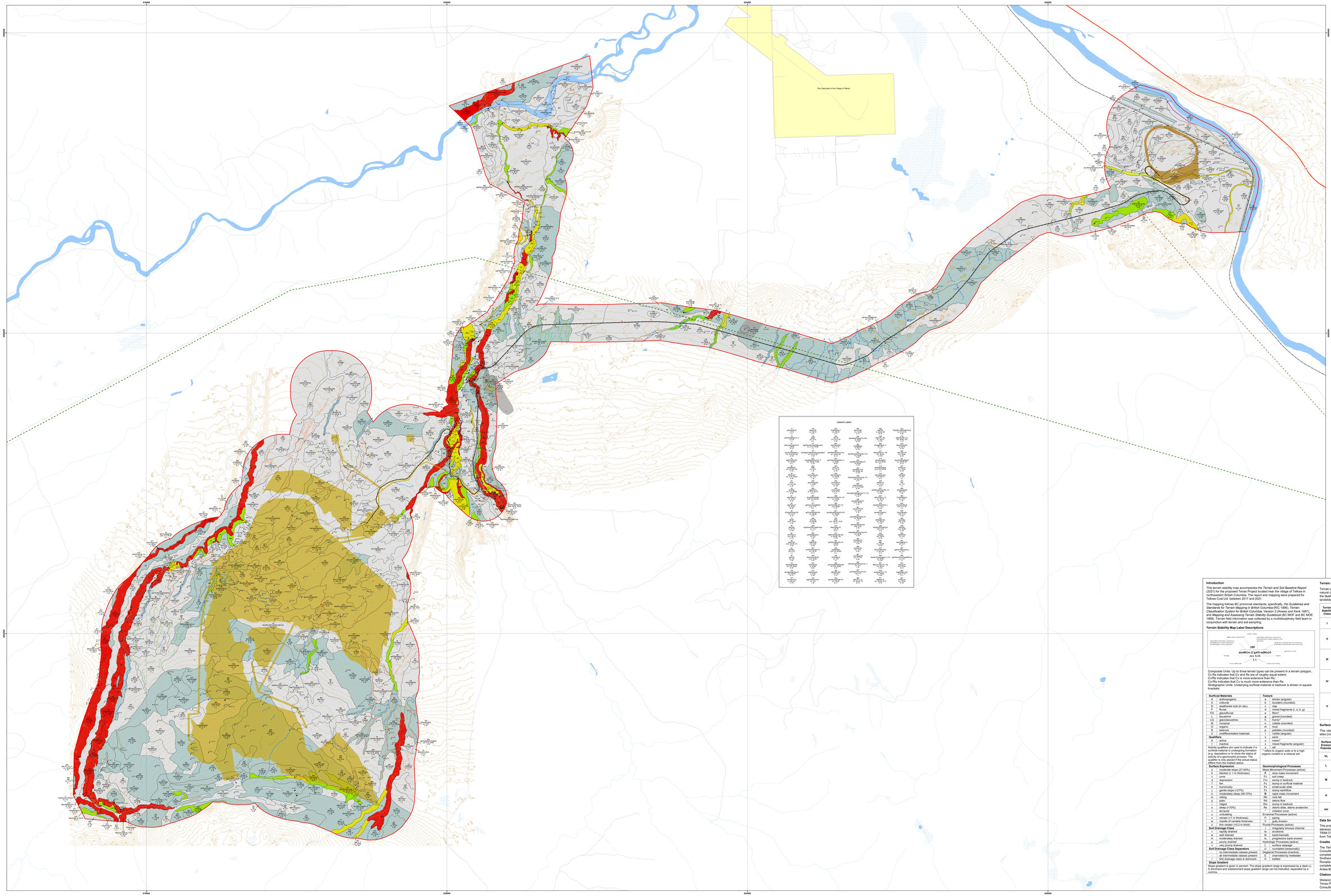
Appendix C 1:10,000 Terrain Stability Mapping



Tenas Project

Terrain Stability Mapping
Telkwa Coal LSA

Legend

Terrain Stability Mapping

- Terrain LSA
- Terrain stability polygon

Field Sites

- Field sites with terrain information
- Field sites with bedrock outcrop
- Geotechnical - Excavator testpit
- Geotechnical - Sonic drill

Note: Geotechnical investigations were carried out by SRK Consulting and Westrek Geotechnical Services Ltd. in 2018 and 2019

On-site Symbols

- Till ridge
- Gravel ridge
- Kettle hole
- Glacial meltwater channel
- Debris slide
- Landslide headscarp, active
- Landslide headscarp, inactive
- Slump, secondary scarp
- Tension crack
- Sackung
- Rock cliff
- Stream bank erosion
- Terrace scarp
- 200 year floodplain (BC MoE, 1984)

Terrain Stability Classification

- Terrain stability class I
- Terrain stability class II
- Terrain stability class III
- Terrain stability class IV
- Terrain stability class V

Topography

- Contours, 5 m interval

Proposed Project Components

- Linear Feature
- Mine Feature
- Rail Feature

Base Map Features

- Highway
- Existing Rail Line
- Road
- Resource Road
- 138 kV Transmission Line
- 500 kV Transmission Line
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- Municipal Area

Notes

All mapped features are approximate and should be used for discussion purposes only.

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.

Map production date: December 6, 2021

This terrain stability map has been prepared and reviewed for Telkwa Coal Ltd by:

Irene Weiland, P.Geo

N

Original Map Scale 1:10,000

0 200 400 600 800 1,000
Meters

NAD 1983 UTM Zone 9N
Page Size 48" x 78"

TELKWA COAL LIMITED

ARDEA BIOLOGICAL CONSULTING

Introduction

This terrain stability map accompanies the *Terrain and Soil Baseline Report* (2021) for the proposed Tenas Project located near the village of Telkwa in northwestern British Columbia. The report and mapping were prepared for Telkwa Coal Ltd. between 2017 and 2021.

The mapping follows BC provincial standards; specifically, the *Guidelines and Standards for Terrain Mapping in British Columbia* (RIC 1996), *Terrain Classification System for British Columbia, Version 2* (Howes and Kenk 1997), and *Mapping and Assessing Terrain Stability Guidebook* (BC MOF and BC MOE 1999). Terrain field information was collected by a multidisciplinary field team in conjunction with terrain and soil sampling.

Terrain Stability Map Label Descriptions

Composite Units: Up to three terrain types can be present in a terrain polygon; Cv Ra indicates that Cv is more extensive than Ra;
Cv/Ra indicates that Cv is much more extensive than Ra.
Stratigraphic Units: Underlying surficial material or bedrock is shown in square brackets

Surficial Materials		Texture	
A	anthropogenic	a	blocks (angular)
C	colluvial	b	boulders (rounded)
D	weathered rock (in situ)	c	clay
F	fluvial	d	mixed fragments (r, a, b, g)
FG	glaciofluvial	e	fibric*
L	lacustrine	g	gravel (rounded)
LG	glaciolacustrine	h	humic*
M	morainal	k	cobble (rounded)
O	organic	m	mesic*
R	bedrock	p	pebbles (rounded)
U	undifferentiated materials	r	rubble (angular)
Qualifiers		s	sand
A	active	u	mesic*
I	inactive	x	mixed fragments (angular)
Activity qualifiers are used to indicate if a process is active or inactive at the present time (e.g. deposition) or to show the status of activity of a geomorphic process. The qualifier is only placed if the actual status differs from the implied status.		* or ~	refers to organic soils or to a high organic content in a mineral soil
Surface Expression		**Geomorphological Processes**	
a	moderate slope (27-50%)	Mass Movement Processes (active)	
b	blanket (> 1 m thickness)	**P**	slow mass movement
c	cone	Fs	soil creep
d	depression	Fm	slump in bedrock
f	fan	Fp	slump in surficial material
h	hummocky	Fs	small-scale slide
j	gentle slope (<27%)	Fd	debris flow/flow
k	moderately steep (50-72%)	**R**	rapid mass movement
m	rolling	Rb	rock fall
p	plain	Rd	debris flow
r	ridged	Rm	slump in bedrock
s	steep (>72%)	Rs	debris slide, debris avalanche
t	terraced	i	initiation zone
u	undulating	Erosional Processes (active)	
v	veneer (<1 m thickness)	P	piping
x	veneer of variable thickness	V	valley erosion
z	thin veneer (<0.2 m thick)	Fluvial Processes (active)	
Soil Drainage Class		f	irregularly sinuous channel
r	rapidly drained	la	avulsions
w	well drained	lb	backchannels
m	moderately drained	ls	progressive bank erosion
p	poorly drained	Hydrologic Processes (active)	
v	very poorly drained	i	inundated (seasonally)
Soil Drainage Class Separators		u	inundated (perennially)
-	no intermediate classes present	Degradal Processes (inactive)	
/	all intermediate classes present	E	channeled by meltwater
/	first drainage class is dominant	H	kettled
Slope Gradient			

Slope gradient is given in percent. The slope gradient range is expressed by a dash (-). A dominant and subdominant slope gradient range can be indicated, separated by a comma.

Terrain Stability Classes and Implications for Development

Terrain polygons were assessed according to their estimated stability under natural conditions and following road construction. The ratings qualitatively rate the likelihood of landslide initiation in the polygon, but give no indication of landslide frequency, magnitude or impact.

Terrain Stability Class	Description	Development Implications
I	Stable, subdued terrain. No evidence of terrain instability exists.	No significant problems of terrain stability are expected.
II	Mainly stable terrain; moderately sloping; minor inclusions of steeper or sensitive terrain. No evidence of terrain instability exists.	No significant problems of instability are expected; low likelihood of minor inclusions of sensitive terrain. Standard construction practices should not be expected to affect terrain stability in the polygon.
III	Moderately stable terrain; moderate and moderately steep slopes; no evidence of natural landslide activity.	Low likelihood of landslide initiation following road construction. Minor inclusions of sensitive terrain are possible (e.g. road construction on colluvial fans or on steep slopes with gradients as low as 35%).
IV	Marginally stable, steep slopes; natural landslides are rare but terrain conditions are similar to nearby unstable slopes; or evidence of small- scale landslides on moderate slopes exists.	Problems of instability are expected; standard (cut and fill) road construction has a high potential to result in filtslope failures. The potential for landslide initiation following forest clearing without ground disturbance is moderate.
V	Significant problems of instability are expected; active or recurrent landslides initiate within mostly steep terrain. Sensitive terrain is common, e.g. steep-sided colluvial fans, or conditions for high soil pore water pressure; undercut tall stream banks.	High potential for continued or accelerated mass movement in parts of the unit during and following road construction. Forest clearing without ground disturbance increases the likelihood of landslide initiation in the polygon.

Surface Erosion Potential Classes and Implications for Development

This classification rates the potential for generating sediment from unvegetated sites (roads, trails, landslide scars).

Surface Erosion Potential	Description	Development Implications
VL	Very low potential for surface erosion.	No or very minor surface erosion is expected.
L	Low potential for surface erosion.	Minor erosion of fines from ditch lines and disturbed soils may be expected. Water should not be channeled onto disturbed sites.
M	Moderate potential for surface erosion.	Water management is very important. Erosion is expected along ditches and on disturbed sites. Erosion prevention measures should be undertaken on disturbed sites.
H	High potential for surface erosion.	Terrain is sensitive to erosion. Water management is very important. Erosion control measures are recommended during construction.
VH	Very high potential for surface erosion.	Severe surface and gully erosion problems exist. Site disturbance should be avoided. Water must not be channeled onto these sites. Erosion control measures are required.

Data Sources

This project was completed using 3D mapping software with the most current stereoscopic air photos, orthophotos, LiDAR (Light Detection and Ranging) and TRIM (Terrain Resource Inventory Mapping) base mapping. Data was obtained from Telkwa Coal Ltd and Geographic Data BC.

Credits

The *Terrain and Soil Baseline Report* (2021) was completed by Ardea Biological Consulting Ltd., Smithers, BC. Terrain stability and bioterrain mapping was completed by Irene Weiland, P. Geo., L. Eng., of Weiland Terrain Sciences, Smithers, BC; soil mapping was completed by Irene Ronalds, R. P. Bio of Irene Ronalds Ecological Consulting, Smithers, BC. Final map production was completed by L. Rach, Terrainchk Environmental Solutions Ltd., and L. Turney, Ardea Biological Consulting Ltd., Smithers BC.

Citation

Weiland, I. I. Ronalds and L. Turney. 2021. Terrain and soil baseline report, Tenas Project. Prepared for Telkwa Coal Ltd. Prepared by Ardea Biological Consulting Ltd., Smithers, BC.

Appendix D Soil Map Unit Descriptions

SMU 1.1 Medium- to Fine-Textured, Well- to Moderately-Drained

SMU 1.1 is characterized by well to moderately-well drained soil derived from morainal till, and is the most common soil map unit in the study area. Rooting zone soil textures include silt loams, silty clay loams and loams. Coarse fragment content is generally 10 to 35%, made up of subrounded gravel and cobble size particles. Common soil development includes Orthic and Brunisolic Gray Luvisols, and Eutric and Dystric Brunisols. Podzols occur to a limited extent at upper elevations in the Tenas Pit area. Average LFH is 14 cm. A horizon is generally 1 to 3 cm. Average rooting depth is 30 cm. Soil pH tends to acidic under coniferous forest, and neutral to basic under mixed and deciduous forest. These soils generally occur on gentle to moderately steep slopes and support mesic ecotypes. Soil nutrient levels are moderate.

Plate C-1: SMU 1.1 soil at plot AD027, SBSmc2/51 in Tenas pit.

Reclamation Suitability and Salvage

Soil salvage potential is good to fair. Clay content is relatively high and results in cohesive soils with low erosion potential. Compact Bt horizons can occur, impeding drainage and restricts rooting.

Agriculture Capability

Soils in this map unit generally fall within agricultural class 4 to 5 rating. Stoniness is the most common limitation to agriculture, and in some cases, soil structure may also be limiting due to compact parent materials. Where this map unit occurs above 600 metres elevation, agriculture potential is severely limited by a short growing season.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------	----------	----------	----------No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	-- Moderate ----------	----------Slow ----------	----------Very slow

SMU 1.2 Medium- to Fine-Textured, Imperfectly- to Poorly-Drained

SMU 1.2 is characterized by rich, medium to fine-textured, imperfect to poorly drained soils that have developed on morainal tills. These soils are located on moisture- and nutrient-receiving sites, generally at the base of slopes and in sloping gullies. These soils have a rich humic and/or Ah layer of generally 25 cm. Humus layers are typically Moders or Mulls. Average rooting depth is 30 cm. Soil textures include silty loams, loams and silty clay loams. Coarse fragment content ranges from 10-40%, made up of subrounded gravel and cobble size particles. Common soil development includes Gleyed Gray Luvisol, Gleyed Melanic Brunisol, and Gleysol. These soils support relatively rich subhygric to hygric ecotypes.

Reclamation Suitability and Salvage Considerations

Soils within this map unit generally have a rich, well-developed humic and Ah layers that could be set aside for soil amendment or top dressing. Overall soil salvage potential is good. B/C layers can have a relatively high clay content. The compact Bt horizon impedes drainage and restricts rooting. Fine- textured soils have a high risk of compaction and erosion, and a low bearing strength. Existing exploration trails within this map unit have impeded drainage so that water is held close to the soil surface. Poorly drained sites may have a high water-table and high erosion potential.

Agriculture Capability

Agricultural capability ratings range from 4, where the range of crops are limited, through to 6, which is considered nonarable, but capable of sustained natural grazing for domestic livestock. Compact soil parent materials, poor drainage, angle of slope, and potential high water-table all influence soil capability.

Plate C-2: SMU 1.2 soil at plot IR034, SBSmc2/10b.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------	----------	----------	----------No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	Moderate ----------	Slow ----------	Very slow

SMU 1.3 Coarse-Textured, Well-Drained

SMU 1.3 is characterized by well-drained, coarse-textured soils that have developed on ablation tills. Coarse fragment content is 30 - 50%, made up of subrounded gravel and cobble size particles. Rooting zone soil texture is typically loamy sand or sandy loam, with high silt content. Soil development is typically Dystric Brunisol, with thin Mor humus forms and signs of eluviation in the A horizon. Average rooting depth is 25 cm. This map unit is common in the northern portion of the Tenas pit on level to gently undulating sites, that often experience cold-air ponding. These soils are nutrient poor, and can be droughty. support submesic ecotypes.

Plate C-3: SMU 1.3 soil at plot IR111, SBSmc2/01c in Tenas Pit area.

Reclamation Suitability and Salvage Considerations

The high coarse fragment content and coarse texture of this soil result in a fair suitability rating for reclamation. Soil nutrient level is poor. Erosion potential is low to moderate. Soils are less cohesive than SMU 1.1.

Agriculture Capability

This soil is considered nonarable, but capable of natural grazing for domestic livestock. Stoniness makes this soil unsuitable for cultivation or use of farm machinery. Stoniness, lack of nitrogen, and soil moisture deficiency all contribute to an agriculture capability class of 6 for soils in this soil map unit.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 15	15-30	30 - 50	> 50
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------	----------	----------	----------No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	Moderate ----------	Slow ----------	Very slow

SMU 2 Coarse-Textured, Well- to Rapidly-Drained

SMU 2 encompasses the well to rapidly-drained, sandy soils derived from glaciofluvial parent materials. Loamy sand and sandy loam soil textures with granular soil structure is typical. Gravel content can be up to 60%, made up of gravel and cobble size particles. Soil classes include Dystric and Eutric Brunisol, with Mor or Moder humus form. Podzols occur to a limited extent at upper elevations in the Tenas pit. Average rooting depth is 30 cm. These soils are nutrient-poor and support submesic ecotypes. SMU 2 and has similar soil characteristics to SMU 4.1 but different parent materials.

Plate C-4: SMU 2 soil plot IR099, SBSmc2/01c.

Reclamation Suitability and Salvage Considerations

Sandy soils with high coarse fragment content and poor moisture holding capacity results in a fair to poor suitability rating for reclamation. Soil nutrient level is poor. Erosion potential is Moderate to high. Where the coarse fragment content is low this unit may be useful as a soil amendment material.

Agriculture Capability

Soils in this map unit are coarse textured, stony, and experience moisture deficits during the growing season, resulting in an ALC rating of 5 to 6.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 15	15-30	30 - 50	> 50
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------			No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	Moderate ----------	Slow ----------	Very slow

SMU 3.1 Fine-Textured, Moderately-Drained

This soil map unit is characterized by moderately drained, fine-textured silty clay, silty clay loam and silt loam soil textures, with no coarse fragments. Typical soil development includes Orthic Gray Luvisol and Brunisolic Gray Luvisol. Average rooting depth is 20 cm due to fine soil texture that can result in a clay pan. Faint mottles may be present. Topography is undulating to moderately sloping. These soils are derived from glaciolacustrine parent materials. Ecotypes supported by this soil type are mesic.

Plate C-5: SMU 3.1 at AD02, SBSdk/01a.

Reclamation Suitability and Salvage Considerations

LFH/A horizons are 14cm thick on average and are generally good for reclamation. B/C horizons are rated fair to poor for reclamation. Fine soil textures and firm consistence result in a moderate to high risk for erosion during construction, salvage and storage operations. The Bt layer is a poor rooting medium and can impede drainage.

Agriculture Capability

Soils in this map unit are classed agriculture capability 3 to 4 D. Climate is still a constraint, but these soils generally have good agriculture capability, providing cultivation is well-managed to avoid compaction or erosion. Soil structure may cause limitations due to fine soil texture.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------	----------	----------	----------No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	Moderate ----------	Slow ----------	Very slow

SMU 3.2 Fine-Textured, Imperfectly- to Poorly-Drained

SMU 3.2 includes rich, imperfectly to poorly drained silt, silt-loam and silty clay-loam soils with no coarse fragment content. Humus and Ah layer development can be up to 20 cm thick. Soils often have a clay pan. Average rooting depth is 25 cm. Soil pH is basic. Typical soil development includes Gleyed Dark Gray Luvisol and Gleyed Brunisolic Gray Luvisol, as well as Humic Luvic Gleysol. These soils typically occur on near-level and depressional sites that have a high water-table, and ephemeral water flow. Parent materials include silty fluvial sediments and localized glaciolacustrine sediments. Ecotypes are rich and subhygric to hygric. SMU 3.2 has similar soil properties to SMU 4.2 that occurs on floodplains.

Plate C-6: SMU 3.2 at plot IR086, SBSmc2/10b.

Reclamation Suitability and Salvage Considerations

Overall fair to good reclamation rating. Soils within this map unit have a rich humic layer that could be set aside for soil amendment or top dressing. B/C layers have fine soil textures resulting in moderate to high erosion potential during salvage and storage. The Bt layer is a poor rooting medium and can impede drainage.

Agriculture Capability

These soils are classed as agriculture capability 5-6 WD, with limitations due to compact soil structure and imperviousness, resulting in excess soil moisture and inundation potential. These soils should not be tilled when soils are saturated.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------No clay			
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid ------- Moderate ----------Slow ----------Very slow			

SMU 4.1 Coarse Sandy-Silty Soil, Well- Drained – On Active Floodplains

SMU 4.1 is characterized by well to rapidly drained loamy sands, sands and sandy loams derived from active fluvial deposits. Coarse fragment content can be up to 60%, made up of rounded gravel and cobble sized clasts. Typical soil development includes Orthic and Cumulic Regosol, maintained by ongoing erosion and deposition. Sites are level to gently sloping. Over-bank flooding inundates low-lying benches during spring freshet and flood events; while middle bench areas may be flooded from below as the water table rises during high water flows. These flood events provide a source of moisture and nutrients. Average rooting depth is 35 cm. This map unit occurs adjacent to Goathorn and Tenas Creeks, and directly adjacent to the Bulkley River. These soils have similar soil textures to SMU 2 and 4.3, but flood events provide a source of nutrients and moisture, resulting in richer more productive ecotypes.

Plate C-7: SMU 4.1 at IR07, adjacent Goathorn Creek.

Reclamation Suitability and Salvage Considerations

In order to maintain riparian function and stream morphology, deposits that occur in or adjacent to stream channels, including the riparian area, are generally not considered suitable for reclamation purposes. These soils can have high coarse fragment content. Erosion potential is moderate to high.

Agriculture Capability

Potential for over-bank flooding, erosion and inundation limit the agriculture capability of these soils, resulting in an agricultural capability rating of 6 . Soils are subject to seasonal overflow of extended duration, or, are flooded to early summer. Soil structure may be a limitation for tillage in silty backchannel areas.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 15	15-30	30 - 50	> 50
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------			-----No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	Moderate ----------	Slow ----------	Very slow

SMU 4.2 Fine Silty Soil, Imperfectly to Poorly Drained

SMU 4.2 are fine-textured, imperfect to poorly drained soils, that have an organically enriched Ah layer up to 25 cm deep. Soil class is Humic Regosol. Soil pH is basic. Soil texture is typically silty clay and coarse fragments are absent. Average rooting depth is 25 cm. These soils develop in back-channel depressions within floodplain deposits, where seasonal high water-tables associated with high river levels transport moisture and nutrients. Soils typically stay moist long after river levels have dropped due to poor
drainage. Ecotypes are nutrient rich and subhygric to hygric. SMU 4.2 has similar soil properties to SMU 3.2 that does not occur on floodplains.

Plate C-8: SMU 4.2 at IR040.

Reclamation Suitability and Salvage Considerations

In order to maintain riparian function and stream morphology, deposits that occur in or adjacent to stream channels, including the riparian area, are generally not considered suitable for reclamation purposes. Otherwise, reclamation rating is fair to good. Soils within this map unit have a rich humic layer that could be set aside for soil amendment or top dressing. The fine soil textures can result in high erosion potential during salvage and storage.

Agriculture Capability

These soils are classed as agriculture capability 5 to 6 WD, with limitations due to compact soil structure and imperviousness. The water table can remain high for extended periods during the growing season. These soils should not be tilled when saturated.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------No clay			
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid ------- Moderate ----------Slow ----------Very slow			

SMU 4.3 Coarse Sandy-Silty Soil, Well- Drained – On In-Active Floodplain

SMU 4.3 are well-drained sandy loams and loamy sands with high silt content, derived from inactive fluvial deposits. Sites are level to gently sloping. Coarse fragment content can be up to 40%. Typical soil development includes Eutric or Dystric Brunisol. LFH and A layers are thin. Average rooting depth is 35 cm. These soils occur adjacent to the Bulkley River, Goathorn and Tenas Creeks. SMU 4.3 has similar properties to SMU 2 but occurs on different parent materials. Ecotypes supported are mesic to submesic, depending on slope position, and are generally nutrient poor.

Plate C-9: SMU 4.3 at QA51, SBSdk/Pasture.

Reclamation Suitability and Salvage Considerations

These soils can have a high coarse fragment content. Soil salvage assessment is rated fair to poor due to coarse soil textures and high coarse fragment content. Soil erosion potential is moderate to high.

Agriculture Capability

These soils typically have an agriculture capability rating of 5, with limitations for poor soil fertility, stoniness and aridity.

	Soil Salvage Potential Rating			
	Good	**Fair**	**Poor**	**Unsuitable**
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 15	15-30	30 - 50	> 50
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	**Mod**	**High**	**V High**
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------			No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	Moderate ----------	Slow ----------	Very slow

SMU 5 Shallow Soils

This map unit describes shallow soils derived from morainal or colluvial veneers where bedrock is less than 1 m from the soil surface. These are well to rapidly-drained sites often with skeletal soils. Silty loam soil textures are typical. Soil classes include Eutric and Dystric Brunisols. Average rooting depth is 20 cm. This unit occurs to a limited extent in the study area, in upper slope positions at the south end of Tenas pit, along the western slopes of Goathorn Creek, and, the bedrock knoll located near the eastern end of the bypass route. Ecotypes are submesic to subxeric.

Plate C-10: SMU 5 at IR050, SBSmc2/01c.

Reclamation Suitability and Salvage Considerations

These soils have poor suitability for reclamation because they have high coarse fragment content and are shallow to bedrock. Soil erosion potential is low to moderate.

Agriculture Capability

Stoniness, bedrock, nutrient and moisture deficits limit these soils for agriculture. Soils in this map unit are classed as 6 to 7, as it is generally considered nonarable, but is capable of producing native and or uncultivated perennial forage crops, where conditions are favourable such as south-facing slopes.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------No clay			
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid ------- Moderate ----------Slow ----------Very slow			

SMU 6 Skeletal Soils

This map unit describes rapidly-drained sites with little to no soil development due to the presence of bedrock outcrops or scree slopes. Soils are skeletal. This unit occurs to a very limited extent in the study area, at upper elevations at the south end of Tenas pit area, along the western slopes of Goathorn Creek, and, the bedrock knoll located near the eastern end of the bypass route. Ecotypes are xeric.

Plate C-11: SMU 6 adjacent IR050.

Reclamation Suitability and Salvage Considerations

Unsuitable. Soil erosion potential is low.

Agriculture Capability

This map unit has no capability for arable culture or for sustained livestock grazing.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------No clay			
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid ------- Moderate ----------Slow ----------Very slow			

SMU 7 Organic Soils

Organic soils develop as veneers or blankets on level and depressional sites where drainage is poor to very poor. The primary water sources include groundwater flow and subsurface flow. These sites have a high water-table throughout most of the growing season, so that organic decomposition is very slow. Typic and Hydric Mesisols are common; Humisols and Fibrisols are less common. Average rooting depth is 30 cm. This map unit may be underlain by SMU 1.2 or 3.2. Ecotypes are subhydric.

Plate C-12: SMU 7 at plot AD157, SBSmc2/10b.

Reclamation Suitability and Salvage Considerations

Good for amendment materials.

Wetland integrity should be preserved where possible. Sites within the mine footprint area, that are to be developed, could be a source of organic amendment materials, therefore soil salvage potential is rated good. Soil erosion potential is low

Agriculture Capability

Agriculture capability is limited by high water-table and inundation. These sites are flooded for most of the growing season. They are classed as O for organic, and are considered unsuitable for agriculture.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------No clay			
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid ------- Moderate ----------Slow ----------Very slow			

SMU 8.1 Varying-Soil Textures – On Steep to Moderately-Steep Slopes with High Failure Potential

This map unit represents a variety of soil types that are distinguished here due to their occurrence on steep to moderately steep slopes with high failure potential above Goathorn Creek, Four Creek, and Tenas Creek. Slope is generally greater than 50%. The unit encompasses a wide range of soil textures, and coarse fragment content is variable. Where soil erosion is ongoing, the typical soil development is Orthic Regosol, however Brunisols and Luvisols also occur. Average rooting depth is 30 cm. Humus forms include Moders and Mulls. Organic enrichment of the Ah layer was observed, but not to the extent as seen in SMU 8.2. This SMU supports mesic and rich ecotypes.

Plate C-13: SMU 8.1 at IR131 SBSdk/AtCv.

Reclamation Suitability and Salvage Considerations

Unsuitable sites for salvage. The steeply sloping terrain can be unstable - soils should not be considered as suitable sources of reclamation material.

Agriculture Capability

Topography, erosion potential, and stoniness present serious limitations to agriculture. Soils within this map unit are classed as 7T. The land is not suitable for arable agriculture or for sustained natural grazing by domestic livestock.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------	----------	----------	----No clay
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid -------	Moderate ----------	Slow ----------	Very slow

SMU 8.2 Varying-Soil Textures – Receiving Sites at Base of Unstable Slopes

SMU 8.2 are imperfectly drained, relatively fine-textured silty clay loams and silty loams with deep organic enrichment that have developed on landslide and slump deposits at the base of seepage slopes along Goathorn and Tenas Creeks. Soils are generally rich due seepage from upslope and mixing of organic materials and are cohesive. Ah development can be up to 20 cm thick. Average rooting depth is 40 cm. Humic Gleysols and Gleyed Humic Regosols are typical. Coarse fragment content is variable, from 0 – 50%. Supports rich subhygric ecotypes.

Plate B-14: SMU 8.2 soil at plot IR132, SBSmc2/53 Mountain alder - miterwort.

Reclamation Suitability and Salvage Considerations

Unsuitable sites for salvage. The steeply sloping terrain can be unstable - soils should not be considered as suitable sources of reclamation material. These are moist, nutrient-rich materials but are subject to erosion and mass wasting.

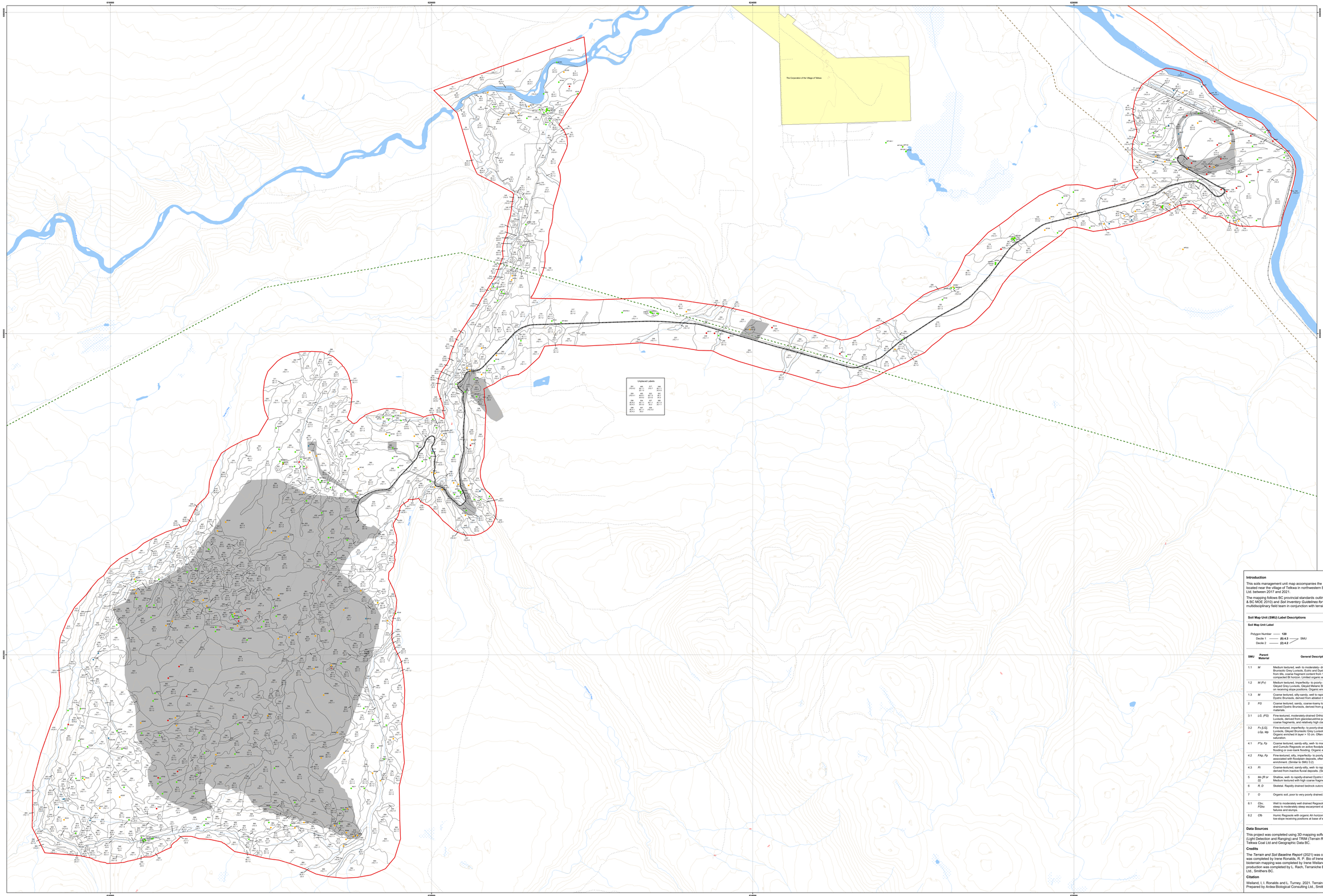
Agriculture Capability

Steep slopes, excess moisture, compact soils and stoniness all contribute to a capability rating of 6. Land can be suitable for sustained natural grazing of domestic livestock.

	Soil Salvage Potential Rating			
	Good	Fair	Poor	Unsuitable
Reaction (pH)	5.0 to 6.5	4.0 to 5.0 6.5 to 7.5	3.5 to 4.0 7.5 to 9.0	< 3.5 or > 9.0
Stoniness	< 30	30 to 50	50 to 80	> 80
Texture	L, SiCL, SCL, SL, FSL	CL, SiL, VFSL, SC, SiC	LS, S, Si, C, HC	Consolidated bedrock
Rooting Zone (cm)	> 50	30 to 50	< 20	< 10
Ah (cm)	> 5	1 to 3	0	0

	Soil Erosion Potential Rating			
	Low	Mod	High	V High
Soil texture	Clay loam and loam	Loamy sand	Fine Sand to Clay	Silt
Cohesive-ness	Clay rich ----------No clay			
Coarse Fragments	Abundant Absent	Angular boulder	Rounded gravelly	Consolidated bedrock
Permeability	Rapid ------- Moderate ----------Slow ----------Very slow			

Appendix E 1:10,000 Soil Map Unit Mapping



Tenas Project

Soil Management Unit Mapping
Telkwa Coal LSA

Legend

- Rail Line
- Highway
- Paved Road
- Gravel Road
- 138 kV Transmission Line
- 500 kV Transmission Line
- Waterbody
- Wetland
- Watercourse
- Municipal Area
- Haul Road
- Project Area
- Soils LSA
- Soil Management Unit Polygon

Soils Mapping Plot Types

- Full (FS882)
- Ground
- Visual
- Note

Notes

All mapped features are approximate and should be used for discussion purposes only.

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.

Map production date: November 18, 2017

N

Original Map Scale 1:10,000

0 200 400 600 800 1,000

Meters

NAD 1983 UTM Zone 9N

Page Size 45" x 72"

TELKWA COAL LIMITED

ARDEA BIOLOGICAL CONSULTING

Introduction

This soils management unit map accompanies the *Terrain and Soil Baseline Report* (2021) for the proposed Tenas Project located near the village of Telkwa in northwestern British Columbia. The report and mapping were prepared for Telkwa Coal Ltd. between 2017 and 2021.

The mapping follows BC provincial standards outlined in the *Field Manual for Describing Terrestrial Ecosystems* (BC MOFRR & BC MOE 2010) and *Soil Inventory Guidelines for British Columbia* (RIC 1995). Soils field information was collected by a multidisciplinary field team in conjunction with terrain mapping, terrestrial ecosystem mapping and soil sampling.

Soil Map Unit (SMU) Label Descriptions

Soil Map Unit Label

Polygon Number —— **120**
Decile 1 —— **(B) 4.3** —— SMU
Decile 2 —— **(2) 4.2**

SMU	Parent Material	General Description	Topography	Soil Texture	Average Rooting Depth (cm)	Coarse Fragment Content (%) R.Z.
1.1	*M*	Medium textured, well- to moderately- drained Orthic and Brunisolic Grey Luvisols, Eutric and Dystric Brunisols derived from tills, coarse fragment content from 10 to 40%. May have compacted Bt horizon. Limited organic enrichment.	Level to moderately steep.	SiL, L, SiCL, (SL)	30	10-35
1.2	*M (Fv)*	Medium textured, imperfectly- to poorly- drained Humic Gleysols, Gleyed Grey Luvisols, Gleyed Melanic Brunisols, derived from tills on receiving slope positions. Organic enriched A layer is typical.	Lower receiving slope positions	SiL, SiCL, SiC, (SL, LS)	30	10-40
1.3	*M*	Coarse textured, silty-sandy, well to rapidly-drained nutrient- poor Dystric Brunisols, derived from ablation tills. Cold air ponding.	Undulating, convex.	SL, LS	25	30-50
2	*FG*	Coarse textured, sandy, coarse-loamy to gravelly, well- to rapidly-drained Dystric Brunisols, derived from glaciofluvial parent materials.	Level to gently sloping	S, LS, (SL)	30	20-60
3.1	*LG, (FG)*	Fine-textured, moderately-drained Orthic and Brunisolic Gray Luvisols, derived from glaciolacustrine parent materials. Zero coarse fragments, and relatively high clay content.	Level to gently sloping	SiCL, SiL, Si	25	0
3.2	*Fv [LG], LGp, Mp*	Fine-textured, imperfectly- to poorly-drained Gleyed Dark Grey Luvisols, Gleyed Brunisolic Grey Luvisols, Humic Luvic Gleysols. Organic enriched A layer > 10 cm. Often signs of prolonged water saturation.	Level to gently sloping and depressions	Si, SiCL, SiL	25	0-10
4.1	*FYp, Fp*	Coarse textured, sandy-silty, well- to moderately-drained Orthic and Cumulic Regosols on active floodplain deposits. Subsurface flooding or over-bank flooding. Organic enrichment variable.	Level to gently sloping	LS, S, SL, SiL	30	0-60
4.2	*FAp, Fp*	Fine-textured, silty, imperfectly- to poorly-drained Humic Regosols associated with floodplain deposits, often with organic enrichment. (Similar to SMU 3.2)	Level	SiL, SiCL, Si	25	0
4.3	*Ft*	Coarse-textured, sandy-silty, well- to rapidly-drained Brunisols derived from inactive fluvial deposits. (Similar to SMU 2)	Level to gently sloping	SL, LS	25	0-40
5	*Mx [R or D]*	Shallow, well- to rapidly-drained Dystric Brunisols over bedrock. Medium textured with high coarse fragments.	Gentle upper slopes and crests	SiL, FSL, SL	20	30-75
6	*R, D*	Skeletal. Rapidly drained bedrock outcrops.	Upper slopes, crests	Skeletal	< 5	Skeletal
7	*O*	Organic soil, poor to very poorly drained. Veneers and blankets.	Level to depression	Fibric, mesic organics	30	n/a
8.1	*Cbv, FGks*	Well to moderately well drained Regosols, Brunisols, Luvisols on steep to moderately steep escarpment slopes, some active failures and slumps.	Moderately steep, steep slopes	SiL, L, SiCL	30	25-80
8.2	*Cfb*	Humic Regosols with organic Ah horizons > 10 cm, situated in toe-slope receiving positions at base of escarpment slopes.	Gentle to moderate receiving slopes	SiL, L, SiCL	40	0-50

Data Sources

This project was completed using 3D mapping software with the most current stereoscopic air photos, ortho-photos, LIDAR (Light Detection and Ranging) and TRIM (Terrain Resource Inventory Mapping) base mapping. Data was obtained from Telkwa Coal Ltd and Geographic Data BC.

Credits

The *Terrain and Soil Baseline Report* (2021) was completed by Ardea Biological Consulting Ltd., Smithers, BC. Soil mapping was completed by Irene Ronalds, R. P. Bio of Irene Ronalds Ecological Consulting, Smithers, BC; terrain stability and bioterrain mapping was completed by Irene Welland, P. Geo. L. Eng., of Welland Terrain Sciences, Smithers, BC. Final map production was completed by L. Rach, Terraniche Environmental Solutions Ltd., and L. Turney, Ardea Biological Consulting Ltd., Smithers BC.

Citation

Welland, I. I. Ronalds and L. Turney. 2021. Terrain and soil baseline report, Tenas Project. Prepared for Telkwa Coal Ltd. Prepared by Ardea Biological Consulting Ltd., Smithers, BC.

Appendix F Soil Nutrient and Trace Metals Analyses Results

Table F-1: Soils nutrient analysis results for all samples analyzed.

Plot Number	Sample Date	General Area	Depth (cm)	Total Organic Carbon (mg/kg dry)	Moisture (%)	pH	Available Potassium (mg/kg dry)	Available Ammonia (as Nitrogen) (mg/kg dry)	Available Nitrate (as Nitrogen) (mg/kg dry)	Available Phosphorus (mg/kg dry)	Particle Size > 4.75 mm (%)	Particle Size > 0.25 mm (%)	Particle Size > 0.1 mm (%)	Sand < 2.0 mm (%)	Silt < 0.05 mm (%)	Clay < 0.002 mm (%)	Texture
AD001	2017-07-25	Rail	0-15	5.26	16.0	6.56	885	6.7	6.8	322.0	<0.1	1.7	2.4	17	62	21	Silt Loam
AD001	2017-07-25	Rail	15-30	0.55	1.7	6.73	475	3.0	2.2	102.0	<0.1	0.7	5.2	22	55	23	Silt Loam
AD012	2017-07-25	Pit	0-15	1.43	2.7	4.92	105	3.5	1.5	6.0	9.1	37.7	17.5	75	15	10	Sandy Loam
AD016	2017-07-25	Pit	0-15	0.64	5.0	6.56	63	3.5	2.1	6.0	1.3	9.4	5.3	23	36	41	Clay
AD021	2017-07-25	Pit	0-15	2.02	4.7	6.59	53	3.0	1.9	10.0	4.4	30.5	6.1	48	34	18	Loam
AD025	2017-07-25	Pit	0-15	13.30	40.5	6.12	126	8.0	7.7	9.0	15.6	18.1	3.4	55	20	25	Silty Clay Loam
AD027	2017-07-26	Pit	0-15	1.08	5.7	6.37	56	3.0	4.7	6.0	14.5	32.9	8.7	64	23	13	Sandy Loam
AD034	2017-07-26	Pit	0-15	20.90	71.1	6.15	84	7.5	29.0	12.0	<0.1	3.8	1.0	39	35	26	Loam
AD039	2017-07-26	Pit	0-15	7.80	33.3	6.39	72	4.0	13.0	5.0	9.2	33.5	10.4	54	25	21	Sandy Clay Loam
AD041	2017-07-26	Pit	0-15	3.40	9.5	6.03	49	2.5	2.7	7.0	5.4	36.5	9.9	59	22	19	Sandy Loam
AD048	2017-07-27	Pit	0-15	0.93	2.5	5.50	72	3.0	1.7	18.0	9.4	49.0	7.0	69	16	15	Sandy Loam
AD054	2017-07-27	Pit	5-30	9.54	24.0	5.69	72	8.0	3.7	6.0	<0.1	3.1	2.0	23	33	44	Clay
IR006	2017-07-25	Rail	0-15	0.56	2.7	5.93	140	3.0	1.3	49.0	<0.1	2.5	11.4	39	43	18	Loam
IR010	2017-07-25	Pit	0-15	12.60	8.5	5.20	206	14.0	5.4	13.0	2.9	14.4	5.0	36	26	38	Clay Loam
IR010	2017-07-25	Pit	15-30	3.29	6.6	5.54	93	7.5	2.6	8.0	5.4	23.8	7.5	47	28	25	Loam
IR011	2017-07-25	Pit	15-30	1.55	3.0	4.79	42	4.5	2.0	2.0	14.2	29.1	7.3	52	33	15	Loam
IR013	2017-07-25	Pit	0-15	4.60	4.2	6.96	58	4.0	2.5	5.0	7.5	30.2	7.0	54	19	27	Sandy Clay Loam
IR013	2017-07-25	Pit	15-30	18.10	38.3	6.84	74	12.0	15.0	10.0	3.7	14.0	4.1	42	36	22	Loam
IR019	2017-07-25	Pit	5-30	1.20	8.8	5.18	70	4.0	2.9	7.0	7.8	27.3	15.2	66	24	10	Sandy Loam
IR025	2017-07-26	Pit	0-15	5.00	16.5	5.74	91	5.3	2.6	6.0	6.5	14.2	4.5	38	25	37	Clay Loam
IR028	2017-07-26	Pit	0-15	5.36	16.4	5.92	104	4.0	2.0	5.0	1.8	30.2	8.5	47	25	28	Sandy Clay Loam
IR030	2017-07-26	Pit	0-15	2.14	12.1	5.86	78	5.0	3.4	6.0	7.4	41.2	9.1	60	22	18	Sandy Loam
IR034	2017-07-27	Pit	0-15	7.11	30.3	5.78	137	16.0	4.9	7.0	<0.1	11.2	4.6	37	26	37	Clay Loam
IR034	2017-07-27	Pit	15-40	1.28	3.5	6.52	65	6.7	1.2	5.0	1.4	28.6	7.8	46	25	29	Sandy Clay Loam
IR035	2017-07-27	Pit	0-15	1.15	3.5	5.42	93	6.0	2.7	17.0	20.7	36.1	8.4	63	22	15	Sandy Loam
IR035	2017-07-27	Pit	15-30	0.45	1.0	5.74	50	4.0	2.0	10.0	16.6	29.3	7.2	66	22	12	Sandy Loam
IR036	2017-07-27	Pit	0-30	1.15	3.6	5.35	123	5.0	4.9	11.0	21.4	36.7	8.9	65	20	15	Sandy Loam
IR039	2017-07-27	Pit	0-30	2.72	4.9	4.99	47	6.0	2.7	8.0	22.1	42.7	8.4	65	22	13	Sandy Loam
IR041	2017-07-27	Pit	0-40	0.79	5.2	5.34	65	5.0	7.1	16.0	25.8	29.8	6.6	53	30	17	Sandy Loam
IR053	2017-07-28	Pit	0-30	6.72	23.9	6.67	108	5.3	6.9	6.0	<0.1	8.4	3.1	35	25	40	Clay Loam
IR058	2017-07-28	Pit	0-30	1.48	8.2	5.36	82	6.5	4.1	10.0	25.1	29.7	5.8	57	24	19	Sandy Loam
IR065	2017-07-28	Pit	0-30	1.58	7.0	6.09	48	4.0	3.4	5.0	15.0	12.5	35.7	64	22	14	Sandy Loam
IR213	2019-06-03	Haul Rd	0-15	2.34	10.8	5.74	70	20.0	1.9	8.0	5.5	40.8	18.4	72	19	9	Sandy Loam
IR214	2019-06-03	Haul Rd	0-15	1.61	11.5	6.00	110	8.0	1.0	3.0	23.8	37.8	5.4	83	11	6	Loamy Sand
IR218	2019-06-03	Haul Rd	0-15	1.46	9.8	6.20	110	28.0	1.7	26.0	30.2	26.3	7.2	62	30	8	Sandy Loam
IR225	2019-06-07	Pit	0-15	1.41	52.3	5.65	135	12.0	1.8	<2	<0.1	3.2	2.1	<1.0	<1.0	<1.0	-
IR227	2019-06-07	Pit	0-15	16.80	19.7	5.34	37	5.3	2.5	3.0	40.3	18.6	5.4	65	29	6	Sandy Loam
IR243A	2019-07-02	Rail	0-15	380.00	5.3	2.10	13	2.5	16.5	6.4	1.0	17.4	33.8	66	33	1	Sandy Loam
IR243B	2019-07-02	Rail	15-30	0.43	4.2	6.41	55	1.0	2.0	5.0	0.6	26.9	44.4	86	12	2	Sand
IR248A	2019-07-15	Rail	0-15	2.84	21.4	5.80	90	5.3	1.6	95.0	<0.1	10.4	9.0	43	48	9	Silt Loam

Plot Number	Sample Date	General Area	Depth (cm)	Total Organic Carbon (mg/kg dry)	Moisture (%)	pH	Available Potassium (mg/kg dry)	Available Ammonia (as Nitrogen) (mg/kg dry)	Available Nitrate (as Nitrogen) (mg/kg dry)	Available Phosphorus (mg/kg dry)	Particle Size > 4.75 mm (%)	Particle Size > 0.25 mm (%)	Particle Size > 0.1 mm (%)	Sand < 2.0 mm (%)	Silt < 0.05 mm (%)	Clay < 0.002 mm (%)	Texture
IR248B	2019-07-15	Rail	15-30	0.28	15.6	6.35	75	4.0	1.0	15.0	<0.1	3.6	17.4	43	46	11	Loam
IR252	2019-07-15	Rail	0-15	0.34	13.2	6.66	47	2.7	<1.0	30.0	<0.1	13.2	55.5	82	17	1	Loamy Sand
IR254	2019-07-15	Rail	0-15	0.58	12.7	6.37	60	3.3	1.0	15.0	<0.1	13.6	50.2	80	20	<1.0	Loamy Sand
IR256	2019-07-15	Rail	0-15	1.29	20.6	6.25	185	5.3	2.8	10.0	<0.1	14.4	13.0	45	53	2	Silt Loam
IR258	2019-07-15	Rail	0-15	4.07	23.7	6.37	59	10.0	3.0	5.0	2.0	3.5	7.5	29	61	10	Silt Loam
IW025	2017-07-26	Pit	0-15	15.80	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LR02	2019-07-15	Haul Rd	5-30	No data	No data	6.27	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LR03	2019-07-15	Haul Rd	5-30	No data	No data	5.59	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LR04	2019-07-16	Haul Rd	5-30	No data	No data	5.71	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LR05	2019-07-24	Haul Rd	5-30	No data	No data	5.01	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LR06	2019-08-01	Haul Rd	5-30	No data	No data	6.00	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LR07	2019-08-01	Haul Rd	5-30	No data	No data	5.85	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LR08	2019-08-01	Haul Rd	5-30	No data	No data	5.21	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg01	2019-08-08	Pipeline	5-30	No data	No data	5.92	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg04	2019-08-08	Pipeline	5-30	No data	No data	6.85	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg06	2019-08-08	Pipeline	5-30	No data	No data	5.83	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg07	2019-08-08	Pit	5-30	No data	No data	4.32	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg08	2019-08-08	Pit	5-30	No data	No data	5.43	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg09	2019-08-08	Pit	5-30	No data	No data	4.88	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg10	2019-08-08	Pit	5-30	No data	No data	5.00	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg11	2019-08-09	Pit	5-30	No data	No data	6.31	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg13	2019-08-09	Pipeline	5-30	No data	No data	6.66	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg14	2019-08-09	Pipeline	5-30	No data	No data	7.11	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg15	2019-08-09	Pit	5-30	No data	No data	5.36	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg18	2019-08-09	Pit	5-30	No data	No data	5.73	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg19	2019-08-09	Pit	5-30	No data	No data	5.24	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
LTVeg20	2019-08-09	Pit	5-30	No data	No data	5.32	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
QA01	2018-08-27	Pit	0-20	16.20	29.6	5.42	270	12.0	12.7	<2	<0.1	6.6	9.5	62	28	10	Sandy Loam
QA31	2018-08-29	Haul Rd	0-20	3.29	2.6	6.66	135	2.5	1.5	2.0	<0.1	20.5	35.7	79	16	5	Loamy Sand
QA32	2018-08-29	Haul Rd	0-15	7.76	18.3	6.57	888	4.0	6.6	<2	<0.1	11.0	7.9	49	39	12	Loam
QA32	2018-08-29	Haul Rd	15-30	3.30	13.2	6.57	445	4.0	6.3	<2	<0.1	16.1	11.7	56	30	14	Sandy Loam
QA35	2018-08-30	Haul Rd	0-15	3.80	10.2	6.34	100	2.0	5.7	<2	<0.1	19.1	15.2	59	31	10	Sandy Loam
QA44	2018-08-30	Haul Rd	0-15	0.13	1.2	7.02	23	1.0	<1.0	<2	<0.1	9.3	85.6	96	3	1	Sand
QA50	2018-08-31	Rail	0-15	2.49	2.2	5.95	400	4.0	4.1	65.0	26.8	4.2	40.3	79	16	5	Loamy Sand
QA51	2018-08-31	Rail	0-15	2.67	5.3	6.75	85	4.0	2.9	28.0	0.5	13.6	9.6	41	45	14	Silt Loam
QA52	2018-08-31	Rail	0-15	1.43	2.3	5.73	65	2.0	<1.0	10.0	30.9	1.9	46.8	82	9	9	Loamy Sand
QA53	2018-08-31	Haul Rd	0-15	3.12	9.5	5.11	70	4.0	1.7	13.0	<0.1	1.8	6.8	21	59	20	Silt Loam

Table F-2: Soils trace metals results (mg/kg dry) for soil plots in the minesite area.

Plot number			AD012	AD016	AD021	AD025	AD027	AD034	AD039	AD041	AD048	AD054	IR010	IR010	IR011	IR013	IR013	IR019	IR025	IR028	IR030	IR034	IR034
Depth (cm)			0-15	0-15	0-15	0-15	0-15	0-15	0-15	0-15	0-15	5-30	0-15	15-30	15-30	0-15	15-30	5-30	0-15	0-15	0-15	0-15	15-40
Analyte	SQG_{IN}[1]	MRL[2]																					
Aluminum		40	8660	17400	19300	29700	14000	18600	20100	14200	18000	30500	21900	13900	11900	18700	14900	11800	26800	20700	15700	34000	16700
Antimony	40	0.1	0.64	0.91	0.78	0.54	0.54	0.42	0.5	0.75	0.51	0.39	0.3	0.42	0.45	0.48	0.36	0.55	0.57	0.48	0.57	0.44	0.47
Arsenic	12	0.3	8.31	8.77	7.89	10.6	6.83	5.16	8.55	7.95	9.03	9.98	5.86	7.04	9.35	11.6	7.31	7.56	15.8	11.4	7.94	16.8	14
Barium	2000	1	174	170	174	577	172	418	334	217	162	670	316	144	113	380	527	177	475	533	215	807	308
Beryllium	8	0.1	0.18	0.34	0.39	1.14	0.34	0.91	0.57	0.42	0.38	0.92	0.64	0.37	0.25	0.76	0.66	0.37	1.05	0.76	0.43	1.07	0.47
Bismuth		0.1	0.11	0.11	<0.10	0.16	0.1	<0.10	0.11	0.11	0.1	0.15	0.13	0.11	0.11	0.15	0.14	<0.10	0.19	0.14	0.1	0.19	0.11
Boron		2	2.6	3.7	4.9	3.3	3.1	4.2	3.5	3.3	2.3	3.1	3.5	2.8	2.5	3.2	3.6	2.6	3	3.2	2.9	3.6	3.8
Cadmium	22	0.04	0.279	0.371	0.279	0.685	0.218	0.793	0.477	0.321	0.113	0.477	0.632	0.226	0.145	0.41	1.04	0.305	0.754	0.43	0.248	0.733	0.373
Calcium		100	1430	5770	11100	12500	3950	31500	10500	4580	1830	8080	6410	3170	1500	6800	24300	1800	5570	5450	3190	9530	4190
Chromium	87	1	16.5	28.7	26.9	31.5	22.8	16.3	25.6	20	21.9	31.4	23.7	21.1	17.7	26	15.7	17.3	30.2	25.1	20.2	35.3	22.7
Cobalt	300	0.1	6.48	14.6	14.9	12.4	10.2	3.68	13.7	11.9	8.06	11.9	11.6	10.3	11.1	14.2	9.27	7.58	20.8	15.9	9.31	15.9	13.5
Copper	91	0.4	10.6	23	36.2	69.5	13.1	52.9	28	17.7	19.4	41.2	33.5	17.7	11.6	50	54.3	16.3	62.5	34.3	20.5	53.8	17.3
Iron		20	34900	41200	39600	39100	32400	15100	35300	37500	32800	39300	28800	30800	31400	38300	23900	31900	55000	38400	34300	50300	38400
Lead	600	0.2	7.57	7.15	7.72	7.6	7.71	2.32	7.67	8.94	7.89	7.93	7.95	7.84	9.68	13.3	9.92	6.75	10.9	9.66	8.22	10.9	9.65
Lithium		0.1	8.69	12	14.1	16.1	15.1	5.31	20.5	19.7	14.2	23.4	20.7	14.5	11.7	67.5	43.5	7.62	24	21.3	14.4	29.1	15.3
Magnesium		10	3030	6690	8710	6560	6220	4090	5900	5780	5950	6800	5770	5320	4790	5470	3600	3210	7110	5620	5560	8640	6730
Manganese		0.4	306	832	1090	1440	841	427	1320	925	436	941	593	593	858	1350	578	446	2270	1550	719	1590	2070
Mercury	50	0.04	<0.040	<0.040	0.045	0.18	<0.040	0.237	0.068	<0.040	<0.040	0.15	0.075	<0.040	<0.040	0.057	0.12	<0.040	0.062	0.067	<0.040	0.13	0.045
Molybdenum	40	0.1	0.64	0.37	0.46	0.8	0.41	0.62	0.52	0.43	0.73	0.8	0.69	0.56	0.81	0.64	0.52	0.6	0.9	0.65	0.61	0.83	0.52
Nickel	89	0.6	9.95	18.4	21.6	28.4	18	14	24.2	15.4	18.6	32	22	17.7	13.6	28.7	22.3	10.6	31.2	29.1	15.9	39.8	22.7
Phosphorus		10	184	207	555	1500	288	2050	697	278	412	942	734	309	212	298	660	191	687	625	251	1150	509
Potassium		40	450	646	709	924	465	280	658	566	400	1060	1210	678	406	671	479	410	1080	1070	621	1870	985
Selenium	2.9	0.2	<0.20	<0.20	<0.20	0.41	<0.20	0.64	<0.20	<0.20	<0.20	0.37	<0.20	<0.20	<0.20	0.31	0.53	<0.20	0.25	0.21	<0.20	0.41	0.22
Silver	40	0.1	<0.10	0.14	<0.10	0.69	0.16	0.51	0.32	<0.10	0.13	0.41	0.37	<0.10	<0.10	0.53	1.29	0.13	0.49	0.29	0.12	0.78	<0.10
Sodium		50	95	141	426	112	135	109	162	262	105	156	117	131	125	124	69	91	127	111	105	176	186
Strontium		0.2	25	50.3	80.9	80.7	36.1	203	82.6	50.9	20.4	72.6	57.1	32.7	22.1	33.9	83.7	27.5	43.9	50.5	40.3	65.5	31.1
Sulphur		1000	<1000	<1000	<1000	1060	<1000	2830	1160	<1000	<1000	<1000	<1000	<1000	<1000	<1000	1760	<1000	<1000	<1000	<1000	1050	<1000
Tellurium		0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium	1	0.1	<0.10	<0.10	<0.10	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	0.15	0.1	0.1	<0.10	0.17	0.11	<0.10	0.14	0.12	<0.10	0.17	<0.10
Thorium		0.5	0.73	0.93	0.89	0.83	0.74	0.62	0.54	0.56	0.93	1.08	<0.50	0.56	0.61	1.02	<0.50	0.86	1.12	0.9	0.61	1.44	1.36
Tin	300	0.2	0.51	0.54	0.51	0.62	0.44	<0.20	0.42	0.51	0.45	0.55	0.53	0.4	0.42	0.6	0.46	0.46	0.7	0.5	0.49	0.8	0.44
Titanium		1	424	441	598	91.3	532	69.3	136	352	355	62.6	68.3	292	347	151	54.5	305	113	83.2	243	54.6	365
Tungsten		0.2	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
Uranium	300	0.05	0.208	0.402	0.433	1.19	0.28	1.21	0.389	0.318	0.278	0.796	0.463	0.309	0.232	0.38	0.407	0.269	0.49	0.419	0.347	0.758	0.388
Vanadium	130	1	72.7	74	77.6	63.4	63.8	20.5	60.2	73.4	64.8	62.5	55.9	57.1	65.9	75.1	45.4	66.9	86	60.9	65.8	79	67.9
Zinc	410	2	74	70.3	72.1	89	68	28.9	69	62.8	72.3	88.5	94.3	66.3	54.7	106	70.7	59.2	133	89.2	73.4	138	87.4
Zirconium		2	<2.0	<2.0	<2.0	3.5	<2.0	6.6	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.7	2.4

Note: 1) CCME Soil Quality Guideline for Industry; 2) Method Reporting Limit; Shading indicates exceedance of CCME Guideline

Table F-2: Soils trace metals results (mg/kg dry) for soil plots in the minesite area (continued).

Plot number			IR035	IR035	IR036	IR039	IR041	IR053	IR058	IR065	IR225	IR227	LTVeg07	LTVeg08	LTVeg09	LTVeg10	LTVeg11	LTVeg15	LTVeg18	LTVeg19	LTVeg20	QA01
Depth (cm)			0-15	15-30	0-30	0-30	0-40	0-30	0-30	0-30	0-15	0-15	5-30	5-30	5-30	5-30	5-30	5-30	5-30	5-30	5-30	0-20
Analyte	SQG_{IN}	MRL																				
Aluminum		40	14700	14300	17500	14100	18300	23900	16600	13800	43100	15000	11300	9680	19000	15400	15900	15200	16500	17200	19400	35800
Antimony	40	0.1	0.45	0.5	0.46	0.43	0.66	0.45	0.64	0.64	0.49	0.42	0.53	0.42	0.45	0.26	0.7	0.39	0.46	0.6	0.42	0.22
Arsenic	12	0.3	7.95	9.42	6.87	5.59	8.27	10.5	7.66	9.97	6.76	5.28	5.5	7.06	10.5	10.2	11.7	8.83	7.88	10.5	12.8	6.03
Barium	2000	1	154	188	146	113	119	333	144	165	470	165	92.4	154	199	164	252	176	141	123	140	449
Beryllium	8	0.1	0.33	0.4	0.35	0.32	0.4	0.76	0.33	0.35	0.73	0.28	0.23	0.19	0.42	0.31	0.42	0.46	0.33	0.33	0.49	0.53
Bismuth		0.1	<0.10	<0.10	0.1	<0.10	0.12	0.16	0.14	0.1	0.16	0.12	0.11	0.14	0.18	0.16	0.12	0.15	0.11	0.12	0.19	<0.10
Boron		2	2.3	2.5	2.4	2.5	2.6	3.4	2.3	2.6	<2.0	<2.0	<2.0	2.3	<2.0	2.3	2.9	<2.0	<2.0	<2.0	<2.0	<2.0
Cadmium	22	0.04	0.131	0.101	0.193	0.156	0.121	0.59	0.091	0.226	0.468	0.128	0.101	0.698	0.189	0.188	0.291	0.201	0.06	0.207	0.118	0.396
Calcium		100	1450	2390	2430	2670	1300	8780	1730	3830	6840	2290	1870	2530	1850	1710	5280	1970	1910	1780	1970	9020
Chromium	87	1	15.6	18.1	22	19.6	23.4	31.1	20.8	21.5	40.3	23	16.1	16.9	25.1	21.2	26.8	25	22	22.6	27.3	26.3
Cobalt	300	0.1	6.69	9	8.03	7.11	8.45	15.6	7.47	10.1	16.9	7.91	6.12	8.13	13.7	10.4	16.4	17.6	8.95	9.02	12.9	10.9
Copper	91	0.4	11.9	18	16.9	14.8	18.7	46.1	20.3	16.4	43.8	15.9	11.1	8.37	18.1	14.9	31.4	23.2	14.8	16.6	18.1	27
Iron		20	34100	37600	34000	31000	36400	40300	34200	37700	41000	29400	24200	30800	37500	32900	35100	34500	31400	37600	36500	30700
Lead	600	0.2	6.08	6.97	6.14	6.58	8.04	7.67	6.55	9.34	7.78	7.15	6.44	7.32	9.38	10.8	9.35	8.07	6.74	7.29	9.55	5.73
Lithium		0.1	12	10.9	15.3	12	14.5	23.2	14.7	12.4	23.7	10.3	9.83	9.03	13.9	31	12.4	14.3	11.4	14.5	17	19
Magnesium		10	4570	6540	5560	5060	5200	7490	4330	5870	8980	4240	4000	3580	5400	4390	6340	4710	5660	4750	5810	7050
Manganese		0.4	328	574	367	399	422	2750	440	770	1290	348	368	765	1150	674	1160	1200	473	423	1040	1040
Mercury	50	0.04	<0.040	<0.040	<0.040	<0.040	<0.040	0.056	<0.040	0.045	0.075	<0.040	<0.040	<0.040	<0.040	<0.040	0.044	0.044	<0.040	<0.040	<0.040	0.152
Molybdenum	40	0.1	0.57	0.52	0.72	0.49	0.5	0.77	0.97	0.83	0.56	0.46	0.47	0.51	0.75	0.72	0.7	0.6	0.68	0.59	1.22	0.59
Nickel	89	0.6	11.4	13.7	19.2	14.3	17.4	32	15.7	17.5	32.8	16.2	11.7	10.3	16.1	15.6	25.9	26.3	18	16.3	21.3	28.2
Phosphorus		10	305	337	335	256	349	628	309	352	897	247	361	560	397	270	695	342	260	387	480	887
Potassium		40	463	497	537	368	431	1300	469	470	1140	354	444	668	947	593	1270	614	694	527	730	1070
Selenium	2.9	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	0.22	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver	40	0.1	0.11	<0.10	<0.10	<0.10	<0.10	0.23	<0.10	0.1	0.34	<0.10	0.13	0.17	0.15	0.16	0.13	<0.10	<0.10	<0.10	0.15	0.39
Sodium		50	91	124	97	144	136	185	103	128	157	206	<50	84	94	123	169	97	130	76	74	192
Strontium		0.2	14.9	23.2	25.7	30.7	15	135	20.1	34.9	56.8	34	20.3	22.5	24.2	24	54.9	22.8	27.2	17	25.1	88
Sulphur		1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Tellurium		0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium	1	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	<0.10	0.17	<0.10	<0.10	<0.10	<0.10	<0.10	0.11
Thorium		0.5	0.76	1	0.9	0.76	1.06	1.15	0.87	0.79	0.88	0.84	0.72	<0.50	0.64	0.71	1.24	0.96	1	0.85	1.07	0.79
Tin	300	0.2	0.49	0.39	0.5	0.44	0.52	0.51	0.5	0.39	0.6	0.56	0.38	0.47	0.58	0.54	0.41	0.45	0.4	0.42	0.49	0.71
Titanium		1	331	436	468	517	350	76.2	259	352	31.9	402	449	518	241	217	384	73.5	522	303	137	42.5
Tungsten		0.2	No data	No data	No data	No data	No data	No data	No data	No data	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium	300	0.05	0.224	0.259	0.287	0.316	0.292	2.37	0.257	0.293	1.12	0.311	0.244	0.228	0.331	0.298	0.328	0.273	0.294	0.274	0.373	0.696
Vanadium	130	1	59.2	64.5	67.1	67.1	68	65.9	61.3	66.5	77.3	70.6	53.8	73.1	84.9	73.5	68.7	58.9	67.4	74.7	68.6	56.6
Zinc	410	2	81.3	66.4	69.8	55.3	72.2	89.2	73.5	69.9	98.7	55.5	50.2	95	96.5	83.6	93	86.4	49.6	95.5	90.7	104
Zirconium		2	2.1	2.6	2.5	<2.0	3.3	2	<2.0	<2.0	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	<2.0	<2.0

Note: 1) CCME Soil Quality Guideline for Industry: 2) Method Reporting Limit; Shading indicates exceedance of CCME Guideline

Table F-3: Soils trace metals results (mg/kg dry) for soil plots in the Goathorn Creek, bypass road and rail infrastructure areas.

Plot number				AD001	AD001	IR006	IR213	IR214	IR218	IR243	IR243	IR248	IR248	IR252	IR254	IR256	IR258	LR02	LR03	LR04	LR05	LR06	LR07
Depth (cm)				0-15	15-30	0-15	0-15	0-15	0-15	15-30	0-15	15-30	0-15	0-15	0-15	0-15	0-15	5-30	5-30	5-30	5-30	5-30	5-30
Analyte	SQG_{AG}[1]	SQG_{RP}[2]	MRL[3]																				
Aluminum	No data	No data	40	13700	13400	13900	15100	13100	14900	14200	12900	15700	16400	13900	14700	16900	17600	11500	18700	25100	7250	15300	15700
Antimony	20	20	0.1	0.25	0.4	0.42	0.62	0.4	0.51	0.46	0.43	0.43	0.62	0.47	0.37	0.45	0.5	0.32	0.29	0.32	<0.10	0.54	0.48
Arsenic	12	12	0.3	2.65	5.83	9.4	9.6	9.43	10.5	7.41	7.29	6.72	10.1	7.65	6.97	8.43	6.98	4.11	9.31	13.2	3.03	10.1	10.7
Barium	750	500	1	218	114	119	189	117	138	142	109	217	179	126	202	212	221	167	144	262	90.1	297	170
Beryllium	4	4	0.1	0.31	0.3	0.3	0.41	0.3	0.41	0.33	0.32	0.37	0.4	0.32	0.33	0.4	0.39	0.22	0.46	0.75	0.14	0.4	0.4
Bismuth	No data	No data	0.1	0.1	<0.10	0.11	<0.10	0.11	0.12	<0.10	<0.10	0.12	0.11	<0.10	<0.10	<0.10	0.12	0.13	0.17	0.27	<0.10	0.19	0.14
Boron	2	No data	2	6.4	2.8	2.4	2.8	<2.0	2.3	2.4	<2.0	2.1	<2.0	<2.0	2.1	2.4	2.9	3.0	2.3	2.4	<2.0	2.9	<2.0
Cadmium	1.4	10	0.04	0.929	0.192	0.194	0.23	0.267	0.227	0.191	0.143	0.15	0.084	0.103	0.161	0.216	0.235	0.165	0.191	0.383	0.146	1.44	0.601
Calcium	No data	No data	100	9170	5130	3120	4970	2680	3370	4440	4120	3360	3650	3700	4090	4810	5900	2970	3520	3820	4620	4560	3320
Chromium	No data	No data	1	19.6	22	20.7	25	21	23.5	23.1	20.7	26.9	31.3	22.5	23.3	26.5	26.8	15.1	23.4	33.6	8.8	21.5	24.6
Cobalt	40	50	0.1	8.24	9.56	9.44	12.3	8.68	11.8	11.5	10.9	14.1	16.1	11.3	11.3	13	12.8	10	10.2	16.5	2.72	15	13.3
Copper	63	63	0.4	20.1	12.8	13.8	24.3	20.9	20.5	19.5	20.2	17.3	30	21.4	17.2	24.5	29.1	17	26.3	32.4	6.32	21.4	20.2
Iron	No data	No data	20	23400	29200	31800	34300	32100	36000	31400	31500	34900	38000	32600	32900	34500	29000	35000	30800	47200	9560	31900	31400
Lead	70	140	0.2	7.77	7.24	7.28	8.24	7.91	9.1	6.99	5.77	10.8	10.1	6.81	7.19	8.33	9.42	7.11	9.74	11.8	3.6	11.5	11.1
Lithium	No data	No data	0.1	10.6	12.4	12.9	11.7	13	13.5	10.6	11	9	10.6	10.7	10.2	11	12.9	11	11.9	15.8	5.34	12	13.9
Magnesium	No data	No data	10	5520	5890	5310	6850	5440	5760	6500	7250	5150	6810	7060	6740	6960	7000	4120	6700	6240	2270	5310	5640
Manganese	No data	No data	0.4	784	466	684	925	644	878	906	817	1640	1030	728	937	1410	875	1060	567	1950	105	1610	1140
Mercury	6.6	6.6	0.04	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.047	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.04	0.045	<0.040	<0.040
Molybdenum	5	10	0.1	0.66	0.39	0.62	0.54	0.92	0.84	0.64	0.44	0.66	0.49	0.44	0.53	0.6	0.75	0.48	0.78	0.62	0.38	0.75	0.68
Nickel	45	45	0.6	14	13.8	20.9	19.1	19.2	21.9	17.8	17.3	17.5	21.7	18.2	17.7	21.2	21.4	9.96	20.5	31	10	22.3	22.3
Phosphorus	No data	No data	10	1700	965	572	858	361	434	634	599	1390	481	653	586	754	642	432	745	1970	486	947	733
Potassium	No data	No data	40	2070	1090	804	806	762	1050	1490	596	761	782	470	597	1050	936	791	1060	1860	455	1170	919
Selenium	1	1	0.2	0.23	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Silver	20	20	0.1	0.18	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	0.12	0.14	0.28	<0.10	0.24	0.14
Sodium	No data	No data	50	128	149	138	195	124	131	139	127	76	85	108	127	180	146	52	145	113	113	55	97
Strontium	No data	No data	0.2	63.3	34.4	35	33.4	30.4	28.8	35.6	31.3	34	39.2	34.3	30.5	39.8	49	20.4	48.6	43.4	48.5	44.2	36.6
Sulphur	500	No data	1000	1100	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Tellurium	No data	No data	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium	1	1	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.16	<0.10	<0.10	<0.10
Thorium	No data	No data	0.5	0.53	1.18	0.83	1.25	0.76	0.92	0.91	1.22	1.07	1.62	1.28	0.96	1.02	1.03	0.67	<0.50	0.97	<0.50	0.53	0.68
Tin	5	50	0.2	0.36	0.37	0.4	0.39	0.41	0.38	0.38	0.38	0.44	0.42	0.33	0.35	0.42	0.39	0.51	0.45	0.61	0.21	0.43	0.39
Titanium	No data	No data	1	500	693	480	649	346	402	750	828	832	999	697	694	706	587	462	353	196	60.5	394	228
Tungsten	No data	No data	0.2	No data	No data	<0.20	No data	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium	23	23	0.05	0.256	0.33	0.275	0.348	0.383	0.353	0.435	0.451	0.322	0.438	0.453	0.363	0.506	0.46	0.203	1.02	0.654	0.157	0.306	0.407
Vanadium	130	130	1	41.5	59.9	59.3	71.9	57	60.5	71.2	68.1	80.3	91.2	72.7	76.9	78.1	72.4	75.1	64.3	71.7	17.3	56.3	56.9
Zinc	250	250	2	182	69.9	87.4	95.7	85.6	75.5	77.6	71.6	96	71.6	68.3	99.1	98.3	89.1	63.5	69.6	136	28.1	229	121
Zirconium	No data	No data	2	<2.0	2	<2.0	<2.0	<2.0	<2.0	<2.0	3.5	<2.0	3.7	4.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

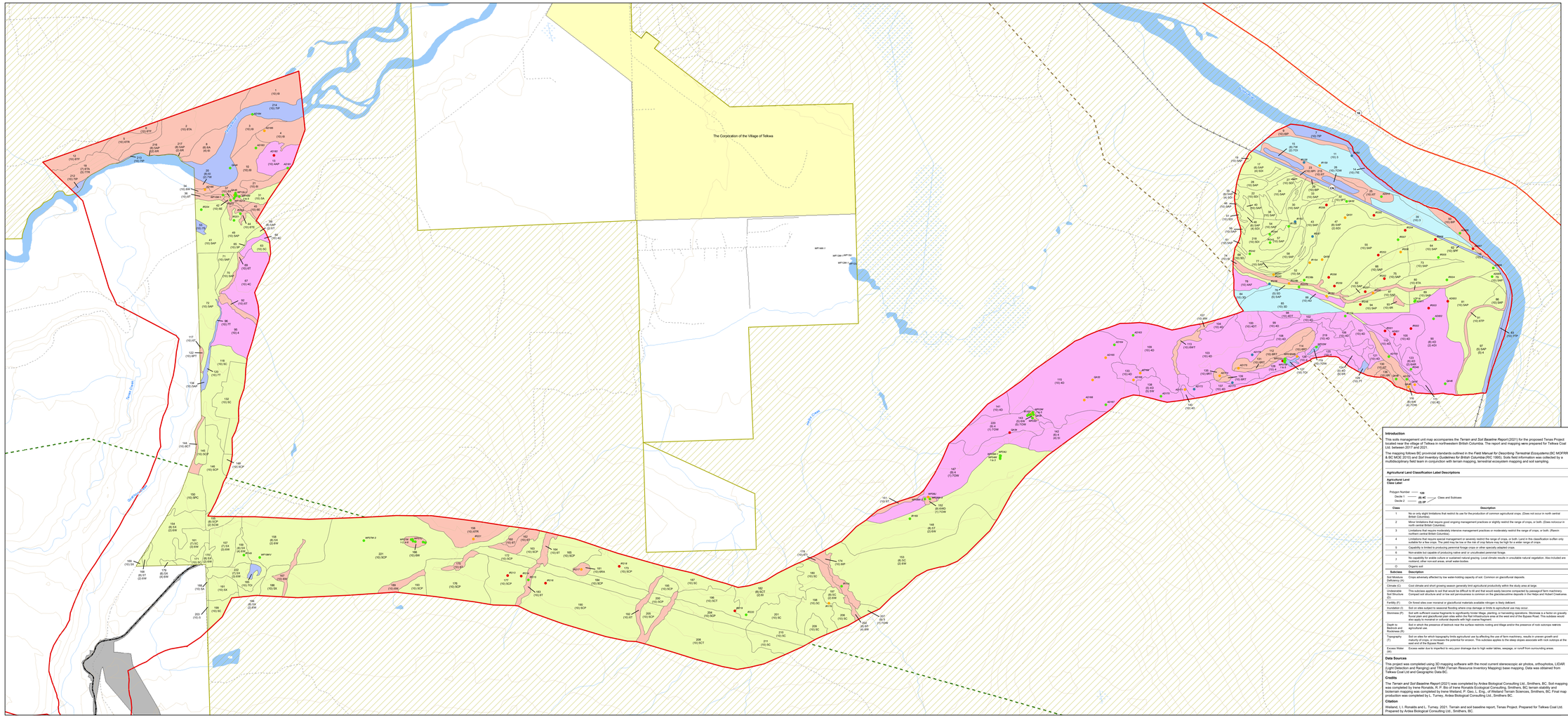
Note: 1) CCME Soil Quality Guideline for Agriculture; 2) CCME Soils Quality Guideline for Residential / Parkland; 3) Method Reporting Limit; Shading indicates exceedance of CCME Guideline

Table F-3: Soils trace metals results (mg/kg dry) for soil plots in the Goathorn Creek, bypass road and rail infrastructure areas (continued).

Plot number				LTVeg01	LTVeg04	LTVeg06	LTVeg13	LTVeg14	QA31	QA32	QA32	QA35	QA44	QA50	QA51	QA52	QA53
Depth (cm)				5-30	5-30	5-30	5-30	5-30	0-20	0-15	15-30	0-15	0-15	0-15	0-15	0-15	0-15
Analyte	SQG_{AG}	SQG_{RP}	MRL														
Aluminum	No data	No data	40	16100	13700	12800	15900	18600	17000	13800	17600	16400	19400	18900	20000	17100	23600
Antimony	20	20	0.1	0.74	0.69	0.55	0.77	0.7	0.78	0.47	0.66	0.59	0.69	0.43	0.44	0.38	0.4
Arsenic	12	12	0.3	9.22	9.7	7.65	10.9	11.3	13.6	13.2	16.5	13.2	7.12	7.12	7.62	7.03	6.1
Barium	750	500	1	121	170	370	214	143	242	225	220	311	126	200	242	96	253
Beryllium	4	4	0.1	0.33	0.33	0.26	0.36	0.45	0.34	0.3	0.36	0.36	0.3	0.32	0.32	0.27	0.47
Bismuth	No data	No data	0.1	0.13	0.21	0.35	0.33	0.22	0.33	0.14	0.2	0.32	<0.10	<0.10	<0.10	<0.10	0.18
Boron	2	No data	2	<2.0	2.7	<2.0	3.5	2.8	2.2	4.7	2.9	<2.0	2.8	2.7	3.6	2.3	2.6
Cadmium	1.4	10	0.04	0.118	0.286	0.587	0.407	0.382	0.37	0.406	0.334	0.458	0.162	0.242	0.355	0.121	0.188
Calcium	No data	No data	100	3440	5650	4220	6570	5990	5570	9100	6300	5550	6700	5000	7920	4700	4420
Chromium	No data	No data	1	23.2	24.4	24.1	26.4	28.4	23.4	17.1	22.9	21.3	19.3	19.8	23.6	19.6	24.2
Cobalt	40	50	0.1	11.1	14.5	11.5	14.2	14.6	15.8	11.5	15.2	14.9	12	11.2	12.1	10.2	14.7
Copper	63	63	0.4	32.7	34.3	18.1	32.1	38.5	49.3	30.4	39.5	50	22.6	19.1	20.6	16.2	15.8
Iron	No data	No data	20	40400	43100	34200	47600	35400	45400	29700	40200	41800	38800	33800	32800	33600	37500
Lead	70	140	0.2	6.17	8.18	9.05	8.17	8.59	8.51	6.81	7.81	8.63	5.66	7.75	7.6	5.66	10.4
Lithium	No data	No data	0.1	14.1	13.5	10.5	17.3	15.6	13.1	9.03	12	12.1	12.3	11.1	10.4	11.7	10.9
Magnesium	No data	No data	10	8460	7760	5080	8180	7600	8270	5300	6660	7310	9700	7340	7460	8230	6630
Manganese	No data	No data	0.4	678	868	1170	1020	1130	1320	936	1180	1220	1070	1150	1280	796	1960
Mercury	6.6	6.6	0.04	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.05	0.04	0.044	<0.040	<0.040	<0.040	<0.040	<0.040
Molybdenum	5	10	0.1	0.72	1.03	1.29	1.21	1	1.4	1.01	1.47	1.47	0.49	0.68	0.82	0.43	1.05
Nickel	45	45	0.6	17.7	21.3	15.2	19.4	28.7	23.2	19.3	23.8	22.5	16.9	16.6	19.3	16.1	21.9
Phosphorus	No data	No data	10	565	549	1040	1070	688	478	560	530	505	622	864	733	657	639
Potassium	No data	No data	40	682	782	1230	1310	1140	949	1810	1530	902	679	1220	1020	643	918
Selenium	1	1	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.21	<0.20	<0.20	<0.20	<0.20	<0.20
Silver	20	20	0.1	<0.10	<0.10	0.24	<0.10	0.13	0.11	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	0.17
Sodium	No data	No data	50	161	109	98	<50	163	243	132	247	220	477	177	237	183	135
Strontium	No data	No data	0.2	17.3	40	34	44.2	49.2	38.2	61.6	48.2	38.6	60.4	34.2	59.8	28.1	52.1
Sulphur	500	No data	1000	<1000	<1000	<1000	<1000	<1000	1910	<1000	<1000	1710	1020	<1000	<1000	<1000	<1000
Tellurium	No data	No data	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium	1	1	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Thorium	No data	No data	0.5	0.95	1	0.63	0.63	1.24	0.96	0.75	0.99	0.96	1.01	0.78	0.87	0.89	0.92
Tin	5	50	0.2	0.34	0.32	0.38	0.34	0.36	0.36	<0.20	0.29	0.29	0.48	0.32	0.35	0.28	0.54
Titanium	No data	No data	1	677	541	239	329	296	233	62	113	118	932	500	542	674	721
Tungsten	No data	No data	0.2	<0.20	<0.20	<0.20	0.33	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium	23	23	0.05	0.318	0.737	0.25	0.376	0.456	0.403	0.283	0.354	0.447	0.363	0.328	0.37	0.313	0.304
Vanadium	130	130	1	84.4	77.6	67.1	76.3	63.7	73.4	47.9	65.8	65	83.3	73.2	74.9	72.9	74.7
Zinc	250	250	2	82	90.7	139	102	85.4	111	116	102	112	89.2	120	112	90.7	127
Zirconium	No data	No data	2	<2.0	3.9	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	2.2	5.2	<2.0	<2.0	<2.0	<2.0

Note: 1) CCME Soil Quality Guideline for Agriculture; 2) CCME Soils Quality Guideline for Residential / Parkland; 3) Method Reporting Limit; Shading indicates exceedance of CCME Guideline

Appendix G 1:10,000 Agricultural Land Capability Mapping



Tenas Project

Agricultural Land Classification Mapping
Telkwa Coal LSA

Legend

- Rail Line
- Highway
- Paved Road
- Gravel Road
- 138 kV Transmission Line
- 500 kV Transmission Line
- Waterbody
- Wetland
- Watercourse
- Municipal Area
- Haul Road
- Project Area
- Soils LSA

Agricultural Land Capability Classes

- 3 - Moderate Management
- 4 - Special Management
- 5 - Forage Crops
- 6 - Native Crops
- 7 - Not Capable

Soils Mapping Plot Types

- Full (FS882)
- Ground
- Visual
- Note

Notes

All mapped features are approximate and should be used for discussion purposes only.

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.

Map publication date: November 18, 2021

N

Original Map Scale 1:10,000

0 200 400 600 800 1,000

Meters

NAD 1983 UTM Zone 9N

Page Size 22" x 52"

TELKWA COAL LIMITED

ARDEA BIOLOGICAL CONSULTING

Introduction

This soils management unit map accompanies the *Terrain and Soil Baseline Report* (2021) for the proposed Tenas Project (Telkwa Coal Project) located in northwestern British Columbia. The report and mapping were prepared for Telkwa Coal Ltd. between 2017 and 2021.

The mapping follows BC provincial standards outlined in the *Field Manual for Describing Terrestrial Ecosystems* (BC MOFRR & BC MOE 2010) and *Soil Inventory Guidelines for British Columbia* (RIC 1995). Soils field information was collected by a multidisciplinary field team in conjunction with terrain mapping, terrestrial ecosystem mapping and soil sampling.

Agricultural Land Classification Label Descriptions

Agricultural Land Class Label

Polygon Number — 129
Decile 1 — (6) 4D
Decile 2 — (5) 5W
Class and Subclass

Class	Description
1	No or only slight limitations that restrict its use for the production of common agricultural crops. *(Does not occur in north central British Columbia)*
2	Minor limitations that require good ongoing management practices or slightly restrict the range of crops, or both. *(Does notoccur in north central British Columbia)*
3	Limitations that require moderately intensive management practices or moderately restrict the range of crops, or both. *(Parsin northern central British Columbia)*
4	Limitations that require special management or severely restrict the range of crops, or both. Land in this classification soften only suitable for a few crops. The yield may be low at the risk of crop failure may be high for a wide range of crops.
5	Capability is limited to producing perennial forage crops or other specially adapted crops.
6	Non-arable but capable of producing native and/ or uncultivated perennial forage.
7	No capability for arable culture or sustained natural grazing. Local climate results in unsuitable natural vegetation. Also included are rockland, other non-soil areas, small water-bodies.
(I)	Organic soil.

Subclass	Description
Soil Moisture Deficit (D)	Crops adversely affected by low water-holding capacity of soil. Common on glaciofluvial deposits.
Climate (C)	Cool climate and short growing season generally limit agricultural productivity within the study area at large.
Undesirable Soil Structure (S)	This subclass applies to soil that would be difficult to till and that would easily become compacted by passaged farm machinery. Compact soil structure and/ or low soil permeameas is common on the glaciolacustrine deposits in the Helps and Hubert Creekareas.
Fertility (F)	On forest sites over morainal or glaciofluvial materials available nitrogen is likely deficient.
Inundation (I)	Soil on sites subject to seasonal flooding where crop damage or limits to agricultural use may occur.
Stoniness (P)	Soil with sufficient coarse fragments to significantly hinder tillage, planting, or harvesting operations. Stoniness is a factor on gravelly fluvial plain and glaciofluvial plain sites within the Rail Infrastructure area at the west end of the Bypass Road. This subclass would also apply to morainal or colluvial deposits with high coarse fragment.
Depth to Bedrock and Rockiness (R)	Soil in which the presence of bedrock near the surface restricts rooting and tillage and/or the presence of rock outcrops restricts agricultural use.
Topography (T)	Soil on sites for which topography limits agricultural use by affecting the use of farm machinery, results in uneven growth and maturity of crops, or increases the potential for erosion. This subclass applies to the steep slopes associate with rock outcrop at the east end of the Bypass Road.
Excess Water (W)	Excess water due to imperfect to very poor drainage due to high water tables, seepage, or runoff from surrounding areas.

Data Sources

This project was completed using 3D mapping software with the most current stereoscopic air photos, orthophotos, LIDAR (Light Detection and Ranging) and TRIM (Terrain Resource Inventory Mapping) base mapping. Data was obtained from Telkwa Coal Ltd and Geographic Data BC.

Credits

The *Terrain and Soil Baseline Report* (2021) was completed by Ardea Biological Consulting Ltd., Smithers, BC. Soil mapping was completed by Irene Ronalds, R. P. Bio of Irene Ronalds Ecological Consulting, Smithers, BC terrain stability and bioterrain mapping was completed by Irene Welland, P. Geo. L. Eng., of Welland Terrain Sciences, Smithers, BC. Final map production was completed by L. Turney, Ardea Biological Consulting Ltd., Smithers BC.

Citation

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