Provincial Agricultural Land Commission - Applicant Submission

Application ID: 61977
Application Status: Under LG Review
Applicant: Douglas Kerr
Agent: Telkwa Coal Ltd
Local Government: Bulkley-Nechako Regional District
Local Government Date of Receipt: 12/29/2020
ALC Date of Receipt: This application has not been submitted to ALC yet.
Proposal Type: Non-Farm Use
Proposal: The Tenas Project covers 1,094.86 ha, with 51.35 ha in the ALR. This is approximately 5% of the total project area.

Component/ Size (ha)
Rail Infrastructure including Stockpiles/19.18
Tenas Access Corridor/32.17
Coal stockpile/3.32
Total/51.35

The Bypass Road, approximately 10.61km long and 25m wide, does not fully fall within the ALR boundaries and that the Coal stockpile is found within the calculated size of the Rail Infrastructure.

Telkwa Coal Ltd. (TCL) is proposing to develop the Tenas Project (the Project), a surface, metallurgical coal mine 25 kilometres (km) south of Smithers and 7 km southwest of the village of Telkwa in northwestern BC. TCL is submitting a Non-Farm Use Application (NFU) to the Agricultural Land Commission (ALC) to seek permission to utilize land within the Agricultural Land Reserve (ALR) for non-agricultural purposes.

The Project is undergoing a regulatory review through the BC Environment Assessment Act, in addition to the BC Mines Act and BC Environmental Management Act, based on a production rate of 775,000 to 825,000 metric tonnes of processed coal per annum over a 25-year mine life. TCL revised the proposed production rate and mine life to incorporate community feedback, optimize operating levels and importantly, ensure the operation is sustainable for the longer term. We are committed to meeting regulatory requirements and to operating in a safe and environmentally responsible manner. TCL is currently in the pre-application stage of the BC Environmental Assessment process.

In 2016, the initial mine plan used purpose-built b-train trucks to transport the processed coal from the Minesite to the Rail Infrastructure on publicly accessible roads. The covered b-train trucks would drive along Telkwa Coalmine road for approximately 13km, after which the trucks would turn right onto Lawson road and continue to drive approximately 6km to the Rail Infrastructure. Please refer to Figure to see an overview of the local roadways in relation to the Project location that were planned to be used. This method of using existing roads was planned to occur during the first three years of mine operations, after which a Bypass Road would be built to avoid using publicly accessible roads for the processed coal haul.

The local community had concerns regarding public safety, as well as potential increased noise, dust, and traffic interactions due to transportation of coal along Telkwa Coalmine road and Lawson road through the village of Telkwa. As a result of this direct community feedback, TCL will be building the Bypass Road which is a component of the Tenas Access Corridor prior to operations commencing to avoid using publicly accessible roads. As a part of the revised mine plan, the Rail Infrastructure, including the 2.5km rail loop, Rail Infrastructure fueling station, and Coal stockpiles, as well as sections of the Bypass Road are all within the ALR polygon ID 3479850. Please see Figure 1.

TCL is applying for a NFU because we recognize the importance of maintaining access to agricultural land in BC. TCL has no interest in applying to exclude land from the ALR permanently, as we would like to limit potential effects to agriculture in the region due to the Project. The NFU application allows TCL

to transport coal, having taken community feedback into consideration, while maintaining a wholesome parcel of land within the ALR.As a part of the legislation that TCL is required to operate under, the Bypass Road and Rail Infrastructure will have a reclamation and closure plan
Please review the attached document Non-Farm Use Application to the ALC, prepared by Environmental Dynamics Inc (EDI) which further outlines mitigation measures for soil conservation and provides a general reclamation plan to support agricultural use.
There is a purchase agreement in place between TCL and the private landowners to sell the property that the Rail Infrastructure will be built on, which will be executed in 2021.

Agent Information

Agent: Telkwa Coal Ltd
Mailing Address:
1410-409 Granville Street
Vancouer, BC
V6C 1T2
Canada
Primary Phone: (604) 220-5703
Email: dfarmer@allegiancecoal.com.au

Parcel Information

Parcel(s) Under Application

1. **Ownership Type:** Fee Simple
   Parcel Identifier: 010-652-043
   Legal Description: DL 222 R5C EXC BKS A & B
   Parcel Area: 64.2 ha
   Civic Address: Smithers Rural (754) - 01033.130
   Date of Purchase: 04/22/2003
   Farm Classification: Yes
   Owners
   1. **Name:** Douglas Kerr

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2. **Ownership Type:** Fee Simple
   Parcel Identifier: 010-652-787
   Legal Description: BK B DL 222 R5C
   Parcel Area: 64.6 ha
   Civic Address: Smithers Rural (754) - 01033.125
   Date of Purchase: 04/22/2003
   Farm Classification: Yes
   Owners
   1. **Name:** Daniel
      Kerr

3. **Ownership Type:** Fee Simple
   Parcel Identifier: 028-406-869
   Legal Description: Block A District A District Lot 223 Range 5 Coast District
   Parcel Area: 21 ha
   Civic Address: Smithers Rural (754) - 01033.150
   Date of Purchase: 12/09/2010
   Farm Classification: Yes
   Owners
   1. **Name:** Bruce Kerr
   2. **Name:** Marie Kerr

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4. **Ownership Type:** Fee Simple
   Parcel Identifier: 013-496-751
   Legal Description: SW 1/4 OF DL 402 R5C
   Parcel Area: 64.4 ha
   Civic Address: Smithers Rural (754) - 01136.000
   Date of Purchase: 07/13/1998
   Farm Classification: Yes
   Owners
   1. **Name:** Colleen Helps

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5. **Ownership Type:** Fee Simple
   Parcel Identifier: 013-581-180
   Legal Description: L A (SEE DF18988) DL 1143 R5C PL 1056 EXC PL 9828
   Parcel Area: 65.2 ha
   Civic Address: 14544 Lawson Road, Telkwa V0J 2X3
   Date of Purchase: 10/14/1993
   Farm Classification: Yes
   Owners
   1. **Name:** Donald
      MacDonald

1.

2. **Name:** Wendy MacDonald

Ownership or Interest in Other Lands Within This Community

1. **Ownership Type:** Crown Lands
   Parcel Identifier:
   Owner with Parcel Interest: Colleen Helps
   Parcel Area: 517.8 ha
   Land Use Type: Agricultural/Farm
   Interest Type: Registered Lease

Current Use of Parcels Under Application

1. Quantify and describe in detail all agriculture that currently takes place on the parcel(s).
The Project overlaps five private parcels of land ranging in size from 0.21 km2 to 1.3 km2.

Parcels 1 and 2 are used for growing hay crops and as pasture for fifteen horses.

Parcel 3 is used as pasture for approximately fifteen horses. A small personal greenhouse is owned by the residents of Parcel 3.

Parcel 4 is used to graze approximately twenty horses and eighty cows that reside on Parcel 4.

Parcel 5 is used to graze two horses that reside on the farm of Parcel 5 as well as cattle from a neighboring farmer. A small personal greenhouse is owned by the residents of Parcel 5.

Refer to Table 1 below for an overview of agricultural activities:

Table 1: Agricultural Activity
Parcel Number Activity Type % of Parcel
Parcel 1 Crop 33.3%
Pasture 66.6%
Parcel 2 Crop 25%
Pasture 75%
Parcel 3 Pasture 100%
Parcel 4 Grazing 100%
Parcel 5 Pasture 96%

2. Quantify and describe in detail all agricultural improvements made to the parcel(s).
Parcel 1 has 1.97 ha of water sumps and 2.25 ha of natural drainage channels used to irrigate crops on this parcel.

Parcel 2 has a piezometer on the property. Parcel 3 has 3.5 ha of limited clearing that has occurred around the property. Please refer to Figure 2.

All parcels have fencing around their perimeters as shown on Figure 2. Please refer to Table 2 for the specific lengths:

Table 2: Fencing Length by Parcel
Parcel Number Fencing Length (km)
Parcel 1 3.2
Parcel 2 4.8
Parcel 3 2.7
Parcel 4 1.6
Parcel 5 4.0

3. Quantify and describe all non-agricultural uses that currently take place on the parcel(s).
The only parcel with non-agricultural use occurring on the land is Parcel 5. Parcel 5 has a house and access road that covers approximately 0.02km2. Parcel numbers 1 through 4 do not have non-agricultural uses within them.

Adjacent Land Uses

North

Land Use Type: Other
Specify Activity: Please see PDF Attachment to the Application for more information

East

Land Use Type: Other
Specify Activity: Please see PDF Attachment to the Application for more information

South

Land Use Type: Other
Specify Activity: Please see PDF Attachment to the Application for more information

West

Land Use Type: Other
Specify Activity: Please see PDF Attachment to the Application for more information

Proposal

1. How many hectares are proposed for non-farm use?
51.4 ha

2. What is the purpose of the proposal?
The Tenas Project covers 1,094.86 ha, with 51.35 ha in the ALR. This is approximately 5% of the total project area.

Component/ Size (ha)
Rail Infrastructure including Stockpiles/19.18
Tenas Access Corridor/32.17
Coal stockpile/3.32
Total/51.35
The Bypass Road, approximately 10.61km long and 25m wide, does not fully fall within the ALR boundaries and that the Coal stockpile is found within the calculated size of the Rail Infrastructure.
Telkwa Coal Ltd. (TCL) is proposing to develop the Tenas Project (the Project), a surface, metallurgical coal mine 25 kilometres (km) south of Smithers and 7 km southwest of the village of Telkwa in northwestern BC. TCL is submitting a Non-Farm Use Application (NFU) to the Agricultural Land Commission (ALC) to seek permission to utilize land within the Agricultural Land Reserve (ALR) for non-agricultural purposes.
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In 2016, the initial mine plan used purpose-built b-train trucks to transport the processed coal from the Minesite to the Rail Infrastructure on publicly accessible roads. The covered b-train trucks would drive along Telkwa Coalmine road for approximately 13km, after which the trucks would turn right onto Lawson road and continue to drive approximately 6km to the Rail Infrastructure. Please refer to Figure to see an overview of the local roadways in relation to the Project location that were planned to be used. This method of using existing roads was planned to occur during the first three years of mine operations, after which a Bypass Road would be built to avoid using publicly accessible roads for the processed coal haul.
The local community had concerns regarding public safety, as well as potential increased noise, dust, and traffic interactions due to transportation of coal along Telkwa Coalmine road and Lawson road through the village of Telkwa. As a result of this direct community feedback, TCL will be building the Bypass Road which is a component of the Tenas Access Corridor prior to operations commencing to avoid using publicly accessible roads. As a part of the revised mine plan, the Rail Infrastructure, including the 2.5km rail loop, Rail Infrastructure fueling station, and Coal stockpiles, as well as sections of the Bypass Road are all within the ALR polygon ID 3479850. Please see Figure 1.
TCL is applying for a NFU because we recognize the importance of maintaining access to agricultural land in BC. TCL has no interest in applying to exclude land from the ALR permanently, as we would like to limit potential effects to agriculture in the region due to the Project. The NFU application allows TCL to transport coal, having taken community feedback into consideration, while maintaining a wholesome parcel of land within the ALR.As a part of the legislation that TCL is required to operate under, the Bypass Road and Rail Infrastructure will have a reclamation and closure plan
Please review the attached document Non-Farm Use Application to the ALC, prepared by Environmental Dynamics Inc (EDI) which further outlines mitigation measures for soil conservation and provides a general reclamation plan to support agricultural use.
There is a purchase agreement in place between TCL and the private landowners to sell the property that the Rail Infrastructure will be built on, which will be executed in 2021.

3. Could this proposal be accommodated on lands outside of the ALR? Please justify why the proposal cannot be carried out on lands outside the ALR.
The Rail Infrastructure and part of the Bypass Road fall within ALR polygon ID 3479850, which has a total area of 901 km2. Due to the large size of the polygon, much of the land surrounding the Minesite is part of the ALR. The Rail Infrastructure and the main CN rail line needed to transport the coal for export in Prince Rupert, are all found within the ALR. There is no alternative corridor that could be built from the Minesite to the Rail Infrastructure that would avoid the ALR, unless publicly accessible roads, such as the Telkwa Coalmine road and Lawson road, were used. See Figure 1.

As discussed earlier in the Application, TCL received community feedback that encouraged TCL to create a direct and private route to the Rail Infrastructure to avoid publicly accessible roads. The community

feels very strongly that the Bypass Road is an essential component of the Project and needs to be built at the outset of construction. Therefore, it is TCLs opinion that it would not be possible to reroute the Bypass Road to an area outside of the ALR by using existing roads due to public opinion on the Project and the location of the CN rail line.

4. Does the proposal support agriculture in the short or long term? Please explain.
The Project overlaps with 51.35 ha of ALR designated land. However, less than 20 ha of this total area coincides with current agricultural land use, as part of the road goes through forested Crown land. Overall, the NFU application applies to 0.02% of the ALR polygon ID 3479850. Therefore, the potential impacts of the Project on agricultural production, operations and infrastructure within ALR polygon ID 3479850 are both minimal and discrete.
The table below shows the change in available area for each parcel of land that can be used for agriculture once the Bypass Road and Rail Infrastructure are built.
Parcel # Total # of km2 # of km2 available for Agriculture % Change due to the Project
Parcel 1 0.64 0.63 1.5%
Parcel 2 1.3 1.29 0.8%
Parcel 3 0.21 0.21 0%
Parcel 4 0.64 0.64 0%
Parcel 5 0.62 0.15 75.8%

In the short term, the proposal will temporarily limit agriculture in the Project area. The building of the Bypass Road and Rail Infrastructure will prevent a relatively small amount of agricultural land from temporarily being used. TCL took current land use activities and landowner preferences into consideration, to avoid and/or minimize potential effects to existing agricultural use. These mitigation measures include building cattle crossings to allow livestock to cross the Bypass Road at given periods of time, which will help maintain agricultural use of land along the Bypass Road. TCL will build fencing along the Bypass Road which allows wildlife movement but prevents livestock from accessing the Bypass Road to mitigate potential livestock mortality due to the Project. Parcel 5, the location of the Rail Infrastructure, has a fence which will be maintained to allow wildlife movement and prevent livestock from moving into the Rail Infrastructure area. TCL is open to discussions with adjacent landowners allow grazing of the area.
In the long term, this proposal will support agriculture as the Bypass Road and Rail Infrastructure will be remediated to support agricultural activities. TCL has outlined several soil conservation measures and reclamation recommendations in the Non-Farm Use Application to the Agricultural Land Commission prepared by EDI.
The Project will not prevent the remainder of the agricultural land in the area from being used before, during and after mine operation and construction. Overall, TCL does not anticipate major effects to the agricultural land next to the Bypass Road. Please refer to Non-Farm Use Application to the Agricultural Land Commission prepared by EDI for more information

5. Do you need to import any fill to construct or conduct the proposed Non-farm use?
Yes

Proposal dimensions

Total fill placement area (0.01 ha is 100 m^2) *10 ha*
Maximum depth of material to be placed as fill *1.2 m*
Volume of material to be placed as fill *35000 m^3*
Estimated duration of the project. *25 Years*

Describe the type and amount of fill proposed to be placed.
Fill from achieving grade on site - approximately 7,000 m3
Topsoil salvage to all works - approximately 17,000 m3

Clean rock from approved CN quarry - approximately 11,000 m3
Processed coal from Project - approximately 35,000 m3

Briefly describe the origin and quality of fill.
Fill from achieving grade is is from the area of the loop and quality is acceptable given it is existing material present.
Topsoil is from the site and has been described as fair to poor based on soil surveys due to quantity of coarse fragments.
Clean rock will be sourced from the Kulum Quarry offsite as it is an approved CN quarry for these materials. Rock will be clean rock and has been used extensively in the region.
Processed coal from site will be temporarily placed for storage until shipped offsite. Coal is primarily an inert mineral.
All Processed coal will be removed in reclamation and some of the clean rock will also be removed for re use by CN. The topsoil salvaged will be used for reclamation purposes.

Applicant Attachments

- Agent Agreement - Telkwa Coal Ltd
- Proposal Sketch - 61977
- Other correspondence or file information - Map
- Other correspondence or file information - Map
- Site Photo - Rail Infrastructure
- Site Photo - Rail Infrastructure
- Professional Report - Soil Report
- Other correspondence or file information - Adjacent Use
- Other correspondence or file information - Other Parcels of Interest
- Certificate of Title - 010-652-043
- Certificate of Title - 010-652-787
- Certificate of Title - 028-406-869
- Certificate of Title - 013-496-751
- Certificate of Title - 013-581-180

ALC Attachments

None.

Decisions

None.

TELKWA COAL
LIMITED

Telkwa Coal Non-Farm Use Application

Land Use of Adjacent Parcels:

Please see Table 3 below, which outlines the primary land use and specific activities of each adjacent parcel of land.

Table 3: Land Use of Adjacent Parcels

Parcel #	Land Use/ Size (ha)	North		East		South		West	
Parcel 1	Land Use	Agriculture (Pasture, Crop)		Agriculture (Pasture, Crop)		Agriculture (Pasture, Crop)		Agriculture (Pasture)	
	Size (ha)	62.11		129.34		259.58		20.52	
Parcel 2	Land Use	Agriculture (Pasture)		Agriculture (Pasture)	Crown Land	Agriculture (Pasture)		Agriculture (Pasture, Crop)	Agriculture (Pasture, Crop)
	Size (ha)	64.80		64.41	64.40	259.58		64.20	62.11
Parcel 3	Land Use	Crown Land	Agricultural, Limited residential (one house)	Agriculture, Farm		Forested private land (TCL)		Crown Land	
	Size (ha)	108.74	62.11	64.19		259.49		108.74	
Parcel 4	Land Use	Crown Land		Crown Land		Crown Land		Agriculture (Pasture, Crop)	
	Size (ha)	64.40		64.95		258.70		128.98	
Parcel 5	Land Use	Agriculture (Pasture, Crop)		Crown Land		Crown Land	Crown Land	Agriculture (Pasture, Crop)	Agriculture (Pasture, Crop)
	Size (ha)	14.11		38.71		60.92	6.48	129.14	30.88

Telkwa Coal Non-Farm Use Application

Other Parcels of Interest

All other parcels of interest are Crown land that are used for grazing purposes.

- RAN076242 A (already included in Online Application)
  - Client Name: Colleen Helps
  - Crown Land
  - Size: 517.79 hectares
  - Active
  - Total Authorized Grazable Forage, Private Land Grazable forage, non-use forage: N/A
  - Max Number of Cattle, Sheep, Horses, other livestock: N/A
- RAN075745 A
  - Client Name: W Diamond Ranch
  - Crown Land
  - Size: 6,549.55 hectares
  - Active
  - Total Authorized Grazable Forage, Private Land Grazable forage, non-use forage: N/A
  - Max Number of Cattle, Sheep, Horses, other livestock: N/A
- RAN077588 A
  - Client Name: Brian McConnell
  - Crown Land
  - Size 152,955.95 hectares
  - Active
  - Total Authorized Grazable Forage (62), Private Land Grazable forage (12), non-use forage (0)
  - Max Number of Cattle (N/A), Sheep (N/A), Horses (10), Other livestock (N/A)

NON-FARM USE APPLICATION TO THE AGRICULTURAL LAND COMMISSION

Tenas Project
Telkwa Coal Ltd

Prepared For
Telkwa Coal Ltd
(A Subsidiary of Allegiance Coal Ltd)
1415 Hankin Avenue
Telkwa, BC, V0J 2X0

Prepared By
EDI Environmental Dynamics Inc.
301 George Street
Prince George, BC, V2L 1R4

EDI Contact
Ryan Buck | Environmental Specialist

EDI Project
18P0421
FINAL_REV.3.1.1
December 2020

ENVIRONMENTAL DYNAMICS INC.
Down to Earth Biology

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1 BACKGROUND & OVERVIEW

Project Description and Setting

Telkwa Coal Limited (TCL) is proposing the development of the Tenas Metallurgical Coal Project (hereafter referred to as the Tenas Project): an open-pit coal mine with an anticipated 25-year mine life located near the village of Telkwa in the Bulkley-Nechako District of British Columbia (BC). A comprehensive description of the Tenas Project (TCL 2018) providing an overview of the Project setting and infrastructure, development phases, regulatory context, and consultation approaches was submitted to the BC Environmental Assessment Office and the Canadian Environmental Assessment Agency in November 2018. As shown on Map 1, the Project is located on a combination of provincial Crown Land and Private Land[1]. The entire Project area (1094.86 ha) is situated within the Skeena Stikine Natural Resource District of the Skeena Natural Resource Region. Forest resources therein are administered by the BC Ministry of Forests, Lands and Natural Resource Operations and Rural Development (MFLNRORD). The northeastern portion of the Project (51.35 ha, representing ~5 % of the total Project area) is situated within the BC Agricultural Land Reserve (ALR). Non-agricultural (i.e., non-farm) land uses therein are regulated by the Agricultural Land Commission (ALC) under the *Agricultural Land Commission* Act. Project features in the ALR comprise part of the Tenas Access Corridor (Bypass Road), the Rail Infrastructure (tying-in to the existing CN Rail line), part of the Water Discharge Infrastructure (referring to an overland pipeline along an existing road corridor), and a Gravel Quarry.

Compilation of Non-Farm Application Requirements

EDI Environmental Dynamics Inc. (EDI) was retained to compile the Non-Farm Use Application for the Tenas Project. This report provides an inventory of land resources for Project features within the ALR (e.g., land use, predominant vegetation and soils, and agricultural capability/suitability), summarizes potential impacts to agricultural production associated with the Project, and identifies measures to mitigate these potential impacts. Planning of the Tenas Project is supported by multiple Project-specific baseline inventories, effects assessments and management plans covering a variety of subject-matter areas[2]. EDI have summarized (herein) baseline information pertaining to vegetation, terrain and soils collected by Ardea Biological Consulting (Ardea) from 2017 to 2019. The reader should consult the Project-specific Vegetation (Ardea 2020a) and Terrain and Soils (Ardea 2020b) baseline reports for comprehensive accounting of these terrestrial resources. Where necessary, this information has been supplemented with provincial spatial inventories (e.g., historical land inventories and soil surveys) to meet the *Criteria for Agricultural Capability Assessment* (ALC 2017). Recommendations for soil conservation and land reclamation have then been developed to conserve the agricultural capability of affected lands and achieve equivalent land capability at the end of the mining tenure. These recommendations are intended to align with and/or supplement all applicable Project-specific environmental management plans and programs, such as the Surface Erosion and Sediment Control Plan, the Vegetation Management Plan and the Reclamation and Closure Plan.

[1] Referring to freehold land parcels owned by TCL and nine coal licences held by TCL and Bulkley Valley Collieries Ltd.

[2] Documents and management plans to be made available to the ALC upon request.

Tenas Project

Project Overview
ALR Boundaries and Land Ownership

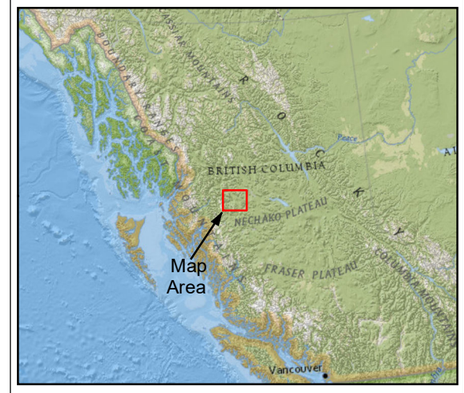
Legend

- ALR Boundary
- Project Footprint

Land Ownership

- Crown
- Private

Inset Map



Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Current Disturbance Data Extent is a 4km buffer around the greatest extent of the Wildlife RSAs and the Telkwa Herd Caribou Core/Matrix Habitat. This is the extent of the spatial data used in the current anthropogenic disturbance layer.

Sources

- Data: British Columbia Government Data Catalogue
- Inset map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

N

1:50,000

0 500 1,000 1,500 2,000 2,500

Meters

NAD 1983 UTM Zone 9N

Page Size: 11" x 17"

	Production Date: Jun 15, 2020	Map 1

ALLEGIANCE COAL LIMITED

EDI ENVIRONMENTAL DYNAMICS INC

2 ASSESSMENT OF TERRESTRIAL RESOURCES

2.1 FIELD SURVEY

From 2017 to 2019, Ardea conducted field surveys to characterize terrestrial ecosystems (i.e., predominant vegetation and land use) and soil resources (i.e., parent material and soil texture, rooting depth, coarse fragment content) for the entire Project area and nearby/adjacent environment (Ardea 2020a,b). These studies were conducted following provincial and federal standards outlined in the *Canadian System of Soil Classification* (SCWG 1998) and the *Field Manual for Describing Terrestrial Ecosystems* (BC-MOFR and BC-MOE 2010). Survey intensity was guided by provincial standards for mapping scale and resolution (RIC 1995) and supported by interpretation of ortho-imagery, LiDAR imagery and topographical and hydrological linework using ESRI Systems ArcInfo GIS (ArcView 9.3.1). During field surveys, agricultural land capability ratings and limitations (based on terrain and soil attributes) were assigned following provincial and federal guidelines outlined in the *Land Capability Classification for Agriculture in British Columbia* (Kenk and Coltic 1983) and the *Canadian Land Inventory Soil Capability Classification for Agriculture* (Canada MOE 1972).

A total of 780 terrestrial survey plots were distributed across the entire Project study area (1094.86 ha) comprising 30 % detailed site assessments and 70 % visual site assessments. A total of 244 terrestrial survey plots were completed within or adjacent to the Project area located within the ALR (51.35 ha) and comprised of vegetation ground inspections and shallow soil inspection plots; of these, 26 comprehensive soil inspection plots were completed. At the discretion of the field assessment team, a Survey Intensity Level 1 was targeted (i.e., referring to a minimum of 1 inspection site per 20 ha) for Project features and sample locations were field-fit to capture the predominant terrain and landscape attributes.

Field data were collected based on methods outlined in the *Land Management Handbook #25 — Field Manual for Describing Terrestrial Ecosystems* (BC-MOE and BC-MOF 1998); all field data were logged and geo-referenced using VPro Digital Forms. Field data cards for detailed soil assessment plots (field data cards #1-26) and sample point UTM coordinates (both vegetation ground inspections & shallow soil inspections, and detailed soil inspections) are presented in Appendix A; Terms and Definitions are presented in Appendix B; overview pictures captured during field survey are presented in Appendix C.

Note: For brevity, field data cards for visual ground inspections and shallow soil inspections used for the delineation and classification of terrestrial ecosystems and soil mapping units are not included herein.

2.2 SITE ASSESSMENT OVERVIEW

Land Use and Terrain

The Project area is located within the Bulkley Mountain range of the Hazelton Mountains Region as well as the Nechako Plateau of the Interior Plateau Region (Banner et al. 1993). Glacial till is the dominant parent material and landform elements are characterized by hummocks and ridges on surface plateaus and floodplains and terraces along rivers and creeks. The Project area is primarily located on undeveloped forested land. Areas have undergone previous disturbance associated with various discrete land use activities including road development and commercial forestry (i.e., cutblocks and access roads) and a lesser amount of agricultural land use (i.e., pasture/hayland or rangeland and cultivated cropland) and rural residential development.

Vegetation and Soil Resources

The entire Project area coincides with a combination of Engelmann Spruce-Subalpine Fir and Sub-Boreal Spruce biogeoclimatic zones (BC-MOF 1991). Based on the field assessment, portions of the Project area located in the ALR occurred on forested land in the Dry Cool subzone of the Sub-Boreal Spruce biogeoclimatic zone (SBSdk). Vegetation assembly (Photos 1-5) was predominantly comprised of trembling aspen (*Populus tremuloides*), lodgepole pine (*Pinus contorta*), hybrid white spruce (*Picea engelmannii x glauca*) and occasionally paper birch (*Betula papyrifera*). Black twinberry (*Lonicera involucrata*), Canada buffaloberry/soopolallie (*Shepherdia canadensis*) and thimbleberry (*Rubus parviflorus*) were commonly observed in the understory, among other native species. Meanwhile, two portions of the Project area coincided with agricultural land use. This refers to a 1 km segment (~1.5 ha) of the Bypass Road that is bordered (north and south) by cultivated cropland and pasture/hayland, and a portion (~18 ha) of the Rail Infrastructure that occurs within mixed forested land and pasture/hayland. Vegetation in pasture/hayland was comprised of mixed forage grasses (Photo 6) such as bluegrass (*Poa pratensis*) and bluejoint (*Calamagrostis canadensis*).

As described further in Sections 2.3 and 2.4, predominant soil orders occurring within the Project area include Gleyed Regosols, Orthic Dystric Brunisols, Vertic Gray Luvisols, Brunisolic Gray Luvisols and Orthic Gray Luvisols. Soil profiles (Photos 7-12) were generally comprised of a combination of shallow organic veneers and blankets followed by thin/shallow mineral soils with integrated coarse fragments (e.g., gravel) and bedrock. Skeletal soils that do not show any profile development were prevalent in some locations. Where present, topsoils (A horizon) had sandy loam, silt loam, silty clay loam and loam textures; upper subsoils (B horizon) had predominantly sand, sandy loam, silt loam and clay loam/loamy clay textures.

2.3 AGRICULTURAL CAPABILITY UNITS

Portions of the Project area located within the ALR were projected in GIS with spatial inventory data from the *Land Capability Classification for Agriculture in BC* (Ministry of Environment and Ministry of Agriculture and Food 1983). There are seven classes within this system describing agricultural limitations of increasing intensity (i.e., from Class 1 to Class 7) that affect the range of suitable crops and associated management actions. Subclasses indicate additional limitations and hazards within a given land class. Map 2 shows agricultural land capability units occurring within the Project area located within the ALR. Table 1 summarizes corresponding land capability Classes and Subclasses, total Project area and associated land capability descriptors. The total ALR usage by the Project is 51.35 ha: most of this land area (77 %) is comprised of Class 3, Class 3/4 and Class 4 land; a lesser amount of land (18 %) is comprised of Class 4/5 and Class 5 land; the remaining land (5 %) is classified as non-arable.

Table 1. Mapped Agricultural Capability Units and Descriptors.

Class (Decile Ratio)	Subclass	Project Area
3 (100 %)	D	1.62 ha
3 (70 %) / 4 (30 %)	C / X	19.20 ha
4 (100 %)	D	3.84 ha
4 (100 %)	T	1.95 ha
4 (100 %)	X	13.00 ha
4 (70 %) / 5 (30 %)	X / P,M	0.33 ha
4 (30 %) / 5 (70 %)	X / I,M	0.25 ha
5 (100 %)	P,M	8.47 ha
7 (100 %)	T,C	2.65 ha
—	—	(Telkwa River) 0.03 ha

Descriptors	
Class 3	Land Requires Moderately Intensive Management Practices and/or Range of Crops Moderately Restricted
Class 4	Land Requires Special Management Practices and/or Range of Crops Severely Restricted
Class 5	Land Capability Restricted to Production of Perennial Forage Crops or Other Specially Adapted Crops
Class 7	Land Holds No Capability for Agriculture or Sustained Natural Grazing
Subclass C	Adverse Climate — Thermal Limitations to Plant Growth.
Subclass D	Undesirable Soil Structure — Soil Properties Restrict and/or Hinder Agricultural Use
Subclass I	Inundation — Overflow by Streams/Lakes Causes Crop Damage or Restricts Agriculture Use
Subclass M	Moisture — Low Moisture Holding Capacity Caused by Adverse Inherent Soil Characteristics
Subclass P	Stoniness — Significant Coarse Fragments Pose Limitations for Agricultural Operations
Subclass T	Topography — Slope Patterns and Steepness Restrict and/or Hinder Agriculture Use
Subclass X	Other — Cumulative Minor Adverse Characteristics

Tenas Project

ALR Precis
Provincial Agricultural Capability Units

Legend

- Detailed Soil Inspection Plots
- Vegetation Ground Inspection and Shallow Soil Inspection Plots
- ALR Boundary
- Agricultural Capability Units
- Project Footprint

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Current Disturbance Data Extent is a 4km buffer around the greatest extent of the Wildlife RSAs and the Telkwa Herd Caribou Core/Matrix Habitat. This is the extent of the spatial data used in the current anthropogenic disturbance layer.

Sources

- Data: British Columbia Government Data Catalogue

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	Production Date: Jun 15, 2020	Map 2

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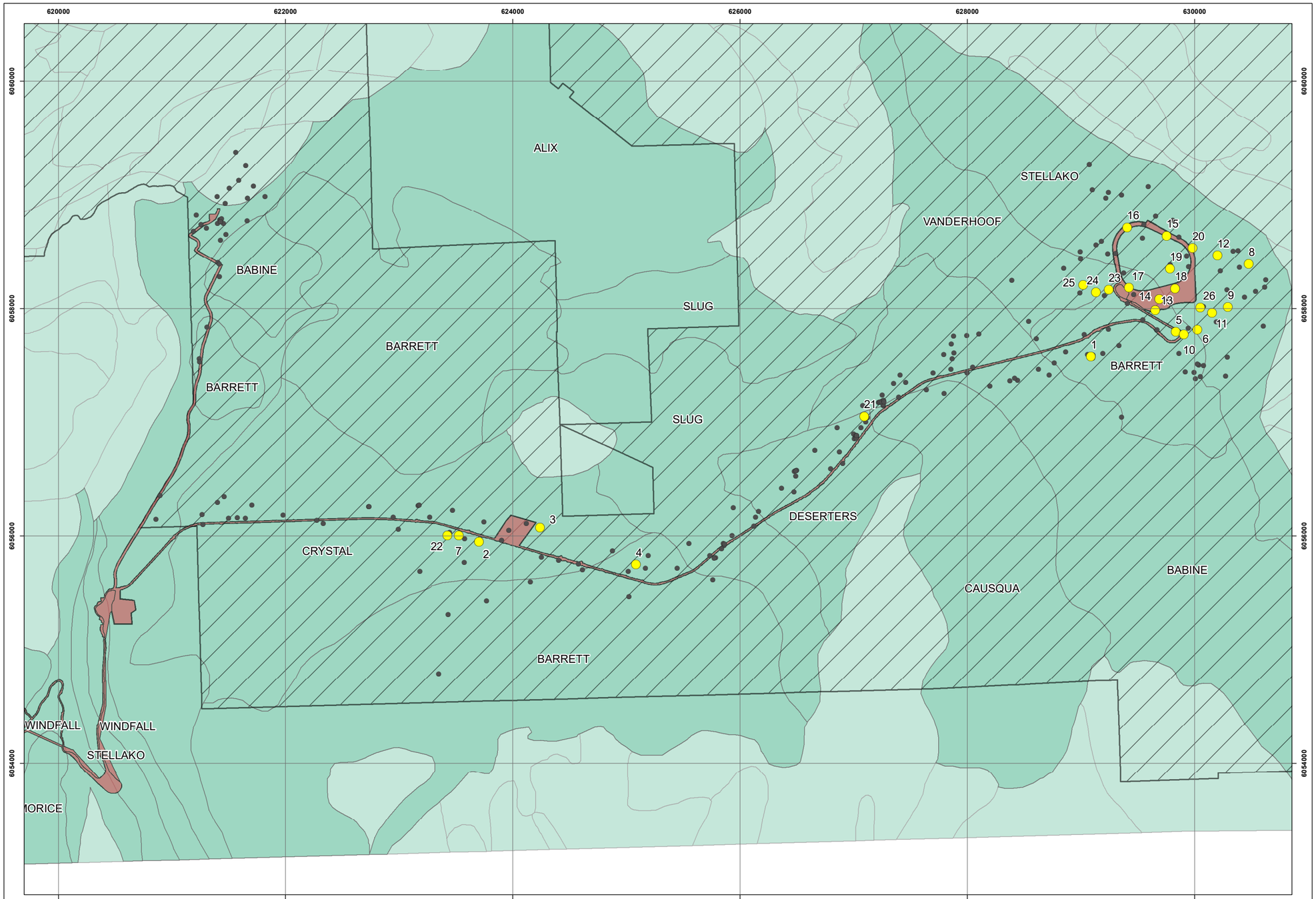
2.4 SOIL SERIES

Portions of the Project area located within the ALR were projected in GIS with soil series spatial inventory data from the *Soil Resources of the Smithers-Hazelton Area* (Runka 1972). Soil series refer to a group of soils with similar profiles developed from similar parent materials under comparable climatic conditions and vegetation. Soil series also describe (to varying extent) agricultural suitability and limitations. Map 3 shows the primary (i.e., first order) soil series units along the Project area located within the ALR; topsoil stripping conditions based on the assessment of comprehensive soil inspection plots (#1-26) are presented therein. Table 2 summarizes the corresponding soil series names and descriptors, landform attributes and total Project area.

Table 2. Mapped Soil Series and Descriptors.

Polygon ID	Primary Series	Surface Expression	Land Area
126781	Alix	Level/Flat to Gently Sloping	4.67 ha
126820, 126828	Babine	Level/Flat to Undulating	3.15 ha
126832, 126837, 126872	Barrett	Undulating to Rolling	15.02 ha
126846	Causqua	Gently to Very Steeply Sloping	0.72 ha
126843, 126863	Crystal	Hummocky Plain, Gently Sloping to Strongly Rolling	12.23 ha
126854, 126878	Deserters	Undulating to Rolling slopes	2.48 ha
126834	Slug	Level/Flat to Steeply Sloping	1.39 ha
126795, 126867	Stellako	Low Relief Floodplain	11.23 ha
126796	Vanderhoof	Level/Flat to Undulating	0.46 ha
Name	**Soil Order**	**Descriptors**	
Alix	Orthic Dystric Brunisols	Rapidly Drained; Coarse and/or Shallow Topsoil; Coarse Skeletal Glaciofluvial Parent Material.	
Babine	Vertic Gray Luvisols	Well Drained; Moderately Fine to Fine-Textured Topsoil; Fine-Textured Glacio-Lacustrine and Morainal Till Parent Material.	
Barrett	Orthic Gray Luvisols	Moderately Well Drained; Medium to Fine-Textured Topsoil; Moderately Coarse Morainal Till Parent Material.	
Causqua	Brunisolic Gray Luvisols	Well Drained; Medium-Textured Topsoil; Moderately Fine Morainal Till Parent Material.	
Crystal	Orthic Dystric Brunisols	Well Drained; Medium-Textured Topsoil; Coarse Skeletal Morainal Till Parent Material.	
Deserters	Brunisolic Gray Luvisols	Moderately Well Drained; Medium to Fine-Textured Topsoil; Moderately Coarse Morainal Till Parent Material.	
Slug	Orthic Dystric Brunisols	Well Drained; Medium-Textured Topsoil; Moderately Coarse Fluvial Parent Material.	
Stellako	Gleyed Regosol	Imperfectly Drained; Weakly Developed Topsoil; Moderately Coarse-Textured Fluvial Parent Material.	
Vanderhoof	Orthic Gray Luvisols	Moderately Well Drained; Medium to Fine-Textured Topsoil; Fine Textured Glacio-Lacustrine Parent Material.	



Topsoil Stripping Conditions

Sample Site - Assessment Site		PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	PL9	PL10	PL11	PL12	PL13	PL14	PL15	PL16	PL17	PL18	PL19	PL20	PL21	PL22	PL23	PL24	PL25	PL26
Land Use / Vegetation		Frst	Frst	Frst	Frst	Frst/Past	Frst	Frst	Frst	Frst	Frst	Frst	Frst	Frst	Frst	Frst/Past	Past	Past	Frst/Past	Frst/Past	Frst	Frst	Frst	Frst/Past	Frst	Past	Frst
Topsoil Depth (cm)	Surface Organic	8	10	9	7	6	1	9	3	5	2	2	6	1.5	0.5	0.5	0	1	1	2	15	8	14	1	1	2	7
	A Horizon	0	0	5	5	11	8	8	7	5	12	0	0	4	0	13	3	6	0	0	15	12	0	0	18	20	9
Stripping Recommendation	Total Stripping Depth (cm)	8	10	14	12	17	9	17	10	10	14	2	6	5.5	0.5	13.5	3	7	1	2	30	20	14	1	19	22	16

Tenas Project

ALR Precis
Provincial Soil Series

Legend

- Detailed Soil Inspection Plots
- Vegetation Ground Inspection and Shallow Soil Inspection Plots
- ALR Boundary
- Project Footprint
- Predominant Soil Series

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Current Disturbance Data Extent is a 4km buffer around the greatest extent of the Wildlife RSAs and the Telkwa Herd Caribou Core/Matrix Habitat. This is the extent of the spatial data used in the current anthropogenic disturbance layer.

Sources

- Data: British Columbia Government Data Catalogue

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Production Date: Jun 15, 2020 | Map 3

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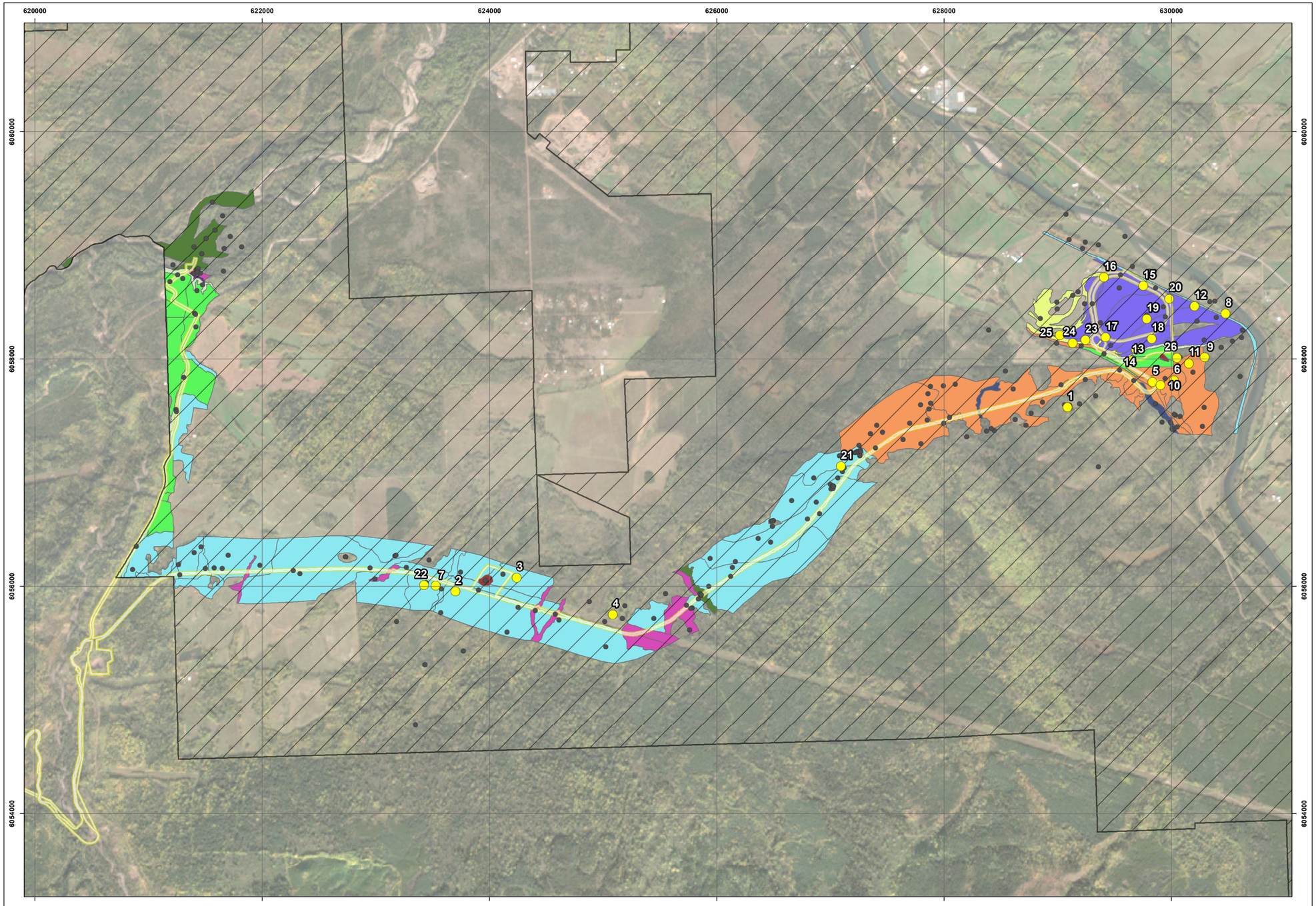
2.5 SOIL MAPPING UNITS

Portions of the Project area located within the ALR were projected in GIS with Soil Mapping Units (SMU's) characterized in the Project-specific *Terrain and Soils Report* (Ardea 2020b). Similar to the concept of soil series, SMU's are groupings of soil with similar characteristics that represent systematic and predictable changes of soil properties across the landscape (MSWG 1981, RIC 1996). Map 4 shows the SMU's along the Project area located within the ALR; topsoil stripping conditions based on the assessment of comprehensive soil inspection plots (#1-26) are presented therein. Table 3 summarizes the corresponding landform attributes, textural characteristics, agricultural ratings (good, fair, poor or unsuitable), and total Project land areas.

Table 3. Soil Mapping Units.

ID	Parent Material	Drainage and Topography	Soil Texture	Rooting Depth	Coarse Fragment	Agricultural Rating	Land Area
1.1	Morainal	Well to Moderate Drainage Level to Moderately Steep Slopes	SiL, L, SiCL	30 cm	10-45 %	Good to Fair	17.98 ha
1.2	Morainal/ Fluvial	Imperfect to Poor Drainage Lower Receiving Slopes	SiL, SiCL, SiC	30 cm	10-45 %	Good	1.40 ha
2	Fluvio-Glacial	Well to Rapid Drainage Level to Gentle Slopes	S, LS	30 cm	20-70 %	Fair to Poor	7.21 ha
3.1	Glacio-Lacustrine/ Fluvio-Glacial	Moderate to Imperfect Drainage Level to Gentle Slopes	SiCL, SiL, Si	25 cm	—	Fair to Poor	6.19 ha
3.2	Glacio-Lacustrine/ Morainal/ Fluvial	Poor Drainage Level to Gentle Slopes & Depressions	Si, SiCL, SiL	25 cm	0-10 %	Fair to Good	0.17 ha
4.1	Fluvial	Well to Moderate Drainage Level to Gentle Slopes	LS, S, SL, SiL	30 cm	0-60 %	Unsuitable	0.54 ha
4.2	Fluvial	Poor Drainage Level Slopes	SiL, SiCL, Si	25 cm	—	Fair to Good	0.62 ha
4.3	Fluvial	Well to Rapid Drainage Level to Gentle Slopes	SL, LS	25 cm	0-40 %	Fair to Poor	15.01 ha
5	Morainal	Well to Rapid Drainage Gentle Upper Slopes and Crests	SiL, FSL, SL	20 cm	30-75 %	Poor	0.88 ha
7	Organic	Poor to Very Poor Drainage Level Slopes and Depressions	Organic	30 cm	—	Unsuitable	0.02 ha
8.1	Colluvium/ Fluvio-Glacial	Rapid to Very Rapid Drainage Moderately Steep to Steep Slopes	SiL, L, SiCL	30 cm	25-80 %	Unsuitable	1.32 ha
8.2	Colluvium	Moderate to Well Drainage Gentle to Moderate Receiving Slopes	SiL, L, SiCL	40 cm	0-50 %	Unsuitable	0.01 ha

L = Loam; SiL = Silt Loam; SiCL = Silty Clay Loam; Si = Silt; SiC = Silty Clay
S = Sand; LS/SL = Loamy Sand/Sandy Loam; FSL = Fine Sandy Loam



Topsoil Stripping Conditions

Sample Site - Assessment Site		PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	PL9	PL10	PL11	PL12	PL13	PL14	PL15	PL16	PL17	PL18	PL19	PL20	PL21	PL22	PL23	PL24	PL25	PL26
Land Use / Vegetation		Frst	Frst	Frst	Frst	Frst/Past	Frst	Frst	Frst	Frst	Frst	Frst	Frst	Frst	Frst	Frst/Past	Past	Past	Frst/Past	Frst/Past	Frst	Frst	Frst	Frst/Past	Frst	Past	Frst
Topsoil Depth (cm)	Surface Organic	8	10	9	7	6	1	9	3	5	2	2	6	1.5	0.5	0.5	0	1	1	2	15	8	14	1	1	2	7
	A Horizon	0	0	5	5	11	8	8	7	5	12	0	0	4	0	13	3	6	0	0	15	12	0	0	18	20	9
Stripping Recommendation	Total Stripping Depth (cm)	8	10	14	12	17	9	17	10	10	14	2	6	5.5	0.5	13.5	3	7	1	2	30	20	14	1	19	22	16

Tenas Project

ALR Precis
Project-Specific Soil Mapping Units

Legend

- Detailed Soil Inspection Plots
- Vegetation Ground Inspection and Shallow Soil Inspection Plots
- ALR Boundary
- Project Footprint

Soil Mapping Units

- 1.1 - Good to Fair
- 1.2 - Good
- 2 - Fair to Poor
- 3.1 - Fair to Poor
- 3.2 - Fair to Good
- 4.1 - Unsuitable
- 4.2 - Fair to Good
- 4.3 - Fair to Poor
- 5 - Poor
- 7 - Unsuitable
- 8.1 - Unsuitable
- 8.2 - Unsuitable

Refer to Table X for associated soil characteristics

Notes

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2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Current Disturbance Data Extent is a 4km buffer around the greatest extent of the Wildlife RSAs and the Telkwa Herd Caribou Core/Matrix Habitat. This is the extent of the spatial data used in the current anthropogenic disturbance layer.

Sources

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3 AGRICULTURAL ASSESSMENT

3.1 POTENTIAL EFFECTS TO AGRICULTURAL PRODUCTION

The Project area located within the ALR mostly occurs on undeveloped forested land and two small areas of agricultural land, i.e., referring to cultivated cropland and hayland along the Bypass Road and hayland/pasture within a portion of the rail infrastructure. Soil resources are generally comprised of thin/shallow mineral topsoils with integrated coarse fragments (e.g., gravel) and skeletal soils are prevalent in some locations. Most of the Project area within the ALR is classified as Class 3 and Class 4 land (or a combination of both) that requires moderately intensive and/or special management practices to achieve sustained agricultural production; this classification also implies conditions that moderately-to-severely restrict the range of potential crops. The total ALR usage by the Project is 51.35 ha. However, less than 20 ha of this total area coincides with agricultural land use. Therefore, the potential impacts of the Project toward agricultural production, operations and infrastructure are both minimal and discrete.

EDI understands that planning of Project features within the ALR took into consideration current land use activities and landowner preferences[3] to avoid and/or minimize detrimental effects to agricultural production. For example, causing the fragmentation of land parcels, the incidental removal or damage to agricultural fencing, and/or the disruption of farm access and movement of farm equipment. Where Project features intersect with and/or occur in proximity to agricultural land use (listed above) recommendations for soil conservation and land reclamation have been elucidated to mitigate potential Project effects. For example, such as the degradation of topsoil during soil salvage, handling and stockpiling, the alteration of drainage patterns and drainage infrastructure due to Project features, and/or the introduction of noxious, nuisance or otherwise undesirable weeds. These mitigation measures (listed in Section 4) are intended to achieve equivalent land capability and conserve the potential for agricultural land use activities (if/where applicable) at the end of the mining tenure.

3.2 SOIL REMOVAL AND FILL PLACEMENT

EDI understands that soil (i.e., topsoil) within the entire Project area will be stripped to recommended depths — i.e., to the extent possible, depending on the amount of integrated coarse fragment materials — and stockpiled in proximity to its origin. For portions of the Project area within the ALR, soil will be stored along the ditchline of the Bypass Road or within other designated stockpile areas. Based on estimates from the Project-specific Terrain and Soil baseline report, topsoil salvage for all earthworks is anticipated to be approximately 17000 m^3. Salvaged soil will then be replaced and redistributed *in situ* during the Project's Decommissioning and Reclamation Phase. If recommendations for soil conservation are followed during all Project phases, there should be no significant loss of soil within portions of the Project located within the ALR insofar as to affect the re-instatement of an equivalent land capability at the time of reclamation.

[3] TCL is the landowner of the Project area. That said, TCL's regional engagement strategy (e.g., pertaining to reclamation endpoints) included consultations with local residents, stakeholder and rights holder groups.

Gravel, rock, and other subgrade materials (i.e., fill) will be used to achieve the specified grade during construction of the Bypass Road and Rail Infrastructure. TCL anticipate a total fill placement area of approximately 10 ha and a maximum depth of fill material of 1.2 m — particularly for construction of the Rail Infrastructure. The volume of gravel fill and clean rock are anticipated to be approximately 7000 m^3 and 11000 m^3, respectively. Clean gravel materials will be sourced from the Project's nearby Gravel Quarry (located along the Bypass Road within Crown Land); these materials have been deemed acceptable for construction and originate from the same predominant parent materials and hold the same characteristics as the placement locations. Clean rock materials will be sourced from the Kulum Quarry (located offsite); these materials are used extensively throughout the region and have been approved by CN Rail for construction of the Rail Infrastructure.

4 MITIGATION MEASURES

4.1 RECOMMENDATIONS FOR SOIL CONSERVATION

Planning of the Tenas Project is supported by multiple Project-specific baseline inventories, effects assessments and management plans covering a variety of subject-matter areas. The Project's Reclamation and Closure Plan, Vegetation Management Plan, and Surface Erosion and Sediment Control Plan (available upon request) will primarily guide soil handling and soil conservation for the entire Project (i.e., both ALR and non-ALR designated areas). Based on the Assessment of Terrestrial Resources (Section 2) and Agricultural Assessment (Section 3), the following recommendations have been advanced to supplement this guidance. These recommendations and TCL commitments are intended to minimize Project effects within the ALR and conserve current and future agricultural land capability therein.

1. To the extent practical, it is beneficial to salvage topsoil prior to construction and minimize admixing (i.e., mixing of the subsoil/parent material with the topsoil) to maintain agricultural capability. Soil stripping/handling and stockpiling will be guided by the Project-specific Reclamation and Closure Plan using methods to the standard of the day. EDI understands that topsoils will be salvaged and stockpiled separately, excluding skeletal soils or thin/shallow topsoils overlying bedrock/parent material.
2. Due to their physical characteristics — i.e., being generally comprised of moderate-to-fine textured topsoils — the identified soil series and SMU's occurring along the Project area may be prone to erosion. EDI understands that most soil stripping/handling will occur during winter whereby frozen-ground conditions will limit/minimize the risk of erosion and sedimentation. Outside of these conditions, construction personnel should avoid or minimize soil stripping/handling and excessive traffic (if/where possible) during wet or very dry conditions to reduce topsoil degradation and rutting.
3. Surface water management should control for run-off, erosion, and/or sedimentation, and be guided by the Project-specific Surface Erosion and Sediment Control Plan. EDI understands that the exact location and extent of control measures will be field-fit during the construction of the Project and that these measures will be monitored/maintained while in place — especially in low-lying areas and/or areas near watercourses.
4. Exposed soil stockpiles should be stabilized as soon as practical, e.g., by seeding and facilitating development of a vegetation cover. Seed mixtures should be appropriate to the region and land use. Exposed soil stockpiles are prone to colonization by noxious and nuisance weed. Weed management will be guided by the Project-specific Vegetation Management Plan.

EDI understands that vegetation will be cleared and soil will be salvaged along or within the Bypass Road, Gravel Quarry and Rail Infrastructure. Vegetation along the Water Discharge Infrastructure will only require light clearing; soils will remain intact. Maps 3 and 4 (in this report) provide soil stripping guidance along portions of the Project area located with the ALR. Additional soil salvage recommendations and volume estimates are listed in the Project-specific Terrain and Soils Report (Ardea 2020b) and the Reclamation and Closure Plan (IEG 2020). EDI recommends that soil salvage and handling activities be monitored and documented by qualified personnel — especially in areas coinciding with and/or in proximity to agricultural land use.

4.2 RECLAMATION PLAN

As described in the Project Description (TCL 2018), the Project is delineated by defined phases and timelines: (1) Construction, (2) Operations, (3) Decommissioning and Reclamation and (4) Post-Closure. These phases correspond with specific design-build activities that consider (to varying extent) final reclamation and end-land use objectives for the entire Project (i.e., both ALR and non-ALR designated areas). Reflecting current and past land use activities within the Project area, the Project's general end land-use objective is to achieve multiple-use forest ecosystems, such as wildlife habitat, recreation, the potential for forest harvest (if/where appropriate), and traditional land uses (i.e., plant and animal harvest). To meet these objectives, the Project-specific Reclamation and Closure Plan (IEG 2020) specifies:

- End Land-Use, Land Capability Objectives and Reclamation Schedule
- Reclamation Approaches
  - Landform Design and Erosion Control
  - Revegetation Strategy and Progressive Reclamation/Sequencing
- Reclamation Research and Post-Closure Monitoring and Maintenance
  - Habitat Compensation Works
  - Trace Element Uptake in Soils and Vegetation
- Reclamation and Closure Prescriptions (i.e., For Specific Project Features/Infrastructure)

The Project-specific Reclamation and Closure Plan is the primary source for planning and guidance to meet the Project's reclamation requirements. The following recommendations have been identified as a supplement to conserve agricultural land capability for portions of the Project located within the ALR:

1. To reclaim disturbances on agricultural land, the proponent is required to meet ALC criteria by restoring soil, topography and vegetation to an equivalent land condition and capability that aligns with land-use.
2. The Project area is located on provincial Crown Land and Private Land. The end land-use objectives should be clearly communicated with all applicable administrative/regulatory agencies and landowners. Likewise, reclamation and aftercare should align with applicable land management initiatives (e.g., Bulkley Land and Resource Management Plan, Bulkley Valley Sustainable Resource Management Plan).
3. Reclaimed land should be recontoured consistently with the original topography and surface drainage patterns. The end landscape should have a suitable aesthetic and be free of remnant construction debris.
4. Replaced topsoils should preserve a minimum standard of quality/quantity compared with adjacent land:
   - Replaced topsoils should target >80 % of the average A horizon depth.
   - Replaced topsoils should have similar characteristics and texture.
   - Admixing should not exceed 30 % and/or result in a net change in soil properties.
   - Subsoils should be decompacted (if/where applicable) to facilitate aeration and root infiltration.
5. Vegetation composition should be consisted with or on a trajectory toward the given end land-use objective(s). Seed mixtures should be appropriate to the region and land use, and selected in consultation with the landowner (if on Private Land) or land management agency (if on Crown Land). Noxious weeds, as listed under the Weed Control Act/Regulation (BC Government 2011), should be monitored and managed until suitable development of the vegetation cover.

Rail Infrastructure

Located on Private Land, the Rail Infrastructure occurs on a combination of forested land and hayland/pasture. This area will be reclaimed back to forested land (via seeding and/or planting of native species) or reclaimed to pasture/hayland (via seeding of mixed forage species) to achieve capability for sustained perennial forage species and/or grazing and thereby enhance agricultural land use.

Bypass Road and Gravel Quarry

Located primarily on Crown Land and a lesser amount of Private Land, the Bypass Road mostly occurs on forested land and a small portion of hayland/pasture and cultivated cropland. This feature will primarily be reclaimed back to forested land (via seeding and/or planting of native species); land management should comply with the Environmental Protection and Management Regulation for reclamation on Crown Land and other applicable land management requirements. The small portion coinciding with agricultural land use will be reclaimed to cultivated cropland or the given land use and cover vegetation at the time of reclamation.

Also located on Crown Land, the Gravel Quarry will be decommissioned, backfilled, and reclaimed back to forested land (as described above).

Water Discharge Infrastructure

Located on Private Land, the Water Discharge Infrastructure (referring to an overland water pipeline) coincides along existing road corridors. Following decommissioning, land affected by the pipeline will likely require only light care and maintenance. No major earthworks or reclamation activities are anticipated for this feature.

TCL is committed to timely and effective reclamation of the Project area. Field assessment to evaluate reclamation performance will be addressed during the Project's Post-Closure phase. For Project features located within the ALR (listed above) reclamation performance should be assessed in comparison with the adjacent undisturbed land using measures of soil, topography and vegetation as indicators of equivalent land condition and capability.

5 CLOSURE

This Non-Farm Use Application has been compiled by EDI and submitted the ALC on behalf of TCL and the Tenas Project. Do not hesitate to contact Ryan Buck (250-301-7926, r.buck@edynamics.com) or Patrick Audet (403-797-0678, p.audet@edynamics.com) should you have any further questions or commentary pertaining to the contents of this report.

The following EDI staff contributed to this report:

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Patrick Audet, PhD., R.P.Bio..... Senior Oversight

Jordyn Renaud BSc, AIT, BIT | Environmental Specialist

JR holds a Bachelor of Science (Environmental Conservation and Land Reclamation) from the University of Alberta. She is registered as an Agrologist in Training (AIT) with the Alberta Institute of Agrology (AIA) and a Biologist in Training (BIT) with the Alberta Society of Professional Biologists. She regularly conducts pre-construction baseline inventories (Schedule A) and post-construction reclamation assessments (Schedule B) for Oil and Gas Projects in the ALR in the Peace River Regional District (PRRD).

Ryan Buck BSc, PAg | Environmental Specialist

RB holds a Bachelor of Science (Environmental Conservation and Soil Science) from the University of Northern British Columbia. He is a registered Professional Agrologist (P.Ag.) with the BC Institute of Agrologists (BCIA) with declared areas of practice in soil and land conservation, reclamation planning and management. He is a field-lead/captain for EDI's pre-construction baseline inventories (Schedule A) and post-construction reclamation assessments (Schedule B) for Oil and Gas Projects in the ALR in the PRRD.

Patrick Audet PhD, RPBio | Team Lead, Senior Scientist

PA is EDI's reclamation planning and assessment Team Lead. He holds a Doctorate of Philosophy (Biology) from the University of Ottawa and has conducted environmental research worldwide, including North and Western Canada (Alberta, BC, Saskatchewan, Yukon Territory, Nunavut), Eastern Australia, Central America and Europe. He has expert proficiency in environmental science and biostatistics and has contributed over 30 peer-reviewed works related to soil and vegetation science. He is an Associate Editor for the journal *Agriculture, Ecosystems & Environment* and has edited two special issue volumes on the topic of ecological restoration.

PA oversees EDI's baseline terrestrial site assessment and post-construction reclamation/closure portfolio for Oil and Gas projects in the PRRD. He also advises mine reclamation projects throughout North and Western Canada.

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Disclaimer:

Maps presented in this document are a geographical representation of known features. Although the data collected and presented herein has been obtained with the utmost attention to quality, this document is not an official land survey and should not be considered for spatial calculation. EDI Environmental Dynamics Inc. does not accept any liability for errors, omissions, or inaccuracies in the data

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APPENDIX A. FIELD DATA

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Appendix Table 1. Field Data Card — Plot ID #1.

SAMPLE #: 1		ARDEA # 7102								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	8-0												
Ccc	0-35	C	—										
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:	*Populus tremuloides, Picea engelmannii x glauca, Lonicera involucrata, Rosa acicularis, Cornus stolonifera, Amelanchier alnifolia, Symphoricarpos albus, Thalictrum occidentale, Maianthemum stellatum, Lathyrus nevadensis, Arnica mollis, Cornus stolonifera, Aralia nudicaulis, Clintonia uniflora, Osmorhiza purpurea*												

Appendix Table 2. Field Data Card — Plot ID #2.

SAMPLE #: 2		ARDEA# 08-3387								PROJECT: 18P0421PL		Slope Class: 3	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	10-0												
Bm	0-20	SL	—								40		PE/CO
C	20-28+	—	—										
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:	*Populus balsamifera, Populus tremuloides, Picea engelmannii x glauca, Lonicera involucrata, Rubus parviflorus, Clintonia uniflora, Lathryrus nevadensis, Arnica cordifolia*												

Appendix Table 3. Field Data Card — Plot ID #3.

SAMPLE #: 3		ARDEA #08-3388								PROJECT: 18P0421PL		Slope Class: 3	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	9-0												
Ahe	0-5	SiCL	10YR3/2					M	GR			10	PE
Bt	5-25	SiCL	10YR5/2					M	SBK			15	PE/CO
C	25+	—	—									30	CO
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				5						Silty Clay Loam			
Vegetation:	*Populus tremuloides, Picea engelmannii x glauca, Rosa acicularis, Lonicera involucrata, Rubus parviflorus, Symphoricarpos albus, Lathyrus nevadensis*												

Appendix Table 4. Field Data Card — Plot ID #4.

SAMPLE #: 4		ARDEA # 08-3389								PROJECT: 18P0421PL		Slope Class: 4	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	7-0												
Ah	0-5	SiCL	10YR2/2									5	PE
Bm	5-10	SiCL	10YR3/4									11	PE/CO
Bt	10-24+	SiCL	10YR4/3									20	PE
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Forested				5						Silty Clay Loam			
Vegetation:	*Populus tremuloides, Betula papyrifera, Symphoricarpos albus, Lonicera involucrata*												

Appendix Table 5. Field Data Card — Plot ID #5.

SAMPLE #: 5		ARDEA # 09-778								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	6-0												
Ah	0-11	SiL	—					F	SBK				
Bm	11-25	SiL	—					F	SBK				
C	25+	SiL	—					F	SBK				
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Pasture				11						Silt Loam			
Vegetation:	*Poa palustris, Vicia americana, Phleum pratense, Taraxacum officinale* *Noxious Weeds: Leucanthemum vulgare, Cirsium arvense*												

Appendix Table 6. Field Data Card — Plot ID #6.

SAMPLE #: 6		ARDEA # 09-779								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	1-0												
Ah	0-8	SiL	—					F	SBK				
Bm	8-20	SiL	—					M	SBK				
C	20-40+	SL	—					F	GR				
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Forested				8						Silt Loam			
Vegetation:	*Populus tremuloides, Picea engelmannii × glauca, Rosa acicularis, Shepherdia canadensis, Amelanchier alnifolia, Symphoricarpos albus, Cornus canadensis, Petasites frigidus var. palmatus, Lathyrus nevadensis, Thalictrum venulosum, Galium boreale, Poa pratensis*												

Appendix Table 7. Field Data Card — Plot ID #7.

SAMPLE #: 7		ARDEA # 12-8503								PROJECT: 18P0421PL		Slope Class: 8	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	9-0												
Ah	0-8	L	10YR2/2					F	GR			5	PE
Bm	8-24	L	10YR3/3					M	GR			10	PE
Bt	24-45	CL	10YR4/3					F	SBK			10	PE
C	45-50+	CL	10YR4/2					M	SBK			20	PE/CO
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Forested				8						Loam			
Vegetation:	*Populus tremuloides, Picea engelmannii x glauca, Rubus parviflorus, Lonicera involucrata, Cornus stolonifera, Gymnocarpium dryopteris, Aralia nudicaulis, Arnica cordifolia*												

Appendix Table 8. Field Data Card — Plot ID #8.

SAMPLE #: 8		ARDEA # 12-8535								PROJECT: 18P0421PL		Slope Class: 4	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	3-0												
Ah	0-7	L	10YR3/1										
Bm	7-13	SL	10YR4/2										
C1	13-26	S	7.5YR4/2										
C2	26-32	LS	—										
C3	32-60+	S	—									1	CO
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Forested				7						Loam			
Vegetation:	*Populus tremuloides, Populus trichocarpa, Amelanchier alnifolia, Lonicera involucrata, Rubus idaea, Salix prolixa, Cornus stolonifera, Viburnum edule, Lathyrus nevadensis, Vicia americana, Symphyotrichum ciliolatum, Solidago canadensis, Aralia nudicaulis, Rubus pubescens*												

Appendix Table 9. Field Data Card — Plot ID #9.

SAMPLE #: 9		ARDEA # 12-8536								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	5-0												
Ah	0-5	SiL	10YR5/2										
Bm	5-15	SiL	10YR5/3										
C1	15-35	SiL	7.5YR5/3										
C2	35-55+	S	5YR4/3										
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Forested				5						Silt Loam			
Vegetation:	*Populus tremuloides, Pinus contorta, Picea engelmannii x glauca, Rosa acicularis, Shepherdia canadensis, Cornus canadensis, Diphasiastrum complanatum, Lycopodium annotinum, Lathyrus nevadensis, Chimaphila umbellata, Aralia nudicaulis*												

Appendix Table 10. Field Data Card — Plot ID #10.

SAMPLE #: 10		ARDEA # 12-8537								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	2-0												
Ah	0-12	SiL	10YR3/1										
Bm	12-18	SiL	10YR4/2										
C	18-42+	SiL	2.5Y5/2										
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				12						Silt Loam			
Vegetation:	*Populus tremuloides, Fragaria virginiana, Melilotus alba, Taraxacum officinale, Phleum pratense, Dactylis glomerata, Poa interior, Lathyrus nevadensis, Ranunculus uncinatus, Elymus glaucus, Festuca altaica*												

Appendix Table 11. Field Data Card — Plot ID #11.

SAMPLE #: 11		ARDEA # 12-8640								PROJECT: 18P0421PL		Slope Class: 2	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	2-0												
Bm	0-6	SiL	—					F	SBK				
Bm2	6-25	SiCL	—					F	SBK				
Cgj	25-45	SiCL	—					F	SBK				
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:	*Pinus contorta, Populus tremuloides, Rosa acicularis, Spiraea douglasii, Shepherdia canadensis, Petasites frigidus var. palmatus, Aralia nudicaulis, Galium boreale, Lathyrus nevadensis, Cornus canadensis*												

Appendix Table 12. Field Data Card — Plot ID #12.

SAMPLE #: 12		ARDEA # 12-8642								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	6-0												
Bm	0-9	SL	—										
C1	9-17	SL	—					M	SBK				
C2	17-35+	S	—									50	PE/CO
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:	*Pinus contorta, Picea engelmannii × glauca, Populus tremuloides, Shepherdia canadensis, Galium boreale, Linnaea borealis, Arnica cordifolia, Elymus glauca*												

Appendix Table 13. Field Data Card — Plot ID #13.

SAMPLE #: PL13		ARDEA # 12-8663								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	1.5-0												
Ah	0-4	SL	5YR4/2										
Bm	4-13	SL	5YR4/3					M	SBK				
BC	13-28	SL	5YR5/2					C	SBK				
C	28-40+	S	5YR4/4					F	GF				
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				4						Sandy Loam			
Vegetation:		*Pinus contorta, Rosa acicularis, Hieracium umbellatum*											

Appendix Table 14. Field Data Card — Plot ID #14.

SAMPLE #: 14		ARDEA # 12-8669								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	0.5-0												
Bm	0-7	S	5YR2.5/2						SGR			25	PE
BC	7-22	S	5YR3/2						SGR			45	PE
C	22-50+	S	5YR3/2						SGR			60	PE
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:		*Pinus contorta, Salix scouleriana, Vaccinium caespitosum*											

Appendix Table 15. Field Data Card — Plot ID #15.

SAMPLE #: 15		ARDEA # 14-0501								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	0.5-0												
Ah	0-13	SiL	7.5YR3/2									35	PE/CO
BC	13-25	S	7.5YR4/2						SGR			45	PE/CO
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested/Range				13						Silt Loam			
Vegetation:		*Populus tremuloides, Rosa acicularis, Hieracium umbellatum, Poa pratensis*											

Appendix Table 16. Field Data Card — Plot ID #16.

SAMPLE #: 16		ARDEA # 14-0502								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
Ah	0-3	SiL	5YR3/2										
Bm	3-9	SiL	5YR3/3					M	SBK				
C1	9-18	SiL	5YR4/3					M	SBK				
C2	18-30	S	5YR3/4						SGR			40	PE/CO
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Pasture				3						Silt Loam			
Vegetation:		*Hieracium sp., Taraxacum officinale, Achillea millefolium, Poa pratensis*											

Appendix Table 17. Field Data Card — Plot ID #17.

SAMPLE #: 17		ARDEA # 14-0503								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	1-0												
Ah	0-6	SiCL	7.5YR3/2					VF	SBK				
C1	6-26	SiL	7.5YR4/2					C	SBK				
C2	26-35+	SiL	7.5YR4/2					C	SBK				
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Pasture				6						Silty Clay Loam			
Vegetation:		*Hieracium sp., Fragaria virginiana, Achillea millefolium, Pleum pratense, Poa pratensis, Taraxacum officinale*											

Appendix Table 18. Field Data Card — Plot ID #18.

SAMPLE #: 18		ARDEA # 14-0505								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	1-0												
Bm	0-8	LS	10YR3/4						SGR				
BC	8-28	S	10YR4/3						SGR				
c	28-40+	S	10YR3/3						SGR			25	PE
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:		*Pinus contorta, Shepherdia canadensis, Rosa acicularis, Amelanchier alnifolia*											

Appendix Table 19. Field Data Card — Plot ID #19.

SAMPLE #: 19		ARDEA # 14-0506								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	2-0												
Bm	0-9	SL	7.5YR3/4						SGR			15	PE
BC	9-22	SiL	7.5YR4/2					F	SBK			18	PE/CO
C	22-40+	S	10YR3/2						SGR			40	PE/CO
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:	*Pinus contorta, Rosa acicularis, Arctostaphylos uva-ursi, Galium boreale*												

Appendix Table 20. Field Data Card — Plot ID #20.

SAMPLE #: 20		ARDEA # 14-0507								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	1.5-0												
Ah	0-1.5	S	10YR3/3										
C1	1.5-13	S	10YR4/3						SGR				
C2	13-32	S	10YR4/2						SGR				
C3	32-45+	S	—						SGR			25	PE
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				1.5						Sand			
Vegetation:	*Pinus controta, Shepherdia canadensis, Rosa acicularis, Arctostaphylos uva-ursi, Vaccinium caespitosum*												

Appendix Table 21. Field Data Card — Plot ID #21,

SAMPLE #: 21		ARDEA # 14-3956								PROJECT: 18P0421PL		Slope Class: 5	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	8-0												
Bm	0-8	L	7.5YR3/2					M	SBK			7	PE/CO
Ae	8-12	SiC	10YR5/2					M	PL			7	PE/CO
Bt	12-30+	C	10YR5/3					M	ABK				
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				12						Silty Clay			
Vegetation:	*Picea engelmannii x glauca, Populus tremuloides, Lonicera involucrata, Viburnum edule, Symphoricarpos albus, Rosa acicularis, Rubus parviflorus, Cornus canadensis, Lathyrus nevadensis, Eurybia conspicua*												

Appendix Table 22. Field Data Card — Plot ID #22.

SAMPLE #: 22		ARDEA # IR213								PROJECT: 18P0421PL		Slope Class: 4	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	14-0												
Bm	0-20	SL	5YR3/4					F	GR			45	CO/PE
C	20+	SL	5YR4/3					F	GR			55	CO/PE
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:	*Populus tremuloides, Picea engelmannii × glauca, Populus balsamifera, Rubus parviflorus Lonicera involucrata, Lathyrus nevadensis, Rubus pubescens, Eurybia conspicua, Calamagrostis canadensis, Arnica cordifolia*												

Appendix Table 23. Field Data Card — Plot ID #23.

SAMPLE #: 23		ARDEA # IR236								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	1-0												
Bm	0-9	FS	10YR3/4										
BC	9-21	S	10YR4/2									15	PE
C	21-50	S	10YR3/2									45	PE/CO
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				0						-			
Vegetation:	*Pinus contorta, Rosa acicularis, Hieracium triste*												

Appendix Table 24. Field Data Card — Plot ID #24.

SAMPLE #: 24		ARDEA # IR238a								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	1-0												
Ah	0-18	Si	10YR2/2						MA				
Bg	18-40	SiC	10YR5/2					M	SBK				
Cg	40-50	S	—										
C	50+	S	—									20	PE
Land Use				A Horizon (cm)						Pre-disturbance Soil Texture			
Forested				18						Silt			
Vegetation:	*Stellaria sp.*												

Appendix Table 25. Field Data Card — Plot ID #25.

SAMPLE #: 25		ARDEA # IR240								PROJECT: 18P0421PL		Slope Class: 1	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	2-0												
Ah	0-20	Si	10YR2/1										
Bm	20-24	SiC	10YR4/1					M	SBK				
C	24+	S	—						SGR			80	PE
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Pasture				20						Silt			
Vegetation:	*Calamagrostis canadensis, Carex rossii, Mentha arvensis, Deschampsia cespitosa*												

Appendix Table 26. Field Data Card — Plot ID #26.

SAMPLE #: 26		ARDEA # VTF16								PROJECT: 18P0421PL		Slope Class: 3	
Profile	Depth (cm)	Texture	Colour	Mottling			Soil Structure			Consistence		Rocks	
				Abun.	Size	Contrast	Grade	Class	Kind	D-M-W	Cons	%	Kind
LFH	7-0												
A	0-9	SL	—					F	GR				
Bm1	9-24	S	—					M	GR				
Bm2	24-47+	SL	—					F	GR				
Land Use				**A Horizon (cm)**						**Pre-disturbance Soil Texture**			
Forested				9						Sandy Loam			
Vegetation:	*Pinus contorta var. latifolia, Picea engelmannii × glauca, Shepherdia canadensis, Lathyrus sp., Pyrola asarifolia, Cornus canadensis*												

Appendix Table 27. Sample Point Coordinates — Detailed Soil Inspections.

Plot ID	Ardea ID	Northing	Easting	Plot ID	Ardea ID	Northing	Easting
1	7102	6057577	629085	14	12-8669	6058084	629689
2	08-3387	6055952	623700	15	14-0501	6058642	629752
3	08-3388	6056076	624239	16	14-0502	6058717	629405
4	08-3389	6055751	625083	17	14-0503	6058189	629422
5	09-778	6057797	629833	18	14-0505	6058179	629828
6	09-779	6057812	630023	19	14-0506	6058352	629784
7	12-8503	6056005	623523	20	14-0507	6058532	629980
8	12-8535	6058397	630476	21	14-3956	6057054	627091
9	12-8536	6058014	630292	22	IR213	6056008	623423
10	12-8537	6057773	629903	23	IR236	6058169	629243
11	12-8640	6057963	630152	24	IR238a	6058143	629132
12	12-8642	6058466	630202	25	IR240	6058208	629019
13	12-8663	6057989	629653	26	VTF169	60580112	630049

All coordinates in NAD83/UTM Zone 9N.

Appendix Table 28. Sample Point Coordinates — Vegetation Ground Inspections and Shallow Soil Inspections.

Ardea ID	Northing	Easting	Ardea ID	Northing	Easting	Ardea ID	Northing	Easting
7102	6057576	629086	AD166	6057290	627637	BR02	6058973	621663
08-3387	6055951	623701	AD167	6057256	627795	BR03	6058774	621659
08-3388	6056075	624240	AD168	6057437	627997	BR04	6058754	621453
08-3389	6055750	625084	AD169	6057488	628046	BR07	6057558	621240
08-3391	6059080	621718	AD170	6057318	628197	BR18	6056757	626656
09-778	6057796	629834	AD171	6057367	628373	BR19	6056741	626873
09-779	6057813	630024	AD172	6057370	628440	BR20	6056955	626854
12-8503	6056004	623524	AD173	6057417	628719	BR21	6056956	627064
12-8535	6058396	630477	AD174	6057468	628626	BR22	6057150	627078
12-8536	6058013	630293	AD175	6057524	628764	BR23	6057148	627258
12-8537	6057772	629904	AD176	6057622	628864	BR24	6057356	627458
12-8640	6057962	630153	AD177	6057775	629027	BR25	6057560	627866
12-8642	6058465	630203	AD178	6057442	629993	BR26	6057762	627879
12-8663	6057988	629654	AD179	6057607	629862	BR37	6056347	621460
12-8669	6058083	629690	AD180	6059050	629098	BR38	6056158	621647
14-0501	6058641	629753	AD181	6058987	621818	BR40	6056150	620858
14-0502	6058716	629406	AD183	6059133	621585	INTWS05	6058711	621301
14-0503	6058188	629423	AD184	6059379	621560	IR004	6058169	630286
14-0504	6058125	629465	AD185	6059259	621648	IR005	6058333	630224
14-0505	6058178	629829	AD186	6058829	621213	IR007	6058462	629929
14-0506	6058351	629785	AR01TW	6056530	626487	IR008	6058372	629948
14-0507	6058531	629981	AR02TW	6057344	627352	IR149	6056157	621498
14-3956	6057053	627092	AR05TW	6055917	625858	IR150	6056191	621262
AD002	6057885	630189	AR06TW	6055757	624578	IR152	6058049	629408
AD004	6058156	630537	AR07TW	6055790	624402	IR153	6057905	629543
AD005	6058193	630617	AR09TW	6056870	627013	IR154	6058295	629284
AD006	6058256	630625	AR28LR	6058784	621419	IR155	6058484	629235
AD008	6058511	630381	AR32LR	6056167	623267	IR156	6058560	629131
AD009	6058506	630337	AR33LR	6056260	622731	IR157	6058973	629217
AD010	6058777	629807	AR41LR	6057390	628414	IR158	6059027	629242
AD011	6058016	630055	AR42LR	6057581	629089	IR159	6059004	629357
AD105	6058816	629657	AR43LR	6055966	623902	IR160	6059077	629591
AD163	6057764	627994	AR44LR	6056269	623166	IR161	6059273	629071
AD164	6057694	627857	AR46LR	6057178	627216	IR162	6058594	629178
AD165	6057600	627793	BR01	6058926	621467	IR163	6057187	627257
IR164	6057243	627250	IR170	6056168	626136	IR176	6055806	625772
IR165	6057043	627120	IR171	6056088	626121	IR178	6055832	625732
IR166	6056856	627003	IR172	6056002	625927	IR179	6056249	625941
IR167	6056593	626797	IR173	6055936	625850	IR201	6058604	621425
IR168	6056574	626486	IR174	6055928	625864	IR202	6058653	621473
IR169	6056423	626363	IR175	6055812	625782	IR203	6058751	621400

Appendix Table 28. Continued.

Ardea ID	Northing	Easting	Ardea ID	Northing	Easting	Ardea ID	Northing	Easting
IR204	6058682	621187	PC17TWB	6057839	621308	QA40	6056355	620892
IR205	6058284	621416	PC26TWA	6058254	628391	QA44	6058987	621397
IR211	6057537	621243	PC27TWA	6057892	628538	QA45	6058787	621428
IR213	6056007	623424	PC28TWA	6058018	630078	QA46	6057409	630273
IR215	6055976	623575	PC29TWA	6058390	629785	QA47	6057403	630051
IR217	6056052	623963	PC30TWA	6058628	629860	QA48	6057387	630006
IR220	6055720	625167	PC31TWA	6058470	630183	QA49	6057444	629916
IR221	6056274	623174	PC32TWA	6058366	630395	QA50	6058318	629374
IR222	6056165	622946	PC33LRB	6056113	622330	QA51	6058624	629542
IR223	6056140	622273	PC33TWA	6058103	630439	QA52	6058743	629553
IR236	6058168	629244	PC34LRB	6056064	622990	QA53	6057437	627698
IR237	6058117	629205	PC35LRB	6056033	623442	QA55	6057191	627252
IR238a	6058142	629133	PC36LRB	6056124	623744	VS04	6058395	621413
IR239	6058140	628990	PC37LRB	6055816	624252	VTF16	6058011	630050
IR240	6058207	629020	PC38LRB	6055703	624611	WF01W-1	6057567	629101
IR241	6058207	629020	PC39LRB	6055870	624875	WF01W-2	6057574	629098
IR242	6058359	628846	PC43TWB	6056187	621978	WF01W-3	6057585	629102
IR243	6058442	628995	PC44TWB	6056276	621701	WF01W-4	6057592	629104
IR244	6058501	628992	PC45TWB	6056298	621399	WF01W-5	6057580	629105
IR245	6057507	630037	PC46LRB	6055768	623571	WF02U	6057050	629357
IR246	6057515	630023	PC47LRB	6055431	623769	WF02W	6057677	629332
IR249	6057992	629650	PC48LRB	6055313	623431	WF03U	6057158	627259
IR250	6058072	629746	PC49LR	6055691	623182	WF03W-1	6057177	627222
IR257	6058486	629304	PC50LRB	6057778	628099	WF03W-2	6057183	627233
PC01LRB	6057612	627880	PC52LRB	6057738	628606	WF03W-3	6057183	627245
PC01TWB	6057500	630078	PC53LRB	6057598	629059	WF03W-4	6057198	627261
PC02LRB	6057417	627408	PC55LRB	6056230	623467	WF03W-5	6057184	627266
PC02TWB	6057848	630605	PC56LRB	6056110	624117	WF04U	6056883	627025
PC03LRB	6057009	627104	PC57LRB	6055598	624152	WF04W-1	6056884	627022
PC03TWB	6057577	630288	PC57TWB	6054784	623346	WF04W-2	6056871	627022
PC04LRB	6056640	626903	PC59TWB	6057467	627853	WF04W-3	6056862	627022
PC04TWB	6057813	629668	PC60TWB	6057221	627396	WF05W-1	6056883	627026
PC05TWB	6057821	629241	PC61TWB	6056899	626998	WF06U	6056581	626497
PC09LRB	6056573	626476	PC62TWB	6056391	626473	WF06W-1	6056574	626492
PC10LRB	6056219	626162	PC63TWB	6056102	621272	WF07U	6056259	622734
PC11LRB	6055888	625836	PC64TWB	6056162	621575	WF10U-1	6058795	621434
PC12LRB	6055718	625445	PC65LRB	6057830	629943	WF10U-2	6058765	621426
PC13LRB	6055692	625014	PC69TWB	6055469	625021	WF03W-3	6057183	627245
PC13TWB	6059063	621503	PC70TWB	6055830	625190	WF03W-4	6057198	627261
PC14TWB	6058742	621255	PC71TWB	6055938	625548	WF03W-5	6057184	627266
PC16TWB	6058406	621403	PC72TWB	6055617	625759	WF04U	6056883	627025

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APPENDIX B. TERMS AND DEFINITIONS

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Appendix Table 29. Field Data Terms and Definitions.

SURFACE EXPRESSION (Selected)	
LVL – Level	A flat or very gently sloping unidirectional surface. Slopes are generally <2%
INC – Inclined	A sloping unidirectional surface with constant slope. Slopes are 2-70%
HUM – Hummocky	A complex sequence of slopes extending from rounded depressions. Slopes are 9-70%
ROL – Rolling	A regular sequence of moderate slopes (>5%) from rounded depressions. Slope length >1.6 km
UND – Undulating	A regular sequence of gentle slopes (2-5%) extending from rounded convexities. Slope length is <1km
TER – Terraced	A scarp face and the horizontal gently inclined surface above it
STP – Steep	Erosional slopes. Slopes are >70%

SURFACE DRAINAGE	SOIL TEXTURE	SLOPE POSITION
G - Good	Si – Silt	C – Crest
M - Moderate	SiL – Silt Loam	U – Upper
P - Poor	SiC – Silty Clay	M – Mid
	SiCL – Silty Clay Loam	L – Lower
	CL – Clay Loam	D – Depression
	S – Sand	F – Flat
	SC – Sandy Clay	
	SL – Sandy Loam	
	SCL – Sandy Clay Loam	
	C – Clay	
	HC – Heavy Clay	
	L – Loam	
	LS – Loamy Sand	

SLOPE CLASS CATEGORIES		
Slope Class	**Percent Slopes**	**Terminology**
1	0 - 0.5	level
2	> 0.5 - 2	nearly level
3	> 2 - 5	very gentle slopes
4	> 5 - 10	gentle slopes
5	>10 - 15	moderate slopes
6	> 15 - 30	strong slopes
7	> 30 - 45	very strong slopes
8	> 45 - 70	extreme slopes
9	> 70 - 100	steep slopes
10	> 100	very steep slopes

SOIL CONSISTENCY CATEGORIES		
Dry (D)	**Moist (M)**	**Wet (W)**
L - Loose	L - Loose	N - None sticky
SO - Soft	VFR - Very Friable	SLS - Slightly Sticky
SLH - Slightly Hard	FR - Friable	S - Sticky
H - Hard	F - Firm	VS - Very Sticky
VH - Very Hard	VF -Very Firm	
EH - Extremely Hard	EF - Extremely Firm	
R - Rigid		

Appendix Table 29. Continued.

SOIL MOTTLING CATEGORIES	SOIL MOTTLING CATEGORIES	SOIL MOTTLING CATEGORIES
Abundance	**Size (mm)**	**Contrast**
Few < 2%	Fine: < 5	Faint
Common 2 – 20%	Medium 5 – 15	Distinct
Many > 20%	Coarse: >15	Prominent
SOIL STRUCTURE CATEGORIES		
Grade	**Class (mm)**	**Kind**
Structureless (N) Moderate (M) Weak (W) Strong (S)	Fine < 2 Medium 2 – 5 Coarse > 5	Platy (PL) Granular (GR)
	Fine < 10 Medium 10 -20 Coarse 20 – 50 Very Coarse >50	Angular Blocky (ABK) Subangular Blocky (SBK)
	Fine < 20 Medium 20 -50 Coarse 50 – 100 Very Coarse > 100	Prismatic (PR) Columnar (COL) Massive (MA)
SURFACE STONINESS CLASS CATEGORIES (>25 cm diameter)		
Class	**Description**	**% Coverage**
S0	Non-Stony	0.01
S1	Slightly Stony	0.01 – 0.1
S2	Moderately Stony	0.1 - 3
S3	Very Stony	3 - 15
S4	Exceedingly Stony	15 - 50
S5	Excessively Stony	50 %
SPECIFIC CLASTIC TEXTURES		
Particle/Coarse Fragment	**Definition**	
BL – Blocks	Angular particles greater than 256 mm in size.	
BO – Boulders	Rounded particles greater than 256 mm in size.	
CO – Cobbles	Rounded particles between 64 and 256 mm in size.	
PE – Pebbles	Rounded particles between 2 and 64 mm in size.	
S – Sand	Particles between .0625 and 2 mm in size.	
Si – Silt	Particles between 2µm and .0625 mm in size.	
C – Clay	Particles less than 2µm in size.	

APPENDIX C. PHOTOGRAPHS

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Photo 1. Forested Land at Plot ID #22. (Ardea: IR213).

Photo 2. Forested Land at Plot ID #3 (Ardea: 08-3388).

Photo 3. Forested Land at Plot ID #10 (Ardea: 12-8537).

Photo 4. Forested Land at Plot ID #19 (Ardea: 14-0506).

Photo 5. Forested Land at Plot ID #21 (Ardea: 14-3953).

Photo 6. Pasture at Plot ID #25 (Ardea: IR240).

Photo 7. Soil Profile at Plot ID #22 (Ardea: IR213).

Photo 8. Soil Profile at Plot ID #3 (Ardea: 08-3388).

Photo 9. Soil Profile at Plot ID #25 (Ardea: IR240).

Photo 10. Soil Profile at Plot ID #10 (Ardea: 12-8537).

Photo 11. Soil Profile at Plot ID #19 (Ardea: 14-0506).

Photo 12. Soil Profile at Plot ID #21 (Ardea: 14-3953).