Report

Premier Tech Horticulture
Conservation and Reclamation Plan - 2022 Update

Phase 1 - Clearwater Peat Harvest Project

Submitted to:

Alberta Environment and Parks

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Distribution List

1 PDF Copy - Alberta Environment and Parks

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1 PDF Copy - Premier Tech Horticulture

Version history

Version	Report No	Date	Comments
1.0	19132041_PTH_C&R_REV0	November 2020	Conservation and Reclamation Plan issued following receipt of AEP SIR #1
2.0	21496738_PTH_C&R_2022 Update_REV0	January 2022	Updated Conservation and Reclamation Plan issued following receipt of SIR #2. All figures and summaries were updated as a result of a slight modification to the footprint, including the 100 m setback from Mud Creek. Additional details added to describe donor sites.

Table of Contents

TABLES

FIGURES

PHOTOS

APPENDICES

1.0 EXECUTIVE SUMMARY

The primary aim of this document is to describe the details of the Conservation and Reclamation strategy for Phase 1 of the Clearwater peat harvest project (the Project) (SML090026), in conjunction with the *Environmental Protection and Enhancement Act* (EPEA) Section 137 (1) Duty to Reclaim, and the Conservation and Reclamation Regulation (C&R Regulation) Section 3 Standards, Criteria and Guidelines.

The overall reclamation strategy for the Project is to return the site to an equivalent end land use of dominantly moderately rich fen and re-establish self-regulatory mechanisms including drainage and established native plant communities.

Premier Tech Horticulture (Premier Tech) applied for the original Development Plan in 2010 (Premier Tech 2010) and submitted the Conceptual C&R Plan in 2018 (Premier Tech 2018). An updated C&R plan was prepared in 2020 for the Project (Golder 2020). The original applications included six harvest sections between Sections 1, 2, and 3-37-7-W5M. The Project footprint has since been updated to be developed in two phases: Phase 1 Development will include Sections 1 and 2-37-7-W5M, and Phase 2 Development will include Section 3-37-7-W5M. This C&R plan will focus on Phase 1 of the Project. Phase 2 will be submitted as an amendment or new application following regulatory consultation with Alberta Environment and Parks (AEP). This report has been updated to address information requests received from AEP on September 15, 2021.

The Project is located in west-central Alberta, southwest of the town of Chedderville approximately 500 m west of Highway 22. The total Project footprint is 155.5 hectares (ha) and will include the drainage or vegetation clearing of approximately 153.5 ha of fen to harvest the peat for horticultural purposes and 2.0 ha of upland vegetation clearing. An estimated 135.9 ha will be cleared from the harvest areas. Upon ceasing the peat harvest operations, Premier Tech is committed to restore the peatland to a wooded coniferous fen using a vegetation transfer technique. The initial pre-disturbance conditions, as well as the techniques and timeline projected for the reclamation of Phase 1 of the Project are described in this document.

End land use objectives for the Project are focused on an ecosystem approach. The ecosystem approach considers all ecosystem components and the resulting ecosystem services in reclamation planning. These ecosystems can be mapped on appropriate areas of the landscape, but rather than limiting each area to one designated end land use (e.g., wildlife habitat) they will allow for multiple, compatible end land use objectives to be targeted.

End land use objectives for the Project focus on ecosystem reclamation as the main goal with a target towards ecosystems that occurred in the pre-existing conditions mapping. A primary goal of reclamation is to achieve reclaimed soils and landforms that are capable of supporting land uses that were available prior to disturbance.

Revegetation of peatlands within the Project footprint will be based on active introduction of plants to accelerate the formation of a new carpet of fen peat material (Quinty and Rochefort 2003). The application of donor wetland community material to the reclamation site has been found to be successful for the restoration of fens (Kratz & Pfadenhauer 2001). A small portion of the Project will be reclaimed to upland. All topsoil and subsoil in upland areas will be salvaged prior to Project development and will be stockpiled for use in reclamation. Following decommissioning, upland sites will be decompacted and recontoured, and soils will be replaced in the order that they were salvaged. Upland sites will be revegetated using tree seedlings as appropriate.

2.0 INTRODUCTION

Premier Tech Horticulture (Premier Tech) retained Golder Associates Ltd (Golder) to address the Supplemental Information Request (SIR) related to the Clearwater peat harvest project (Clearwater Project; the Project) received from Alberta Environment and Parks (AEP) on May 28, 2019, and September 15, 2021. The original Conceptual Closure and Reclamation for C&R Plan for the Clearwater Project was submitted to AEP on January 2018 (Premier Tech 2018). The original Development Plan and surface material lease (SML) application (Premier Tech 2010) and Conceptual C&R Plan (Premier Tech 2018) included six harvest sections between Sections 1, 2, and 3-37-7-W5M. The Project footprint has since been updated to be developed in two phases: Phase 1 Development will include Sections 1 and 2-37-7-W5M, and Phase 2 Development will include Section 3-37-7-W5M. This application will focus on Phase 1 of the development. Phase 2 will be submitted as an amendment or new application following regulatory consultation with AEP.

The following report presents an updated C&R Plan for Phase 1 Clearwater Project incorporating responses to relevant SIRs received from AEP.

2.1 Closure Objectives

Closure objectives for the Clearwater Project include:

- Geotechnically stable landforms that are integrated with the surrounding landforms.
- Drainage systems that are designed for horizontal fen development.
- Reclaimed areas that meet the target end land use.
- On-site public health and safety is protected.
- Self-regulatory mechanisms that will lead back to functional peat accumulating ecosystems are re-established.

The approach for reclamation and restoration activities have been adapted from the guidance of the *Peatland Restoration Guide* (2003) developed for sphagnum peatland restoration in Eastern Canada (Quinty and Rochefort 2003).

2.2 Regulatory Framework

The operation of the Clearwater Project is largely governed by the *Water Act,* and the *Environmental Protection and Enhancement Act* (EPEA). Under the EPEA, after a specified land activity has been completed, Operators must obtain a reclamation certificate. Reclamation certificates are managed through AEP and Alberta Energy Regulator (AER).

The *Conservation and Reclamation Regulation*, Alberta Regulation Section 137(1) Duty to Reclaim (GOA 2000), and the *Conservation and Reclamation Regulation* Section 3 Standards, Criteria and Guidelines, outline the Operator’s obligation to reclaim specified land to equivalent land capability. The *Requirements for Conservation and Reclamation Plans for Peat Operations in Alberta* (C&R Plan Requirements; GOA 2016a) published by the Government of Alberta in 2016 provides information on the C&R Plan requirements for renewals and new peat operations in Alberta.

2.3 Scope of Work

This C&R Plan has been prepared to meet the requirements outlined in the C&R Plan Requirements (GOA 2016a), and to provide the tools required to achieve target end land uses after reclamation. As the Phase 1 of the Clearwater Project continues to evolve, this Plan will be amended.

2.4 Premier Tech's Experience in Peatland Reclamation

Premier Tech has initiated over 40 peat harvest projects across Canada, of which 21 are currently undergoing or have completed reclamation activities. Premier Tech is also part of the collaborative Peatland Ecology Research Group (PERG) in association with the University of Laval. PERG is a partnership between scientific communities, the Canadian peat moss industry and associated federal and provincial agencies. The main areas of research with PERG include peatland restoration, plant propagation of fen species and the establishment of fen species in degraded peatland ecosystems.

Premier Tech has experience with fen reclamation at the harvest site near Giroux, Manitoba. Reclamation at this fen was initiated in 2009 and Photo 2.4-1 shows the site 10 years post reclamation in 2019. Based on preliminary assessment and monitoring completed by Premier Tech, vegetation establishment and wetland function have been largely restored. Native fen vegetation has colonized and the water table has stabilized to baseline conditions. Areas of bare peat are below 25%. The reclaimed fen is suitable for wildlife habitat, as species such as the Trumpeter Swan (*Cygnus buccinator*) have been observed on site.

Photo provided by Premier Tech

Photo 2.4-1: Ten years post reclamation of a fen near Giroux, MB.

3.0 BACKGROUND AND SITE CONDITIONS

3.1 Site Overview

The Clearwater Project is located on Crown land in Clearwater County, approximately 3.4 km southwest of Chedderville, Alberta (Figure 3.1-1) in Sections 1 and 2-37-7-W5M. Phase 1 of the Clearwater Project will include the clearing, drainage and/or harvest of approximately 135.9 ha of fen for horticultural purposes. The associated *Public Lands Act* and *Water Act* Approvals required to construct and operate the Clearwater Project are SML090026 and WA00387959.

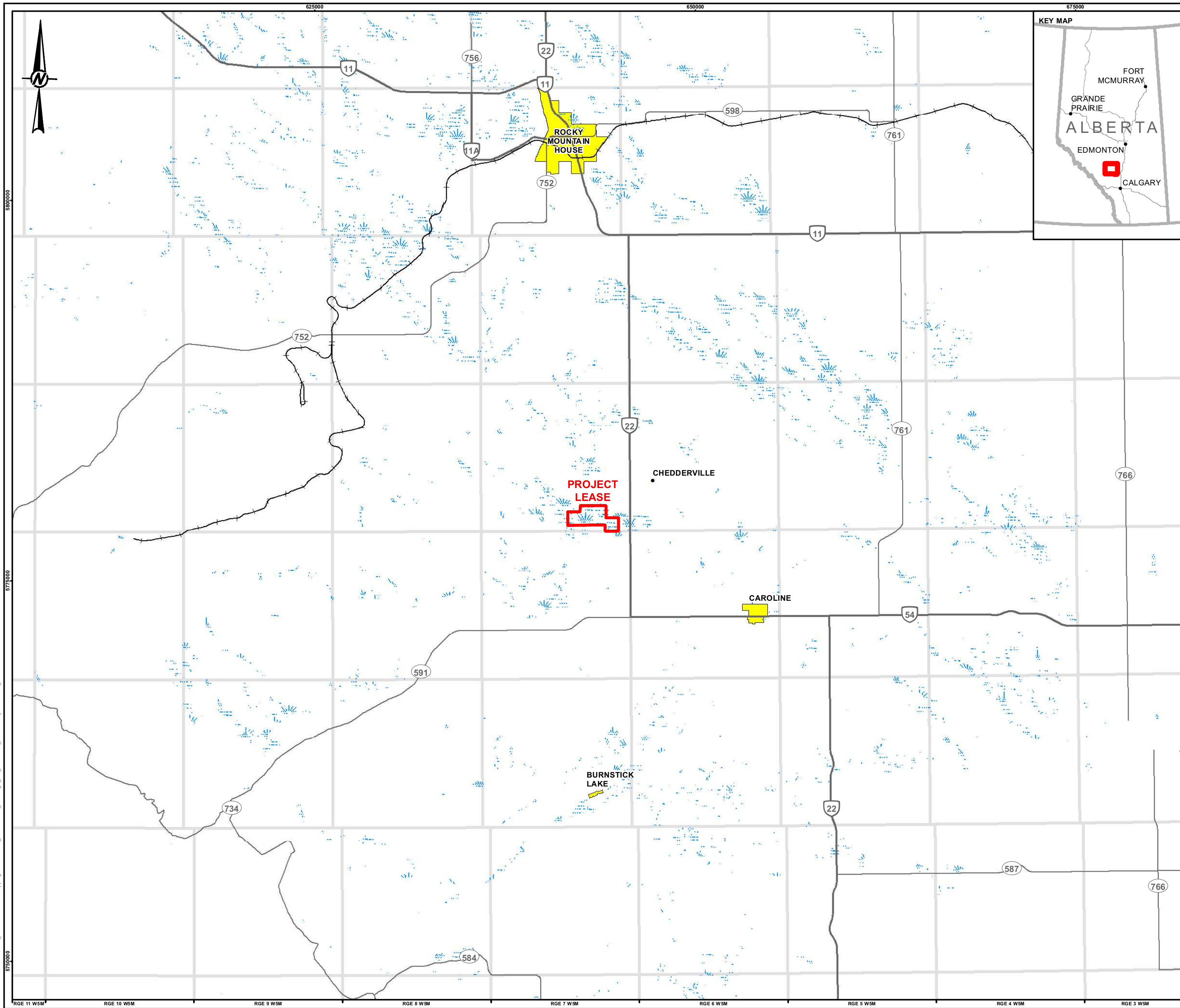
The Clearwater Project footprint will consist of five harvest sections, seven sedimentation ponds, culverts, one yard site, drainage ditches, and access roads (Figure 3.1-2). The proposed development plan and schedule for harvesting each section is also provided in Figure 3.1-2. The total Clearwater Project footprint is 155.5 ha.

The Clearwater Project will have an essential role to play to meet commercial demand for peat moss and supply material to the Premier Tech Horticulture processing and packaging facilities.

The Clearwater Project is within the Foothills Natural Region and the Lower Foothills Subregion. The landscape within 1 km of the Clearwater Project footprint is dominated by wetland ecosites including shrubby fens, wooded coniferous fens, and graminoid fens, interspersed with upland ecosites dominated by low-bush cranberry aspen and low-bush cranberry lodgepole pine ecosite units. Forestry is generally limited within the Project footprint and the footprint is not crossed by Forest Management Units or Forest Management Agreement areas. Land use within 5 km of the Clearwater Project is dominated by agriculture and some existing oil and gas development.

The main access road to the Clearwater Project will be from the south of the lease with access from Alberta Provincial Highway 22 and Township Road 365A. Premier Tech will develop a 3.2 km long by 10 m wide permanent access road from Township Road 365A along Range Road 71 to access the Clearwater Project footprint. An alternate access road from the north of the lease area along Range Road 71 is being considered by Premier Tech; however, the south access route will be considered the main access road for the purpose of this Plan. A gate will be installed on the access road to limit public access to the entrance of the Clearwater Project footprint.

Prior to harvest, Premier Tech will construct the main access road, harvest roads, drainage ditches and sedimentation ponds. The Clearwater Project will be developed in five stages over the course of five years, at one stage per year.



LEGEND

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- RAILROAD
- WATERCOURSE
- POPULATED PLACE
- WATERBODY
- WETLAND
- PROJECT LEASE BOUNDARY

0 5,000 10,000

1:250,000 METRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

TITLE
PROJECT LOCATION MAP AND PROPOSED DEVELOPMENT PLAN

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	KH
PREPARED	ANK
REVIEWED	SC
APPROVED	LM

PROJECT NO.	PHASE	REV.	FIGURE
21496738	2000	0	3.1-1

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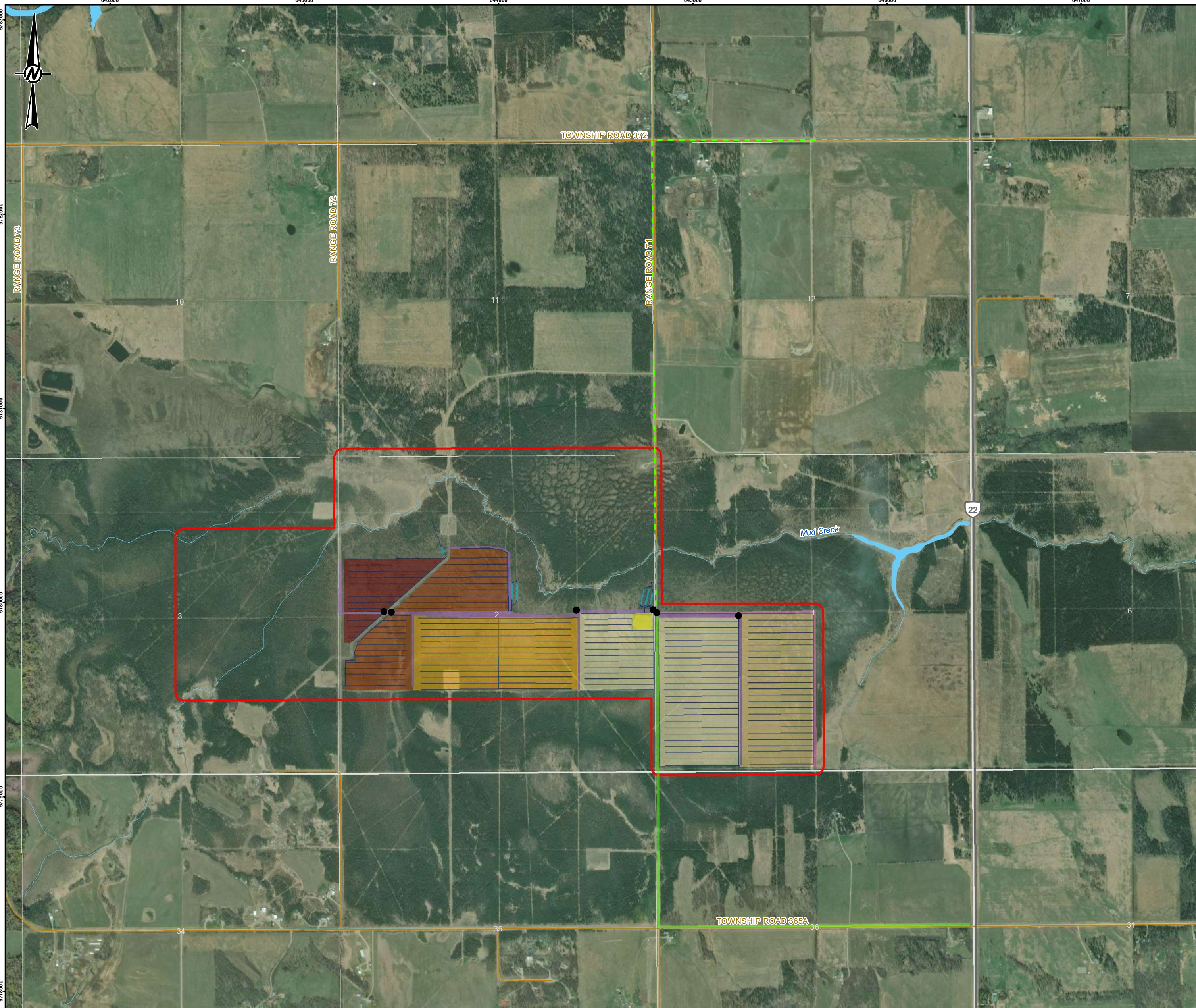

LEGEND

- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- CULVERT
- ALTERNATE ACCESS ROAD
- PROJECT LEASE BOUNDARY

PROJECT FOOTPRINT COMPONENTS

- ACCESS ROAD
- MAIN ACCESS ROAD
- MAINTENANCE
- DRAINAGE DITCH
- SEDIMENT POND
- YARD SITE

HARVEST SECTIONS (PHASE 1)

- YEAR 1
- YEAR 2
- YEAR 3
- YEAR 4
- YEAR 5

0 400 800

1:20,000 METRES

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PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

TITLE
PROJECT FOOTPRINT AND PROPOSED DEVELOPMENT PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	KH
PREPARED	ANK
REVIEWED	SC
APPROVED	LM

PROJECT NO.	PHASE	REV.	FIGURE
21496738	2000	0	3.1-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

3.2 Pre-development Site Characteristics

A Biophysical Report (Golder 2020) was prepared in accordance with the *Guide to Surface Materials Lease Information Requirements for Peat Operations* (GOA 2017) The report was updated in 2022 to address a minor footprint change to the Project in response to information requests from AEP (Golder 2022). A high-level summary of the pre-development conditions are described below.

3.2.1 Area Overview

The Clearwater Project is within the Foothills Natural Region and the Lower Foothills Subregion. The Lower Foothills Subregion is a low elevation foothills zone that is a transition zone between the cordillera and boreal zones. The climate, soils, and vegetation are similar to both the Upper Foothills and the Central Mixedwood Subregions (Natural Regions Committee 2006).

3.2.2 Climate

The Lower Foothills Subregion is characterized by a cooler and moister growing season when compared to the boreal forest (Natural Regions Committee 2006). The climate is more continental relative to higher elevation foothills regions. The mean temperature of the warmest month is approximately 14.7 (degrees Celsius [°C]) and the mean temperature of the coldest month is approximately -12.8°C. The annual precipitation averages 588 mm.

3.2.3 Vegetation

Vegetation throughout this subregion varies depending on elevations and moisture regimes. Lodgepole pine (*Pinus contorta*) tends to dominate dryer sites and is typically associated with bearberry (*Arctostaphylos uva-ursi*), bog cranberry (*Vaccinium vitis-idaea*), or hairy wild rye (*Leymus innovatus*). Aspen (*Populus tremuloides*) stands tend to be located on submesic sites and have an understory composed of bearberry, common blueberry (*Vaccinium myrtilloides*), or Canada buffaloberry (*Shepherdia canadensis*) (Natural Regions Committee 2006). Forests located on mesic sites are more heterogeneous and may include a mixture of lodgepole pine, white spruce (*Picea glauca*), and aspen, although pure stands of these species are also found. Boreal vegetation species such as low bush cranberry (*Viburnum edule*), green alder (*Alnus viridis*), prickly rose (*Rosa acicularis*), wild sarsaparilla (*Aralia nudicaulis*), dewberry (*Rubus pubescens*), and marsh reed grass (*Calamagrostis canadensis*) are also common on mesic sites (Natural Regions Committee 2006). Stands of lodgepole pine and black spruce (*Picea mariana*) with Labrador tea (*Ledum groenlandicum*) are common on nutrient-poor mesic sites. Moist sites support pure stands and mixed forests of aspen, lodgepole pine, and white spruce, with an understory typically dominated by bracted honeysuckle (*Lonicera involucrata*) and fern species (Natural Regions Committee 2006). Black spruce and tamarack (*Larix laricina*) occur on poorly drained sites with bog and fen understory species such as sedges, Labrador tea, bryophytes, and lichens.

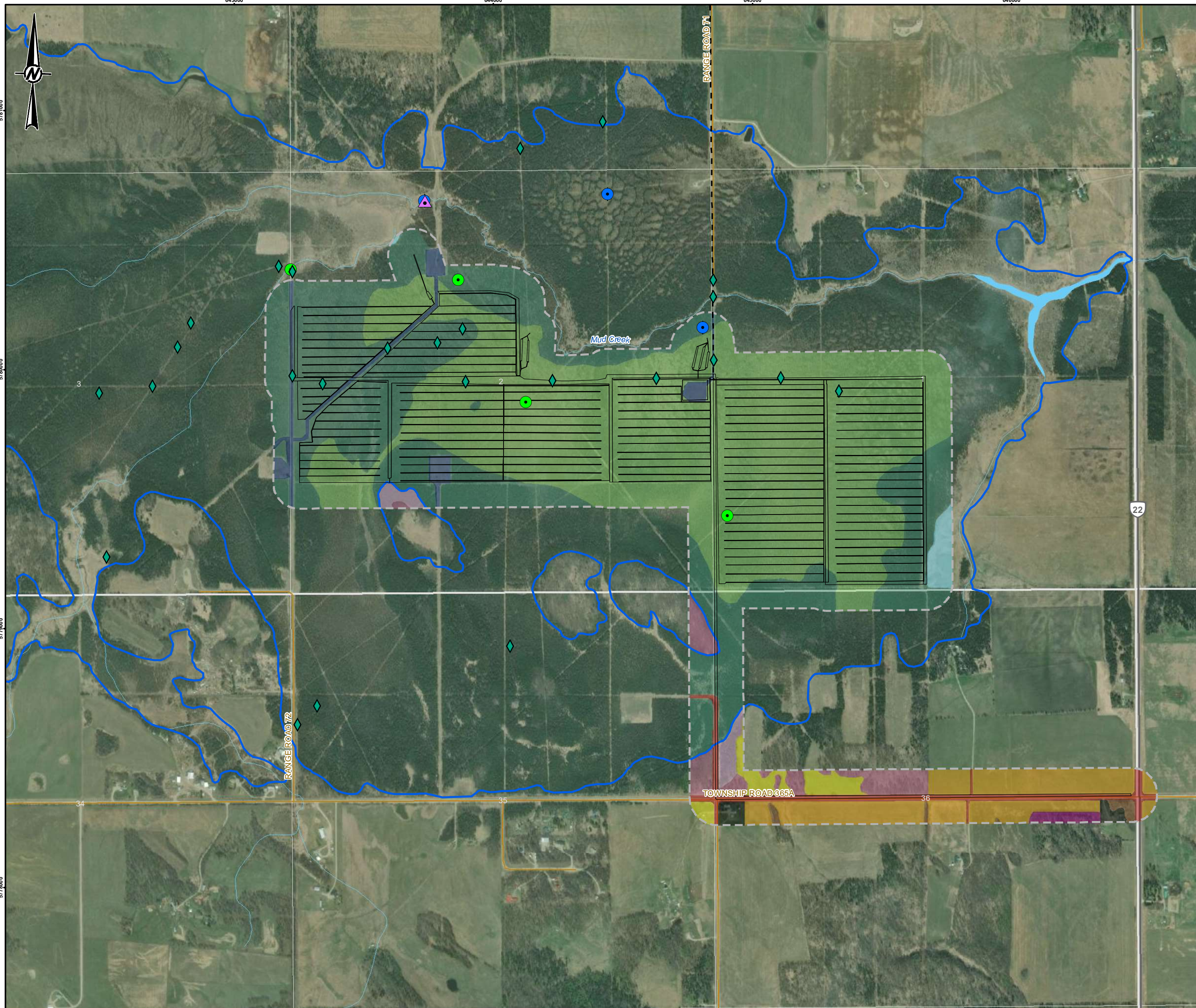
Vegetation surveys were conducted by Stantec in 2005 and 2006 (Stantec 2005, 2006) and Golder in 2017 and 2020 (Golder 2017, Golder 2022) to identify listed plants and describe vegetation communities.

Land cover types within the Clearwater Project footprint are outlined in Table 3.2-1. Land cover within the footprint is dominated by shrubby fen, wooded coniferous fen and graminoid fen plant community types (Table 3.2-1, Figure 3.2-1). Upland ecosite phases are crossed by a small portion of harvest area 3, harvest area 4, and the main access road (Table 3.2-1).

No listed plant species or listed plant communities were observed during any of the vegetation surveys.

Table 3.2-1: Phase 1 Clearwater Project Land Cover Areas

Harvest Section	Land Cover	Area (ha)	Percentage of Harvest Section (%)	Percentage of Total (%)
Harvest Section 1	Developed - Cleared Fen	0.1	<1	<1
	Shrubby Fen	42.8	98	28
	Wooded Fen	0.8	2	<1
	Subtotal	*43.6*	*100*	*28*
Harvest Section 2	Shrubby Fen	21.9	79	14
	Wooded Fen	5.9	21	4
	Subtotal	*27.8*	*100*	*18*
Harvest Section 3	Developed - Cleared Fen	0.8	3	1
	Shrubby Fen	24.2	80	16
	Wooded Fen	5.2	17	3
	Woodland - e1 low bush cranberry Pl	<0.1	<1	<1
	Subtotal	*30.2*	*100*	*19*
Harvest Section 4	Shrubby Fen	8.8	38	6
	Wooded Fen	14.5	62	9
	Woodland - e1 low bush cranberry Pl	<0.1	<1	<1
	Subtotal	*23.3*	*100*	*15*
Harvest Section 5	Developed - Cleared Fen	<0.1	<1	<1
	Shrubby Fen	2.3	21	1
	Wooded Fen	8.6	78	6
	Subtotal	*11.0*	*100*	*7*
Main Access Road	Developed – Cleared Fen	<0.1	-	<1
	Hayland	<0.1	-	<1
	Existing Road/Trail	2.0	-	1
	Shrubby Fen	0.8	-	1
	Wooded Fen	0.4	-	<1
	Woodland – e2 low bush cranberry Aw	0.1	-	<1
Drainage Ditches	Developed - Cleared Fen	0.1	-	<1
	Shrubby Fen	5.3	-	3
	Wooded Fen	1.9	-	1
Harvest Roads	Developed - Cleared Fen	0.3	-	<1
	Shrubby Fen	4.6	-	3
	Wooded Fen	1.7	-	1
Sediment Ponds	Shrubby Fen	0.3	-	<1
Yard Site	Developed - Cleared Fen	0.6	-	<1
	Shrubby Fen	0.1	-	<1
Maintenance Access	Graminoid Fen	<0.1	-	<1
	Shrubby Fen	0.8	-	1
	Wooded Fen	0.6	-	<1
	Subtotal	*19.5*	*-*	*13*
	Total	**155.5**	**-**	**100**



LEGEND

- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- ALTERNATE ACCESS ROAD
- PROJECT FOOTPRINT - PHASE 1
- TERRESTRIAL LOCAL STUDY AREA - PROJECT FOOTPRINT + 100 M BUFFER
- 2017 DETAILED WETLAND SURVEY POINT
- 2017 WETLAND CLASSIFICATION POINT
- 2020 DETAILED VEGETATION SURVEY POINT
- WEED LOCATION
- FEN BOUNDARY

UPLAND AGRICULTURAL AND MISCELLANEOUS LAND COVER TYPES

- SHRUBLAND
- FARM YARD
- TAME PASTURE
- ROAD/TRAIL
- HAYLAND

UPLAND ECOSITE PHASES

- LOW-BUSH CRANBERRY LODGEPOLE PINE (e1)
- LOW-BUSH CRANBERRY ASPEN (e2)
- LOW-BUSH CRANBERRY ASPEN-WHITE SPRUCE-LODGEPOLE PINE (e3)

WETLANDS

- GRAMINOID FEN
- SHRUBBY FEN
- WOODED CONIFEROUS FEN
- CLEARED FEN

0 300 600
1:15,000 METRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

TITLE
LAND COVER TYPES WITHIN THE TERRESTRIAL LOCAL STUDY AREA

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	KH
PREPARED	ANK
REVIEWED	SC
APPROVED	LM

PROJECT NO.	PHASE	REV.	FIGURE
21496738	2000	0	3.2-1

3.2.4 Terrain, Soils and Peat Depths

The Project falls in the Lower Foothills natural region of Alberta (Natural Regions Committee 2006). The lower foothills natural region is mainly underlain by Tertiary sandstones and siltstones in the south and sandstones and shales from the Upper Cretaceous in the north.

Published surficial geology reports described material in the Terrain and Soils Local Study Area (LSA), defined as the Project footprint, as primarily organic deposits with bedded silt, sand, and clay glaciolacustrine sediment to the north and fine to medium grained eolian sand to the west and south (Boydell et al. 2005). The glaciolacustrine sediment is associated with glacial lake Crammond II (Boydell 1978). Two water wells in the north portion of the Project area (GIS Well IDs 454707 and 499578) indicate the mineral surface is comprised of a layer of sand approximately 6 m thick overlying clay (AEP 2015). The Natural Regions Committee describes wetlands in the Lower Foothills Natural Region as dominantly organic deposits (poor to rich fens) with mainly Mesisolic soil developed in them. These Mesisols are described as having equal Terric (mineral soil within 1.6 m of the surface) and Typic (Mineral soil greater than 1.6 m from the surface) subgroups and commonly having Orthic Gleysols in the mineral soil adjacent to these wetlands (Natural Regions Committee 2006).

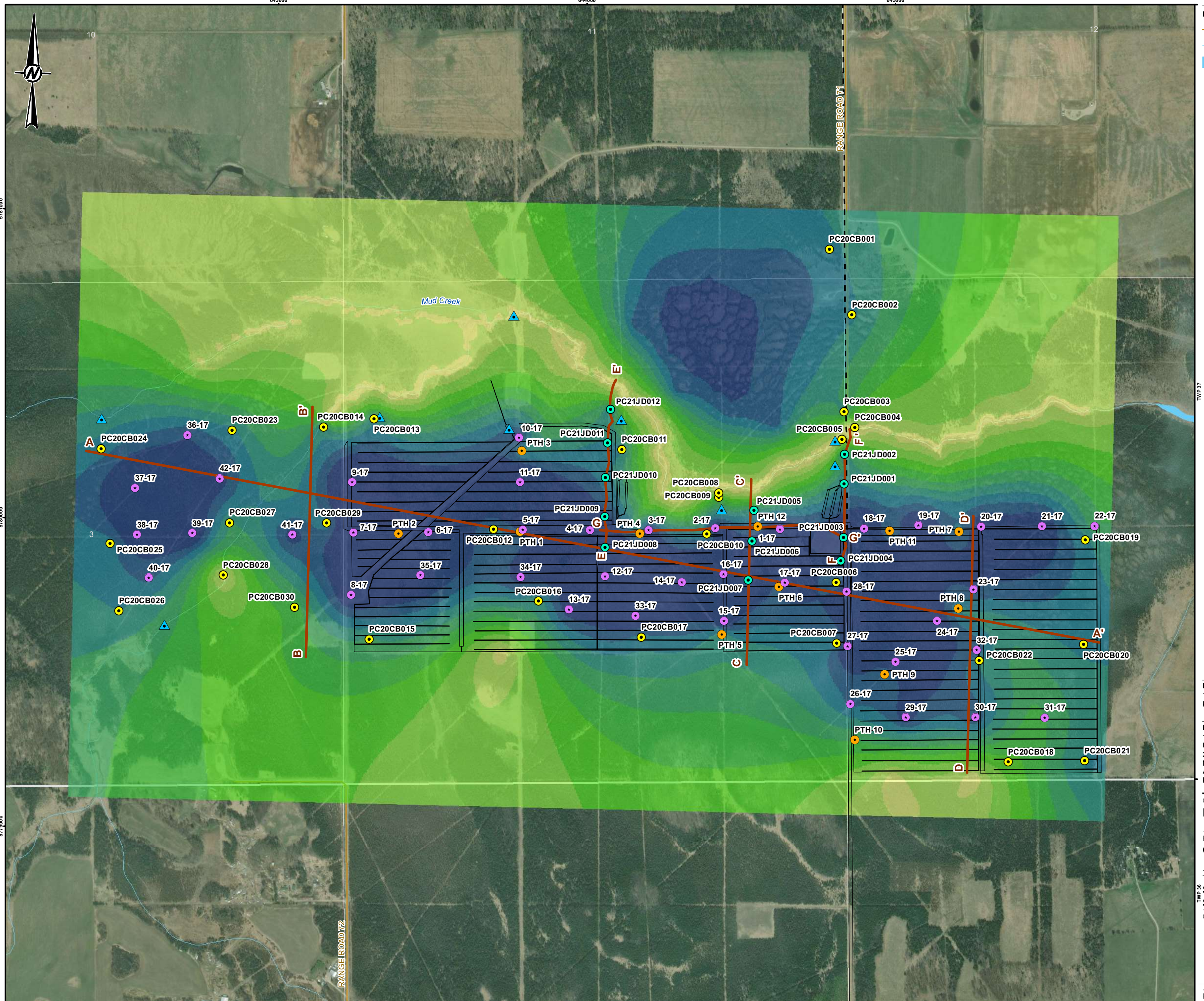
The LSA falls in Soil Correlation Area 13 (AAFC 2016), the Lower Foothill Area of West-Central Alberta. Provincial soil mapping in the Agricultural Region of Alberta Soil Inventory Database (AGRASID) correlates with the surficial geology mapping showing Niton (a Typic Mesisol) as the dominant soil in the LSA bordered by the Caroline soil series, a Brunisolic Gray Luvisol developed on medium textured wind or water deposited sediment.

Soil and peat sampling were completed by Premier Tech in 2008 and 2017, and Golder in 2020 and 2021 (2022) to describe the current peat depths and soil conditions within the Clearwater Project footprint.

The elevation in the Project footprint ranges from 1,065 metres above sea level (masl) in the north near Mud Creek to 1072 masl in the southwest.

In total, 96 peat sampling sites have been inspected within the Terrain and Soils LSA; 12 in 2008, 42 in 2017, 30 in 2020, and 12 in 2021 (Figure 3.2-2). Of these sites, 44 are composed dominantly of mesic (H5-H6 [on Von Post Humification scale]) material (Mesisols), 30 are dominantly fibric (H1-H4) material (Fibrisols), 19 are dominantly humic material (H7-H10) (Humisols), and the remaining are either Terric Organic soils (mineral soil within 160 cm of the surface), or imperfectly and poorly drained mineral soils with less than 40 cm of organic matter at the surface (Figure 3.2-2). The highest concentration of sites with dominantly humic material is recorded in Phase 2. Mineral soils (Regosols and Gleysols) are found in association with Mud Creek, along the alternate access road, and pockets of upland area in Phase 2. Detailed soil field site data are summarized in Appendix A. The spatial extent and location of each peat harvesting component is found on Figure 3.2-2.

Cross sections of peatlands profiles found in the Project footprint were generated from recorded field data and are displayed in Figure 3.2-2 and Appendix A.



LEGEND

- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- ALTERNATE ACCESS ROAD
- PROJECT FOOTPRINT - PHASE 1
- 2020 PEAT SURVEY SITE
- 2021 PEAT SURVEY SITE
- PREVIOUS PREMIER TECH SOIL SURVEY SITE, 2008
- PREVIOUS PREMIER TECH SOIL SURVEY SITE, 2017
- SURFACE WATER MONITORING STATION
- CROSS SECTION LOCATION

PEAT THICKNESS (cm)[1]

- 0 - 30
- 31 - 60
- 61 - 90
- 91 - 120
- 121 - 150
- 151 - 180
- 181 - 210
- 211 - 240
- 241 - 270
- 271 - 300+

0 250 500

1:12,500 METRES

NOTE(S)

1. PEAT THICKNESS INTERPOLATED BASED ON PEAT SURVEY SITE DATA AND OTHER SITE KNOWLEDGE AND SHOULD BE CONSIDERED APPROXIMATE.

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

TITLE
SOIL SAMPLING SITES, PEAT THICKNESS AND CROSS SECTION TRANSECTS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	CB
PREPARED	ANK
REVIEWED	SC
APPROVED	LM

PROJECT NO.	PHASE	REV.	FIGURE
21496738	2000	0	3.2-2

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25mm

3.2.5 Fish and Fish Habitat

Mud Creek and an unnamed tributary to Mud Creek join together immediately northwest of the Project, and flow eastward along the northern boundary of the Clearwater Project footprint approximately 10 km upstream from where Mud Creek enters the Clearwater River. This location has been identified as within the range of Bull Trout (*Salvelinus confluentus*), which is a species at risk in Alberta. Field surveys were conducted to describe the fish community and current habitat conditions in Mud Creek and the unnamed tributary adjacent to the Clearwater Project and evaluate the potential for *Species at Risk Act* (SARA) listed species (i.e., Bull Trout) within Mud Creek adjacent to, and downstream of, the Clearwater Project footprint. An overwintering survey and an open water survey aimed at describing the fish community and habitat conditions in Mud Creek and the unnamed tributary to Mud Creek occurred in February and May of 2020 (Golder 2022).

The fish and fish habitat surveys conducted for the Clearwater Project along Mud Creek and in the unnamed tributary to Mud Creek found suitable overwintering and rearing habitat for forage fish due to the sites not being frozen to bottom during winter months, suitable levels of dissolved oxygen during winter conditions, sufficient water depth, and undercut banks providing instream and overhead cover. However, there is limited overwintering, rearing, and spawning habitat for sport fish and sucker species due to the narrow channel, under-ice water depth less than 0.50 m during the winter, as well as limited amounts of coarse substrate and fast flowing water required for spawning.

Four fish species were captured, all of which were forage species, during the fish inventory. Fish were captured at all sites sampled, including in both Mud Creek and the unnamed tributary to Mud Creek. However, the largest number of fish were captured at the site furthest downstream on Mud Creek (Golder 2022).

3.2.6 Wildlife

The Foothills Natural Region has high habitat diversity because of variable topography and surface and groundwater flow regimes, which leads to variable plant communities (Natural Regions Committee 2006). The location of the Foothills Natural Region between the Rocky Mountain and Boreal Forest Natural Regions contributes to a relatively high species diversity. Significant wildlife species that occur in the Foothills Natural Region include grizzly bear (*Ursus arctos*), woodland caribou (*Rangifer tarandus caribou*), and wolverine (*Gulo gulo*) (Natural Regions Committee 2006). Secondary grizzly bear range intersects the western portion of the wildlife Regional Study Area (RSA [i.e., 5 km buffer around the Clearwater Project footprint]) (AEP 2020a).

Baseline wildlife surveys were conducted in 2020 including a winter track program, and deployment of Autonomous Recording Units (ARUs) programmed to record migratory breeding birds and amphibians (Golder 2020).

A total of eight wildlife species were recorded during winter track surveys, in addition to human use. Species recorded included cougar (*Puma concolor*), coyote (*Canis latrans*), deer species (*Odocoileus* spp.), mouse species, moose (*Alces alces),* red squirrel (*Tamiascirus hudsonica*), snowshoe hare (*Lepus americanus*) and weasel species.

Three species of amphibian were detected during ARU transcription: boreal chorus frog (*Pseudacris maculata*), wood frog (*Lithobates sylvaticus*), and western toad (*Anaxyrus boreas*). Western toad is a species of special concern under the SARA (GOC 2019). There are two designated populations of western toad: calling and non-calling. Alberta contains most of the global population of calling western toads (ECCC 2016). The calling population remains widespread and may be expanding its range (ECCC 2016). However, declines are suspected and projected based on known species vulnerabilities and threats (ECCC 2016). The main threats to western toads include habitat fragmentation and mortality from transportation corridors, mortality from infection with the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*), habitat loss from forestry, agriculture and oil and gas activities, climate change, and pollution of waterbodies used for breeding (ECCC 2016).

A total of 122 individuals of 37 avian species were observed during breeding bird ARU transcription, with an additional 2 species observed incidentally during amphibian survey ARU transcription (barred owl [*Strix varia*] and long-eared owl [*Asio otus*]). Lincoln's sparrow (*Melospiza lincolnii*) and hermit thrush (*Catharus guttatus*) were the most commonly occurring species. Other commonly occurring species included Wilson's snipe (*Gallinago delicata*), dark-eyed junco (*Junco hyemalis*), American robin (*Turdis migratorius*), and chipping sparrow (*Spizella passerina*). Sora (*Porzana carolina*), alder flycatcher (*Empidonax alnorum*), and common yellowthroat (*Geothlypis trichas*) are considered sensitive species in Alberta (AEP 2020b). No federally listed species were detected during the breeding bird transcription.

3.2.7 Hydrology

The Project is located south of Mud Creek and east of an unnamed tributary that flows into Mud Creek from the southwest. Mud Creek continues to about another 9 km further downstream where it flows into the Clearwater River. Baseline flow estimates for these watercourses at key locations are provided in the *Biophysical Report* and *Peat Development and Operations Plan* (Golder 2022).

The total Project footprint, including harvest sections, access roads, harvest roads, sedimentation ponds and drainage ditches is 155.5 ha (1.55 km^2). The topography of the site is relatively flat with a gentle slope of the peat surface and water table orienting northward towards Mud Creek. A survey of peat surface and water table elevations completed on 30 October 2021 indicated that the water table is near the peat surface near the centre of the fen and water table depth increases to more than 1.0 m to 2.0 m close to Mud Creek (Figure 3.2-2e,f). However, the water table was near the peat surface all the way to Mud Creek at one centrally located transect (Appendix A; Figure 3.2-2c). The underlying substrate is glaciolacustrine sediment to the north (although two local wells were completed in sand approximately 6 m thick overlying clay) and fine to medium grained eolian sand to the west and south (Section 3.2.4).

The fen does not have natural outflow channels therefore outflows are usually from seepage or shallow groundwater flow (when the water table is below the peat surface) or sometimes due to overland flow (when the water table rises above the surface). Typically, outflow from the peatland would be highest following snowmelt during the spring freshet when the peat is still frozen but seepage outflows could continue year-round.

3.2.8 Water Quality

Water quality for the Project has been collected from five stations between 2016 and 2019. The full water quality baseline report and map of water quality sampling locations is presented in Appendix D of the Biophysical Report and Peat Development and Operations Plan (Golder 2022). Additional sampling events are planned for fall 2020. Key findings from the baseline water quality data are:

- The water sampled in the Clearwater Project footprint (Station 1) can be characterized as circumneutral to slightly alkaline (based on laboratory pH analyses), with generally moderate concentrations of total dissolved solids (TDS) and soft to moderately hard water. Water in Mud Creek (Stations 2 to 5) was slightly alkaline with generally moderate concentrations of TDS and moderately hard to very hard water. Total alkalinity concentrations at both the Clearwater Project footprint station and in Mud Creek indicate a low sensitivity to acidification.
- The dominant ions were calcium and bicarbonate at the Clearwater Project footprint station and in Mud Creek. The typical ionic relationship for these waters can generally be expressed as follows: HCO_3 >Ca >Mg >>SO_4 >Na >K >Cl, except for Station 5 in Mud Creek where concentrations of sulphate were similar to or higher than magnesium.

- Station 1 (Clearwater Project footprint) was relatively nutrient rich, with higher concentrations of phosphorus, nitrogen, and dissolved organic carbon, compared to water in the receiving streams. Concentrations of total phosphorus (TP) were indicative of eutrophic conditions in the Clearwater Project footprint and oligo-trophic to meso-eutrophic conditions in Mud Creek.
- Metal concentrations at the Clearwater Project footprint station and in Mud Creek were typically low and below guidelines for aquatic life. Approximately 50% of the metals included in the analyses of samples collected at the five stations were detected in both total and dissolved forms; more metals were detectable at the Clearwater Project footprint station than the receiving water stations.
- Water chemistry at Station 1 (Clearwater Project footprint) was different compared to the chemistry of water collected from Stations 2 to 5 (receiving water of Mud Creek); the chemistry of water from the stations in Mud Creek were generally similar to each other. Station 1 had lower concentrations or values of (circumneutral) pH, TDS, hardness, and alkalinity, and higher concentrations or values of total suspended solids (TSS), turbidity, total nitrogen (TN), TP, dissolved organic carbon (DOC), and metals relative to water sampled in Mud Creek.
- Clear and consistent seasonal patterns were generally not observed at the sampling stations. Seasonal patterns observed in the baseline data were limited to lower TDS concentrations, hardness, and alkalinity in the spring at both the Clearwater Project footprint and in Mud Creek, likely as a consequence of dilution during the spring melt.
- Water chemistry results at Stations 1 to 5 occasionally exceeded Alberta or Canadian guidelines (GOA 2018, CCME 1999) for the protection of aquatic life. Not surprisingly, more guideline exceedances and frequency of guideline exceedances at Station 1 were observed than the receiving water stations. The following exceedances in the 2016 to 2019 baseline data set were noted:
  - Station 1 (Clearwater Project footprint): dissolved oxygen, and total aluminum, copper, iron, mercury, and zinc.
  - Stations 2 to 5 (Mud Creek): dissolved oxygen, and total aluminum and iron.

4.0 POST DISTURBANCE SITE CHARACTERISTICS

4.1 Harvested Section

The harvest section represents generally more than 89% of the disturbance in the Clearwater Project footprint. The pH for Clearwater Project is higher (~ 6.5) due to minerotrophic conditions that characterize the area. The harvest section is divided in domed-shaped fields (30 m width), divided by secondary drainages.

4.2 Drainage and Hydrology

4.2.1 Secondary and Perimeter Ditches

On a peat harvest operation, the harvest section is drained by multiple secondary ditches dividing the peat harvest fields. These smaller ditches have a depth of approximately 1.5 m and are V-shaped, with a top width of approximately 1.5 m and a bottom width of 0.3 m (see Photo 4.2-1).

Photo 4.2-1: Picture showing a V-ditcher digging a secondary ditch

The secondary ditches connect to larger perimeter ditches surrounding the harvest section. The main ditches are deeper (i.e., 1.5 to 2 m) allowing the fen to evacuate water from the harvest section to the sedimentation ponds.

4.2.2 Sedimentation Ponds and Discharge

The sedimentation ponds are designed to prevent organic matter (i.e., peat dust) from entering Mud Creek. The volume the ponds can contain is proportional to the harvesting area from which the water is drained. Table 4.2-1 summarizes the dimensions of the sedimentation ponds according to different harvest sections (Figure 3.1-2). On each side of the ponds, the excavated material will be piled for future reclamation (see Section 7).

Water will be discharged from three outlet locations (i.e., West Outlet, Central Outlet, and East Outlet) by pumping to the peat surface; the outlets are located outside the 100 m setback from Mud Creek and its unnamed tributary (Table 4.2-1).

Table 4.2-1: Sedimentation ponds projected dimensions for the Clearwater Project

Pond Number and Associated Outlet Location	Length (m)	Top Width (m)	Bottom Width (m)	Depth (m)	Harvest Areas drained
1 (East Outlet to Mud Creek)	83	7	3	2	Areas 1 & 2
2 (East Outlet to Mud Creek)	83	7	3	2	Areas 1 & 2
3 (East Outlet to Mud Creek)	62	7	3	2	Areas 1 & 2
4 (Central Outlet to Mud Creek)	83	7	3	2	Area 3
5 (Central Outlet to Mud Creek)	83	7	3	2	Area 4
6 (West Outlet to unnamed tributary)	45	7	3	2	Area 5

Discharge of water will be required during construction and operations. The proposed drainage ditches and sedimentation ponds will be constructed during the winter months once the peat is sufficiently frozen to support the weight of heavy equipment. Construction of sedimentation ponds will occur first and dewatering of saturated peat will be required. Water will be pumped during pond construction to the peat surface and the 100 m setback from the watercourses will be maintained. The discharge of water may slightly increase flows in the adjacent watercourses; the calculated rate of discharge assumed to occur over one week per pond varied from 0.0005 m^3/s for Pond 6 (the smallest pond) to 0.0009 m^3/s for the larger ponds; further details are provided in the Biophysical Report and Peat Development and Operations Plan (Golder 2022).

Water that collects in the newly constructed ditches would be routed through the sedimentation ponds and released the following spring using the methods described above. It was assumed the ditch networks would be initially full of water, and estimated discharge rates considered that pumping at each of the outlet locations (once developed) would be ongoing for a period of a week in May until ditch water levels were reduced by 0.75 m. The calculated rate of discharge assumed to occur over one week per outlet location varied from 0.0058 m^3/s for the West Outlet (with the smallest harvest and ditch network area) to 0.0232 m^3/s for the East Outlet (with the largest harvest and ditch network area). Releases from each outlet location will be staggered by one week which will reduce the flow rate to the receiving environment. Discharge water will be pumped to the peat surface and dispersed over the vegetated buffer.

Peat harvesting activities will require ongoing collection of water in ditches and sedimentation ponds and releases will be ongoing releases during the open water period during operations. During regular operations during the open-water period, the average discharge is estimated to be up to 0.0029 m^3/s which accounts for the water yield from peat harvesting activities.

4.3 Infrastructures

4.3.1 Roads

Harvest roads that are 4.5 m wide will be constructed within harvest sections of the Clearwater Project footprint. Harvest roads will include a 0.5 m thick base layer of non-commercial timber (mostly cleared black spruce) laid down as corduroy (Photo 4.3-1). A 0.5 m layer of clay will be placed on top of the corduroy. A supplementary 7 to

10 cm layer of gravel will be added to the surface of the road to improve usability by vehicles. This type of road allows water to travel through the corduroy layer to both sides of the road and facilitates decompaction during the reclamation process.

Photo 4.3-1: Corduroy road during its construction, before adding the layer of clay.

4.3.2 Buildings

The Yard will be located on a former 80 x 80 m well pad (Figure 3.1-2), where the main office, the maintenance garage and the diesel tank will be installed. The main office will consist in a mobile construction facility (4 x 10 m). The maintenance garage (8 x 15 m) and will be constructed with a cement floor to prevent spills. A 10,000 litre (L) double wall tank on a concrete floor to prevent spills. It will be surrounded by concrete blocks for security. The Yard site will be one of the last components to be reclaimed (see Table 6.0-1).

4.4 Borrow Pits

No clay borrow pits will be excavated in the SML. Clay will be provided from off-site by a local contractor.

5.0 SOIL SALVAGE AND COARSE WOODY DEBRIS

5.1 Soil Salvage Plan

5.1.1 Soil Salvage Procedures

In upland areas within the Clearwater Project footprint, mineral topsoil and subsoil will be salvaged prior to construction. The only upland areas crossed by the Project footprint include the main access road. The goal for soil salvage is to preserve the quality and quantity of topsoil and subsoil that is available for use in reclamation of disturbed landscapes.

Best management practices for mineral soil salvage include:

- A qualified professional (QP) will monitor soil salvage by sampling and/or visually identifying materials to be salvaged, recommending appropriate depths for salvage, and record keeping.
- Low ground bearing pressure salvage machinery will be used.
- Salvaging operations will be suspended if the ground becomes too wet such that stripping causes severe rutting or compaction.

For the sedimentation pond, the full depth of material (i.e., peat) excavated during construction will be stockpiled around the edges of the ponds. At the end of the peat operations, the stockpiled material will be backfilled into the ponds.

No soils salvage is planned for harvest roads on peat. Corduroy, clay, and gravel will be placed over the intact peat surface.

5.1.2 Soil Stockpile Procedures

The best management practices for soil stockpiling will be implemented at the Clearwater Project:

- A QP will direct stockpiling activities and monitor the effectiveness of mitigation measures implemented to protect stockpiles from erosion, degradation, and contamination, record and sign of stockpile locations, and where necessary, recommend additional mitigation measures.
- Soil stockpiles will be located near the salvage location to minimize handling requirements during salvage and reclamation.
- Where possible, soil stockpiles will be placed in already disturbed and cleared areas to reduce the disturbance footprint.
- Soil stockpiles will be designed, constructed, and protected to minimize soil erosion (i.e., overall slopes will not exceed 3H:1V if possible).
- Soil stockpiles will be located and protected to minimize sedimentation into watercourses, wetlands, and waterbodies.
- Stockpiles will be placed to a maximum height of approximately 4 m.
- Rough and irregular surfaces will be created on stockpiles to reduce the potential for erosion and increase the area for seed capture, seed germination, and moisture retention.
- Stockpiles will be seeded with rapidly establishing erosion control vegetative species that are consistent with species in the surrounding area.
- Soil stockpiles will be monitored for erosion and invasive plant establishment regularly.

5.2 Coarse Woody Debris Material Handling

During peat harvest operations, non-merchantable ligneous material (i.e., coarse woody debris) will be collected at the surface of the peat harvest field to prevent quality issues with horticultural peat and machinery breaks. This material will be kept in piles and used for road maintenance as needed. Based on an estimated stand volume of about 2 m^3/ha for wetlands with trees heights less than 5 m, it is expected that about 100 m^3 of coarse woody debris will be available for salvage form the harvest section (GOA 2020).

During reclamation, the stockpiled coarse woody debris will be placed over ripped roads to increase topographic diversity at closure.

Merchantable timber and coarse woody debris salvage within the upland areas of the access road will be completed prior to the development of the access road.

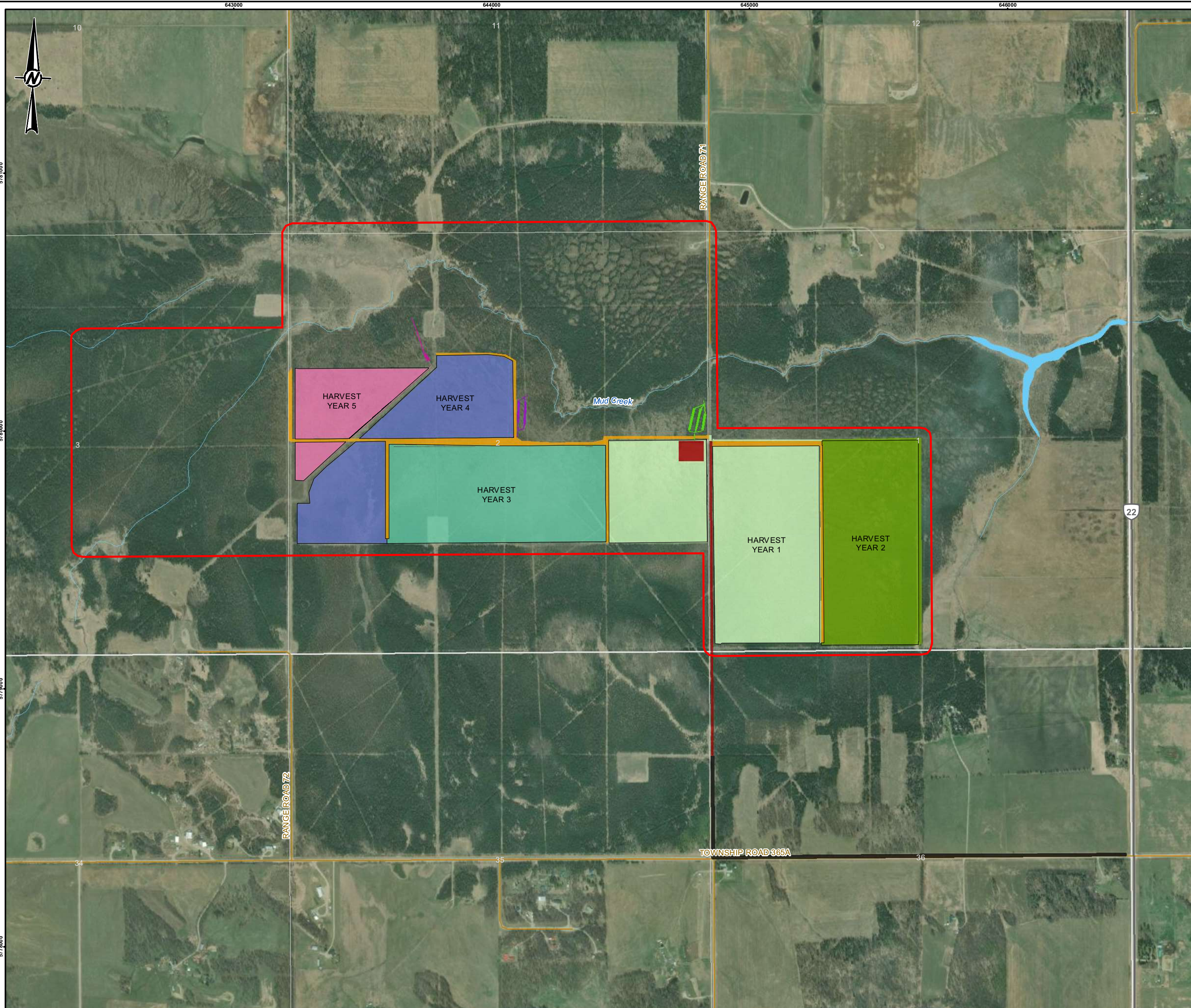
6.0 RECLAMATION SCHEDULING

Progressive reclamation will be completed from Year 18 to Year 22 of the harvesting operation. Figure 6.0-1 shows the areas of reclamation and projected reclamation dates. The final Phase 1 Clearwater Project schedule will be confirmed after regulatory approvals are in place and the final investment decision from Premier Tech has been made. Premier Tech is proposing to start extraction as early as 2022 (Year 1). The following reclamation schedule and areas are proposed for Phase 1 of the Clearwater Project (Table 6.0-1, Figure 6.0-1).

Table 6.0-1: Phase 1 Clearwater Project Schedule

Harvest Section	Active Peat Removal	Ready for Reclamation	Reclamation Initiated	Ready for Reclamation Certification (Projected)
Harvest Section 1	Year 2 to 17	Year 18	Year 18 to 20	Year 28 to 30
Harvest Section 2	Year 3 to 18	Year 19	Year 19 to 21	Year 29 to 31
Harvest Section 3	Year 4 to 19	Year 20	Year 20 to 22	Year 30 to 32
Harvest Section 4	Year 5 to 20	Year 21	Year 21 to 23	Year 31 to 33
Harvest Section 5	Year 6 to 21	Year 22	Year 22 to 24	Year 32 to 34
Harvest Road	N/A	Year 29	Year 29	Year 35
Sedimentation Pond (Harvest Section 1 & 2)	N/A	Year 21	Year 21	Year 29 to 31
Sedimentation Pond (Harvest Section 3)	N/A	Year 20	Year 22	Year 32
Sedimentation Pond (Harvest Section 4)	N/A	Year 21	Year 23	Year 33
Sedimentation Pond (Harvest Section 5)	N/A	Year 22	Year 24	Year 34
Yard Site	N/A	Year 30	Year 30	Year 35
Access Road	N/A	Year 30	Year 30	Year 35

N/A=not applicable.



LEGEND

- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- PROJECT LEASE BOUNDARY
- HARVEST SECTION (PHASE 1)

RECLAMATION INITIATION

- YEAR 18 TO 20
- YEAR 19 TO 21
- YEAR 20 TO 22
- YEAR 21
- YEAR 21 TO 23
- YEAR 22 TO 24
- YEAR 23
- YEAR 24
- YEAR 29
- YEAR 30
- NO RECLAMATION REQUIRED

0 300 600
1:15,000 METRES

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PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

TITLE
PROJECTED YEARS OF RECLAMATION FOR THE DISTURBANCES TO THE CLEARWATER PROJECT

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	SC
PREPARED	ANK
REVIEWED	SC
APPROVED	LM

PROJECT NO.	PHASE	REV.	FIGURE
21496738	2000	0	6.0-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm

7.0 DECOMMISSIONING AND REMEDIATION

Decommissioning will begin when a part of the Phase 1 Clearwater Project infrastructure is no longer required for operations or maintenance. Decommissioning of each piece of infrastructure will occur in a timely manner and the following general procedures will be undertaken:

- Equipment, infrastructure, and structures will be removed and will be reused, recycled, or disposed of in a suitable landfill.
- Where required, contaminated soils will be remediated and/or removed such that the site is suitable for reclamation.
- Waste and debris associated with decommissioning will be removed from the footprint.
- Areas to be reclaimed will be contoured to drain naturally, blend with the surrounding landscape, and support the target end land use.

As infrastructure is removed, reclamation will be completed progressively. Areas with compacted soils will be ripped, stockpiled soils will be replaced in the order they were salvaged, and areas will be revegetated as required depending on the target end land use.

Temporary access roads will be reclaimed unless the Government of Alberta express preference to have them left in place. No other infrastructure will be left on the footprint.

7.1 Contaminated Sites

No contaminated sites clean up is anticipated to be required; however, if needed, spills will be contained, and contaminated soil or water will be cleaned up to meet AEP *Tier 2 Soil and Groundwater Remediation Guidelines* (AEP 2019).

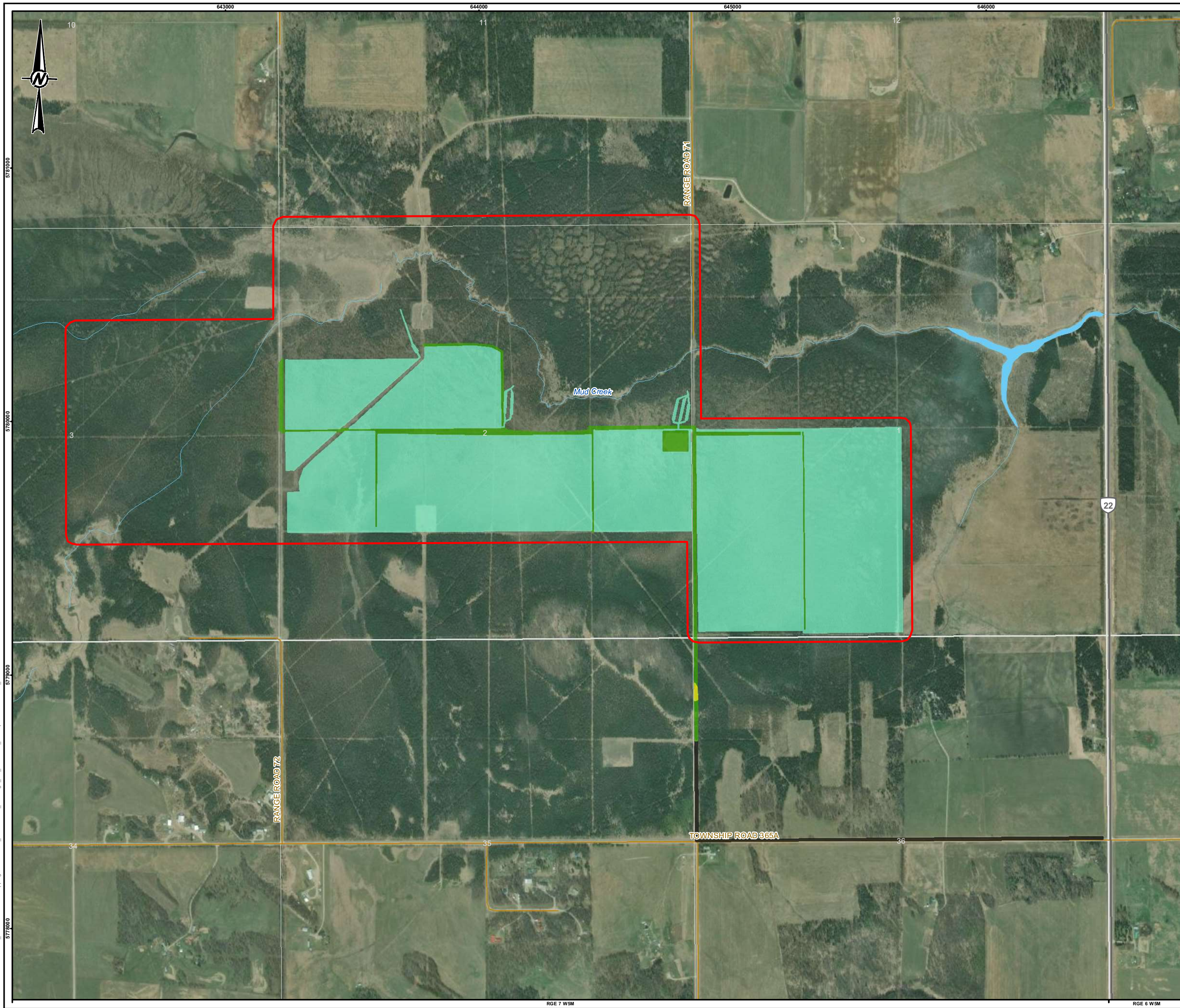
8.0 RECLAMATION AND LAND USE PLAN

Where feasible, the post-reclamation landscape will mimic the pre-disturbance topography. The goal for reclamation for the Clearwater Project is to re-establish self-regulatory mechanisms that will lead back to functional peat accumulating ecosystems. The majority of the Project (99%) will be reclaimed to a wooded coniferous fen, while a small portion of the Project associated with the main access road will be reclaimed to upland (Table 8.0-1). A figure of the conceptual restoration plan is outlined in Figure 8.0-1.

Table 8.0-1: Clearwater Project Reclamation Areas

Land Cover	Harvest Section	Area (ha)	Percentage of Total (%)
Wetland (Wooded Coniferous Fen)	Harvest Section 1	43.6	28
	Harvest Section 2	27.8	18
	Harvest Section 3	30.2	19
	Harvest Section 4	23.3	15
	Harvest Section 5	11.0	7
	Access Road	1.2	1
	Drainage Ditches	7.3	5
	Harvest Roads	6.6	4
	Sediment Ponds	0.3	<1
	Yard Site	0.7	<1
	Maintenance Access	1.4	<1
	Subtotal Wetland	*153.4*	99
Upland	Harvest Section 3	<0.1	<1
	Harvest Section 4	<0.1	<1
	Main Access Road [(a)]	0.1	<1
	Subtotal Upland	*0.1*	*1*
	Total	**153.5[(a)]**	**100**

(a) The main access road consists of 2 ha of existing roads/trails that have already been developed by Clearwater County or other industrial users. This portion of the access road is not considered as part of the reclamation area.



LEGEND

- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- PROJECT LEASE BOUNDARY

END LAND USE GOALS

- NO RESTORATION REQUIRED
- UPLAND
- WOODED CONIFEROUS FEN
- WOODED CONIFEROUS FEN (HIGH TREE DENSITY)

0 300 600
1:15,000 METRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

TITLE
CONCEPTUAL END LAND USE PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	SC
PREPARED	ANK
REVIEWED	SC
APPROVED	LM

PROJECT NO.	PHASE	REV.	FIGURE
21496738	2000	0	8.0-1

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8.1 End Land Use Planning

End land use objectives define the uses that are expected to be supported by the closure landscape. End land use objectives envelope a multitude of values that may exist beyond ecological conditions. Defining end land use objectives is a critical component of closure planning because end land use objectives inform all other aspects of closure planning including reclamation plans and prescriptions. End land use objectives must be compatible with other closure requirements and must be achievable in an efficient and economically viable manner.

End land use objectives for the Clearwater Project are focused on an ecosystem approach. The ecosystem approach considers all ecosystem components and the resulting ecosystem services in reclamation planning. These ecosystems can be mapped on appropriate areas of the landscape, but rather than limiting each area to one designated end land use (e.g., wildlife habitat) they will allow for multiple, compatible end land use objectives to be targeted.

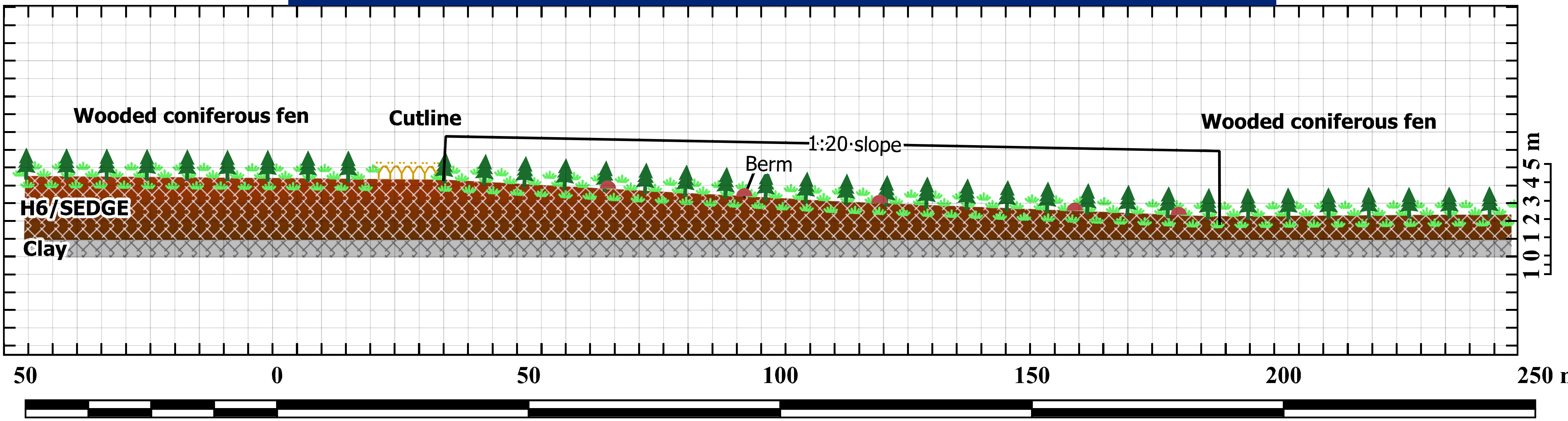
End land use objectives focus on ecosystem reclamation as the main goal with a target towards ecosystems that occurred in the pre-existing conditions mapping. Where possible, overlapping end land use objectives have been targeted to maximize the utility of the reclaimed landscape for multiple interests. As such, human uses such as recreation may also be possible on the reclaimed landscape. End land uses are expected to change over time as the reclaimed ecosystems continue on a trajectory toward functional, mature ecosystems.

8.2 Reclamation Topography

The Clearwater Project footprint will be decompacted (upland only) and recontoured to integrate with the surrounding area as part of reclamation activities. The land will be reclaimed in a manner that blends into the surrounding landscape allowing for integration of drainage that does not erode more than natural systems or cause unacceptable environmental impacts. Reclamation topography will improve site conditions to meet end land use targets, increase available water supply for fen development, and reverse the drainage and drying of the Clearwater Project footprint that was conducted for extraction purposes. The main objective is to maintain an even distribution of water to avoid deep and permanent flooding or flooding smaller sections causing areas of open water that may result in wave action that will disturb establishing plant fragments.

A conceptual cross section diagram outlining the post-reclamation topography of the Project is provided in Figure 8.2-1.

Figure 8.2-1a: Topography Restoration Map
Clearwater Restoration: Transect A - B



Transect Legend

Berm

Surface

Grass

Wooded coniferous fen (Higher tree density)

Wooded coniferous fen

Material

H6/SEDGE

Clay

Water

Map Legend

Transect

Road

Wooded coniferous fen

Wooded coniferous fen (Higher tree density)

Phase 2

PREMIER TECH

Ver:2020/10/16 Par/By:jeap2

Projection: EPSG:3857
Sources: PTH, Bing

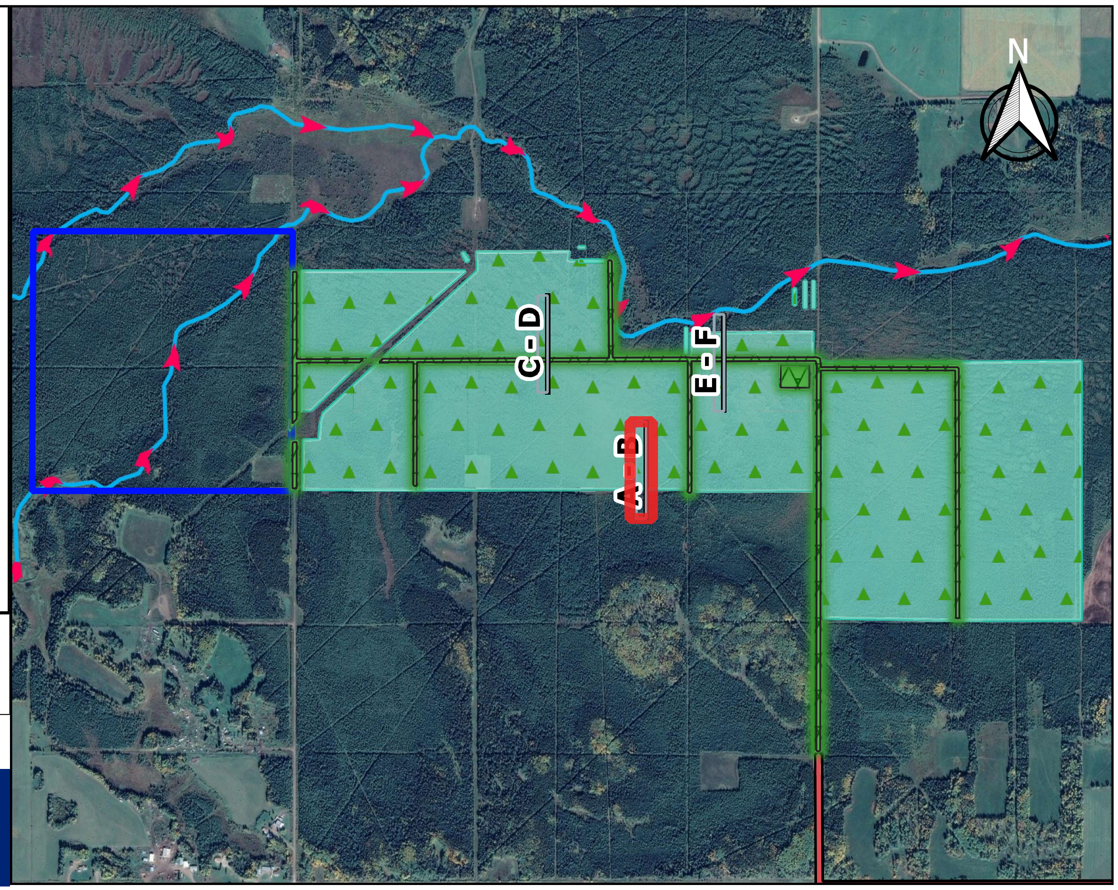
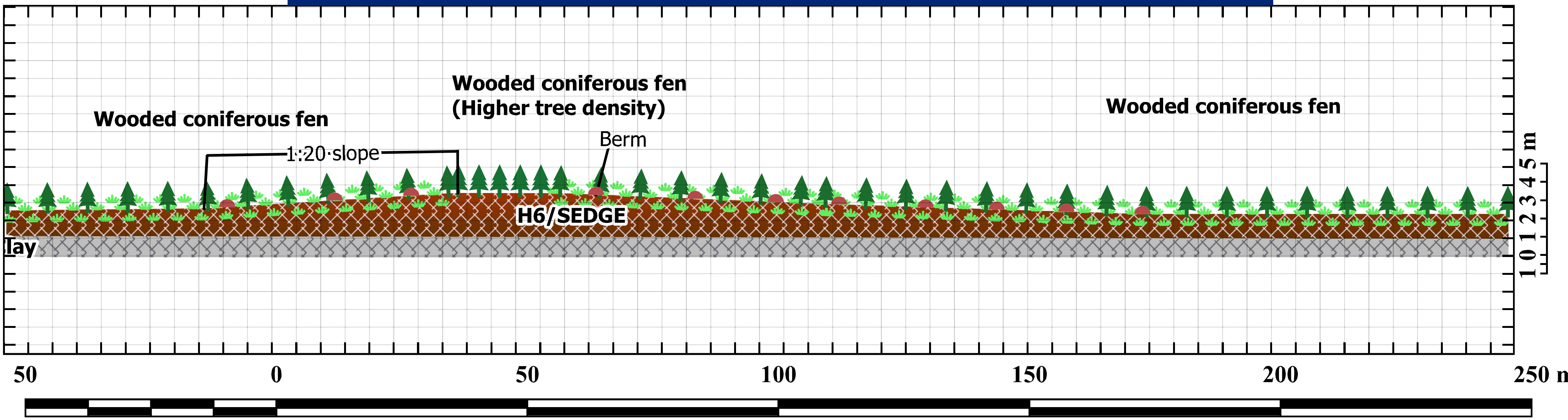


Figure 8.2-1b: Topography Restoration Map
Clearwater Restoration: Transect C - D



Transect Legend

Berm

Surface

Grass

Wooded coniferous fen (Higher tree density)

Wooded coniferous fen

Material

H6/SEDGE

Clay

Water

Map Legend

Transect

Road

Wooded coniferous fen

Wooded coniferous fen (Higher tree density)

Phase 2

PREMIER TECH

Ver:2020/10/16 Par/By:jeap2

Projection: EPSG:3857
Sources: PTH, Bing

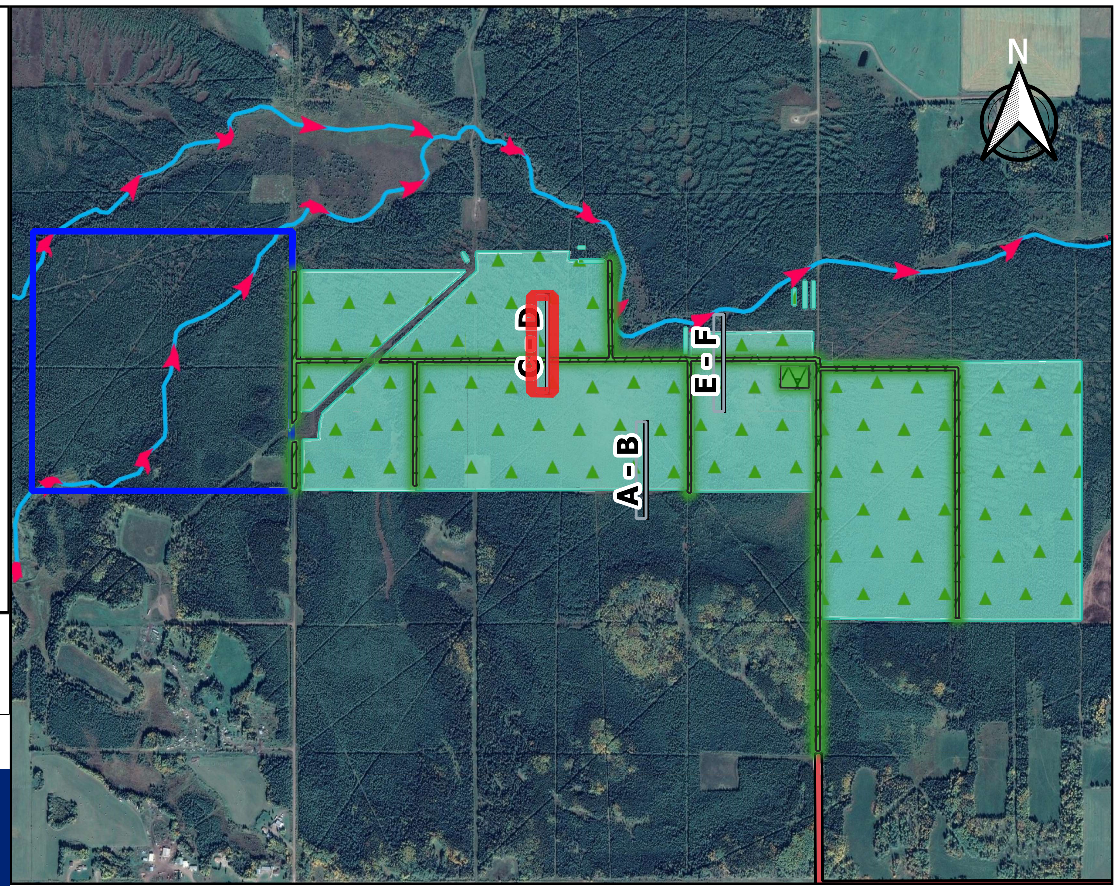
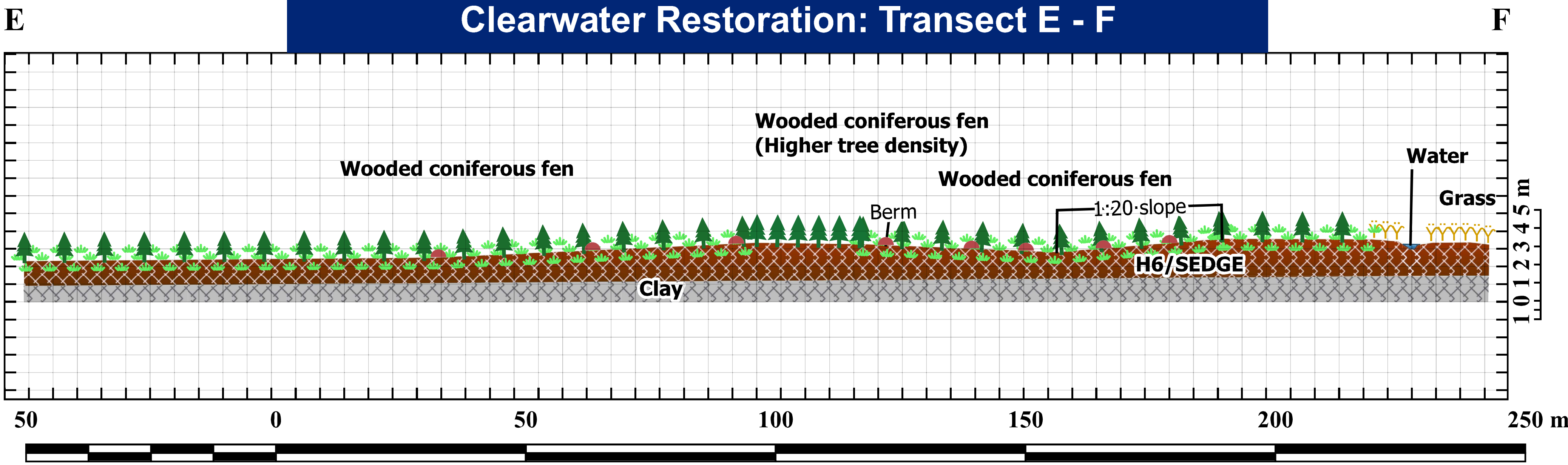


Figure 8.2-1c: Topography Restoration Map
Clearwater Restoration: Transect E - F



Transect Legend

- Berm

Surface

- Grass
- Wooded coniferous fen (Higher tree density)
- Wooded coniferous fen

Material

- H6/SEDGE
- Clay
- Water

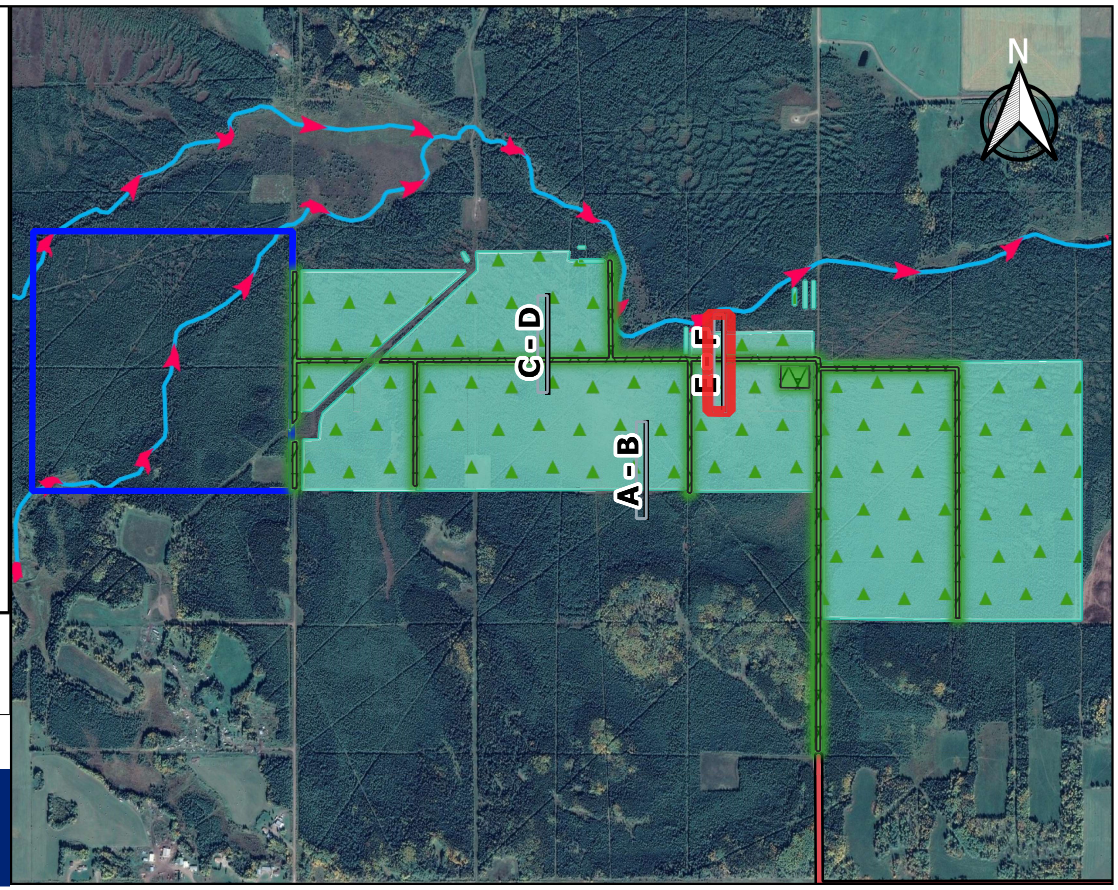
Map Legend

- Transect
- Road
- Wooded coniferous fen
- Wooded coniferous fen (Higher tree density)
- Phase 2

PREMIER TECH

Ver:2020/10/16 Par/By:jeap2

Projection: EPSG:3857
Sources: PTH, Bing



8.3 Reclamation Material Placement

No reclamation material will be placed within the harvest section; however, a minimum of 100 cm (50 cm for berm construction and 50 cm for restoration) of existing fen material will left during extraction operations. For the sedimentation ponds, stockpiled soil will be replaced in the order it was salvaged.

8.3.1 Filling Ditches

Secondary ditches will be filled by backfilling and compacting fen material collected from nearby surfaces. Backfilling will be completed in conjunction, where possible, with the Clearwater Project operations and activities such as scaping loose surfaces or recontouring fields.

Main drainage ditches will be blocked and filled with previously excavated material. All culverts will be removed and recycled. An excavator will be used to put the dredged spoil back into the main ditch. Using a small bulldozer, the topography between the non-impacted peatland and the depleted peat field will be smoothed to a 1:20 slope.

Filling ditches will allow the local water levels to increase naturally and assist with revegetation (Section 8.4).

8.3.2 Berms

Berms will be established in harvest sections to facilitate the re-establishment of native fen species. The main purpose of the berms is to limit water movement and to keep water as long as possible on site rather than retaining large masses of water (Quinty and Rochefort 2003). Berms will also act as a windbreak to prevent the loss of placed donor material (i.e., harvested plant material) and straw, and effectively act as a snow trap further contributing to the accumulation of water in the spring. Several berm types will be established in the harvest section: peripheral berms, across slope berms, and cheeseboard berms.

Berms will be established using available fen peat material utilizing equipment that is capable of pushing or moving peat material. Sufficient peat material will be left after harvesting to both construct berms (50 cm) and still leave 50 cm of fen peat on the harvest areas to support revegetation. The height of water retained behind a berm will determine the size of berm required.

Best management practices for berm development include:

- Preparing surface material prior to berm building (e.g., removing the surface peat material and other vegetation).
- Using decomposed fen peat material whenever possible.
- Removing wood, branches, and other debris.
- Compacting berm material once it has been pushed into the mound to reduce pore spaces and increase the water holding capacity.
- Making berms no higher than 40 to 50 cm to provide sufficient water holding capacity.
- Installing overflow pipes to allow for discharge of surplus water.
- Preparing berms in the summer or fall to avoid using frozen material.

8.3.3 Sedimentation Ponds

Sedimentation ponds will be filled with the dredged spoil from regular cleanings. An excavator and a small bulldozer will be used to fill the pond. The outlet area will be filled and compacted so that water from Mud Creek will not be diverted into the restored area. Filling in the sedimentation ponds will allow the local water levels to recover naturally and assist with revegetation (Section 8.4).

8.4 Revegetation Plan

A primary goal of reclamation is to achieve reclaimed soils and landforms that are capable of supporting land uses that were available prior to disturbance. Revegetation of peatlands will be based on active introduction of plants to accelerate the formation of a new carpet of fen peat material (Quinty and Rochefort 2003). The restoration and successful colonization of fen peat communities on harvested peat sites are limited by the availability of suitable propagules (Quinty and Rochefort 2003). The application of donor wetland community material to the reclamation site has been found to be successful for the restoration of bogs (Rochefort et al. 2003), marshes (Brown & Bedford 1997, Stauffer & Brooks 1997), and fens (Kratz & Pfadenhauer 2001).

Upland areas will be revegetated by planting native tree and shrub seedlings that are suitable to the target ecosite at a density of approximately 2,500 stems per hectare (sph).

The successful re-establishment of the Project site drainage and moisture regime to the reclaimed fen will aid in deterring undesirable species. These undesirable species include upland species, marsh species (species associated with non-peat forming wetlands), and non-native or agronomic species (Environment and Parks 2017). Undesirable species will be monitored throughout the reclamation process.

8.4.1 Collection of Donor Material

Poor quality donor propagules will have a direct impact on the success of the reclamation and revegetation efforts. The target reclamation plant communities must cover the entire surface of the collection site. Plant material will be extracted from donor sites in the surrounding fen peat communities within the Clearwater SML as they will contain pioneer species as well as fen peat diaspores. The donor diaspore material, containing seeds, rhizomes, moss fragments, and other plant propagules, will be collected from two different types of natural fens (Cobbaert et al. 2004). Collection sites will be assessed for plant composition and size of the collection site and will be collected to a typical depth of 10 cm as recommended by Quinty and Rochefort (2003). Quinty and Rochefort (2003) recommend that the size of the donor site to reclamation site be a ratio of 1:12 to 1:10 (plant collection area: reclamation site area). The recommended areas for the collection of donor propagules are estimated in Table 8.4-1. The SML contains sufficient area to support the 1:10 donor area requirement ratio. Proposed collection areas are shown in Figure 8.4-1. The proposed collection area is larger than the area required (Table 8.4-1) to account for selective harvesting of areas that are rich in *Sphagnum* species and to allow for machinery access by avoiding trees. A total of 15.3 ha is required to meet the 1:10 donor area requirement ratio (Table 8.4-1). An estimated 16 ha of collection sites have been identified for donor material (Table 8.4-2). The proposed collection areas will be sited outside of the 40 m non-development buffer required as per the *Guide to Surface Materials Lease Information Requirements for Peat Operations* (GOA 2017) and outside of the 100 m vegetative buffer from Mud Creek.

Mitigation strategies as recommended by Quinty and Rochefort (2003) will be used to reduce the impacts to donor sites, including:

- Donor material will be collected from the tops of the hummocks. The tops of hummocks are easily accessible and mores suitable for reclamation.

- Collecting only the top 10 cm of the collection sites allows for rapid regeneration and recovery of donor sites.
- Collection sites will not be harvested more than once.
- Spring collection of material will be prioritized as the surface will still be frozen, reducing compaction.
- Premier Tech has planned collection sites to align with future proposed development of Phase 2 which will reduce the total impact to peatlands within the SML.

Table 8.4-1: Clearwater Project Donor Areas

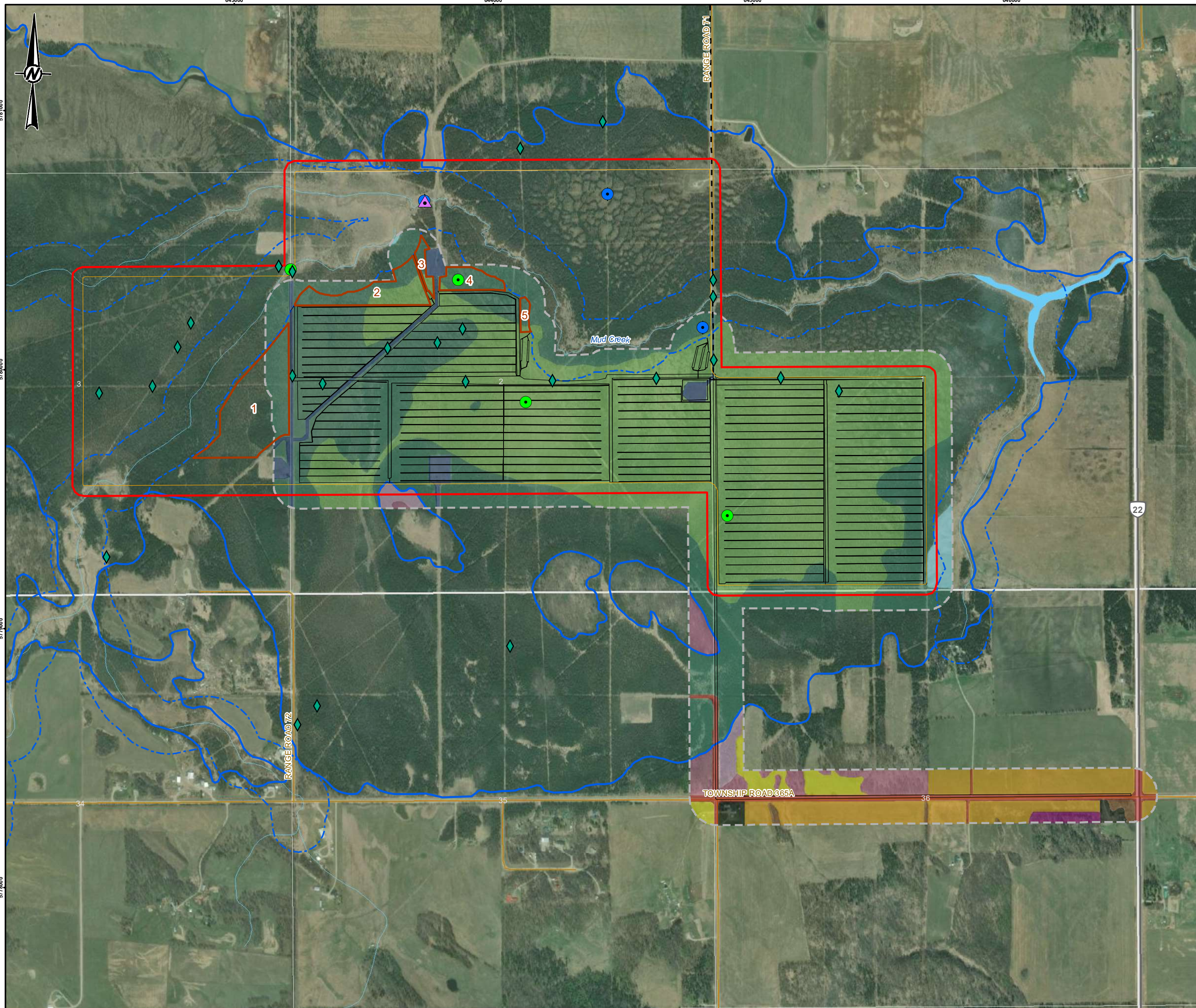
Harvest Section	Reclamation Area (ha)	Donor Area Requirement for 1:12 Ratio (ha)	Donor Area Requirement for 1:10 Ratio (ha)
Harvest Section 1	43.6	3.6	4.4
Harvest Section 2	27.8	2.3	2.8
Harvest Section 3	30.2	2.5	3.0
Harvest Section 4	23.3	1.9	2.3
Harvest Section 5	11.0	0.9	1.1
Access Road	1.2	0.1	0.1
Drainage Ditches	7.3	0.6	0.7
Harvest Roads	6.6	0.6	0.7
Sediment Ponds	0.3	<0.1	<0.1
Yard Site	0.7	0.1	0.1
Maintenance Access	1.4	0.1	0.1
Total	**153.4** [(a)]	**12.7**	**15.3**

(a) Reclamation areas for donor sites does not include a summary of upland sites (2.0 ha of road/trail, and 0.1 ha of upland sites)

Table 8.4-2: Donor Area

Harvest Section	Wetland Classification [(a)]	Area (ha)
Collection Area 1	Wooded Coniferous Fen	9.2
Collection Area 2	Shrubby Fen	1.7
	Wooded Coniferous Fen	2.4
Collection Area 3	Shrubby Fen	0.2
	Wooded Coniferous Fen	0.4
Collection Area 4	Shrubby Fen	0.1
	Wooded Coniferous Fen	1.7
Collection Area 5	Shrubby Fen	0.1
	Wooded Coniferous Fen	0.4
Total	-	16

(b) Alberta Wetland Classification System (AWCS 2015)



LEGEND

- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- ALTERNATE ACCESS ROAD
- PROJECT LEASE BOUNDARY
- PROJECT LEASE BOUNDARY INNER 40 M BUFFER
- PROJECT FOOTPRINT - PHASE 1
- TERRESTRIAL LOCAL STUDY AREA - PROJECT FOOTPRINT + 100 M BUFFER
- WATERCOURSE - 100 m BUFFER
- 2017 DETAILED WETLAND SURVEY POINT
- 2017 WETLAND CLASSIFICATION POINT
- 2020 DETAILED VEGETATION SURVEY POINT
- WEED LOCATION
- FEN BOUNDARY
- PROPOSED COLLECTION AREA

UPLAND AGRICULTURAL AND MISCELLANEOUS LAND COVER TYPES

- SHRUBLAND
- FARM YARD
- TAME PASTURE
- ROAD/TRAIL
- HAYLAND

UPLAND ECOSITE PHASES

- LOW-BUSH CRANBERRY LODGEPOLE PINE (e1)
- LOW-BUSH CRANBERRY ASPEN (e2)
- LOW-BUSH CRANBERRY ASPEN-WHITE SPRUCE-LODGEPOLE PINE (e3)

WETLANDS

- GRAMINOID FEN
- SHRUBBY FEN
- WOODED CONIFEROUS FEN
- CLEARED FEN

0 300 600
1:15,000 METRES

REFERENCE(S)

1. IMAGERY COPYRIGHT © 20190511 ESRI AND ITS LICENSORS. SOURCE: VIVID-MAXAR. USED UNDER LICENSE, ALL RIGHTS RESERVED.
2. ALBERTA DIGITAL BASE DATA MAY BE OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED, ALTALIS LTD.© GOVERNMENT OF ALBERTA 2016. ALL RIGHTS RESERVED. OR IHS ENERGY INC.

PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

TITLE
PROPOSED COLLECTION AREAS

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	LM
PREPARED	ANK
REVIEWED	SC
APPROVED	LM

PROJECT NO.	PHASE	REV.	FIGURE
21496738	2000	0	8.4-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm

8.4.2 Revegetation Procedure

Best management practices for revegetation include:

- Revegetation will be conducted as soon harvesting of material has been completed to control erosion and invasive species establishment.
- Harvest section revegetation will be completed using propagules from surrounding donor sites.
- Seeding will not be completed on the harvest sections; donor propagules will be utilized to establish natural vegetation and fen plant compositions to achieve the end land use.
- Upland areas will be planted with native tree and shrub species at a density of about 2,500 sph.

8.4.3 Straw Application

Straw mulch will be applied to the harvest section reclamation areas to create optimum growing conditions for fen peat establishment. The straw mulch acts as a barrier maintaining an air layer and increasing humidity, as well as creating a protective layer from wind and drying of the donor material. Cobbaert et al. (2004) found that the application of long and rigid straw mulch on donor seed bank from natural fens significantly increased fen peat establishment, and increased fen plant cover and richness after two growing seasons (Cobbaert et al. 2004).

Best management practices for straw mulch application:

- Long and rigid straw mulch is recommended to maintain a protective air layer
- Wet and rotten straw mulch should be avoided
- Straw mulch should be applied at approximately 3,000 kg/ha; such that light can still penetrate through the straw layer to the underlying soil and plant fragments in spots (Quinty and Rochefort 2003).
- Straw mulch should be applied as soon as possible after donor propagules are placed.
- Avoid driving over donor propagules during straw mulch application

8.4.4 Fertilization

No fertilizers will be used at the Clearwater Project.

9.0 MONITORING

Monitoring of restoration and reclamation efforts are essential to assess if reclamation objectives have been met. Monitoring will include the collection of measurable data at pre-determined times to evaluate the progression of reclamation. These efforts will assess the short-term objectives for hydrology (re-establishing and maintaining water tables) and vegetation (successful revegetation with donor material and upland planting), as well as long-term vegetation objectives (a self-sustaining ecosystem).

The proposed monitoring program has been developed based on professional experience, guidance documents, and ongoing research findings. Relevant guidance documents and research projects that were used to help develop the proposed monitoring program include:

- *Peatland Restoration Guide* (Quinty and Rochefort 2003)
- *Canadian Oil Sands Innovation Alliance (COSIA) Guide for Reclaiming In Situ Pads and Roads to Peatlands* (COSIA 2017)

- *Reclamation Criteria for Wellsites and Associated Facilities for Peatlands* (GOA 2013)
- *Assessment of Relevant Indicators for the Monitoring of Reclaimed Sites in Peatlands* (COSIA 2019a)
- *Removing the Wellsite Footprint (iFROG)* (COSIA 2019a)
- *Boreal Ecosystem Recovery And Assessment (BERA)* (COSIA 2019a)
- *Peatland Reclamation Markers of Success* (COSIA 2019b)
- *Alberta Wetland Restoration Directive (GOA 2016b)*

Monitoring will begin starting two years after reclamation efforts are complete (Quinty and Rochefort 2003).

Best management practices for monitoring include:

- Monitoring should be conducted two, three, four, and five growing seasons after reclamation work is completed (Quinty and Rochefort 2003; GOA 2016b). Basic maintenance inspections will occur annually, beginning in the first year following reclamation (GOA 2016b).
  - To meet the Alberta Wetland Restoration Directive, vegetation monitoring must be completed during the third and fourth growing seasons (GOA 2016b). Detailed vegetation indices that will be monitored at minimum between years three and four are outlined in Section 5 of the Alberta Wetland Restoration Directive (GOA 2016b).
- A Wetland Restoration Verification and verification report will be completed following the requirements of Section 6 of the *Alberta Wetland Restoration Directive (*GOA 2016b*)*. The verification will be completed a minimum of four years after restoration and a verification report will be completed by a third-party professional (GOA 2016b).
- Short-term monitoring will include:
  - Uniformity of the site.
  - Presence and location of ponding, erosion, and sedimentation.
  - Presence and location of non-targeted species.
  - Presence and location of trees.
  - Dominant vegetation species.
  - Monitoring of water table depths at established water wells.
- Long-term monitoring (permanent plots) will include:
  - Establish a permanent plot in each targeted land cover.
  - Plots will be five meters by five meters with markers at each corner.
  - Evaluation of each vegetation strata will be completed each monitoring year.
  - Percent cover will be collected for each vegetation strata at each permanent plot.
  - pH levels will be measured.

10.0 CONTINGENCY PLANNING

Progressive reclamation activities allow opportunities to test, monitor, and adapt reclamation strategies where required. Premier Tech relies upon past experience, topic specific experts and research findings to identify methods for achieving reclamation and closure objectives.

The underlying strategy for reclamation is that it is founded on a management approach that is iterative based on monitoring results, research findings, and changes to best practice and regulation (Figure 10.0-1). The monitoring program can be used to help support an adaptive management approach to reclamation by identifying areas for mitigation and improvement in reclamation design. Results may highlight areas for improvement or indicate aspects of the design that are working well and may be implemented elsewhere on the landscape.

Figure 10.0-1: Adaptive Management Cycle

11.0 CLOSURE

The material contained in this report reflects Golder's best judgment based on the information available and provided at the time of preparation. Golder has relied upon the representations or opinions of persons contacted during the preparation of this report. The accuracy of these representations and opinions will affect the accuracy of this report.

The reported information is believed to provide a reasonable representation of the general environmental conditions at the Project location. Any use of this report or any reliance on, or decisions based on this report by a third party is the responsibility of such third parties. Golder will not be held responsible or liable for any damages to the physical environment, any property, or to life, which may have occurred from actions of decisions based upon any of the information within this report.

Signature Page

Golder Associates Ltd.

<Original signed by>

<Original signed by>

Kyle Hodgson, P.Ag.
Senior Agrologist

Lisa May
Associate, Reclamation Senior

SC/tt/al

https://golderassociates.sharepoint.com/sites/153472/project files/6 deliverables/04. conservation and reclamation plan/final/21496738_pt_c&r_2022 update_rev0.docx

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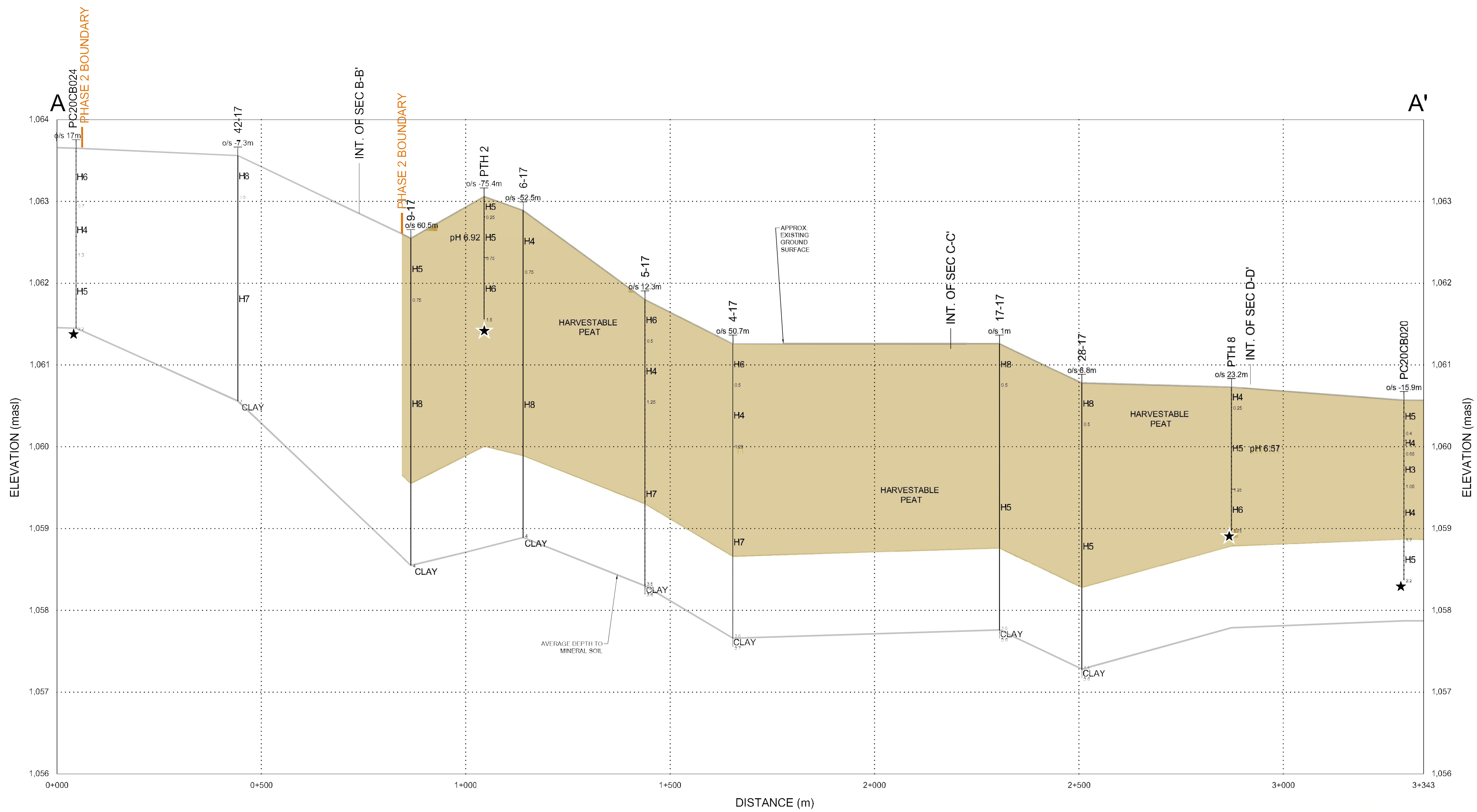
APPENDIX A

Cross Sections of Peat Profiles



LEGEND

PC20CB022	SAMPLE ID
o/s -33m	DISTANCE OFFSET FROM PROFILE LINE
H4 pH 7.53	H VALUE / pH VALUE
0.96	DEPTH BELOW GROUND SURFACE
H5 pH 6.86	
Silty Clay/Dark Gray	SOIL TEXTURE
★	INDICATES DEPTH TO BOTTOM OF SAMPLE

VON POST

SCALE	DECOMPOSITION	PLANT STRUCTURE	LIQUID
H1	Undecomposed	Unaltered	Clear water (light yellow-brown)
H2	Almost undecomposed	Distinct	Clear water (light yellow-brown)
H3	Very weak	Distinct	Turbid (brown), no peat passes between fingers, mushy residue
H4	Weak	Distinct	Strongly turbid, peat substance between the fingers, residue very mushy
H5	Moderate	Clear, becoming indistinct	Turbid water (brown), some peat between fingers, residue vey mushy
H6	Strong	Somewhat indistinct, clearer in squeezed residue	1/3 peat escapes between fingers, residue strongly mushy
H7	Strong	Indistinct but recognizable	½ peat escapes between fingers
H8	Very strong	Very indistinct	2/3 peat escapes between fingers, remaining residue root fibers and wooc
H9	Almost complete	Almost unrecognizable	almost all peat escapes between the fingers
H10	Complete	Unrecognizable	all the peat escapes between fingers

Canadian System of Soil Classification (1998)

NOTE(S)

1. FOR LOCATION OF CROSS-SECTION A-A', REFER TO FIGURE 2.3-5
2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT SAMPLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN THE BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN. FOR DETAILED STRATIGRAPHY OF EACH BOREHOLE LOCATION REFER TO THE RECORD OF SAMPLE SHEET
3. SAMPLE LOCATIONS ARE OFFSET FROM THE PLAN VIEW PROFILE LINE. ELEVATION OF THE GROUND SURFACE IS INTERPOLATED BETWEEN SAMPLE POINTS.
4. PTH = PREMIER TECH HORTICULTURE
5. SOME PROFILES APPEARS TO BE ABOVE OR BELOW THE GROUND SURFACE ON THE PEAT PROFILE. THIS IS BECAUSE THAT PROFILE DOES NOT FALL DIRECTLY ON THE TRANSECT LINE AND IS OFF SET (OS) BY A NUMBER OF METRES LISTED AT THE TOP OF THE PROFILE. ALL PROFILES INCLUDED ARE REPRESENTATIVE OF THE TRANSECT EVEN IF OFF SET FROM THE CROSS SECTION LOCATION.

REFERENCE(S)

DATA OBTAINED FROM PREMIER TECH 2010, PREMIER TECH 2018, GOLDER 2020, AND GOLDER 2021.

0 250 500

1:10,000 METRES

VERTICAL EXAGGERATION = 200X

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	JH
PREPARED	RFM
REVIEWED	CB
APPROVED	KH

TITLE
CROSS-SECTION A-A'

PROJECT NO.	CONTROL	REV.	FIGURE
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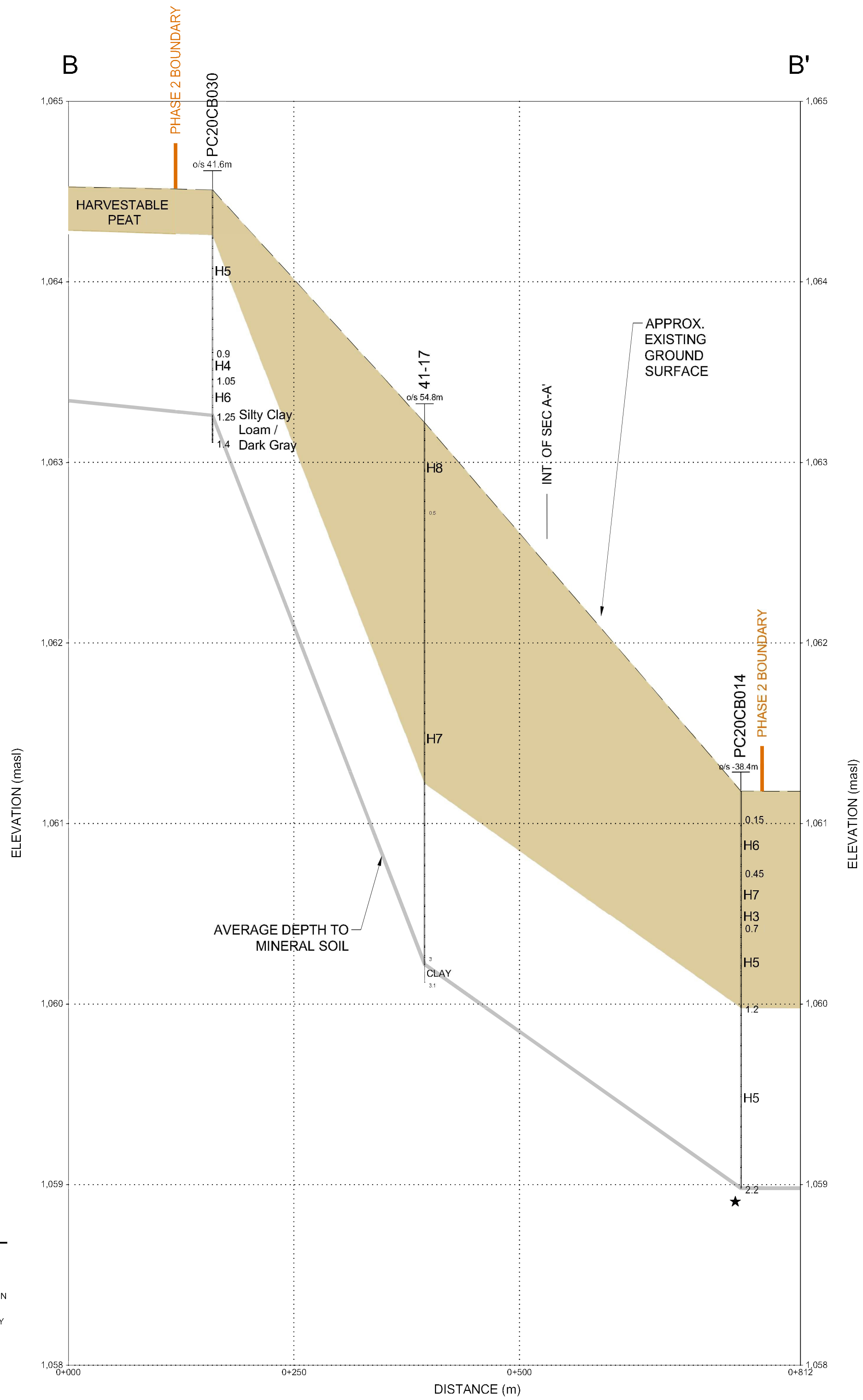


LEGEND

HYDROLOGY STUDY DEPTH MARKER

APPROXIMATE WATER TABLE ELEVATION FROM HYDROLOGY STUDY

TOP OF PEAT FROM HYDROLOGY STUDY

-0.89% PERCENT WATER TABLE GRADE

PC20CB022 SAMPLE ID

o/s -33m DISTANCE OFFSET FROM PROFILE LINE

H4 pH 7.53 H VALUE / pH VALUE

0.95 DEPTH BELOW GROUND SURFACE

H5 pH 6.86

Silty Clay SOIL TEXTURE

★ INDICATES DEPTH TO BOTTOM OF SAMPLE

VON POST

SCALE	DECOMPOSITION	PLANT STRUCTURE	LIQUID
H1	Undecomposed	Unaltered	Clear water (light yellow-brown)
H2	Almost undecomposed	Distinct	Clear water (light yellow-brown)
H3	Very weak	Distinct	Turbid (brown), no peat passes between fingers, mushy residue
H4	Weak	Distinct	Strongly turbid, peat substance between the fingers, residue very mushy
H5	Moderate	Clear, becoming indistinct	Turbid water (brown), some peat between fingers, residue vey mushy
H6	Strong	Somewhat indistinct, clearer in squeezed residue	1/3 peat escapes between fingers, residue strongly mushy
H7	Strong	Indistinct but recognizable	½ peat escapes between fingers
H8	Very strong	Very indistinct	2/3 peat escapes between fingers, remaining residue root fibers and wood
H9	Almost complete	Almost unrecognizable	almost all peat escapes between the fingers
H10	Complete	Unrecognizable	all the peat escapes between fingers

Canadian System of Soil Classification (1998)

NOTE(S)

1. FOR LOCATION OF CROSS-SECTION B-B, C-C' AND D-D", REFER TO FIGURE 2.3-5
2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT SAMPLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN THE BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN. FOR DETAILED STRATIGRAPHY OF EACH BOREHOLE LOCATION REFER TO THE RECORD OF SAMPLE SHEET
3. SAMPLE LOCATIONS ARE OFFSET FROM THE PLAN VIEW PROFILE LINE. ELEVATION OF THE GROUND SURFACE IS INTERPOLATED BETWEEN SAMPLE POINTS.
4. PTH = PREMIER TECH HORTICULTURE
5. SOME PROFILES APPEARS TO BE ABOVE OR BELOW THE GROUND SURFACE ON THE PEAT PROFILE. THIS IS BECAUSE THAT PROFILE DOES NOT FALL DIRECTLY ON THE TRANSECT LINE AND IS OFF SET (OS) BY A NUMBER OF METRES LISTED AT THE TOP OF THE PROFILE. ALL PROFILES INCLUDED ARE REPRESENTATIVE OF THE TRANSECT EVEN IF OFF SET FROM THE CROSS SECTION LOCATION.

REFERENCE(S)

DATA OBTAINED FROM PREMIER TECH 2010, PREMIER TECH 2018, GOLDER 2020, AND GOLDER 2021.

0 100 200

1:5,000 METRES

VERTICAL EXAGGERATION = 200X

CLIENT
PREMIER TECH HORTICULTURE

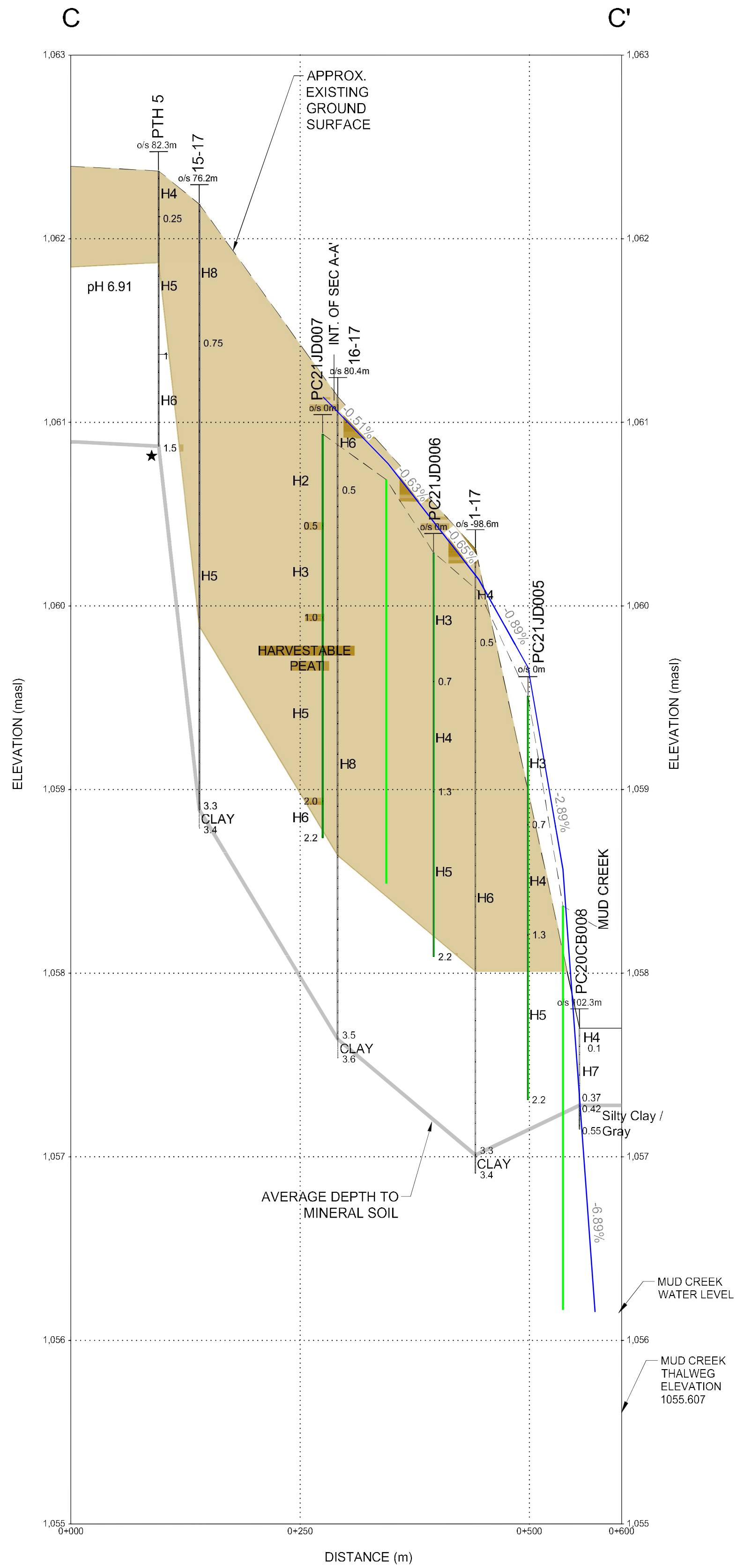
PROJECT
CLEARWATER PEAT HARVEST PROJECT

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	JH
PREPARED	RFM
REVIEWED	CB
APPROVED	KH

TITLE
CROSS-SECTION B-B'

PROJECT NO.	CONTROL	REV.	FIGURE
21496738	1000-PT-0001	0	2.3-5b



LEGEND

- HYDROLOGY STUDY DEPTH MARKER
- APPROXIMATE WATER TABLE ELEVATION FROM HYDROLOGY STUDY
- TOP OF PEAT FROM HYDROLOGY STUDY
- -0.89% — PERCENT WATER TABLE GRADE
- PC20CB022 o/s -33m — SAMPLE ID, DISTANCE OFFSET FROM PROFILE LINE
- H4 pH 7.53 — H VALUE / pH VALUE
- DEPTH BELOW GROUND SURFACE
- H5 pH 6.86 Silty Clay — SOIL TEXTURE
- ★ — INDICATES DEPTH TO BOTTOM OF SAMPLE

NOTE(S)

1. FOR LOCATION OF CROSS-SECTION B-B, C-C' AND D-D", REFER TO FIGURE 2.3-5
2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT SAMPLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN THE BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN. FOR DETAILED STRATIGRAPHY OF EACH BOREHOLE LOCATION REFER TO THE RECORD OF SAMPLE SHEET
3. SAMPLE LOCATIONS ARE OFFSET FROM THE PLAN VIEW PROFILE LINE. ELEVATION OF THE GROUND SURFACE IS INTERPOLATED BETWEEN SAMPLE POINTS.
4. PTH = PREMIER TECH HORTICULTURE
5. SOME PROFILES APPEARS TO BE ABOVE OR BELOW THE GROUND SURFACE ON THE PEAT PROFILE. THIS IS BECAUSE THAT PROFILE DOES NOT FALL DIRECTLY ON THE TRANSECT LINE AND IS OFF SET (OS) BY A NUMBER OF METRES LISTED AT THE TOP OF THE PROFILE. ALL PROFILES INCLUDED ARE REPRESENTATIVE OF THE TRANSECT EVEN IF OFF SET FROM THE CROSS SECTION LOCATION.

REFERENCE(S)

DATA OBTAINED FROM PREMIER TECH 2010, PREMIER TECH 2018, GOLDER 2020, AND GOLDER 2021.

VON POST

SCALE	DECOMPOSITION	PLANT STRUCTURE	LIQUID
H1	Undecomposed	Unaltered	Clear water (light yellow-brown)
H2	Almost undecomposed	Distinct	Clear water (light yellow-brown)
H3	Very weak	Distinct	Turbid (brown), no peat passes between fingers, mushy residue
H4	Weak	Distinct	Strongly turbid, peat substance between the fingers, residue very mushy
H5	Moderate	Clear, becoming indistinct	Turbid water (brown), some peat between fingers, residue vey mushy
H6	Strong	Somewhat indistinct, clearer in squeezed residue	1/3 peat escapes between fingers, residue strongly mushy
H7	Strong	Indistinct but recognizable	½ peat escapes between fingers
H8	Very strong	Very indistinct	2/3 peat escapes between fingers, remaining residue root fibers and wood
H9	Almost complete	Almost unrecognizable	almost all peat escapes between the fingers
H10	Complete	Unrecognizable	all the peat escapes between fingers

Canadian System of Soil Classification (1998)

0 100 200
1:5,000 METRES
VERTICAL EXAGGERATION = 200X

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

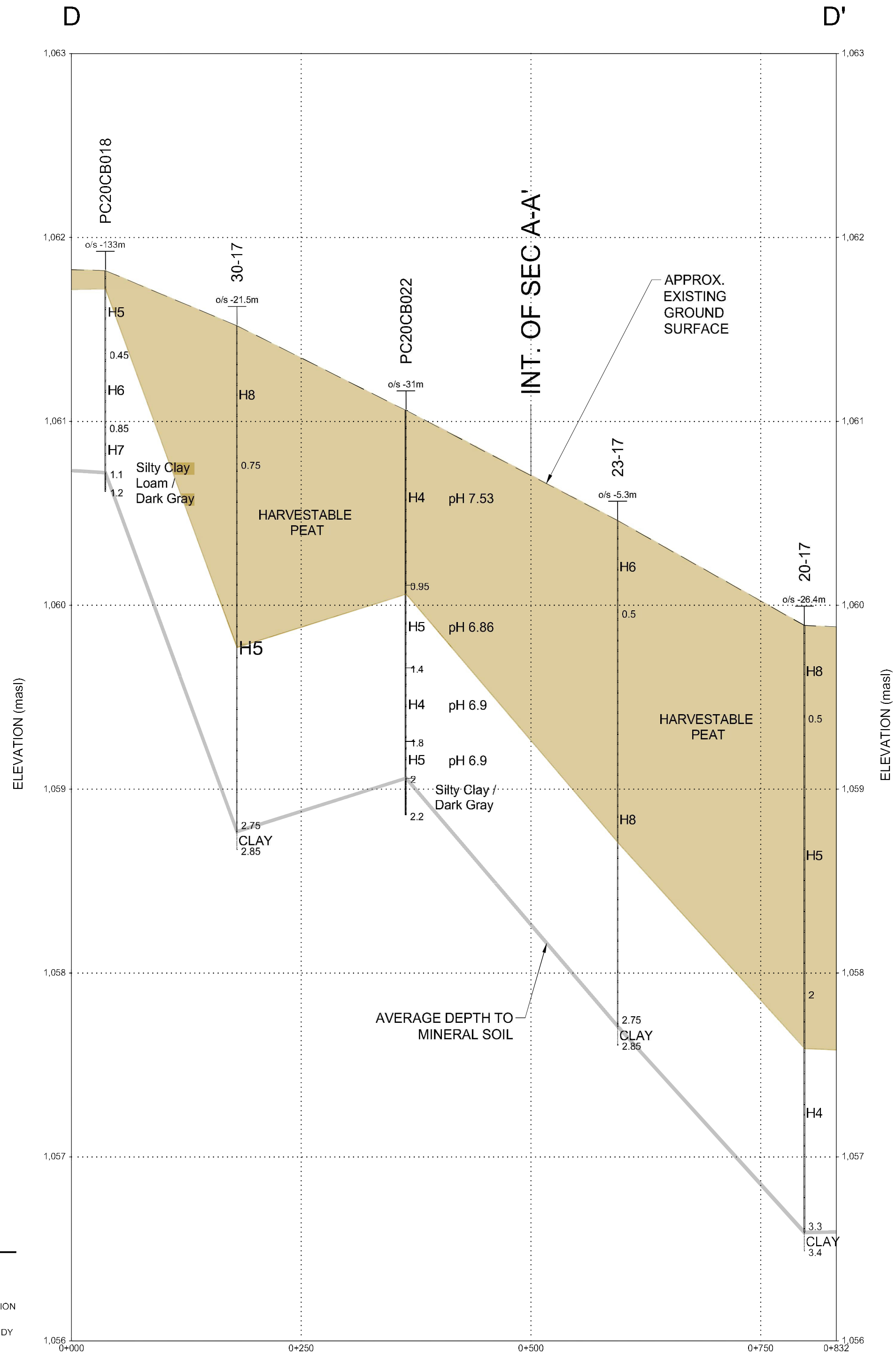
CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	JH
PREPARED	RFM
REVIEWED	CB
APPROVED	KH

TITLE
CROSS-SECTION C-C'

PROJECT NO.	CONTROL	REV.	FIGURE
21496738	1000-PT-0001	0	2.3-5c



LEGEND

HYDROLOGY STUDY DEPTH MARKER

APPROXIMATE WATER TABLE ELEVATION FROM HYDROLOGY STUDY

TOP OF PEAT FROM HYDROLOGY STUDY

-0.89% PERCENT WATER TABLE GRADE

PC20CB022 o/s -33m — SAMPLE ID, DISTANCE OFFSET FROM PROFILE LINE

H4 pH 7.53 — H VALUE / pH VALUE

DEPTH BELOW GROUND SURFACE

H5 pH 6.86

Silty Clay — SOIL TEXTURE

★ INDICATES DEPTH TO BOTTOM OF SAMPLE

VON POST

SCALE	DECOMPOSITION	PLANT STRUCTURE	LIQUID
H1	Undecomposed	Unaltered	Clear water (light yellow-brown)
H2	Almost undecomposed	Distinct	Clear water (light yellow-brown)
H3	Very weak	Distinct	Turbid (brown), no peat passes between fingers, mushy residue
H4	Weak	Distinct	Strongly turbid, peat substance between the fingers, residue very mushy
H5	Moderate	Clear, becoming indistinct	Turbid water (brown), some peat between fingers, residue vey mushy
H6	Strong	Somewhat indistinct, clearer in squeezed residue	1/3 peat escapes between fingers, residue strongly mushy
H7	Strong	Indistinct but recognizable	½ peat escapes between fingers
H8	Very strong	Very indistinct	2/3 peat escapes between fingers, remaining residue root fibers and wood
H9	Almost complete	Almost unrecognizable	almost all peat escapes between the fingers
H10	Complete	Unrecognizable	all the peat escapes between fingers

Canadian System of Soil Classification (1998)

NOTE(S)

1. FOR LOCATION OF CROSS-SECTION B-B, C-C' AND D-D", REFER TO FIGURE 2.3-5
2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT SAMPLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN THE BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN. FOR DETAILED STRATIGRAPHY OF EACH BOREHOLE LOCATION REFER TO THE RECORD OF SAMPLE SHEET
3. SAMPLE LOCATIONS ARE OFFSET FROM THE PLAN VIEW PROFILE LINE. ELEVATION OF THE GROUND SURFACE IS INTERPOLATED BETWEEN SAMPLE POINTS.
4. PTH = PREMIER TECH HORTICULTURE
5. SOME PROFILES APPEARS TO BE ABOVE OR BELOW THE GROUND SURFACE ON THE PEAT PROFILE. THIS IS BECAUSE THAT PROFILE DOES NOT FALL DIRECTLY ON THE TRANSECT LINE AND IS OFF SET (OS) BY A NUMBER OF METRES LISTED AT THE TOP OF THE PROFILE. ALL PROFILES INCLUDED ARE REPRESENTATIVE OF THE TRANSECT EVEN IF OFF SET FROM THE CROSS SECTION LOCATION.

REFERENCE(S)

DATA OBTAINED FROM PREMIER TECH 2010, PREMIER TECH 2018, GOLDER 2020, AND GOLDER 2021.

0 100 200
1:5,000 METRES
VERTICAL EXAGGERATION = 200X

CLIENT
PREMIER TECH HORTICULTURE

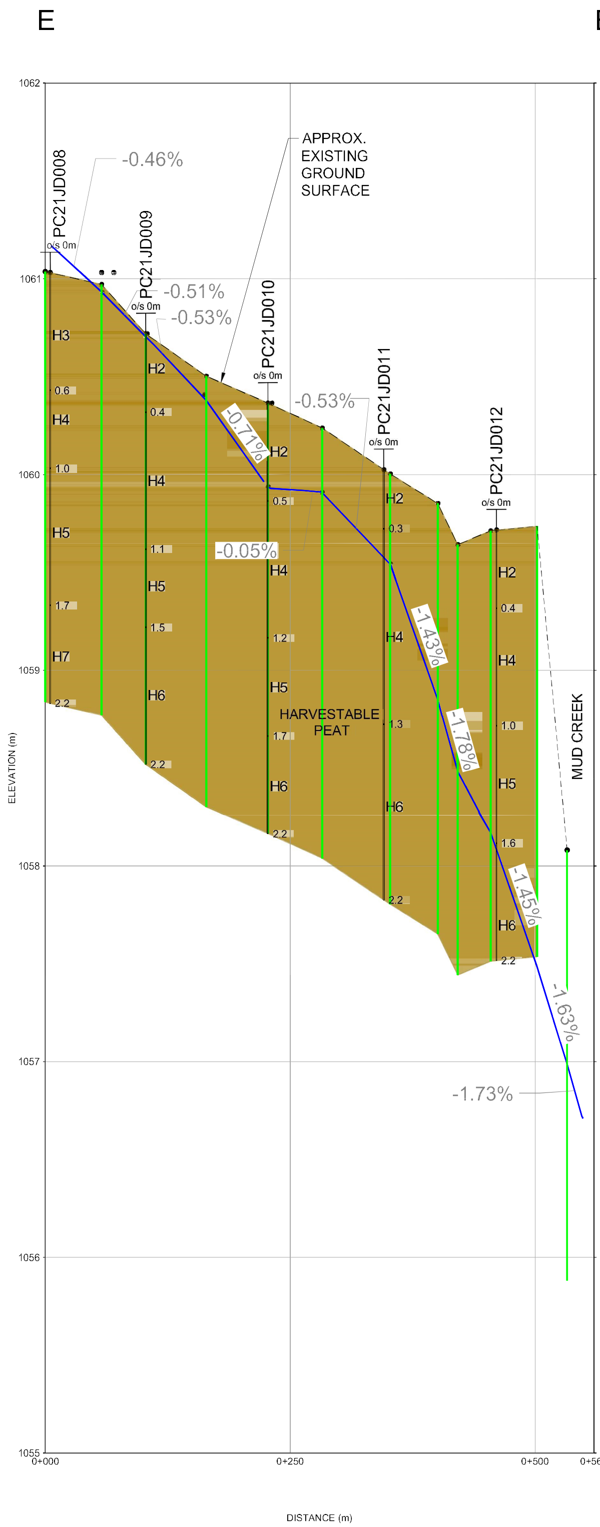
PROJECT
CLEARWATER PEAT HARVEST PROJECT

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	JH
PREPARED	RFM
REVIEWED	CB
APPROVED	KH

TITLE
CROSS-SECTION D-D'

PROJECT NO.	CONTROL	REV.	FIGURE
21496738	1000-PT-0001	0	2.3-5d



LEGEND

HYDROLOGY STUDY DEPTH MARKER

APPROXIMATE WATER TABLE ELEVATION FROM HYDROLOGY STUDY

TOP OF PEAT FROM HYDROLOGY STUDY

-0.89% PERCENT WATER TABLE GRADE

PC20CB022 o/s -33m — SAMPLE ID, DISTANCE OFFSET FROM PROFILE LINE

H4 pH 7.53 — H VALUE / pH VALUE

DEPTH BELOW GROUND SURFACE

H5 pH 6.86 Silty Clay — SOIL TEXTURE

★ INDICATES DEPTH TO BOTTOM OF SAMPLE

VON POST			
SCALE	**DECOMPOSITION**	**PLANT STRUCTURE**	**LIQUID**
H1	Undecomposed	Unaltered	Clear water (light yellow-brown)
H2	Almost undecomposed	Distinct	Clear water (light yellow-brown)
H3	Very weak	Distinct	Turbid (brown), no peat passes between fingers, mushy residue
H4	Weak	Distinct	Strongly turbid, peat substance between the fingers, residue very mushy
H5	Moderate	Clear, becoming indistinct	Turbid water (brown), some peat between fingers, residue vey mushy
H6	Strong	Somewhat indistinct, clearer in squeezed residue	1/3 peat escapes between fingers, residue strongly mushy
H7	Strong	Indistinct but recognizable	½ peat escapes between fingers
H8	Very strong	Very indistinct	2/3 peat escapes between fingers, remaining residue root fibers and wood
H9	Almost complete	Almost unrecognizable	almost all peat escapes between the fingers
H10	Complete	Unrecognizable	all the peat escapes between fingers
Canadian System of Soil Classification (1998)			

NOTE(S)

1. FOR LOCATION OF CROSS-SECTION B-B, C-C' AND D-D'', REFER TO FIGURE 2.3-5
2. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT SAMPLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN THE BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN. FOR DETAILED STRATIGRAPHY OF EACH BOREHOLE LOCATION REFER TO THE RECORD OF SAMPLE SHEET
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REFERENCE(S)

DATA OBTAINED FROM PREMIER TECH 2010, PREMIER TECH 2018, GOLDER 2020, AND GOLDER 2021.

0 100 200
1:5,000 METRES
VERTICAL EXAGGERATION = 200X

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

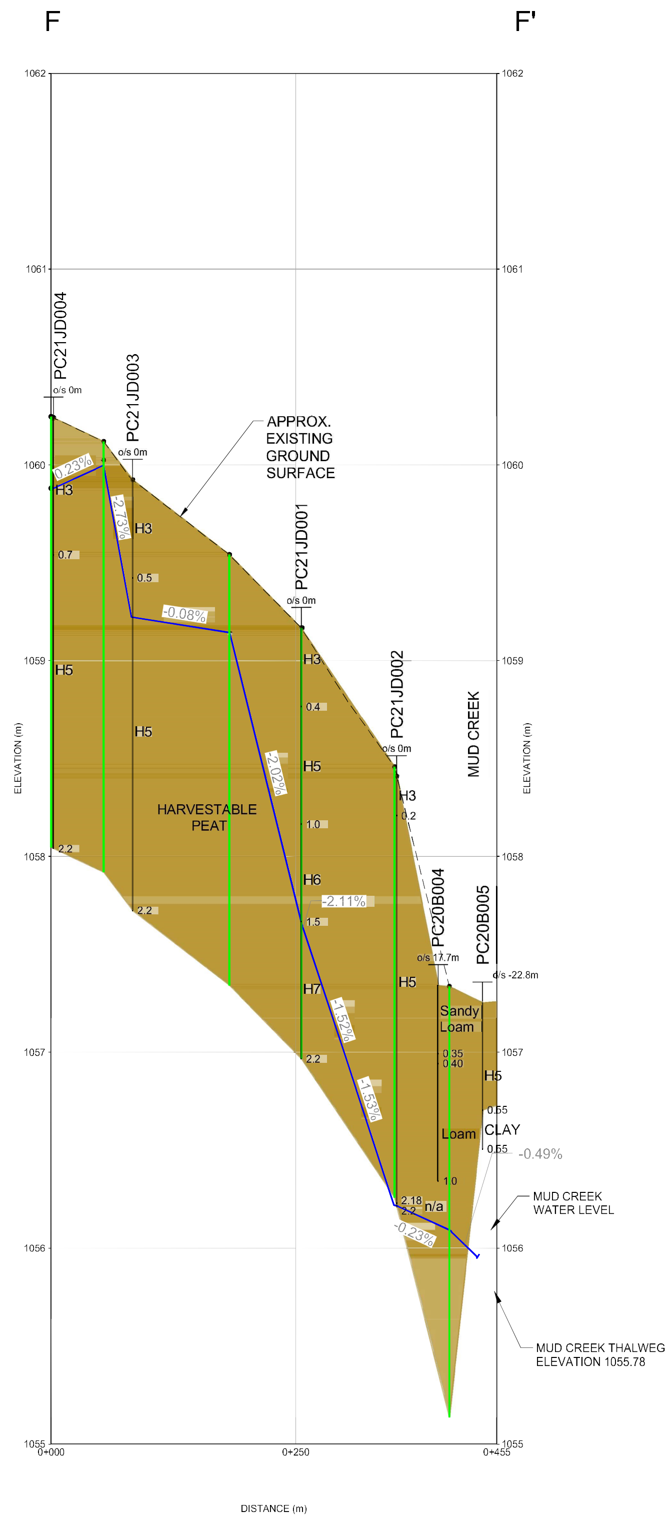
CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	JH
PREPARED	RFM
REVIEWED	CB
APPROVED	KH

TITLE
CROSS-SECTION E-E'

PROJECT NO.	CONTROL	REV.	FIGURE
21496738	1000-PT-0001	0	2.3-5e



LEGEND

- HYDROLOGY STUDY DEPTH MARKER
- APPROXIMATE WATER TABLE ELEVATION FROM HYDROLOGY STUDY
- TOP OF PEAT FROM HYDROLOGY STUDY
- -0.89% PERCENT WATER TABLE GRADE

PC20CB022 o/s -33m — SAMPLE ID, DISTANCE OFFSET FROM PROFILE LINE

H4 pH 7.53 — H VALUE / pH VALUE

DEPTH BELOW GROUND SURFACE

H5 pH 6.86 Silty Clay — SOIL TEXTURE

★ INDICATES DEPTH TO BOTTOM OF SAMPLE

VON POST			
SCALE	DECOMPOSITION	PLANT STRUCTURE	LIQUID
H1	Undecomposed	Unaltered	Clear water (light yellow-brown)
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H3	Very weak	Distinct	Turbid (brown), no peat passes between fingers, mushy residue
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H8	Very strong	Very indistinct	2/3 peat escapes between fingers, remaining residue root fibers and wood
H9	Almost complete	Almost unrecognizable	almost all peat escapes between the fingers
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Canadian System of Soil Classification (1998)

NOTE(S)

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REFERENCE(S)

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0 100 200
1:5,000 METRES
VERTICAL EXAGGERATION = 200X

CLIENT
PREMIER TECH HORTICULTURE

PROJECT
CLEARWATER PEAT HARVEST PROJECT

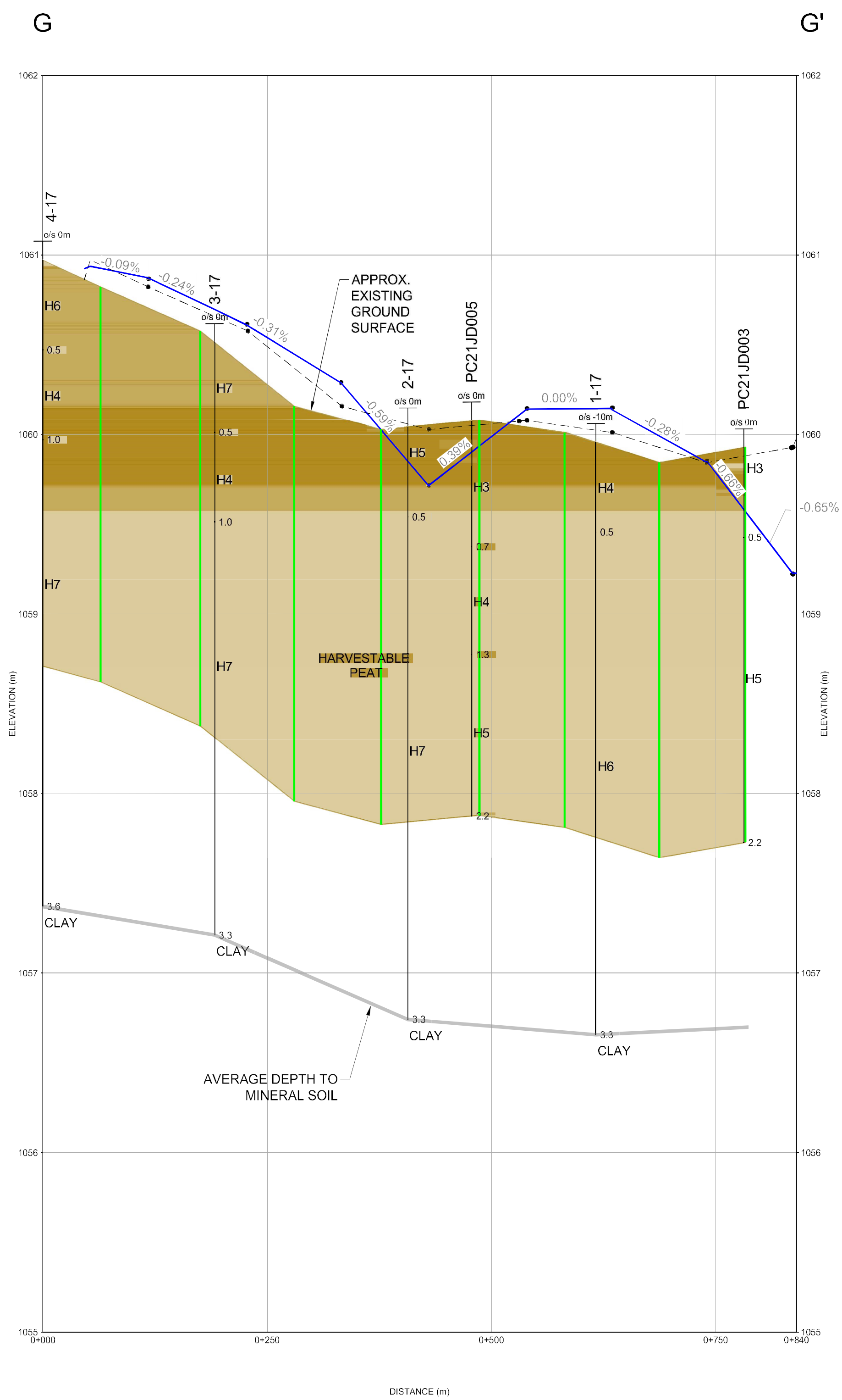
CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	JH
PREPARED	RFM
REVIEWED	CB
APPROVED	KH

TITLE
CROSS-SECTION F-F'

PROJECT NO.	CONTROL	REV.	FIGURE
21496738	1000-PT-0001	0	2.3-5f



LEGEND

HYDROLOGY STUDY DEPTH MARKER

APPROXIMATE WATER TABLE ELEVATION FROM HYDROLOGY STUDY

TOP OF PEAT FROM HYDROLOGY STUDY

-0.89% PERCENT WATER TABLE GRADE

PC20CB022 — SAMPLE ID

o/s -33m — DISTANCE OFFSET FROM PROFILE LINE

H4 pH 7.53 — H VALUE / pH VALUE

0.95 — DEPTH BELOW GROUND SURFACE

H5 pH 6.86

Silty Clay — SOIL TEXTURE

★ INDICATES DEPTH TO BOTTOM OF SAMPLE

VON POST

SCALE	DECOMPOSITION	PLANT STRUCTURE	LIQUID
H1	Undecomposed	Unaltered	Clear water (light yellow-brown)
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Canadian System of Soil Classification (1998)

NOTE(S)

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REFERENCE(S)

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0 100 200

1:5,000 METRES

VERTICAL EXAGGERATION = 200X

CLIENT

PREMIER TECH HORTICULTURE

PROJECT

CLEARWATER PEAT HARVEST PROJECT

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-28
DESIGNED	JH
PREPARED	RFM
REVIEWED	CB
APPROVED	KH

TITLE

CROSS-SECTION G-G'

PROJECT NO.	CONTROL	REV.	FIGURE
21496738	1000-PT-0001	0	2.3-5g

GOLDER
MEMBER OF WSP

golder.com