish bearing. One stream, site 24 in the Salt Creek watershed, could have white sucker present. White sucker have been caught in 2011 approximately 4 km downstream of the project. There is no over wintering habitat. Stream depth (mean residual pool depth 0.25 m) coupled with the step-pool morphology would suggest the use of the habitat by fish is limited. While no defined barrier to fish passage was identified, sampling in August 2012 indicated the site was dry to at least 150 m downstream of the project footprint.

6.13.5 Lower Trophic Communities

Lower trophic communities, benthic macro invertebrates (BMI) and periphyton, were sampled in 2006 and 2011. Sampling was limited by substrate variances and suitability sampling methods were modified accordingly. In 2006 a hess was used in erosional habitat and a scoop/grab sample used in lotic habitat. In 2011 lotic and lentic habitats were sampled by a kick net following Ontario Benthos Biomonitoring Network (OBBN) and Canadian Aquatic Bioindicator Network (CABIN) protocols.

Chlorophyll and periphyton sampling in 2006 was conducted at one site in reach 6 of Salt Creek. Mean chlorophyll a concentrations were 0.9 mg/m^2 well below the BC approved

water quality criteria of 50 mg/m^2 for recreation in streams. Periphyton were dominated by diatoms of the genus Achnanthes and order Cymbellales. In 2011 chlorophyll samples in Jackpine Creek reach 1 were dominated by the cyanobacteria of the order Pseudanabaenales. In Salt Creek reaches 2 and 4 chlorophyll of the order Cymbellales and of the genus Fragilaria, Navicula and Nitzschia were dominant. Mean chlorophyll concentration was highest in reach 2 of Salt Creek at 12 mg/m^2.

6.13-6: Habitat Information for Streams Identified Intersecting the Project Footprint

Stream Site # or name	Watershed	Mean bank full width (m)	Mean residual pool depth (m)	Gradient (%)	Stream length in surface footprint (m)	Present at 1:50K mapping	Fish bearing	Rationale
24	Salt Creek	1.52	0.25	11	100	Yes	Default	Spring use only, dry in August 2012, no overwintering habitat
27		0.71	0.11	14	120	No	No	Gradient, enters a non fish bearing reach
Jackpine Creek	Jackpine Creek	2.4	0.2	3	100	Yes	No	Non fish bearing, NCD and NVC down stream
266		1.31	0.13	25	50	No	No	Gradient
267		2.30	0.20	5	250	Yes	No	Enters NCD and non fish bearing tributary
272		1.52	0.16	4	100	Yes	No	Enters NCD and non fish bearing tributary
268		1.32	0.11	24	50	No	No	Gradient
270		1.76	0.07	15	0	Yes	No	Enters NCD and non fish bearing tributary

In 2006 three sites were sampled for BMI, in reach 3 and 4 in Jackpine Creek and reach 6 in Salt Creek. Both erosional and depositional sites were sampled. At erosional sites in Salt Creek ephemeroptera (mayflies) were the dominant taxa with small numbers of Trichoptera (caddis flies) and Diptera (true flies). In contrast in Jackpine Creek erosional habitat was dominated by gastropoda (snails) with small numbers of dipteral and tipulidae (crane flies). BMI abundance and diversity was greatest in the lentic environments in Jackpine Creek with ephemeroptera, plecoptera and tricoptera (EPT) taxa being dominant.

Results from 2011 sampling show high numbers of organisms and diversity at Jackpine Creek reach 3. Numbers of organisms collected was lowest in Jackpine Creek reach 2 depositional site and highest at Jackpine Creek reach 3 depositional site with mean numbers of 250 compared to 5,000 respectively. Erosional lotic sites in Jackpine Creek were dominated by the dipteran simulidae, the ephemeropterans baetis and heptageniidae and the plecopteran capniidae at all sites. In Salt Creek lotic sites chironomidae were the dominant taxa present followed by the same families as lotic sites in Jackpine Creek. At depositional or lentic sites in both creeks sites were dominanted by the ephemeropterans caenidae and leptophlebiidae, chironomidae and arachnida.

6.13.6 Tissue Metal Burdens

Tissue metal burdens were analysed in plant, invertebrates and fish in 2006 and 2012. Fish species and sample numbers and location varied between the years. A strong focus on selenium analysis resulted in a limited number of metals being analysed. In algae and BMI only selenium was analysed. In 2012 fish tissue, gammarus and macrophytes were analysed for a large suite of metals consistent with BC MOE, 2011a.

Selenium in fish tissue sampled in 2006 exceeded the BC interim guideline for total selenium in tissue of 1µg/g wwt at Salt Creek reach 1 and Jackpine Creek reach 5. Slimy sculpin and lake chub were sampled at these sites respectively with the maximum recorded concentration of 1.36 µg/g wwt. White sucker sampled in Salt Creek in reach 4 and 7 did not have total selenium concentrations above 0.6 µg/g wwt. No other exceedances were observed in algae or BMI although BMI tissue from Salt Creek reach 5 did have a selenium concentration of 0.92 µg/g wwt.

Selenium concentrations from fish sampled in 2011 indicated similar patterns to the 2006 results although concentrations are high. Lake chub in Jackpine Creek reach 3 and 5 exceeded the interim guideline for total selenium. Concentrations in sampled fish ranged from 1.01 to 2.33 µg/g wwt with the exception of 1 fish at 0.6 µg/g wwt (n=16). White suckers sampled in Salt Creek did not have total selenium concentration above 0.9 µg/g wwt. In both years whole body fish were analysed. Rainbow trout sampled in reach of Jackpine Creek had total selenium concentrations of 0.5 – 0.9 µg/g wwt (n=3) in muscle tissue.

Total mercury in all fish tissue from 2011 exceeded the BC approved guideline for the concentration of methyl Hg in fish or shellfish consumed by wildlife at 0.033 µg/g wet weight.

There were no exceedances based on the interim total selenium or methyl mercury guideline for wildlife consumption for gammaridae or macrophytes sampled.

6.14 Socio-Economics

The Project site is situated in northeast British Columbia close to the Municipal District of Tumbler Ridge. This area has undulating topography and is sparsely populated. The nearest communities are Tumbler Ridge to the southwest along Highway 52 and Dawson Creek to the northeast. The socio-economic regional study area (SRSA) selected for this assessment consists of those urban and rural communities that are most likely to provide the manpower, goods and services needed to construct and operate the mine and/or that will be directly or indirectly affected by mine construction or operation.

The boundary of the SRSA was also chosen to reflect the statistical reporting units used by Statistics Canada and the Government of British Columbia. The Statistics Canada reporting units in this region include only three communities and two RDEAs:

- Urban communities:
  - City of Dawson Creek;
  - District Municipality of Tumbler Ridge;
  - District Municipality of Chetwynd;
- RDEAs:
  - Peace River D;
  - Peace River E;

There are two Aboriginal groups with interests in the SRSA:

- Saulteau First Nations, East Moberly Lake 169 reserve; and
- West Moberly First Nations, West Moberly Lake 168A reserve.

6.14.1 Demographics

In 2006, the population of the SRSA was 25,187 people, which is an increase of 2.5% from 2001. About 64% of the regional population lived in the communities of Dawson Creek, Tumbler Ridge and Chetwynd, 23% in the rural areas and the balance in smaller communities. Dawson Creek is the largest community in the region, with a population of 10,995 in 2006. Next in size is Chetwynd (2,633 residents in 2006), followed by Tumbler Ridge (2,454 residents in 2006). The rural areas include Peace River, which had a combined population of 8,780 in 2006.

In the SRSA in 2006 approximately 22% of the population was Aboriginal, with 325 living on reserves and 2,874 living off reserves. The reserves in the region include East Moberly Lake 169 and West Moberly Lake 168A.

6.14.2 Economics

In 2006, just over one-third of the regions workforce was employed in primary industries which include the agriculture and resource-based, manufacturing and construction industries (Statistics Canada 2007a, Internet site). In recent years, the regional economy has been

evolving through the development of more value-added processing of resources and the expansion of tourism and eco-tourism. The resource-based industry employs 18.6% of those working in the region. This includes extensive agriculture, forestry and mining as well as oil and gas exploration and development (Northwest Corridor Development Corporation 2006b, Internet site). The health and education sectors employ 14.9% of the regional workforce.

6.14.3 Education

In the SRSA in 2006, 28.9% of adults aged 18 years and older had not completed high school. The highest incidence of training in the trades was for males in Tumbler Ridge (28.2%). Females in the SRSA were more likely than males to have earned a college diploma, completed some university or earned a university degree; 31.0% of females had a college diploma or higher compared to 23.2% of males. There are 20 public schools in the region and these represent the majority of the 24 schools in the Peace River South School District. Twelve public schools are located in Dawson Creek, two are located in Tumbler Ridge, four in Chetwynd, and two in rural locations in the SRSA. There are four private schools in the SRSA: three in Dawson Creek and one in Chetwynd.

6.14.4 Community Services and Infrastructure

6.14.4.1 Housing

Approximately 75.6% of the homes in the SRSA were privately owned. In Dawson Creek, 34.2% of housing was rented. In Tumbler Ridge 81.3% of housing was owner occupied and 18.7% was rented. About 61.5% of the Aboriginal off-reserve population owned their homes. Housing has been an issue in the SRSA, especially in Tumbler Ridge. During 2006 and 2007 building permits were issued for 279 new units for a value of $54.7 million, with 44.1% of these being single-family dwellings. Nearly two-thirds of this development (65.2%) occurred in Dawson Creek and 29.4% in Chetwynd. Only 5.4% of new housing building permits (15 units) were issued for Tumbler Ridge in these years. However, the number of building permits for new residential development in Tumbler Ridge actually increased, with permits for 22 units being issued in 2009. The District Municipality of Tumbler Ridge notes that the current stock of housing in the community is quite dated (built in the mid-1980s) and it is expected there will be considerable demand for new housing due to a growing population from people coming to the community for new employment and retirement (Tumbler Ridge Community Development, 2010, Internet site). Since original construction Tumbler Ridge is experiencing an unprecedented level of investment in new construction and renovations. There is considerable land for development and the infrastructure was originally designed to accommodate 10,000 residents. Rental properties are in high demand.

6.14.4.2 Utilities

In Dawson Creek, potable water is currently being drawn from the Kiskatinaw River, but the new proposed reclaimed water plant will treat effluent currently being released into the Dawson Creek and be reclaimed for industrial purposes, which may reduce the amount drawn from the Kiskatinaw. In Tumbler Ridge, potable water is drawn primarily from wells. Both urban communities have liquid waste disposal systems (a treatment plant in Dawson

Creek and a lagoon in Tumbler Ridge) and landfills. BC Hydro provides power to these communities, and Pacific Northern Gas provides gas for heating.

6.14.5 Services and Facilities

6.14.5.1 Law Enforcement

Both urban communities in the SRSA have RCMP detachments; there are 28 officers in Dawson Creek and four in Tumbler Ridge. Officers in Dawson Creek provide service to the surrounding communities (north to Fort St. John, west to Chetwynd, east to the border and south to Kelly Lake) as well as backup for Tumbler Ridge.

6.14.5.2 Fire Protection and Emergency Services

Dawson Creek has 12 professional and 12 volunteer firefighters who serve Dawson Creek and the surrounding area. The Fire Department has mutual aid agreements with Pouce Coupe, Tumbler Ridge, Chetwynd, Tom's Lake, Moberly Lake and the adjacent areas. There has been a slight increase in the number of calls over the past few years, but the current infrastructure and personnel are adequate for the existing demand. Ambulance service is also available in Dawson Creek (City of Dawson Creek 2010, Internet site).

Tumbler Ridge has a professional fire chief and 20 volunteer firefighters. They are assisted by the Dawson Creek Fire Department when necessary. Ambulance services are provided through the community Health and Social Services Centre (District of Tumbler Ridge 2010, Internet site).

6.14.5.3 Social Services and Facilities

The British Columbia government provides child, family and other social services for child protection, abuse prevention and responding to the needs of residents. Dawson Creek provides a full range of services as it is the centre for social, community and protection services in the region.

6.14.5.4 Health Services and Facilities

Dawson Creek is fully equipped with medical facilities, including a number of health centres and a hospital that serves Dawson Creek and the surrounding area. Tumbler Ridge has a health centre equipped with an emergency department and the facilities needed to stabilize patients before transfer to a hospital. Mental health services are delivered by the Mental Health Centre in Dawson Creek.

6.14.6 Regional Transportation

Dawson Creek is a key transportation hub in the Peace River region. It is at the junction of three major highways: Highway 97 west to Chetwynd and north to Fort St. John, Highway 2 south to Grande Prairie, and Highway 49 east to Spirit River. Tumbler Ridge can be accessed by two highways: Highway 29 northwest to Chetwynd, and Highway 52 northeast toward Highway 97 and Dawson Creek. Both Dawson Creek and Tumbler Ridge have rail and air access.

6.14.7 Municipal Government

In the SRSA, the communities of Dawson Creek and Tumbler Ridge are governed by an elected council comprised of a mayor and six members. In the Peace River Regional District there is a common board chairperson and each district has a director. In the Aboriginal community of West Moberly Lake 168A, a chief and four council members govern the community.

6.15 Land Use

6.15.1 Land Use Regulatory, Policy, Planning and Management Setting

The area surrounding the Project study area is a combination of Crown lands and private lands that are managed by a variety of land use policies, plans and regulations. They include the Dawson Creek Land and Resource Management Plan (LRMP), the Peace River Regional District Rural Official Community Plan and the *Agricultural Land Commission Act* relating to the Agricultural Land Reserve (ALR).

In British Columbia, 85% of Crown land is forested and administered by the BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO) under the *Forest Act*, the *Forest and Range Practices Act* (which replaced the *Forest Practices Code of British Columbia Act* in 2004) and a protocol agreement with the BC Ministry of Agriculture and Lands (formerly the BC Ministry of Crown Lands). Crown land other than provincial forests is administered under the *Land Act* by the BC Ministry of Agriculture and Lands, Crown Lands Branch.

6.15.2 Land and Resource Management Plans

6.15.2.1 Dawson Creek Land and Resource Management Plan

The Dawson Creek LRMP provides broad direction for the sustainable use of Crown land and resources. Now that it is has been approved by government, the Dawson Creek LRMP will be implemented by government agencies including the provincial ministries of FLNRO, Environment, and Energy and Mines. The overall goal of the Dawson Creek LRMP is "*to provide a stable strategic plan balance between resource development industries with continued access to natural resources outside the Protected Areas, and the protection of environmental and recreational resource values*" (BC MoNRO [now FLNRO], 2011).

The LRMP is divided into twelve resource management zones (RMZs) based on resource values, existing economic activity, environmentally important areas and agricultural land reserve boundaries. The study area intersects two of twelve resource management categories in the LRMP, consisting of South Peace RMZ and Plateau RMZ (Figure 6.15-1).

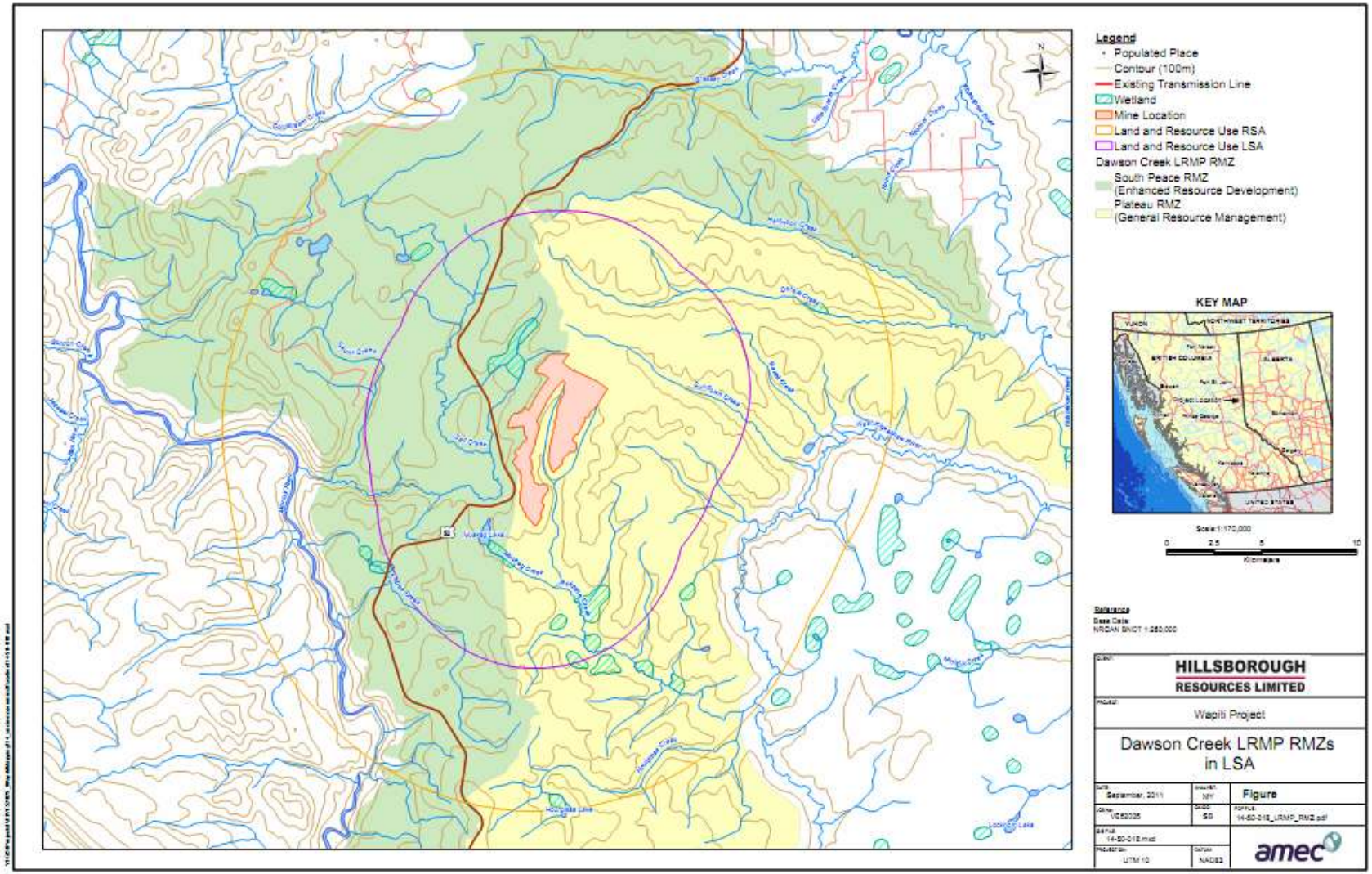


Figure 6.15-1 Dawson Creek LRMP Resource Management Zones

Objectives and strategies for each RMZ guide resource management activities and operational planning in the zones. The following management directions apply to the RMZ land use designations:

- Enhanced resource development, which includes land identified as suitable for intensive development of timber, mineral and petroleum resources and destination resorts. Resource development activities are a priority in this zone and are subject to all relevant provincial laws and regulations (e.g., the *Forest and Range Practices Act*); and
- General resource management, which includes lands managed to integrate a wide range of resource values. Access within these zones is relatively unrestricted, with the exception of any land that may need special management considerations. While recognizing this zone's role in supporting economic development, resource development activities are subject to all relevant provincial laws and regulations.

Figure 6.15-1 shows the relevant RMZ boundaries. The Project is on the western border of the general RMZ.

6.15.3 Parks, Protected Areas and Recreation

There are no parks or protected areas proximate to the Project area. The exact extent of recreational activity is not known in the areas within and adjacent to the Project Area because recreationists are not required to register their activities, but it is evident that recreational opportunities and areas are plentiful for summer, winter and water-related activities. Recreational areas in the LSA include the Paradise Valley trail that generally runs in a north-south direction primarily in the western half of the LSA, Muskeg Lake (privately owned), Muskeg Creek, Murray River and Muskeg Lake Trail. In the RSA recreational areas include Murray River Canyon Overlook, Teepee Falls, Bearhole Lake Trail and Wasp Lake Trail. There are no designated trails that cross the Project deposit.

6.15.4 Agricultural Land Reserve

There are no agricultural land reserves proximate to the Project site.

6.15.5 Guide Outfitting, Hunting and Trapping

One guide-outfitter's territory (British Columbia *Wildlife Act* Management Unit) covers the Project area, but the territory is 533,672 ha and the projected mining area is a very small percentage of this territory. Forest harvesting has been actively carried out in the general area, including the portions of the planned mining footprint and thus industrial disturbance pre-dates the Project. Hunting for large mammals (moose, deer, bears, carnivores) and birds is allowed in the general area of the project under BC hunting regulations. The extent of hunting in the Project area is not known.

Currently, four trapping areas or traplines (trapping management units) intersect the study area. Trapline 0721T011 intersects the largest proportion of the study area at 24,496 ha or 67% of the study area. Traplines 0720T010 and 0720T011 intersect significant proportions

of the study area (6,725.5 ha and 4,356 ha respectively) or 18.4% and 11.9% of the study area, respectively. Trapline 0721T008 intersects the smallest proportion of the study area at 974 ha or 2.7% of the study area.

6.15.6 Forestry

Within the LSA, there are two timber tenure agreements and four forest tenure managed licenses. The two timber tenure agreements cover 95.5% and 4.5% of the LSA respectively. The spatial extents of the four forest tenure managed licenses range from 11.1 ha to 308.4 ha and are individually less than 1% of the study area. However, the total aerial extent of the four managed licences intersects 1.8% of the LSA. The entire study area and forestry tenures fall within the Dawson Creek Timber Supply Area. Figure 6.15-2 shows the overlap of the forest tenures and the Project deposit which is covered by mineral claims owned by Hillsborough.

6.15.7 Oil and Gas

There are no wells directly on the Heritage or Centre Blocks. However a natural gas pipeline constructed by Encana crosses the northern part of the Heritage Block.

There are 83 energy production tenures within the study area consisting of three leases and 80 right-of-ways. The three leases are for the specific purpose of compressors sites and are located at Teepee Creek. Of the 80 right-of-ways, 56 are interim licences and 24 are statutory right-of-ways; 77 are drill sites/well sites and three are meter sites; eight are located at Jackpine Creek, four are located at Murray River, 13 are located at Oetata Creek, 11 are located at Salt Creek, one is located at Skunk Creek, 35 are located at Sundown Creek, two are located at Teepee Creek, one is located at West Kiskatinaw Creek, two are located at Burial Creek, one is located at Mount Bennett and two are located at Muskeg Creek. A list of oil and gas lease holders will be appended to the EIA baseline.

6.15.8 Mining

There are four operating coal mines in the northeast BC region and several projects that have active extensive exploration ($1 to $3 million based on Ministry of Energy and Mines [MEM] statistics). Teck has two closed mines, one of which has potential to reopen (Quintette). Table 6.15-1 lists know projects based on MEM statistics. Figure 6.15-2 shows the locations. Table 6.15-2 lists recent past coal mine projects based on MEM statistics (Ryan and Lane 2006).

Table 6.15-1: Coal Mines and Active Advanced Coal Projects in Northeast BC

Operating Coal Mine	**Operator**
Willow Creek	Walter Energy
Wolverine	Walter Energy
Brule	Walter Energy
Trend	Peace River Coal
Former Operating Mines	**Owner**
Quintette	Teck
Bullmoose	Teck
Active Advanced Exploration	**Owner**
Echo Hill	Hillsborough Resources
Bullmoose	Canadian Dehua International
Wapiti	Canadian Dehua International
Roman	Peace River Coal
Central South	First Coal
Lossan	Xtrata Coal
Murray River	Canadian Dehua International

Table 6.15-2: Past Active Coal Projects in Northeast BC

West Brazion	Belcourt N & S
Horizon – 2 deposits	Omega
Falling Creek	Saxon
Hermann	Hasler
Pine Pass	Burnt River South
Bri-Dowling	Sukunka

Ownership has changed over the years in many cases, thus owners are not listed.

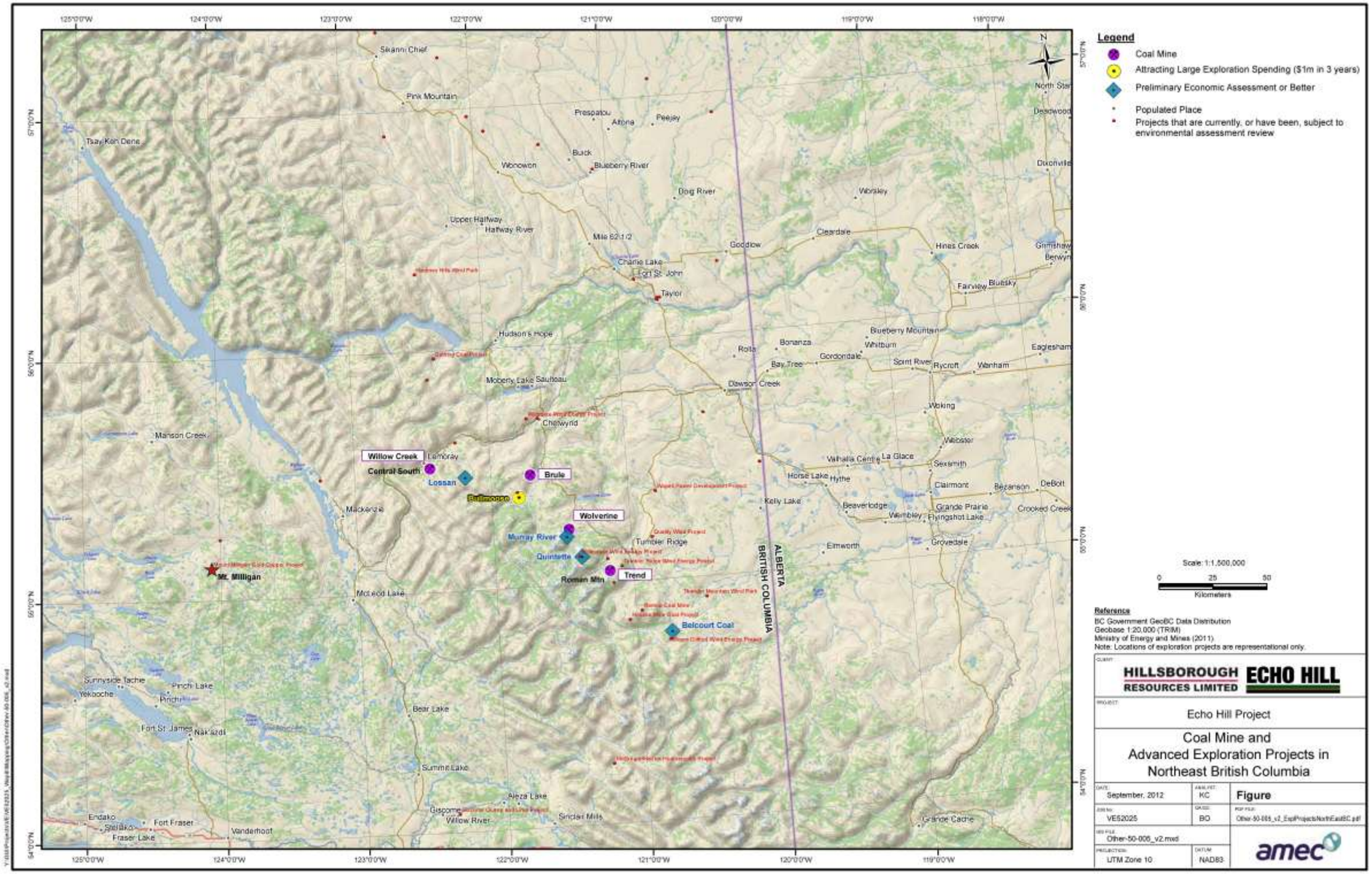


Figure 6.15-2: Operating Coal Mines and Active Advance Coal Projects in Northeast BC

6.15.8 Access

Linear access within the Project area consists of a highway, local two-lane roads and rough/loose single lane roads, trails, right of ways and water bodies. The Project is accessed by Highway 52 from Tumbler Ridge or Dawson Creek and forest service road to the Project site. An access management plan will be developed and a conceptual plan provided in the EIA; a detailed plan will be prepared prior to construction as part of mine permitting.

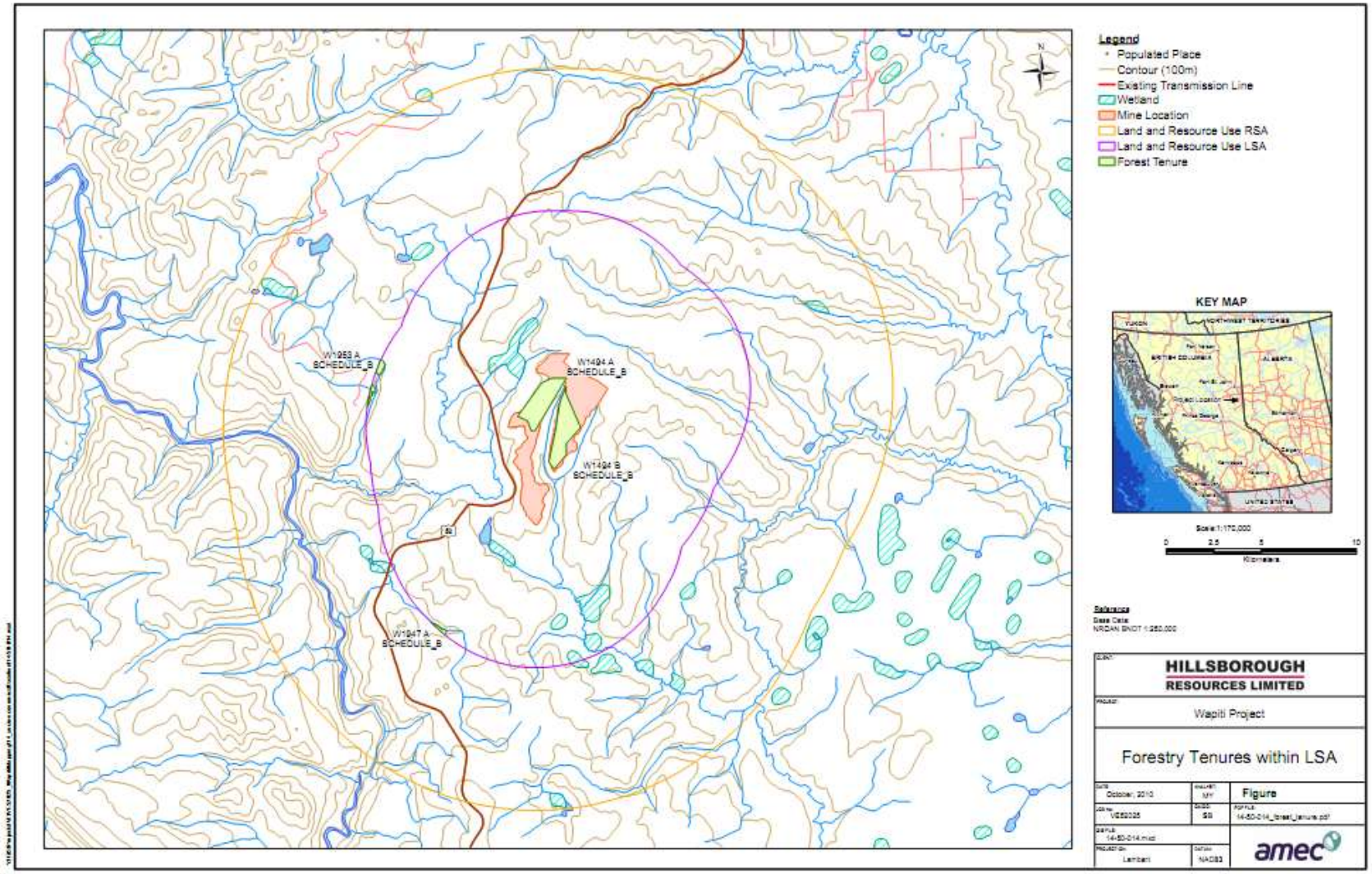


Figure 6.15-3: Forest Tenure Coverage in the Project Area

6.16 Archaeology

An archaeological overview assessment (AOA) was completed in 2006 (CH2M Hill 2006). Nearly all of the commercially valuable timber has been logged from the immediate Project area and there are consequently few undisturbed areas. The AOA identified two sites well away from the proposed mine footprint: a culturally modified tree 4.9 km southeast, and surface lithics 5.4 km southeast.

An archaeological impact assessment (AIA) of the proposed surface disturbance area for contour mining was conducted in 2011 and no artifacts were found. Upon finalizing the precise location for additional infrastructure, a further assessment will be undertaken.

7.0 POTENTIAL ENVIRONMENTAL EFFECTS

7.1 Physical and Biological Environments

7.1.1 Air Quality

7.1.1.1 Particulate Matter

It is anticipated that the Project will generate a small amount of particulate matter when operational. The principal sources will include:

- The raw coal crusher and screen
- Overburden stockpiling and rehandling (required to open contour areas for the highwall miner)
- Dust generated by mobile equipment
- Particulate matter from diesel-powered equipment

Overburden removal and backfill into the completed mining area as part of the progressive development will leave material exposed for a short period of time. Mobile equipment tires moving on unpaved areas during dry weather could generate dust. A minor contributor of fine particulates ($PM_{2.5}$) will be from diesel powered equipment including trucks, dozers, back hoes and power generation. With properly maintained equipment, limited equipment numbers and normal air dispersion, this source should not be significant, i.e., raise $PM_{2.5}$, in and of itself above guidelines. Generation of suspended particulate matter is not expected to be significant from transport of coal by truck since transport will be largely on paved roads and coal trucks will be covered or coal sprayed with a tackifier. Watering can be used on unsurfaced roads to mitigate dust generation during times of the year when temperatures are above freezing. Watering could also be investigated for stockpiles should dusting become problematic.

Air quality modelling will be conducted to predict levels of air contaminants and to identify where mitigation will be required. Dust will be controlled at the rail load out to mitigate any suspended particulates at the transfer operation.

7.1.1.2 Gaseous Parameters

Gaseous pollutants will be generated by fixed and mobile internal combustion engines both on the mine property and in transporting the coal to rail loadout south or west of Tumbler Ridge. The main sources on the mine site will be diesel powered generators (assuming alternate sources such as wind power are not available or are not cost competitive). SOx, NOx, CO and CO_2 will be generated by these sources. An inventory of these sources will be made and sources modelled for particulate matter to predict the potential additions of these gases from the various mine phases. Mitigation will include minimizing through engineering and behavioural controls and by selecting clean alternatives where available and cost effective.

Project related air emissions will be placed in the context of existing and foreseeable emission sources.

Potential air emission sources and possible mitigation are summarized in Table 7.1-1.

Table 7.1-1: Potential Air Emission Sources and Mitigation Strategies

Potential Issue	Mitigation/Management Strategies
Dust generation from coal handling around the coal processing plant, refuse piles and trucking/ rail tranport Greenhouse gases from mobile/stationary equipment and underground Methane Other emissions	• Watering to reduce dust on refuse piles • Tarping trucks • Using latex coating to cover coal transport train cars • Using a dust suppresant on mine roads • Enclose or semi-enclose crusher and conveyor systems where possible • Strategic use of snow fencing to train wind away from potential sources of dust. • Progressive reclamation/ re-vegetation of refuse piles as available • Progressive reclamation/re-vegetation of contour benches • Limit GHGs to the extent practical by use of renewable sources of energy • Use of electrified instead of fuel-powered equipment where practical • Limit unnecessary use of vehicles. • Use low-sulphur fuel.

7.1.2 Noise

Ambient noise is recognized as an issue because noise is defined as any unwanted sound and the project will change the noise levels in the local study area. The following discussion summarizes how ambient noise could be affected by the project in each of the three phases.

During construction, there will be heightened activity at the mine site and access road corridors from heavy machinery and vehicle movements, diesel generators, erection of plant building, and process equipment installation. During operations noise generation will be reduced; the principal sources will be earth moving equipment during construction and reclamation of contour benches, limited noise from the highwall miner (whose moving parts will be mostly underground and therefore muffled), and raw and finished coal haul trucks. During closure, noise generation will be reduced further to earth moving and demolition activities at the mine site which will reduce as reclamation and closure progresses.

Blasting is not expected to be required, but if used, would occur only to aid construction of contour benches.

An inventory of noise sources by type and location will be made and noise levels modelled to predict impacts on human and wildlife receptors. Mitigation will be in the form of best management practices and engineered sound reduction devices such as mufflers, baffles, etc. to the extent practical.

7.1.3 ARD/ML Potential

Disturbance of geologic materials during mine activities will result in increased exposure of rock surfaces, which increases the ML/ARD potential post mining relative to the present undisturbed condition. Possible sources of ML/ARD include runoff and seepage from the contour bench floor, waste rock and coarse rejects (from the crushing and screening plant).

Mitigation of acid rock drainage will be undertaken during operations to prevent acidic waters from emanating from the major mine facilities. The primary mitigation method is the overall design of the mine that limits the volume of waste rock produced and progressive reclamation that limits the extent of exposed highwall surfaces at any one point in time. In addition, mixing the PAG waste rock derived from strata immediately adjacent to the coal seam with the non-PAG strata mined from the overlying Wapiti Formation and oversize rock from the coal screening will provide excess alkalinity to neutralize the PAG materials. Similarly, placing the blended waste rock in the contour mine cut will provide alkalinity and limit water contact with the PAG strata that will be exposed at the base of the high wall. Residual coal in the highwall-auger holes in the coal zone may result in groundwater seeping into the auger voids and releasing metals from the PAG coal. If required, the seepage from the auger voids will be directed through water management structures.

Kinetic testing has indicated that there is the potential for neutral metal leaching from the Echo Hill strata. Selenium is the element that has been identified to have the greatest likely-hood to exceed BC freshwater aquatic life guidelines. Other parameters that could also be leached at rates that could result in potential effects include sulphate and cadmium based on observations from other coal mines in the region. Minimization of water contact with the disturbed materials will be the primary mechanism to limit metal leaching from the mine site.

7.1.4 Terrain, Soils and Surficial Geology

The Project could potentially interact with terrain, soils and surficial geology in the following principal ways listed in Table 7.1-2:

Table 7.1-2: Potential Project Effects on Terrain, Soils and Surficial Geology

Potential Issue	Potential Effects
Soil disturbance	Soil disturbance is the physical removal of soil during the construction phase. This action is most commonly associated with the salvage and stockpiling of baseline soils.
Soil redistribution	Soil reclamation refers to the re-distribution of salvaged soils during the closure phase of the project. This key issue is related directly to the volume of reclamation material available at project closure.
Chemical and physical alternation of soils	Mechanisms identified for the chemical alterations of soils include accidental spills or releases and contaminated seepage from the mixed coal refuse and cleaned coal stockpiles, potentially occurring during each project phase. Physical alteration of baseline soils, including compaction or admixing, may be directly incurred by equipment or machinery operation during each project phase.

Potential Issue	Potential Effects
Suitability of reclamation materials	Chemical and physical alterations to salvaged and cover soils may alter the reclamation suitability of these materials, including compaction, puddling, rutting and accidental spills or releases. Admixing of upper subsoil horizons with topsoil during salvage is an important mechanism of interaction for this issue.
Surficial geology	Development of the contour benches, stockpile pads, building foundations, and borrow source areas (if applicable) directly involves the removal and re-distribution of surficial deposits, throughout all phases of the project.

Till and overburden will be removed in creating the contour benches for operation of the highwall miner. Soils will be stockpiled for reclamation purposes. Soils suitable for reclamation on the Heritage Block plateau will also be stockpiled for reclamation use. To avoid excessive rehandling and attendant degradation of soil physical qualities and handling costs, soils will be stockpiled as close as practical to their final use location consistent with maintenance of a safe work place.

A diesel fuel spill is seen as the mostly likely cause of soil contamination. Storage of fuel and fuelling of vehicles will be localized to reduce the areas where soil contamination could occur. The fuel farm will be bermed and any tanks outside the fuel farm will be double walled with leak detection. Standard operating procedures will be developed for refuelling vehicles and stationary equipment. Incidences of spills will be regularly reviewed with the objective of continual improvement in fuel handling.

7.1.5 Vegetation

Construction and operation of the mine will require removal of vegetation. However, the proposed mine site is an area of active logging and thus much disturbance has occurred and will continue to occur in the area. Clearing will be required for the contour mining benches along hill slopes and on the upland bench of the Heritage Block for site facilities. This upland area has been previously logged and only removal of second growth and under-storey vegetation will be required. Non-merchantable timber and timber harvesting waste will be salvaged with the coversoil.

Selected areas will be cleared for mine roads. Overall the area of cleared land at any time will be relatively small with the progressive reclamation of the contour mining bench. Further discussion is provided in Section 5.

The potential principal effects of the Project on vegetation are listed in Table 7.1-3 and include:

Table 7.1-3: Potential Project Effects on Vegetation

Potential Issue	Potential Effects
Loss from disturbance	Mine, processing, storage and support facilities will require vegetation clearing
Wildlife habitat	Wildlife depend on natural vegetation to a lesser or greater extent and vegetative cover is a critical requirement for some life history stages and project surface disturbance could potentially affect wildlife as some habitat will be altered during mining, to be reclaimed when no longer needed.
Rare plants	Surface disturbance may result in removal of rare plants or significant reduction in habitat capacity to support rare plants
Invasive species	Clearing related to mine activities including roads could result in establishment of invasive species
Wildfire hazard	Some human activities can spark fires and other activities can increase the effects of fire, e.g., vegetative fuel accumulation (slash), and inflammable liquids storage

The principal mitigation and management actions to reduce negative effects on vegetation will include:

- minimizing total Project disturbance by massing facilities wherever feasible
- maintenance of vegetation habitats critical for wildlife where viable alternatives exist, particularly for critical habitat of threatened or endangered wildlife
- protection of rare plants or salvage where preservation of the plants and habitat are not possible
- control of invasive (weed) species through proactive management
- minimizing fire hazards and actively managing fire risks
- progressively reclaiming areas once mined.

One aim of the land and resource management plan for the Dawson Creek resource management area is conservation of old growth forests where possible. There are no old growth forests in the proposed mine area and thus this will not be an issue for the Project.

7.1.6 Wildlife

The principal ways the Project may potentially affect wildlife are the following listed in Table 7.1-4

Table 7.1-4: Potential Project Effects on Wildlife

Potential Issue	Potential Effects
Wildlife habitat availability	Changes to wildlife habitat and its associated use by wildlife may result from the removal of habitat during construction and operation, and the reclamation of habitat during post-closure. Direct effects occur in areas where habitat is lost (example nesting areas for migratory birds caused by tree clearing mine development), and indirectly in areas immediately adjacent, where wildlife use patterns may change in response to a habitat edge, and greater proximity to disturbance. A potential During post-closure, reclamation efforts will restore the site to productive habitat though habitat composition will be permanently altered.
Habitat degradation	The degradation of habitat in and around the proposed mine footprint may result from the generation of dust (proposed dust control measures include wetting and possibly application of a magnesium chloride solution) and emissions caused by traffic, equipment operations and other associated activities in the mine site, and hazardous material spills and forest/brush fires. Exposed soil could result in erosion issues. Other chemicals can pass through the food chain in a variety of ways: through ingestion of contaminated soil, ingestion of contaminated vegetation, ingestion of contaminated water, ingestion of prey/carrion that have consumed contaminated water, soil and vegetation and dermal absorption.
Disruption of movement	New facilities could change the pattern of movement of wildlife, particularly ungulates and furbearers which may be repelled or attracted by mine facilities and activities. The project is off the migratory path of caribou so disruption of movement is not expected to be a concern.
Displacement	Human activities have the potential to cause wildlife to vacate the areas of activity thereby losing the use of former habitat. Displacement can be direct—loss of habitat—or indirect—noise, human presence causing avoidance.
Attractants	Wildlife may be attracted to re-generating vegetation on road-sides and reclaimed sites, cleared right-of-ways that serve as travel corridors, buildings and structures that provide roosting and nesting sites, and smells associated with cooking, garbage and sewage treatment. Wildlife movement patterns vary between species because of species-specific attributes such as size and age, habitat use patterns, home range size, and other factors such as time of day and season, but some may be attracted either during active hours or after hours by curiosity, the odour of machine oils and garbage.
Mortality	Vehicular traffic on the mine access road may result in an increase in wildlife mortality because of collisions with vehicles. The removal of problem wildlife, to protect workers, may represent a direct project related increase in wildlife mortality.

Mitigation and management measures to minimize effects could include (Table 7.1-5):

Table 7.1-5: Possible Mitigation and Management to Minimize Project Effects

Potential Issue	Mitigation Strategy
Wildlife habitat availability	Limit the footprint by massing project facilities to the extent practical consistent with safe and efficient operations.
Habitat degradation	Develop and institute management plans to control generation and export of contaminants of concern from operations. Avoid clearing in areas where birds are nesting where possible, including surveys by qualified biologists prior to any clearing necessary during the nesting season.
Disruption of movement	Avoid migration corridors where practical; limit the footprint by massing project facilities to the extent practical consistent with safe and efficient operations.
Displacement	Develop wildlife, noise and air quality management plans with specific actions to address wildlife disturbance.

Attractants	If found to be a potential issue, use non attractive vegetation species for reclamation where possible. Manage the disposal of putriceable wastes by incineration or other means to prevent attraction of wildlife. Use wildlife proof containers for temporary storage or store to prevent wildlife access.
Mortality	Limit speed limits on mine roads. Institute site wide policies of "wildlife have the right-of-way" and "Don't feed wildlife". Institute a bear awareness or similar program to educate employees to actions to take to counter bear or other large wildlife attacks.

Following the inventory and baseline work (discussed in Section 6.8) the environmental assessment application will identify potential direct and indirect effects on wildlife, including migratory birds and their habitats (including habitats used by migratory birds defined and protected under the federal *Migratory Birds Convention Act*) giving consideration to, and demonstrating linkages between, predicted physical and biological changes resulting from the proposed Project. The Application will individually assess each species identified as a Valued Component (VC) (which will include migratory birds).

Consultation with government, the general public, First Nations and other stakeholders will help inform potential issues and practical mitigation measures.

7.1.7 Watershed Drainage

7.1.7.1 Hydrology

Two drainages have the potential to be directly affected by the Project: Jackpine Creek and Salt Creek, the former because it drains the deposit area and the latter because a tributary drains the western side of the Project area. Indirect effects are possible for the West Kiskatinaw and Murray rivers, although likely not measurable.

Neither Jackpine Creek nor Salt Creek will require diversion as a result of mining. Runoff from contact areas will need to be treated, at least by removal of suspended sediment, before discharge. A certain amount of this water will be lost due to evaporation or be used as a water source for mining and/or processing operations. Groundwater that could otherwise recharge in Jackpine Creek could be intersected by mine workings and require treatment prior to discharge to the creek. A certain amount of mine water will be lost in coal extraction as surface moisture on the coal. A lesser amount of potable water will also be required which could be derived from a well or wells on the property.

As part of the effects assessment and for water management purposes a detailed water balance will be developed as part of mine design engineering. The water balance model outputs will be used to predict effects on water quantity through the various phases of mining and suggest possible design changes to minimize identified potential impacts. This information will identify the amount of water required and suggest possible practical sources, be they ground or surface water. Water balance model outputs, in turn, will provide input into water quality predictions and be used to predict effects on Jackpine and Salt creek flows which could affect aquatic habitats.

A water management plan will be developed to control and mitigate water use for the mining operation. Current best practices will be followed with the objective of reducing to the extent

practical negative effects on Jackpine and Salt creeks and thereby any potential for effects downstream of either of these water bodies.

7.1.8 Water Quality

Water that is in contact with mine components, including the contour bench floor, waste rock, and coarse reject, has the potential to carry elevated levels of contaminants to receiving environment streams. Mine contact water may potentially affect receiving water quality due to ML/ARD. Water quality may also be affected by increased sediment loads from roads and cleared areas leading to elevated total suspended sediment (TSS) levels. The receiving environment for the LSA is Jackpine Creek and Salt Creek.

Typical contaminants of concern from coal mines in British Columbia's northeastern coal region include cadmium, selenium, nitrate, sulphate, and TSS. Leaching of cadmium, selenium, and sulphate will be mitigated by the Project design, which includes measures to prevent ARD formation and to limit the leaching of contaminants from waste rock and other exposed surfaces (see Section 7.1.3). In the absence of the use of explosives during construction or operation (Section 5.3.9), nitrate is not expected to be elevated in contact water. Settling ponds will be constructed to reduce TSS levels in water prior to discharging to the receiving environment. A water quality monitoring program during construction and operation will be implemented in order to identify changes to water quality due to mining activities. A selenium monitoring program will be implemented that includes monitoring selenium levels in tissues of biota in contact with water in the LSA (e.g. fish, amphibians, water birds) in addition to monitoring selenium concentration in water. The monitoring program will allow additional mitigation measures, such as water management or treatment, to be triggered if necessary.

7.1.9 Hydrogeology

Potential effects on groundwater in the project area may be produced by both contour mine operations and coal augering. Groundwater quality may also be affected by the influence of ML/ARD on waters seeping through the mine area.

Mining operations will likely result in increased drainage from the perched aquifer in the Wapiti Formation sandstone. The removal of till and overburden associated with the construction of the contour benches will increase groundwater discharge along the periphery of the Heritage and Centre blocks. The perched water table is expected to be lowered in the vicinity of the contour benches. Downward groundwater leakage from the perched water table may also increase as a result of augering the underlying coal seam, potentially lowering the perched water table in the Wapiti-sandstone. Groundwater seepage from the perched water table may infiltrate through the coal seam and footwall and increase recharge rates into the underlying Chungo sandstone and Hanson siltstone. Mitigation through design is planned by limiting subsidence over the augered coal, thus, limiting the potential for enhanced seepage.

Vegetation removal associated with mine construction and operation may temporarily result in decreased groundwater recharge along hill slopes of the contour benches and on the

upland bench of the Heritage Block. Recharge would likely decrease in these areas due to increased surface runoff and decreased infiltration. Mitigation is planned by progressive reclamation that would limit the exposure duration of unvegetated surfaces.

Seepage through disturbed mined areas has the potential to impact groundwater quality in the Chungo sandstone and Hanson siltstone that underlie the coal seam.

7.1.10 Fisheries and Aquatics

7.1.10.1 Habitat and Populations

Issues of potential concern for the aquatic environment that may be influenced by the Project are listed in Table 7.1-6 and include:

Table 7.1-6: Potential Aquatic Effects of the Project

Potential Issue	Potential Effects
Contamination metals seepage from coal spoils and mine workings	An increase in exposure surface of coal seams with mining and the potential for metals leaching could lead to increased metal loadings to Jackpine Creek and possibly Salt Creek through its tributary that drains the extreme western border of the Project site.
Increase in sedimentation	Upland disturbance of land surfaces required for construction and operation of the mine could lead to sedimentation of Jackpine Creek if not adequately managed.
Reduction in stream flow	While there are no fish in Jackpine Creek in the area of the proposed mine a large reduction in surface and groundwater recharge to Jackpine Creek in the area of the proposed mine could lead to downstream effects on fish habitat.
Effects on wetlands	Wetlands are affected by water levels and a significant drop in water levels in Jackpine Creek could lead to reduction in productivity of downstream wetlands.
Spills of hazardous substances during transport	The largest volume hazardous substance used at the mine will be diesel fuel. A diesel spill could lead to contamination of Jackpine Creek or any of the streams crossed along the transport route.
Spills of hazardous substances during storage	Diesel fuel, oils and lubricants and anti-freeze will be stored and dispensed at the warehouse and maintenance complex. A spill during storage or dispensing could impact water or soil.
Spills of hazardous substances during operations	A mishap in the mining area (contour or highwall operation) could lead to a spill of diesel fuel, oil or antifreeze which could impact water and soils.
Release of domestic waste water	Sewage contamination could lead to increase in nitrogen, phosphorous and coliform bacteria in Jackpine Creek with concomitant decrease in water quality.

Both the AMEC 2010 – 2011 and CH2M Hill commissioned studies in 2006 found no fish in Jackpine Creek at the Project deposit location. Rainbow trout were not caught by either study more than a few hundred metres above the middle of the Jackpine drainage basin. Reference to the project description in Section 5 indicates direct effects on Jackpine Creek, i.e., mining in the creek proper will not occur. Thus potential effects would be limited to changes in water quality and possibly flow reductions due to loss of groundwater recharge occasioned by mining and the use of groundwater seepage in mine workings for mining and processing purposes. The potential for and estimated magnitude of these changes will be the objective of hydrology, hydrogeology, water quality and aquatics effects assessments.

No fish or fish habitat as defined by the amend *Fisheries Act* 2012 are expected to be affected by the Project as no fish have been found within the Project area during multiple surveys over multiple years.

Export of sediment and contact from the mine site will be controlled such that no impacts to Jackpine Creek from surface runoff are expected. Effects on Salt Creek are likewise not expected since, with control of contact water to prevent export, effects on the Salt Creek tributary originating on the west side of the project site will be prevented.

Water used in the mine together with groundwater intercepted in the course of mining will be recycled to the greatest extent practical. Clean water will be routed around active mine areas and contact water will be collected and recycled where practical or required by quality of the water. During construction, settling ponds will be used to mitigate sediment release downslope of clearing operations.

A transportation plan including shipment of goods and materials to the mine and transport of finished coal to the rail loadout will be developed conceptually for the EIA and in full detail prior to construction. The transportation plan, together with an emergency response and spill contingency plan which addresses spill prevention, containment and clean-up will identify risks and develop means to mitigate these risks thereby significantly reducing both the chances of spills occurring and the damage should spills occur.

Hazardous waste materials generated on site (used oil and anti-freeze) and materials contaminated by hazardous substances will be collected and stored in a designated area prior to offsite disposal.

7.1.10.2 Selenium Mobility and Toxicity

Selenium leaching from mined coal deposits is currently a concern of BCMOE and will be addressed in the environmental impact assessment (EIA). The disturbed strata and coal are being tested to assess the selenium leaching potential and, if required, water quality and aquatic biota in the vicinity of the Project will be monitored to determine the extent to which selenium is mobilizing in the environment and posing a potential risk to fish, wildlife, and humans.

7.1.11 Water Resources Effects Summary

Specific water related issues and overview of possible mitigation are summarized in Table 7.1-7.

Table 7.1-7: Specific Water Related Issues and Potential Mitigation Strategies

Potential Issue	Mitigation/Management Strategy
Water balance	• Develop Water management plan as outlined in Section 5 above
Water quality degradation	• Recycle mine water to the extent practical; treat water non-compliant to discharge objectives.
Increased nutrients in receiving waters	• Increases in salinity are not expected to be problematic, but water quality will be modeled as part of the EA and feasibility study • Institute mining practices to limit the generation of N and P; recycle mine water to the extent practical
Increased salinity in receiving water may cause a change in species occurrence and abundance	
Fish habitat	• Limit mine footprint to the extent practical consistent with safe and efficient operation • Mass mine infrastructure into one watershed (Jackpine Creek) • Habitat compensation for unavoidable loss of fish habitat • Re-establish stream courses where possible on closure
Abundance and diversity of fish species Individual fish health Health of piscivorous birds and mammals	• The mitigation strategies outlined above for water balance, water quality, and habitat will ensure that adverse health effects to fish are minimized. • All real or perceived potential health effects associated with altered water balances, water quality, or habitat will be investigated collaboratively by experienced fisheries biologists and toxicologists.

7.2 Land Use

Potential land use issues are listed in Table 7.2-1 and include:

Table 7.2-1: Potential Land Issues for the Project

Potential Issue	Potential Effects
Forestry	Competing land use could limit both mine and forestry use of the Project area
Oil and gas	Competing land use could limit both mine and oil and gas use of the Project area
Mining	Competing land use could limit both mine and oil and gas use of the Project area
Recreation	The mine area will be closed to recreational use during mining for public and worker safety considerations
Guiding and trapping	Guiding and trapping territories which are large both encompass the Project Area and there may be concerns about effects of mining on both these activities

7.2.1 Forestry

A large portion of the proposed mine footprint has been previously logged and the area replanted. Cleared areas and relative duration of use during mining will consist of:

- limited time for contour benches
- life of mine for any processing facilities, administration complex, maintenance shop, fuel farm, clean coal pad

These changes will affect tree rotation times on forest tenure managed licenses that overlap the proposed facilities.

7.2.2 Oil and Gas

One natural gas pipeline crosses the northern part of the Heritage Block and there are no gas wells on either the Heritage or Centre blocks. A number of oil and gas and/or forestry access roads cross the Project deposit. Oil and gas tenure holders will be contacted and informed about the proposed mining operations as part of public consultation. This process should serve to identify any potential tenure conflicts and afford a means of developing resolutions if required.

7.2.3 Mining

There will be no land use conflicts with other mines since Hillsborough, by way of its extensive mineral claims and a mining lease once the mine is approved and permitted, will essentially preclude others from mining in the immediate area.

7.2.4 Recreation

The footprint of the proposed mine has limited recreational potential. There are no organized trails nor are there fish-bearing water bodies. Access is restricted to the Moore Forest Service Road and one oil and gas service road north of the Centre Block. Hunting may occur off the Moore Forest Service Road during hunting season but discharge of fire arms is prevented within 400 m of the road by provincial law.

7.2.5 Trapping and Guiding

Given the large size of the trapping and guiding territories that encompass the Project deposit and previous forestry and natural gas activities at the site, no issues are expected. However tenure holders will be contacted to discuss the Project and Hillsborough will seek to determine whether there are any issues that need to be addressed.

7.3 Visual Aesthetics

No facilities should be visible from the Heritage Highway (Highway 52). The area east of Highway 52 parallel to the Project deposit is classified as a scenic area and thus any changes in the viewscape from the highway may result in concerns and need to be addressed.

The Moore Forest Service Road is an industrial road with both logging and oil and gas activities and because of these existing activities, visual aesthetics are not expected to be an issue. However, a visual impact assessment will be completed using models and presented at public consultation sessions to obtain public opinions on the visibility of proposed facilities.

7.4 Archaeology

An archaeological impact assessment has been conducted over the contour mining area but not the remainder of the potentially disturbed areas. No artifacts were discovered but additional surveys are planned once the footprint of the remainder of facilities is identified.

7.5 Social, Health and Community Issues

There are a number of positive economic benefits, as well as some social impacts associated with the proposed Project. Overall, the Project is but one of several proposed and operating industrial activities in the Peace region and therefore in the context of regional development will not be the dominant factor in any issues that may arise as a result, except on a local scale. Potential social, health and community issues for the Project are listed in Table 7.5-1.

Table 7.5-1: Potential Social, Health and Community Issues for the Project

Potential Issue	Potential Effects
Employment	The Project will provide employment opportunities for skilled and unskilled workers in the Peace region and elsewhere in British Columbia and Canada.
Training	The Project will develop and underwrite training programs for and semi-skilled workers to assist in upgrading their skills.
Business opportunities	The Project will provide contract opportunities for Peace region supplies of goods and services. The Project will also require specialized equipment and contract services which will come from outside the region.
Royalties and taxes	The Project will result in royalties and taxes paid to provincial and federal governments.
Housing	Housing is in relatively short supply in Tumbler Ridge and to the extent that employees are drawn from areas outside Tumbler Ridge and chose to live in the city, some pressures on the housing supply will likely occur. Some employees may choose to live in Dawson Creek which is within a long commuting distance from the proposed mine, which could remove some of the demand for housing in Tumbler Ridge.
Municipal and health services	The Project is but one of a number of coal mines and oil and gas developments that may occur in the region. There will likely be challenges that need to be met to accommodate developments that are proposed and that will eventually be constructed and operated.
Population influx	A rapid influx of population can have negative effects on such factors as crime, alcohol and drug abuse. Past experience with rapid increases in population in Tumbler Ridge from former coal mines may help in adjusting to the new boom which is currently happening in northeast BC, and which the Project is but one of the players.

7.6 Workforce and Employment

The Project will create direct and indirect employment opportunities during the construction and operation phases for the neighbouring communities and beyond. Employment and contracting practices will be established to promote hiring and training of local personnel.

7.6.1 Construction

The estimated manpower requirement during the construction phase is estimated to be 25. Construction of on-site infra-structure includes the maintenance shop, warehouse, office

building and structures for support services. It is expected that the bulk of the work required for construction will be conducted by local contractors.

7.6.2 Operation

The estimated direct manpower requirement during the operation phase is expected to be 120 (employment estimates will be refined during the Mine Permitting stage). In additional there will be employment opportunities for materials and services suppliers.

7.7 Sustainability

7.7.1 Background

Sustainable development is defined as *development that meets the needs of the present, without compromising the ability of future generations to meet their own needs* (World Commission on Environment and Development 1987, Government of Canada 2002). Mining is an extractive industry that supplies the world's mineral and metal markets. Inherently, mining disturbs land by removing a non-renewable resource (KJPR 2007). For a socially responsible corporation, the challenge is to develop a financially viable mine in such a way that opportunities for future generations are maintained or enhanced.

The underlying sustainability goal and Hillsborough corporate policy is to leave a legacy of trained personnel in the employment catchment area of the mine who will be able to shift to other mining or heavy industrial professions and trades once the Echo Hill Mine closes at the end of its 10 to 14 year mine life.

7.7.2 Regulatory Context

In Canada and British Columbia, the concept of sustainable development is the foundation of environmental assessment, which considers environmental, social and economic activities in an integrated manner (Canada-British Columbia Agreement for Environmental Assessment Cooperation 2003). In terms of specific legislation, the Canadian Environmental Assessment Act (CEAA) (Government of Canada 2012) requires the consideration of potential adverse environmental effects of the capacity of renewable resources that are likely to be significantly affected by the project. There are no requirements to consider effects on non-renewable resources.

7.7.3 General Approach and Objectives

This assessment of sustainability commences by determining the communities' current view of sustainable development. The general objectives of the sustainability assessment are to determine whether the Project as currently proposed meets the community criteria for sustainability and then to identify opportunities by which Hillsborough can further contribute to sustainable development in the regional communities. The assessment will need to consider economic, social and environmental sustainability.

7.7.4 Methodology

The sustainability assessment will be completed conceptually following these steps:

- Determine if the capacity of renewable resources are likely to be significantly affected by the project.
- Identify publicly available documents pertaining to sustainability in the Peace region.
- Extrapolate potential sustainability goals from the documents under three categories: economic, social and (natural) environment.
- For each potential sustainability goal:
    - determine if the project as currently proposed meets the goal
    - leverage opportunities identified using professional judgment and discussions documented in community meeting minutes.

7.8 Cumulative Effects

A cumulative effects assessment (CEA) will be conducted to identify the potential for cumulative effects to occur and to assess the significance of those effects; both provincial and federal (if CEAA review is required) guidelines will be followed. The assessment of cumulative environmental effects largely depends on effective scoping, i.e., setting the boundaries of the assessment and focus of the analysis. Scoping includes:

- identifying environmental effects to be considered
- identifying likely cumulative environmental effects within those limits
- setting the spatial and temporal boundaries for the assessment

The Canadian Environmental Assessment Agency (CEAA) defines cumulative effects as: “changes to the environment that are caused by an action in combination with other past, present and future human actions” (Hegmann et al., 1999). Under this definition “actions” include human projects and activities. Projects are typically some form of commercial or industrial development that is planned, constructed and operated – a mine development or resource access road, for example. Activities may either be part of a project or may arise over time due to ongoing human presence in an area. Examples of activities are public traffic, hiking and hunting (Hegmann et al., 1999).

Although cumulative effects can occur in various ways, four potential effects are described below (Hegmann et al., 1999):

- Physical-chemical transport: A physical or chemical constituent is transported away from the action under review where it then interacts with another action (e.g., air emissions, waste water effluent, sediment).
- Spatial and temporal crowding: Cumulative effects can occur when too much is happening within too small an area and in too brief a period of time. A threshold may be exceeded and the environment may not be able to recover to pre-disturbance conditions. This can occur quickly or gradually over a long period of time before the effects become apparent. Spatial crowding results in an overlap of effects among actions (e.g., noise from a highway adjacent to an industrial

site, confluence of stack emission plumes, close proximity of timber harvesting, wildlife habitat and recreational use in a park). Temporal crowding may occur if effects from different actions overlap or occur before the VEC has had time to recover.

- Growth-inducing potential: Each new action can induce further actions to occur. The effects of these "spin-off" actions (e.g., increased vehicle access into a previously relatively inaccessible area) may add to the cumulative effects already occurring in the vicinity of the proposed action, creating a "feedback" effect. Such actions may be considered as "reasonably foreseeable actions."
- Nibbling loss is described as the gradual disturbance and loss of land and habitat (e.g., clearing of land for a new sub-division and roads into a forested area). Regional plans are required that clearly establish regional thresholds of change against which the specific actions may be compared in order to address effects associated with "nibbling" (Hegmann et al., 1999).

7.8.1 Methodology

The CEA will be limited to those residual effects (post mitigation) on valued components (VCs) resulting from past, present or reasonably foreseeable human activities or actions which occur within the area where a linkage between the residual effects resulting from the Echo Hill project related activities and the residual effects of other actions occurs. The cumulative effects assessment area is that area where cumulative effects from multiple activities can occur. The cumulative effects assessment for each VEC includes the following steps:

- determine if a project activity will have an effect on a VC
- if an effect occurs, determine if the incremental effect acts cumulatively with the effects of other human activities, either past, existing or reasonably foreseeable
- determine if the effect of the project, in combination with other effects, may cause a significant change now or in the future after the application or mitigation

7.8.1.1 Cumulative Effects Assessment (CEA) Assessment Framework

Tasks typically considered within the basic EIA framework include scoping, analysis, mitigation, significance determination and follow-up (CEAA 1999). Following the completion of the effects assessment the following steps are conducted for the cumulative effects assessment:

- residual effects identified in the effects assessment during construction, operation and decommissioning/closure are carried forward as VCs in the CEA
- temporal and spatial boundaries are defined
- other projects and human activities considered in the CEA are identified and described
- incremental effects associated with other projects/human activities are identified

- significance of residual cumulative effects and likelihood after mitigation are discussed
- the level of certainty and any limitations in the CEA are described

7.8.1.2 Valued Components (VC) Selection

The VCs that will be selected are those from the broader list set out in the Application Information Requirements (AIR) issued by BCEAO which are determined from the effects assessment to potentially have residual effects derived from the project after mitigation has been applied.

7.8.1.3 Temporal and Spatial Boundaries

Temporal

Temporal boundaries define the timeframe over which the effects originating from the project development are anticipated to occur. The CEA will encompass the effects for all phases of the project including construction, operations, closure/decommissioning and post-closure.

Spatial

Spatial boundaries for the Project were identified using the following criteria:

- the physical extent of the proposed project, including any offsite facilities or activities;
- the extent of potential effects arising from the project
- the extent of the aquatic and terrestrial ecosystems, economic systems, communities and First Nations interests potentially affected by the project
- the size, nature and location of past, present and reasonably foreseeable projects and activities which could interact with the project's own effects.

Spatial boundaries for the CEA will be selected to ensure that the area(s) over which the potential for cumulative effects was assessed are appropriate. Due to the difference in spatial scales over which residual project effects are assessed for an EIA, two separate study areas will be developed for the natural (biophysical) environment and the social economic environment.

- *Biophysical CEA Study Area*

The discipline specific regional study areas (RSAs) will be used to identify linkages within a specific spatial area for each VC. Potential project effects on VCs included assessing linkages with other disciplines. For the CEA incremental effects will be identified for each VC in combination with other projects/human activities utilizing the discipline specific RSA.

The Biophysical CEA Study Area will include the regional study areas described for the various disciplines and will describe a summary area developed in the Non-traditional Land

Use assessment. This area will be used to ensure relevant land use activities were addressed and provided a fixed area for the inclusion of foreseeable projects.

- *Socio-economic CEA Study Area*

A regional approach will be used for the socio-economic assessment. The regional Socio-Economic CEA Study Area selected for the assessment will coincide with the Socio-Economic Regional Study Area (SRSA) used to assess project effects and will consist of those urban and rural communities that are most likely to provide the manpower, goods and services needed to construct and operate the mine and/or that will be directly or indirectly affected by mine construction or operation.

7.8.1.4 Other Projects and Human Activities Considered in the CEA

The selection of other projects and human activities to be considered in the CEA are initially identified by reviewing available information for the following:

- historical (closed) projects/activities within the CEA study areas
- existing (currently active) projects within the CEA study areas
- general land use activities within the CEA study areas
- reasonably foreseeable future projects occurring within the CEA study areas.

7.8.1.5 Effects Analysis

The analysis of cumulative effects follows the following steps:

- identify linkages
- describe potential project effects on VCs that include assessing linkages with other disciplines
- determine whether incremental effects are predicted to occur on a VC in combination with other projects/human activities
- provide mitigation, monitoring and management strategies to reduce/limit potential cumulative effects
- determine significance of residual cumulative effects and likelihood after mitigation
- provide a discussion regarding level of certainty.

8.0 ABORIGINAL GROUP ENGAGEMENT AND PUBLIC CONSULTATION

Hillsborough is committed to comprehensive engagement and consultation with Aboriginal groups, local residents, stakeholders and regulatory agencies regarding the Project. The strategy developed to fulfill this commitment will:

- Be consistent with the guidelines from the BC Environmental Assessment Act and the Canadian Environmental Assessment Act, 2012
- Recognize that the proposed development is located in the traditional territory of Aboriginal groups
- Acknowledge the common interest of all groups to protecting the environment
- Encourage involvement in understanding in the project and addressing the concerns and needs of the various communities.
- Ensure an ongoing and enduring process.

Meeting with individual groups, public meetings, open houses and newsletters will be part of an open and transparent consultation process throughout all stages of the project.

8.1 Aboriginal Group Consultation

The Project is within the Treaty 8 Region, which includes the traditional territory of eight First Nations in the northeast corner of the province. The BCEAO has provided an initial indication (to be finalized through the Section 11 Order) that four of the eight First Nations need to be engaged and consulted with on the project as well as the Treaty 8 Tribal Association. The First Nations included along with contact information is tabulated below.

First Nation	Contact Information		
	Chief	Phone	Address
Halfway River First Nations	Russell Lilly	(250) 772-5058	PO Box 59 Wonowon, BC V0C 2N0
West Moberly First Nations	Roland Willson	(250) 788-3663	PO Box 90 Moberly Lake, BC V0C 1X0
Saulteau First Nations	Harley Davis	(250) 788-7260	PO Box 1020 Chetwynd, BC V0C 1J0
McLeod Lake Indian Band	Derek Orr	(250) 750-4415	General Delivery McLeod Lake, BC V0J 2G0

The Project is also within an area of interest of the Metis Nation of British Columbia due to its proximity to the Kelly Lake Metis Communities. Contact information is tabulated below.

Organization	Contact Information		
	Contact	Phone	Address
Metis Nation British Columbia	Dave Hodgson, Natural Resources and Environment	(604) 557-5851	30691 Simpson Road Abbotsford, BC V2T 6C7
Kelly Lake Metis Settlement Society	Lyle Letendre, President	(250) 356-3338	PO Box 54 Tomslake, BC V0C 2L0

To-date initial introductory meetings have been held with each of the four First Nations and draft "Protocol Agreements" are being reviewed. A summary of these meeting is tabulated below.

Date	Aboriginal Group	Purpose	Comments/Concerns
February 2, 2012 (letters)	McLeod Lake Indian Band West Moberly First Nations Halfway River First Nations Saulteau First Nations	Introduction	
April 18, 2012 (meeting)	McLeod Lake Indian Band • Alec Chingee • Eran Spence • Bob Inkpen	Project and communications overview	Employment/contracting opportunities, involvement in baseline work and hunting access
April 19, 2012 (meeting)	West Moberly First Nations • Rolland Willson • Dean Dokkie • Clarence Willson	Project and communications overview	Employment/contracting opportunities, involvement in baseline work and hunting access
April 20, 2012 (meeting)	Halfway River First Nations • Roslyn Pokiak	Project and communications overview	Employment/contracting opportunities
May 29, 2012	Saulteau First Nations • Patricia Blandin • Tammy Watson • Teena Demeulemeester • Rick Publicover	Project and communications overview	Employment/contracting opportunities, involvement in baseline work and hunting access
July 10, 2012 (letters and e-mail)	McLeod Lake Indian Band West Moberly First Nations Halfway River First Nations Saulteau First Nations	Draft "Protocol Agreements" provided for comment	
November 5, 2012	McLeod Lake Indian Band • Derek Ore • Geraldine Salonas • Janine Salonas	Project update	Water protection Need for a MOU
November 5, 2012	Saulteau First Nations • Harley Davis • Lana Garbitt	Project update	Involvement in future baseline work and TLU study Training programs

	• Patricia Blandin • Tammy Watson • Teena Demeulemeester • Rick Publicover		Need for a Participation Agreement
November 6, 2012	Halfway River First Nations • Roslyn Pokiak • Tim Watson	Project update	Traditional use (trails) Capacity funding TLU study
December 10, 2012	West Moberly First Nations • Clarence Willson • Dean Dokkie • Cecile Heron • Lisa McArthur	Project update	Need for a Protocol Agreement TLU study Water quality Access for hunting Capacity funding and IBA

Discussions with the First Nations to date have indicated the existence of environmental values of interest that are important considerations for the Project. The environmental values of interest span a range of issues from historical and current resource uses to socio-economic considerations. Historical issues include archaeology, traditional use, and aboriginal rights and title related to environmental resources and quality (including water, land, vegetation and wildlife). Socio-economic considerations include topics such as employment and business opportunities.

While previous assessment of the Project area concluded that there were no known or pre-recorded archeology sites within the footprint of the mine, it is expected that the general vicinity of the Project area is likely to have been utilized by First Nations in the past for a variety of hunting, trapping, fishing and plant gathering activities.

A summary of potential adverse impacts to natural resources and associated impacts on plant and wildlife species linked to traditional uses by Aboriginal groups along with possible mitigation measures are summarized below.

Possible Impact	Potential Effect on Aboriginal Rights	Possible Mitigation
Changes to the environment: Potential impact to downstream aquatic habitat and water quality from sediment and effluent discharge and from the use of water resources for Project operation.	Could affect FN treaty rights to traditional food harvesting practices, including fishing and plant food harvesting.	Project design (including producing a non-washed product) will insure that a very limited amount of water will be used for operations. The Proponent is committed to developing a water management and monitoring plan for the Project prior to construction and operation,
Changes to the environment:	Could affect FN treaty	Impacts to wildlife and habitat on

Potential impacts to vegetation and wildlife that support subsistence hunting and traditional use caused by physical disturbances (logging, overburden and coal removal, road construction) on the Project footprint.	rights to traditional food harvesting practices, including hunting, trapping and plant food harvesting.	the Project footprint are reversible, with the significance of the impact mitigated by: • Highwall auger mining minimizes the overall disturbance footprint • Progressive reclamation will minimize the area of productive habitat lost at any given time during the life of the Project The Proponent is committed to developing a wildlife management and monitoring plan for the Project prior to construction and operation.
Changes to the environment: Continued development in the area (coal mining, oil and gas activity and timber harvesting) having a cumulative impact on water, habitat, wildlife and terrain.	Could affect FN treaty rights to traditional food harvesting practices, including fishing, hunting, trapping, plant food harvesting and non-subsistence harvesting.	The Project design will minimize impacts and the progressive plan will insure the site is returned to productive habitat after decommissioning.
Social impacts: Training, employment and contracting opportunities during construction and operations		During the EA phase discussions will be held with Aboriginal groups to develop strategies for training and employment and contracting opportunities.
Traditional use: Loss of access to the Project area for hunting	Could affect FN treaty rights to traditional food harvesting practices, including hunting and trapping.	Through site visits and discussion on the final mine plan efforts will be made to minimize effects on access for traditional uses

Hillsborough engaged “The Pathways Partnership” to assist with the initial development of a “Strategic Consultation Plan” and the execution of that plan. Key components of this strategic plan include:

- Early and effective engagement
- Maintaining respect for persons
- Proactive approach to facilitating solutions

The following chart outlines the anticipated Aboriginal engagement and consultation activities and their timeline.

Timeline	2012		2013				2014				2015	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Protocol Agreements	• Communications and participation plan											
Traditional Use Study and Issues Assessment			• Historical and cultural resources • Land and resource use • Local and regional economics Mitigation measures									
Impact and Benefits Agreement								• Participation opportunities • Environmental protection • Ongoing communications				

The EA will include up-to-date details on the Aboriginal engagement process.

8.2 Provincial Government Consultation

Hillsborough held two meetings with Ministry of Environment, Prince George to outline the proposed project and baseline programs proposed. An on-site meeting was also held with Ministry staff. Table 8.2-1 lists meetings.

Table 8.2-1: Provincial Government Consultation to August 2012

Meeting Date	Organization	Results
23 September 2010	MOE, Prince George	Project introduction to regulators
26 May 2011	MOE/DFO, Prince George	Review aquatics and water resources programs with regulators. Suggestions made by MOE regarding monitoring selenium in the aquatic environment: include bull trout in lower Salt Creek—no permit issued; sample amphibian eggs—no permit issued in 2011—will reapply for 2012.
June 2011	MOE, at project site	AMEC aquatic biologist discussed aquatics program. MOE suggested expansion of fish tissue analysis program to include metals other than selenium and expansion of aquatics program to include sampling of gammarid copepods and periphyton. MOE recommendations implemented; periphyton will be collected in fall 2012. MOE suggested installation of a hydrometric station on upper Jackpine Creek and under ice flow measurements in Salt Creek. A station was subsequently installed and under ice flow measurements taken in Salt and Jackpine Creeks. Under ice dissolved oxygen measurements had been taken the previous winter.

Meeting Date	Organization	Results
June 2012	MOE, Victoria	Direction with respect to TEM codes to employ in TEM mapping
16 Aug 2011 e-mail comments on work plan	MOE	MOE suggested lower trophics aquatic sites be included on lower and upper Salt Creek. Sites were established. Fish barrier on upper Jackpine Creek confirmed. Consistency between water and aquatics sampling sites requested and complied with where feasible.

8.3 Regional Government Consultation

Regional and local government agencies will also be involved in the consultation process. It is expected that the following jurisdiction will be included:

- Town of Tumbler Ridge
- City of Dawson Creek
- Community of Kelly Lake
- Community of Arras
- Peace River Regional District

Expected points of interest on the project include water use and quality (the Kiskatinaw River is the drinking water source for the City of Dawson Creek and community of Arras), housing availability and local economy.

The following table summarizes consultation meeting held to date with regional and local governments.

Meeting Date	Organization	Results
December 11, 2012	District of Tumbler Ridge	Project introduction. Areas of interest included truck traffic associated with the coal haul to the train loadout and workforce size and housing
December 11, 2012	City of Dawson Creek	Project introduction. Areas of interest included impact to water quality and quantity in the Kiskatinaw River and workforce size and housing
December 11, 2012	Peace River Regional District	Project Description. Areas of interest included potential of a campsite to house workers.

8.4 Public and Stakeholder Consultation

Overlapping and adjacent tenure holders and interest groups will also be consulted with during the EA process. This is expected to include energy production right-or-ways for drill sites and well sites related for natural gas exploration and production, timber woodlot licences, forest harvest licences, trappers, guide-outfitters and wind power permit areas.

The Integrated Land and Resource Registry ("ILRR") database will be used as a resource to identify overlapping tenures in the Project area.

Consultation activities to date have been related to Notice-of-Work applications for exploration and have included:

- Adjacent private land owners – contact has been maintained and access to and through the property has been granted for baseline data collection
- Trappers – initial contact has been made for consultation relating to exploration drilling
- Guide Outfitter
- Oil and Gas companies
    - Encana – discussions have been held and information shared regarding planned activities within the project area
    - BP Canada Energy
- Forestry companies
    - West Fraser Mills Ltd. - discussions have been held and information shared regarding planned activities within the project area
    - Private woodlot owner - discussions have been held and information shared regarding planned activities within the project area, including use of the access road for exploration drilling

8.5 Planned Consultation

8.5.1 Objectives

The objectives of the Project's consultation program are to:

- provide and distribute information on the Project, amendments to the Project and all related environmental and social studies where relevant;
- to respect the constitutionally protected rights of the First Nations;
- provide each consultation group with the opportunity to participate and/or provide input regarding the Project EAC application and all relevant concurrent permit applications;
- identify, document, and resolve all issues raised by each consultation group; and
- incorporate comments and input from consultation groups at a strategic level related to Project development, environmental mitigation, management and monitoring plans.

8.5.2 Activities

The Project permit application consultation program will include:

- meetings, ongoing communication and information sharing with the First Nations, general public and government;

- meetings with technical Working Groups;
- formal notification of Project related events through advertising and gazetting;
- Project information open houses in relevant consultation communities;
- engagement of public interest group representatives which have indicated an interest in a mine proposal to make presentations to and/or attend Regional Mine Development Review Committees (RMDRC) meetings pertaining to the Project; and
- communications and consultation documentation and tracking.

8.5.3 Outcomes

Hillsborough will be required to provide the following information prior to or within their EAC Application:

- list of all groups (and specific individuals where relevant) consulted;
- dates, locations, and times of consultations;
- summary of issues and interests identified through the consultation program;
- demonstration of how Hillsborough considered and addressed each issue and interest; and
- demonstration of how comments or suggestions were incorporated into the Project design, mitigation, management and/or monitoring plans.

9.0 PROPOSED DEVELOPMENT SCHEDULE

The Project may not trigger the *Canadian Environmental Assessment (CEA) Act, 2012,* however federal agencies have not yet made a decision on the Project as per the *CEA Act* and *the Regulations Designating Physical Activities.* The Company has need for ongoing site investigations in order to undertake a Project feasibility assessment, complete the EAC Application and pursue additional exploration opportunities.

Baseline environmental studies will be completed in 2013 to allow completion of the EAC Application. A high level schedule for the Project is set out in Figure 9.0-1. A summary of key dates related to the EAC Application are listed below:

- November 2012 – submit the Project Description
- February 2013 – receive the Order under Section 10
- May 2013 - submit the draft Application Information Requirements (AIR)
- March 2014 - submit the EA Application
- April 2015 – receive the EAC

Applications for other required permits, such as a Water Licence in terms of the *Water Act*, *Environmental Management Act* emissions permits and Forest Act licences to cut, will be prepared concurrently with the EAC Application. Hillsborough would like permits to be in hand in 2ndQ-2015.

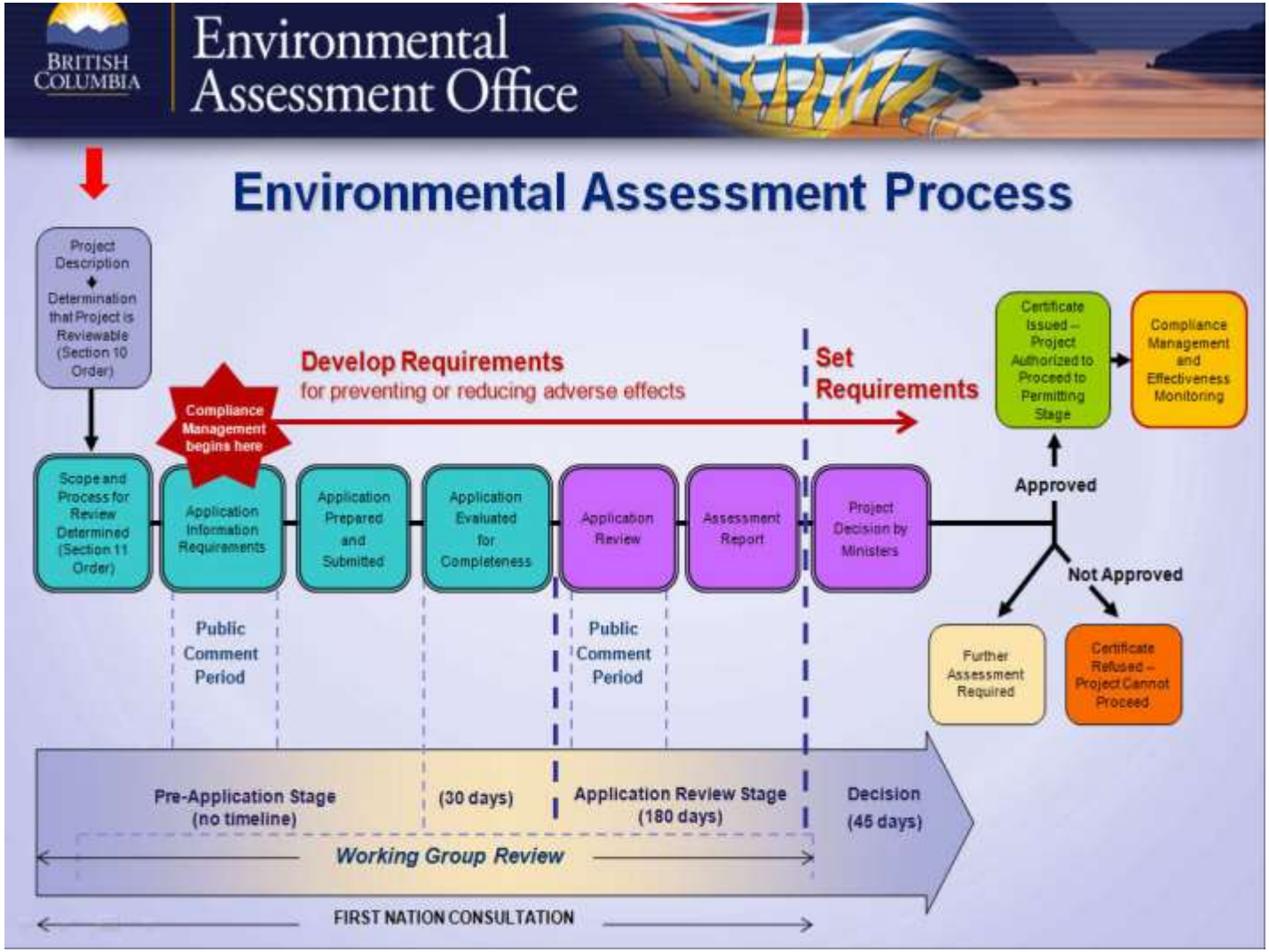


Figure 9.0-1: Environmental Assessment Certificate Application and Approval Schedule for the Echo Hill Coal Project

10.0 REQUIRED PERMITS

10.1 Environmental Assessment Review Process

New and modified major mining projects in British Columbia are subject to environmental assessment and review prior to certification and issuance of permits to authorize construction and operations. Environmental assessment is a means of ensuring the potential for adverse environmental, social, economic, health, and heritage effects or the potential adverse effects on Aboriginal interests or rights are addressed prior to project approval. There are generally two stages in the environmental assessment: pre-application phase when appropriate studies are identified through consultation and studies are undertaken and application review phase during which further consultation occurs and potential environment, economic, social, heritage and health effects are identified, mitigated, or avoided. Generally, the scope, procedures, and methods of each assessment are flexible and tailored specifically to the Project circumstances. These are defined in both the Section 11 Order and an approved AIR document.

There are both provincial and federal environmental assessment processes. Either or both processes may apply, depending upon the scope of the Project. The provincial and federal processes are subject to a harmonization agreement to avoid duplication and expedite reviews. BCEAO will explore options to have only one jurisdiction undertake a review per provisions of Section 27 of the *British Columbia Environmental Assessment Act*.

In general each environmental assessment contains four common main elements (McLaren 2008):

- opportunities for all interested parties, including Aboriginal groups and neighbouring jurisdictions, to identify issues and provide input;
- technical studies of the relevant environmental, social, economic, heritage and health effects of the proposed Project;
- identification of ways to prevent or minimize undesirable effects and enhance desirable effects; and
- consideration of the input of all interested parties in compiling the assessment findings and making recommendations about project acceptability.

All documents submitted to BCEAO as part of the assessment process are posted on the BCEAO website and are part of the public record for the project.

10.1.1 British Columbia Environmental Assessment Act Process

Criteria for inclusion in the *BCEAA* process can be found in the *Reviewable Projects Regulation* under that Act. The proposed Echo Hill Project will require a review under the *Act* as it will exceed the threshold for coal mines of production of more than 250,000 tonnes per year.

10.1.2 Canadian Environmental Assessment Act Process

The Canadian Environmental Assessment Act, 2012 provides the *"Regulations Designating Physical Activities"* which identifies types of projects that may be subject to a federal environmental assessment. Relating to coal mining this regulation indicates *"The construction, operation, decommissioning and abandonment of a coal mine with a coal production capacity of 3 000 t/d or more"* as an activity that would require a federal environmental assessment. The planned annual capacity of the Project is between 1.0 and 1.5 million tonnes, or 2,700 to 4,000 t/d based on a 365 day/year operating schedule.

10.2 Other Required Permits and Approvals

Any required federal and provincial EA processes must be completed before the respective jurisdictions can issue permits, licences or other authorizations required in order to allow the development to proceed. There are authorizations required for a broad range of development activities as described in the following sections.

10.2.1 British Columbia Authorizations, Licences and Permits

The primary BC authorization for the development of the Project is a permit under the provincial *Mines Act.* The provincial *Mines Act* permit process includes an environmental assessment as described in Part 10 of the Health, Safety, and Reclamation Code for Mines in British Columbia. In any situation where the *BCEAA* does not apply, such as the Notice of Work Permit Application and review under the provincial *Mines Act,* this Act constitutes the primary provincial review process.

Once a Certificate is granted under the *BCEAA*, the Northeast Mine Development Review Committee will assist in coordinating the issuance of other major provincial authorizations required for the Project, and the federal Major Projects Review Office may do likewise for federal authorizations required.

Table 10.2-1 shows a preliminary list of the BC authorizations, licences and permits that Hillsborough will potentially be required to obtain. The completed technical studies and EA will form the basis of the applications. The permit requirements will be reviewed and updated as the Project advances through the EA and permitting process.

10.2.2 Reclamation Security

Section 10 of the provincial *Mines Act* stipulates that the Chief Inspector of Mines may, as a condition of issuing a permit, require that the mine owner provide monetary security for mine reclamation and to provide for protection of, and mitigation of damage to, watercourses and cultural heritage resources affected by the mine. Security will remain in effect until such time as the Chief Inspector of Mines determines that all reclamation obligations have been met and the Company can be indemnified. Hillsborough has posted a C$58,000 bond, which is required under the current Notice of Work permit.

Table 10.2-1: BC Authorizations, Licences and Permits Required for the Echo Hill Project

BC Government Permits and Licences	Enabling Legislation
Permit Approving Work System & Reclamation Program (Mine Site – Initial Development)	*Mines Act*
Amendment to Permit Approving Work System and Reclamation Program (Pre-production)	*Mines Act*
Amendment to Permit Approving Work System and Reclamation Program (Bonding)	*Mines Act*
Amendment to Permit Approving Work System and Reclamation Program (Mine Plan – Production)	*Mines Act*
Permit Approving Work System and Reclamation Program (Gravel Pit/Wash Plant/Rock Borrow Pit)	*Mines Act*
Mining Lease amendment (if required)	*Mineral Tenure Act*
Water Licence – Notice of Intention (Application)	*Water Act*
Water Licence – Storage and Diversion	*Water Act*
Water Licence – Use	*Water Act*
Water Licence – Construction of fences, screens and fish or game guards across streams to conserve fish or wildlife	*Water Act*
Water Licence – Alteration of Stream or Channel	*Water Act*
Authority to Make a Change In and About a Stream – Notification	*Water Act / Water Regulation*
Authority to Make a Change In and About a Stream – Approval to Make a Change	*Water Act / Water Regulation*
Authority to Make a Change In and About a Stream – Terms and Conditions of Habitat Officer	*Water Act / Water Regulation*
Occupant Licence to Cut – Access Road	*Forest Act*
Occupant Licence to Cut –Mine Site/Tailings Impoundment	*Forest Act*
Occupant Licence to Cut – Gravel Pits	*Forest Act*
Occupant Licence to Cut – Borrow Areas	*Forest Act*
Road Use Permit (existing Forest Service Road)	*Forest Act*
Special Use Permit – Access Road	*Forest Practices Code of British Columbia Act*
Licence of Occupation – Staging Areas	*Land Act*
Licence of Occupation – Pump House/Water Discharge Line	*Land Act*
Licence of Occupation – Borrow/Gravel Pits	*Land Act*
Surface Lease – Minesite Facilities	*Land Act*
Waste Management Permit – Effluent (Sediment, Tailings and Sewage)	*Environmental Management Act*
Waste Management Permit – Air (Crushers, Ventilation, Dust)	*Environmental Management Act*
Waste Management Permit – Refuse	*Environmental Management Act*
Special Waste Generator Permit (Waste Oil)	*Environmental*

BC Government Permits and Licences	Enabling Legislation
	Management Act (Special Waste Regulations)
Sewage Registration	*Environmental Management Act*
Camp Operation Permits (Drinking Water, Sewage Disposal, Sanitation and Food Handling)	*Health Act / Environmental Management Act*
Waterworks Permit	*Drinking Water Protection Act*
Fuel Storage Approval	*Fire Services Act*
Food Service Permits	*Health Act*
Highway Access Permit	*Highway Act*

During the mine planning, the MEM Reclamation costing spreadsheet will be completed as the basis for initiating reclamation security negotiations with the Province. The amount of security required, and the form in which the security is to be provided, will be agreed between the proponent and the Chief Inspector of Mines (with input from Ministry of Finance), as part of the permitting process.

Performance bonds are an acceptable means of providing this security. In addition, enough "hard" security must be posted so that at any point in time, the amount will fully cover the next five-year period of expected post-closure costs related to water treatment, site management and monitoring. Reclamation securities are reviewed periodically during the mine operation and post-closure periods to ensure required levels of security reflect operational circumstances and prevailing financial conditions.

10.2.3 Federal Authorizations, Licences and Permits

Table 10.2-2 shows a preliminary list of the potential federal authorizations, licences and permits that may be required by Hillsborough to operate the Project.

Table 10.2-2: Federal Authorizations, Licences and Permits Required for the Echo Hill Project

Federal Government Approvals and Licences	Enabling Legislation
CEA Act Approval	*Canadian Environmental Assessment Act*
Radio Licences	*Radio Communications Act*

11.0 FEDERAL REQUIREMENTS

Federal guidelines for Project Descriptions under the new *CEA Act* 2012 were issued by the CEA Agency (2012).

Under *CEA Act* 2012 a new coal mine project is a "Designated Project", i.e., reviewable, if production capacity exceeds 3,000 tonnes per day. Most federal requirements for project descriptions are covered in the preceding. Additional information not covered previously is contained in this section.

11.1 Transmission Line

No power transmission line is currently envisaged. Should the option of obtaining power from area wind farms be undertaken the transmission line would not be longer than 40 km and thus no NEB trigger would occur.

11.2 Canada Port Authority Administration

The Project, and any component under control of Hillsborough, will not take place within the jurisdiction of any Canada Port Authority.

11.3 Federal Funding

No federal funding is anticipated to be sought for this Project.

11.4 Navigable Waters

No Project activity is expected to take place in, on, over, under, through or across any navigable water as defined by the *Navigable Waters Protection Act*.

11.5 Fisheries Act

Fish and fish habitat baseline assessment work done to-date on the Project indicates that:

- Within the area of the mine footprint there is no fish or fish habitat
- Within the local study area there are no fish but there is fish habitat
- Within the regional study area there are both fish and fish habitat

These finding indicate the potential requirement for a Fisheries Act authorization.

11.6 Explosives Act

Explosives are not expected to be used. If explosives are manufactured on site, an *Explosives Act* permit, or permits, will be applied for.

11.7 Migratory Birds

Migratory birds frequent the Project site and provisions of the *Migratory Birds Convention Act* will be followed.

11.8 Rare and Endangered Species

Species at Risk Act, Schedule 1 listed species have been observed on the Project site and provisions of the *Act* will be followed for the protection of these species.

12.0 REFERENCES

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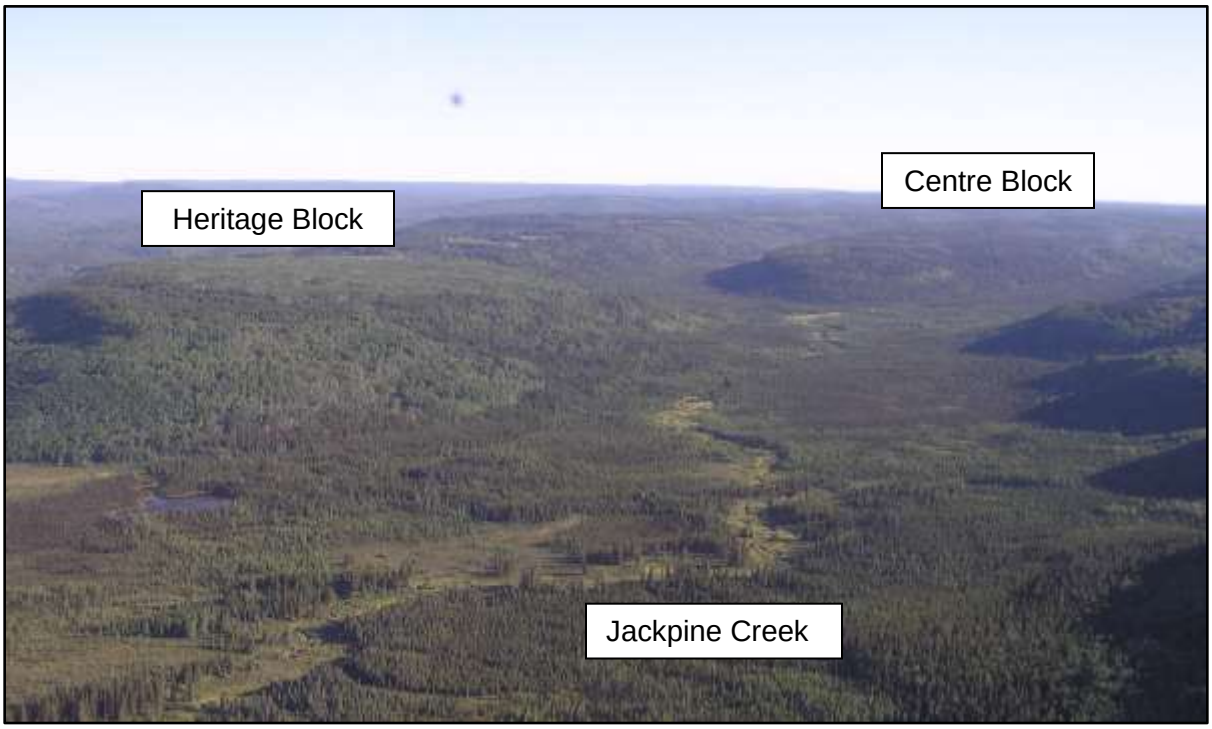
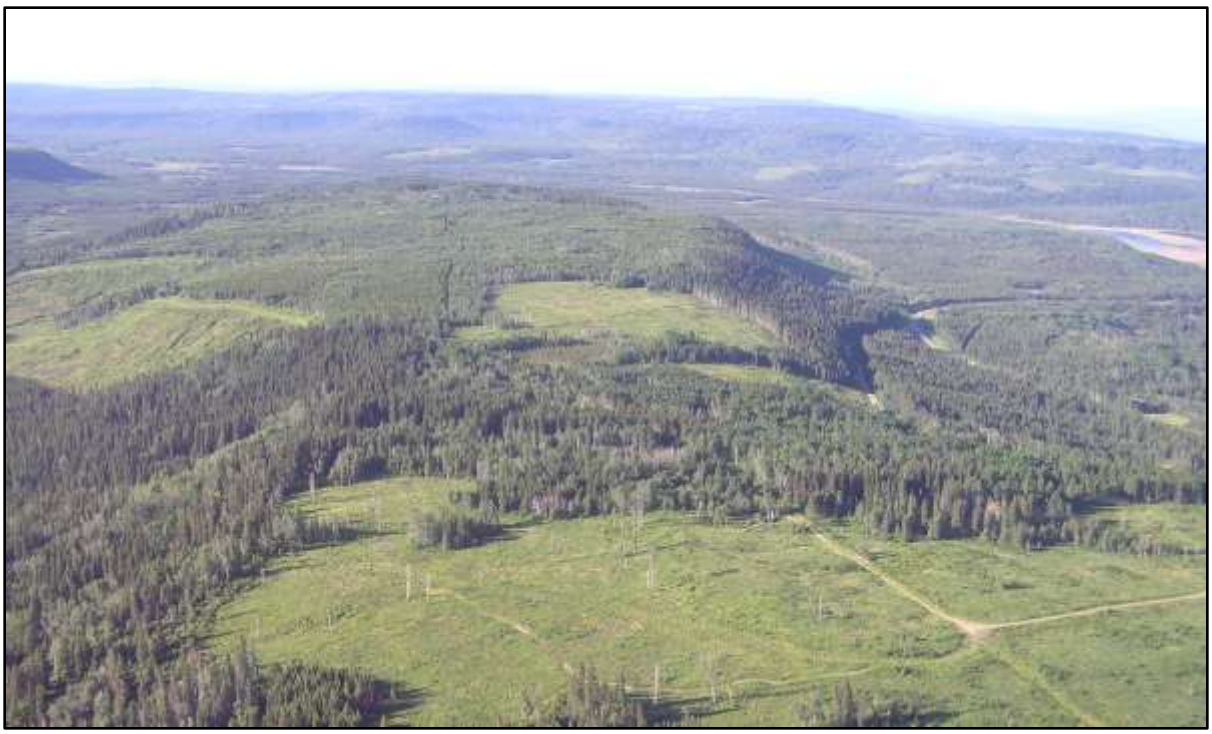
Appendix 1. Photographs of the Echo Hill Project Area



Photograph 1: Aerial Photograph of Heritage and Centre Block Looking North



Photograph 2: Aerial Photograph of Heritage Block Looking South

Photograph 3: Bulk Sample Test Trench and Adit (2010)

Photograph 4: Environmental Baseline Studies on Jackpine Creek

Photograph 5: Weather Station

Photograph 6: ARD/ML Field Bins

Photograph 7: Exploration Drilling