Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment #3)

CGL80373-JEG-ENV-RPT-0002

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Revision 0

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Jacobs

Executive Summary

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an amendment (Amendment #1) to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of the Project (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at:
https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR) amendment (Amendment #1) is located on the BC EAO website at:
https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:
https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Amendment Application outlines the rationale for the proposed Groundbirch Connector and provides a summary of relevant baseline information and an assessment of potential effects associated with the proposed Groundbirch Connector, where appropriate.

The proposed Groundbirch Connector will be developed and operated by TransCanada PipeLines Limited, an affiliate of TC Energy Corporation, on behalf of Coastal GasLink. The proposed Groundbirch Connector will be located in the Peace River Regional District (PRRD), approximately 40 kilometres (km) west of Dawson Creek, BC. The proposed Groundbirch Connector is located approximately 400 metres (m) east of the existing Certified Pipeline Corridor, on flat cultivated freehold lands.

The scope of the proposed Groundbirch Connector consists of the construction of approximately 3 km of 48-inch pipe and an in-line inspection launcher. The purpose of the proposed Groundbirch Connector will be to provide the Project with an additional source of natural gas in addition to the connections currently being planned by each of the LNG Canada partners. While the individual LNG Canada connections are expected to provide the bulk of the gas for the Project, the proposed Groundbirch Connector will have the capacity to provide sufficient gas from the NOVA Gas Transmission Ltd. (NGTL) System should there be an interruption in supply from these other connections (for example, during maintenance activities). The scope for this proposed Groundbirch Connector was not included in the original EAC Application because the state of upstream arrangements had not been finalized at that time. The proposed Groundbirch Connector begins at an NGTL meter station planned to be located at NW 34-78-19 W6M, and ends at the certified Wilde Lake Compressor Station, located at SW 33-78-19 W6M.

The process of selecting an appropriate pipeline route for the proposed Groundbirch Connector involved collaborating with experts from various disciplines, including land, environment, engineering, and construction, and included:

- Checking that the current routing was informed by consultation with landowners (carried out in 2015)
- Identifying the potential location of the proposed tie-ins
- Engaging Indigenous groups through sharing Project information, scheduling meetings to discuss any concerns or questions, and incorporating feedback into Project planning where possible
- Conducting engineering and environmental field and desktop investigations

This Amendment Application relies on the EAC Application to describe baseline conditions for the proposed Groundbirch Connector where they are comparable to the conditions for the Project. It was determined that the potential positive and negative, direct and indirect effects for the Project remain unchanged as a result of this Amendment Application. Table ES-1 summarizes the changes to effects on Valued Components (VCs), corresponding mitigation measures, and change to effects pathways and characterization of residual effects. The EAC Amendment Application for the proposed Groundbirch Connector amendment addresses all assessment matters in Section 25 of the BC EAA 2018 to the extent that these matters apply to the proposed amendment to the Project.

Table ES-1. Summary of Changes to Mitigation, Effects Pathways, and Characterization of Residual Effects

VC	Change to Mitigation	Change to Effects Pathways and Characterization of Residual Effects
Soil Capability	No change	No change
Terrain Integrity	No change	No change
Acid Rock Drainage (ARD)	No change	No change
Acoustic Environment	No change	No change
Air Quality	No change	No change
Greenhouse Gas (GHG) Emissions	No change	No change
Protection of Recreationally, Commercially and/or Culturally Important Fish and Fish Habitat	No change	No change
Species of Conservation Concern	No change	No change
Surface Water	No change	No change
Groundwater	No change	No change
Ecological Communities of Concern	No change	No change
Plant Species of Concern	No change	No change
Wetland Function	No change	No change
Wildlife and Wildlife Habitat	No change	No change
Economy	No change	No change
Employment and Labour Force	No change	No change
Current Use of Land and Resources	No change	No change
Domestic Water Supply	No change	No change
Community Utilities and Services	No change	No change

Table ES-1. Summary of Changes to Mitigation, Effects Pathways, and Characterization of Residual Effects

VC	Change to Mitigation	Change to Effects Pathways and Characterization of Residual Effects
Transportation Infrastructure and Services	No change	No change
Community Quality of Life	No change	No change
Current Use of Land and Resources for Traditional Purposes	No change	No change
Cultural Sites	No change	No change
Archaeological Sites	No change	No change
Historic Sites	No change	No change
Palaeontological Sites	No change	No change
Architectural Sites	No change	No change
Human Health	No change	No change
Ecological Health	No change	No change

The assessment of baseline conditions for all VCs concluded that the baseline conditions for the proposed Groundbirch Connector is comparable to the baseline conditions for the Certified Pipeline Corridor for the environmental, social, economic, heritage, and health setting. In addition, the assessment concluded that the potential residual adverse effects and cumulative adverse effects associated with the proposed Groundbirch Connector are comparable to the Certified Pipeline Corridor. In accordance with the BC EAA, this Amendment Application does not include significance determinations, as the BC EAO will complete an assessment report that includes significance conclusions. Similarly, a confidence rating for the significance determination is also not provided in this Amendment Application. Table ES-2 (the Table of Concordance) indicates where there are updates to information provided in sections of the EAC Application as a result of the proposed Groundbirch Connector. Table ES-3 summarizes the Section 25 required assessment matters included in the BC EAA and where they are addressed in this Amendment Application.

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
PART A – INTRODUCTION AND BACKGROUND	
1 – Proposed Project Overview	
1.1 – Proponent Description	No - there is no change to proponent description, as described in the EAC Application
1.2 – Proposed Project Description	Yes – see Section 1.1, Amendment Description
1.3 – Applicable Permits	No – there is no change to Applicable Permits, as described in the EAC Application
1.4 – Alternative Means of Conducting the Proposed Project	Yes – see Section 2, Alternative Means of Conducting the Project
1.5 – Project Benefits	No – there is no change to Project benefits, as described in the EAC Application
1.6 – Scope of the EA	No – there is no change to scope of the EA, as described in the EAC Application
1.7 – References	Yes - reference updates are included in Section 26, References

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
2 – Environmental Assessment Process	
2.1 – Provincial Environmental Assessment Process	Yes – see Section 1.2, Regulatory and Policy Setting
2.2 – Federal Involvement	No – there is no change to federal involvement, as described in the EAC Application
2.3 –Environmental Assessment Participants	No – there is no change to Environmental Assessment participants, as described in the EAC Application
2.3.1 – Working Group	No – there is no change to working group, as described in the EAC Application
2.3.2 – Aboriginal Groups	No – there is no change to Environmental Assessment process related to Aboriginal groups (now referred to as Indigenous groups), as described in the EAC Application
2.3.3 – Public	No – there is no change to Environmental Assessment process related to public, as described in the EAC Application
2.4 – References	Yes - reference updates are included in Section 26, References
PART B – ASSESSMENT OF POTENTIAL EFFECTS, MITIGATION, AND SIGNIFICANCE OF RESIDUAL EFFECTS	
3 – Effects Assessment Methods	
3.1 – VCs and Assessment Boundaries	No – there is no change to effects assessment methods related to VCs and assessment boundaries, as described in the EAC Application
3.2 – Baseline Information	No – there is no change to effects assessment methods related to baseline information, as described in the EAC Application
3.3 – Project Effects	No – there is no change to effects assessment methods related to Project effects, as described in the EAC Application
3.4 – Mitigation	No – there is no change to effects assessment methods related to mitigation, as described in the EAC Application
3.5 – Characterization of Potential Residual Adverse Effects	No – there is no change to effects assessment methods related to characterization of potential residual adverse effects, as described in the EAC Application
3.6 – Significance Determination	No longer included – in accordance with the BC EAA, this Amendment Application does not include significance determinations, as the BC EAO will complete an assessment report that includes significance conclusions; similarly, a confidence rating for the significance determination is also not provided in this Amendment Application
3.7 – Confidence	No longer included – in accordance with the BC EAA, this Amendment Application does not include significance determinations, as the BC EAO will complete an assessment report that includes significance conclusions; similarly, a confidence rating for the significance determination is also not provided in this Amendment Application
3.8 – Cumulative Adverse Effects	Yes – see Section 3.4, Cumulative Effects; a qualitative analysis was considered appropriate for the assessment of potential cumulative adverse effects, given the scope and context of the proposed Groundbirch Connector, and reasonably foreseeable future developments considered in the cumulative effects assessment for the proposed Groundbirch Connector are included in Table 3-3
3.9 – Characterization of Residual Cumulative Adverse Effects and Significance Determination	No - there is no change to effects assessment methods related to characterization of residual cumulative adverse effects, as described in the EAC Application; in accordance with the BC EAA, this Amendment Application does not include significance determinations, as the BC EAO will complete an assessment report that includes significance conclusions, and similarly, a confidence rating for the significance determination is also not provided in this Amendment Application
3.10 – References	Yes - reference updates are included in Section 26, References

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
4 – Environmental Effects Assessment (Overview)	
5 – Geophysical Environment	
5.1 – Selection of VCs and Key Indicators (KIs)	No – there is no change to selection of VCs and KIs, as described in the EAC Application
5.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
5.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
5.4 – Baseline Information and Proposed Project Setting	Yes – see Section 5.1, Baseline Information and the Groundbirch Connector Soils Technical Data Report (TDR) and Terrain TDR (Appendices A and B in this Amendment Application, respectively)
5.5 – Soil Capability Effects Assessment	No – there is no change to soil capability effects assessment, as described in the EAC Application (see Section 5.2 for rationale)
5.6 – Terrain Integrity Effects Assessment	No – there is no change to terrain integrity effects assessment, as described in the EAC Application (see Section 5.3 for rationale)
5.7 –ARD Effects Assessment	No – there is no change to ARD effects assessment, as described in the EAC Application (see Section 5.4 for rationale)
5.8 – References	Yes - reference updates are included in Section 26 (References) and Appendices A and B in this Amendment Application
6 – Atmospheric Environment	
6.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
6.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
6.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
6.4 – Baseline Information and Proposed Project Setting	Yes – see Section 6.1, Baseline Information and the Groundbirch Connector Atmospheric Environment Technical Memorandum (Appendix C in this Amendment Application)
6.5 – Acoustic Environment Effects Assessment	No – there is no change to acoustic environment effects assessment, as described in the EAC Application (see Section 6.2 for rationale)
6.6 – Air Quality Effects Assessment	No – there is no change to air quality effects assessment, as described in the EAC Application (see Section 6.3 for rationale)
6.7 – GHG Emissions Effects Assessment	No – there is no change to GHG emissions effects assessment as described in the EAC Application (see Section 6.4 for rationale)
6.8 – References	Yes - reference updates are included in Section 26 (References) and Appendix C in this Amendment Application
7 – Aquatic Environment	
7.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
7.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
7.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
7.4 – Baseline Information and Proposed Project Setting	Yes – see Section 7.1, Baseline Information and the Groundbirch Connector Fish Habitat Assessment Technical Memorandum (Appendix D), Hydrology Technical Memorandum (Appendix E), and Hydrogeology TDR (Appendix F) in this Amendment Application
7.5 – Protection of Recreationally, Commercially and/or Culturally Important Fish and Fish Habitat Effects Assessment	No – there is no change to protection of recreationally, commercially, and/or culturally important fish and fish habitat effects assessment as described in the EAC Application (see Section 7.2 for rationale)
7.6 – Species of Conservation Concern Effects Assessment	No – there is no change to species of conservation concern effects assessment as described in the EAC Application (see Section 7.3 for rationale)
7.7 – Surface Water Effects Assessment	No – there is no change to surface water effects assessment as described in the EAC Application (see Section 7.4 for rationale)
7.8 – Groundwater Effects Assessment	No – there is no change to groundwater effects assessment as described in the EAC Application (see Section 7.5 for rationale)
7.9 – References	Yes - reference updates are included in Section 26 (References) and Appendices D, E, and F in this Amendment Application
8 – Vegetation	
8.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
8.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
8.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
8.4 – Baseline Information and Proposed Project Setting	Yes – see Section 8.1, Baseline Information and Groundbirch Connector Vegetation TDR (Appendix G in this Amendment Application)
8.5 – Ecological Communities of Concern Effects Assessment	No – there is no change to ecological communities of concern effects assessment, as described in the EAC Application (see Section 8.2 for rationale)
8.6 – Plant Species of Concern Effects Assessment	No – there is no change to plant species of concern effects assessment, as described in the EAC Application (see Section 8.2 for rationale)
8.7 – References	Yes - reference updates are included in Section 26 (References) and Appendix G in this Amendment Application
9 – Wetlands	
9.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
9.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
9.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
9.4 – Baseline Information and Proposed Project Setting	Yes – see Section 9.1, Baseline Information and the Groundbirch Connector Wetlands TDR (Appendix H in this Amendment Application)
9.5 – Wetland Function Effects Assessment	No – there is no change to wetland function effects assessment, as described in the EAC Application (see Section 9.2 for rationale)

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
9.6 – References	Yes - reference updates are included in Section 26 (References) and Appendix H in this Amendment Application
10 – Wildlife and Wildlife Habitat	
10.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
10.2 – Regulatory and Policy Setting	Yes – see Section 10.1, Baseline Information
10.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
10.4 – Baseline Information and Proposed Project Setting	Yes – see Section 10.1 Baseline Information and the Groundbirch Connector Wildlife and Wildlife Habitat TDR (Appendix I in this Amendment Application)
10.5 – Potential Adverse Effects on Wildlife and Wildlife Habitat	No – see Section 10.2, Wildlife and Wildlife Habitat Effects Assessment for rationale
10.18 – References	Yes - reference updates are included in Section 26 (References) and Appendix I in this Amendment Application
11 – Economic Effects Assessment (Overview)	
12 – Economy	
12.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
12.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
12.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
12.4 – Baseline Information and Proposed Project Setting	No – there is no substantial change to Baseline Information and Proposed Project Setting as described in the EAC Application (see Section 11 and the Groundbirch Connector Social and Economic TDR (Appendix J in this Amendment Application) for rationale)
12.5 – Economy Effects Assessment	No – there is no change to economy effects assessment as described in the EAC Application (see Section 11 for rationale)
12.6 – Employment and Labour Force Effects Assessment	No – there is no change to employment and labour force effects assessment as described in the EAC Application (see Section 11 for rationale)
12.7 – References	Yes - reference updates are included in Appendix J in this Amendment Application
13 – Social Effects Assessment (Overview)	
14 – Land and Resource Use	
14.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
14.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
14.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
14.4 – Baseline Information and Proposed Project Setting	Yes – see Section 13.1, Baseline Information, and Appendix J in this Amendment Application

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
14.5 – Current Use of Land and Resources Effects Assessment	No – there is no change to current use of land and resources effects assessment as described in the EAC Application (see Section 13.2 for rationale)
14.6 – Domestic Water Supply Effects Assessment	No – there is no change to domestic water supply effects assessment as described in the EAC Application (see Section 13.2 for rationale)
14.7 – References	Yes - reference updates are included in Section 26 (References) and Appendix J in this Amendment Application
15 – Community and Regional Infrastructure and Services	
15.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
15.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
15.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
15.4 – Baseline Information and Proposed Project Setting	No – there is no substantial change to baseline information and proposed Groundbirch Connector setting, as described in the EAC Application (see Section 14 and the Groundbirch Connector Social and Economic TDR [Appendix J in this Amendment Application] for rationale)
15.5 – Community Utilities and Services Effects Assessment	No – there is no change to community utilities and services effects assessment, as described in the EAC Application (see Section 14 for rationale)
15.6 – Transportation Infrastructure and Services Effects Assessment	No – there is no change to transportation infrastructure and services effects assessment, as described in the EAC Application (see Section 14 for rationale)
15.7 – Community Quality of Life Effects Assessment	No – there is no change to community quality of life effects assessment, as described in the EAC Application (see Section 14 for rationale)
15.8 – References	Yes - reference updates are included in Appendix J in this Amendment Application
16 – Traditional Land and Resource Use	
16.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
16.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
16.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
16.4 – Spatial Boundaries	No – there is no change to spatial boundaries, as described in the EAC Application
16.5 – Baseline Information and Proposed Project Setting	Yes – see Section 15.1, Baseline Information
16.6 – Current Use of Land and Resources for Traditional Purposes Effects Assessment	No – there is no change to current use of land and resources for traditional purposes effects assessment, as described in the EAC Application (see Section 15.2 for rationale)
16.7 – Cultural Sites Effects Assessment	No – there is no change to cultural sites effects assessment, as described in the EAC Application (see Section 15.3 for rationale)
16.8 – References	Yes - reference updates are included in Section 26, References

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
17 – Heritage Effects Assessment (Overview)	
18 – Heritage Resources	
18.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
18.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
18.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
18.4 – Baseline Information and Proposed Project Setting	Yes – see Section 17.1, Baseline Information
18.5 – Methods	No – there is no change to methods, as described in the EAC Application
18.6 – Archaeological Sites Effects Assessment	No – there is no change to Archaeological Sites Effects Assessment, as described in the EAC Application (see Section 17.2 for rationale)
18.7 – Historic Sites Effects Assessment	No – there is no change to historic sites effects assessment, as described in the EAC Application (see Section 17.3 for rationale)
18.8 – Palaeontological Sites Effects Assessment	No – there is no change to palaeontological sites effects assessment, as described in the EAC Application see Section 17.4 for rationale)
18.9 – Architectural Sites Effects Assessment	No – there is no change to Architectural Sites Effects Assessment, as described in the EAC Application (see Section 17.5 for rationale)
18.10 – References	Yes - reference updates are included in Section 26, References
19 – Health Effects Assessment (Overview)	
20 – Human and Ecological Health	
20.1 – Selection of VCs and KIs	No – there is no change to selection of VCs and KIs, as described in the EAC Application
20.2 – Regulatory and Policy Setting	No – there is no change to regulatory and policy setting, as described in the EAC Application
20.3 – Assessment Boundaries	No – there is no change to assessment boundaries, as described in the EAC Application
20.4 – Baseline Information and Proposed Project Setting	Yes – see Section 19.1, Baseline Information
20.5 – Human Health Effects Assessment	No – there is no change to human health effects assessment, as described in the EAC Application (see Section 19.2 for rationale)
20.6 – Ecological Health Effects Assessment	No – there is no change to ecological health effects assessment, as described in the EAC Application (see Section 19.3 for rationale)
20.7 – References	Yes - reference updates are included in Section 26, References
21 – Accidents or Malfunctions	**No – there is no change to accidents or malfunctions as described in the EAC Application**
22 – Effects of the Environment on the Proposed Project	**No – there is no change to effects of the environment on the proposed Groundbirch Connector as described in the EAC Application**

Table ES-2. Table of Concordance with the Environmental Assessment Certificate Application for the Project

Sections in the EAC Application	Update Required in Amendment Application (Yes/No)
23 – Indigenous Consultation	**Yes – see Section 20, Indigenous Groups Information Requirements; only information related to Indigenous groups whose traditional territory or interests are potentially affected by the proposed Groundbirch Connector is included in this Amendment Application**
24 – Public Consultation	**Yes – see Section 21, Public Consultation; consultation specific to the proposed Groundbirch Connector is included in this Amendment Application**
25 – Construction and Operational Environmental Management Plans (EMPs) and Follow-up Programs	**No – there is no change to construction and operational EMPs and follow-up programs as described in the EAC Application; all issues concerning the EMPs were resolved to the satisfaction of the BC EAO and the management plans requiring approval have now been approved**
26 – Conclusions	**Yes – conclusions pertaining to the proposed Groundbirch Connector are included in Section 25**

Table ES-3. Concordance with Section 25 of the British Columbia *Environmental Assessment Act*

Section 25 of the BC EAA Required Assessment Matter	Included in Project Application Information Requirements (AIRs)?	Included in Amendment Application?	Amendment Application Section	Rationale
1 The effects of a Project on Indigenous groups and rights recognized and affirmed by section 35 of the *Constitution Act, 1982* must be assessed in every assessment	Yes	Yes	20	It is understood that the Amendment Application is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(a) Positive and negative direct and indirect effects of the reviewable project, including environmental, economic, social, cultural and health effects and adverse cumulative effects	Yes	Yes	4 to 24	Sections 4 to 24 of this Amendment Application include effects assessment summaries for each VC. To avoid repetition, effects of the Project are not repeated in this Amendment Application and cross references to the EAC Application are provided instead. Direct adverse effects (or negative direct and indirect effects) were assessed in sections 4 through 24 of the EAC Application. Project benefits (or positive direct and indirect effects) were described in Section 1.5 of the EAC Application. Spatial boundaries for the Project were developed to identify potential direct and indirect effect pathways within the zones of influence for the Project and reasonably foreseeable future projects. A summary of how positive and negative direct and indirect effects were considered in the proposed Groundbirch Connector Application for each KI can be found in the following sections of this EAC Amendment Application: • Soils Capability: Section 5.2 • Terrain Integrity: Section 5.3 • ARD: Section 5.4 • Acoustic Environment: Section 6.2 • Air Quality: Section 6.3 • GHG Emissions: 6.4 • Fish and Fish Habitat: Section 7.2 • Surface Water: Section 7.3 • Groundwater: Section 7.4 • Vegetation: Section 8.2 • Wetland Function: Section 9.2 • Wildlife and Wildlife Habitat: Section 10.2 • Economic: Section 11 and Section 24.4.1 • Social: Sections 13 to 15 and Section 24.4.1 • Current Use of Land and Resources: Section 13.2 • Domestic Water Supply: Section 13.3 • Current Use of Land and Resources for Traditional Purposes: Section 15.2 • Cultural Sites: Section 15.3 • Archaeological Sites: Section 17.2 • Historic Sites: Section 17.3 • Palaeontological Sites: Section 17.4 • Architectural Sites: Section 17.5 • Human Health: Section 19.2 • Ecological Health: Section 19.3 • Indigenous Group Effects Assessment: Section 20.2 • Disproportionate Effects on Distinct Human Populations: No potential effects identified (see Section 22) • Biophysical Factors that Support Ecosystem Function: Section 23.2 • Effects on Current and Future Generations: Section 24.5

Table ES-3. Concordance with Section 25 of the British Columbia *Environmental Assessment Act*

Section 25 of the BC EAA Required Assessment Matter	Included in Project Application Information Requirements (AIRs)?	Included in Amendment Application?	Amendment Application Section	Rationale
2(b) Risks and uncertainties associated with those effects, including the results of any interaction between effects	Yes	No	Not assessed (see Rationale)	Subsection 3.10 of the AIR indicates that additional risk analysis may be required to fully characterize the potential risk associated with uncertain outcomes, where there is a high degree of uncertainty with the possibility of a substantial adverse effect, and follow-up programs are not considered sufficient to manage the potential risk. In the assessment of potential adverse effects of the Project, including proposed amendments, no situations like this arose. Therefore, the assessments do not contain additional information on risk. As described in Section 3 (Assessment Method) of the EAC Application, the probability of occurrence was included in the characterization residual effects.
2(c) Risks of malfunctions or accidents	Yes	No	No	The proposed amendment is not expected to have any new risks of malfunctions or accidents that have not been identified and assessed in the EAC Application. It is understood that the Amendment Application is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(d) Disproportionate effects on distinct human populations, including populations identified by gender	No	Yes	22	New required assessment matter not included under the previous BC EAA. It is understood that the proposed amendment is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(e) Effects on biophysical factors that support ecosystem function	No	Yes	23	New required assessment matter not included under the previous BC EAA. It is understood that the proposed amendment is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(f) Effects on current and future generations	No	Yes	24	New required assessment matter not included under the previous BC EAA. It is understood that the Amendment Application is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(g) Consistency with any land use plan of the government or an Indigenous group if the plan is relevant to the assessment and to any assessment conducted under sections 35 or 73	Yes	Yes	13	It is understood that the Amendment Application is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(h) GHG emissions, including the potential effects on the province being able to meet its targets under the *GHG Reduction Targets Act*	Yes	Yes	6	An assessment of GHG was previously required under the AIR. An assessment of the potential effects on the Province's ability to meet its targets under the *GHG Reduction Targets Act* is a new requirement since the AIR was developed and is included in Section 6. It is understood that the Amendment Application is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(i) Alternative means of carrying out the project that are technically and economically feasible, including through the use of the best available technologies, and the potential effects, risks, and uncertainties of those alternatives	Yes	Yes	2	It is understood that the Amendment Application is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(j) Potential changes to the reviewable project that may be caused by the environment	Yes	No	No	The proposed amendment is not expected to have any new potential effects from the environment that have not been identified and assessed in the EAC Application. It is understood that the Amendment Application is only required to address these matters as they apply to the proposed amendment and not the Certified Project.
2(k) Other prescribed matters	No	No	No	There were no other prescribed matters in the Project AIR.

Contents

Appendices

Tables

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Acronyms and Abbreviations

AIA	Archaeological Impact Assessment
AIR	Application Information Requirements
ALC	Agricultural Land Commission
ALCA	*Agricultural Land Commission Act*
ALR	Agricultural Land Reserve
Amendment Application	Environmental Assessment Certificate Amendment Application (for the proposed Coastal GasLink Groundbirch Connector)
ARD	acid rock drainage
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC MFLNRORD	British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development
BC MTI	British Columbia Ministry of Transportation and Infrastructure
BC OGC	British Columbia Oil and Gas Commission
BWBSmw	Boreal White and Black Spruce subzone
CAC	criteria air contaminant
CAO	Chief Administrative Officer
Coastal GasLink	Coastal GasLink Pipeline Ltd.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
dBA	A-weighted decibels
EAA	*Environmental Assessment Act*
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
EMP	Environmental Management Plan
GHG	greenhouse gas
ha	hectare(s)
HCA	*Heritage Conservation Act*
KI	Key Indicator
km	kilometre(s)
KP	Kilometre Post (used along the Certified Pipeline Corridor)
L_{dn}	day-night sound level
LRMP	Land and Resource Management Plan
LSA	Local Study Area
m	metre(s)
mm	millimetre(s)
N/A	not assessed

No.	Number
OCP	Official Community Plan
OGMA	Old-Growth Management Area
PRRD	Peace River Regional District
RSA	Regional Study Area
SARA	*Species at Risk Act*
SEEMP	Socio-economic Effects Management Plan
SHAR	South of Houston Alternate Route
SMU	soil map unit
TDR	Technical Data Report
the Project	the Coastal GasLink Pipeline Project
TLRU	Traditional Land and Resource Use
TLU	Traditional Land Use
VC	Valued Component
WMU	Wildlife Management Unit

1. Introduction

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at:
https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Amendment Application outlines the rationale for the proposed Groundbirch Connector and provides a summary of relevant baseline information and an assessment of potential effects associated with the proposed Groundbirch Connector, where appropriate.

1.1 Amendment Description

The Project involves the construction and operation of an approximately 670-kilometre (km) 48-inch (nominal pipe size 48) (1,219-millimetre [mm])-diameter natural gas transmission pipeline from an area near the community of Groundbirch (approximately 40 km west of the City of Dawson Creek, BC) to the certified LNG Canada export facility in the District of Kitimat, BC.

The proposed Groundbirch Connector is located in the Peace River Regional District (PRRD), approximately 400 m east of the existing Certified Pipeline Corridor, on flat cultivated freehold lands. Reference points along the existing Certified Pipeline Corridor are referred to as Environmental Assessment Kilometre Posts (KPs). KPs along the proposed Groundbirch Connector are referred to as Groundbirch KPs. The proposed Groundbirch Connector consists of approximately 3 km of connecting pipeline that begins at an NGTL meter station located at NW 34-78-19 W6M and ends at the certified Wilde Lake Compressor Station, located at SW 33-78-19 W6M. The proposed Groundbirch Connector also includes the installation of associated aboveground facilities, including pigging stations that would be located within the designated pipeline right-of-way and cathodic protection measures to protect the pipeline.

An overview map of the proposed Groundbirch Connector is provided on Figure 1-1.

The Groundbirch Connector will be constructed in compliance with the EAC #E14-03 and the Project's Environmental Management Plan (EMP) and associated resource management and contingency plans, programs and reports pending regulatory approval.

Coastal GasLink has identified the following changes to the EAC #E14-03:

- This Amendment Application seeks approval for an Application Corridor associated with the proposed Groundbirch Connector

There is no change to the Applicable Permits required, compared to those described in the EAC Application.

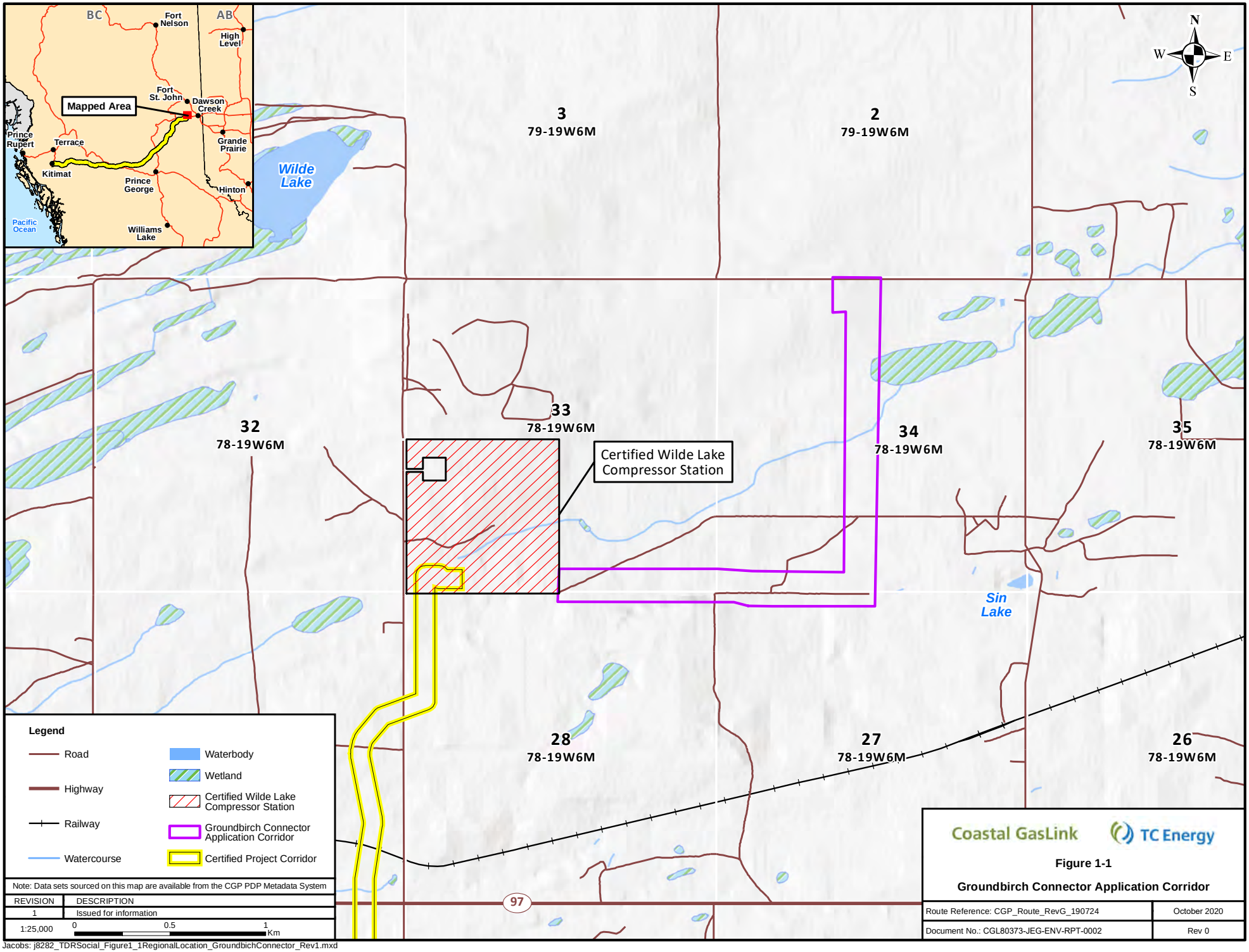
1.2 Regulatory and Policy Setting

A revitalized BC EAA received royal assent in November 2018 and came into force on December 19, 2019. Section 25 of the BC EAA defines assessment matters that must be considered, and some of these are new and were not previously considered. This Amendment Application for the proposed Groundbirch Connector amendment addresses all assessment matters in Section 25 of the Act, to the extent that these matters apply to the proposed amendment to the Project.

Section 25 of the Act lists required assessment matters that must be considered in every assessment. Table ES-3 summarizes the Section 25 required assessment matters included in the Act and where they are addressed in this Amendment Application. Most of the Section 25 required assessment matters under the 2018 BC EAA are consistent with the original Project Application Information Requirements (AIRs) and the scope of the Project EAC Application. The Section 25 required assessment matters that were not directly assessed in the Project EAC Application include:

- Disproportionate effects on distinct human populations, including populations identified by gender
- Effects on biophysical factors that support ecosystem function
- Effects on current and future generations

This Amendment Application addresses these three additional Section 25 required assessment matters. The assessment approach for each of the three topics is included in sections 22 to 24.



Jacobs: j8282_TDRSocial_Figure1_1RegionalLocation_GroundbichConnector_Rev1.mxd

2. Alternative Means of Conducting the Project

Alternative means are the various ways that are technically and economically practical to implement and carry out the Project. Coastal GasLink considered alternative means through the routing and siting process. Coastal GasLink has conducted a pipeline route identification, analysis, and evaluation process for the Project that resulted in iteratively considering environmental constraints and feedback from relevant regulatory agencies, stakeholders, and Indigenous groups, and eventually led to the development of the Certified Pipeline Corridor. A full description of the pipeline route selection process for the Project is contained in Section 1.4 of the EAC Application.

The process of selecting an appropriate pipeline route for the Groundbirch Connector amendment involved collaborating with experts from various disciplines, including land, environment, engineering, and construction. The route selection process involved:

- Checking that the route was informed by consultation with landowners (carried out in 2015)
- Identifying the potential location of the proposed tie-ins
- Engaging Indigenous groups through sharing Project information, scheduling meetings to discuss any concerns or questions, and incorporating feedback into Project planning where possible
- Conducting engineering and environmental field and desktop investigations

The proposed Groundbirch Connector amendment route is the most feasible in terms of environmental, social, heritage, and cultural impacts, as it is sited on cultivated freehold lands. The proposed route was developed in consultation with existing landowners. Coastal GasLink believes this route to be the most technically and environmentally sound option, and therefore, did not propose additional route alternatives for this Amendment Application.

3. Effects Assessment Methods

The methodology applied to the effects assessment in this Amendment Application is consistent with the methodology applied in the EAC Application. This Amendment Application considers the five interconnected and interdependent pillars within the effects assessment: environment, economy, social, heritage, and health.

This Amendment Application relies on the EAC Application to describe baseline conditions for the proposed Groundbirch Connector where they are comparable to the conditions for the Certified Pipeline Corridor. A description of baseline conditions for the proposed Groundbirch Connector is provided where they differ from the conditions described for the Project in the EAC Application. This Amendment Application also relies on the assessment of Valued Components (VCs) in the EAC Application, consistent with the AIR for the Project (BC EAO 2013), where the potential residual adverse effects are comparable to those predicted in the EAC Application for the Project. An effects assessment of VCs was completed when potential adverse effects could be different as a result of a change in baseline conditions or a change in interactions of proposed activities for the proposed Groundbirch Connector. Potential residual adverse effects that are unchanged, after applying approved mitigation, are not reassessed in this Amendment Application.

As described in Section 1.2, this Amendment Application addresses the following three additional assessment matters required under Section 25 of the 2018 Act:

- Disproportionate effects on distinct human populations, including populations identified by gender
- Effects on biophysical factors that support ecosystem function
- Effects on current and future generations

The assessment approach for each of the three topics is included in sections 22 to 24.

3.1 Identification of Potential Interactions with Valued Components

Table 3-1 provides a description of the potential for interactions of the proposed Groundbirch Connector during construction, operations, and decommissioning and abandonment with the VCs identified in the EAC Application and outlines change to mitigation or potential adverse effects described in the EAC Application. Potential interactions with Indigenous interests are provided in Section 20. Required assessment matters under Section 25 of the 2018 BC EAA are addressed in sections 22 to 24 of this Amendment Application.

Table 3-1. Potential Interactions of the Proposed Groundbirch Connector with Identified Valued Components

Pillar	Topic	VC	Interaction with Project Activity			Change to Mitigation or Potential Adverse Effects Described in the EAC Application
			Construction[a]	Operations[b]	Decommissioning and Abandonment[c]	
Environmental	Geophysical Environment	Soil Capability	Yes	Yes	Yes	No change
		Terrain Integrity	Yes	No	Yes	No change
		Acid Rock Drainage (ARD)	No	No	No	No change
	Atmospheric Environment	Acoustic Environment	Yes	No	Yes	No change
		Air Quality	Yes	No	Yes	No change
		Greenhouse Gas (GHG) Emissions	Yes	No	Yes	No change
	Aquatic Environment	Protection of Recreationally, Commercially and/or Culturally Important Fish and Fish Habitat	No	No	No	No change
		Species of Conservation Concern	No	No	No	No change
		Surface Water	No	No	No	No change
		Groundwater	Yes	Yes	Yes	No change
	Vegetation	Ecological Communities of Concern	Yes	No	Yes	No change
		Plant Species of Concern	No	No	No	No change
	Wetlands	Wetland Function	Yes	Yes	Yes	No change
	Wildlife	Wildlife and Wildlife Habitat	Yes	Yes	Yes	No change
Economic	Employment and Economy	Economy	Yes	Yes	Not assessed (N/A)[d]	No change
		Employment and Labour Force	Yes	Yes	N/A[d]	No change

Table 3-1. Potential Interactions of the Proposed Groundbirch Connector with Identified Valued Components

Pillar	Topic	VC	Interaction with Project Activity			Change to Mitigation or Potential Adverse Effects Described in the EAC Application
			Construction[a]	Operations[b]	Decommissioning and Abandonment[c]	
Social	Land and Resource Use	Current Use of Land and Resources	Yes	Yes	N/A[d]	No change
		Domestic Water Supply	Yes	Yes	N/A[d]	No change
	Community and Regional Infrastructure and Services	Community Utilities and Services	Yes	Yes	N/A[d]	No change
		Transportation Infrastructure and Services	Yes	Yes	N/A[d]	No change
		Community Quality of Life	Yes	Yes	N/A[d]	No change
	Traditional Land and Resource Use (TLRU)	Current Use of Land and Resources for Traditional Purposes	No	No	N/A[d]	No change
		Cultural Sites	Yes	Yes	N/A[d]	No change
Heritage	Heritage Resources	Archaeological Sites	Yes	No	No	No change
		Historic Sites	Yes	No	No	No change
		Palaeontological Sites	Yes	No	No	No change
		Architectural Sites	Yes	No	No	No change
Health	Human and Ecological Health	Human Health	Yes	Yes	Yes	No change
		Ecological Health	Yes	Yes	Yes	No change

[a] Activities during construction include construction surveys, clearing, grading, stringing and welding, trenching, backfilling, testing, cleanup, and postconstruction reclamation as well as watercourse crossings.

[b] Activities during operations include aerial patrols, vegetation management, and integrity digs.

[c] Activities during decommissioning and abandonment may include dismantling proposed Groundbirch Connector infrastructure and reclamation.

[d] It is difficult to predict when or how the Project will be decommissioned and abandoned, or to predict the social or economic conditions at that time. As a result, the EAC Application and this Amendment Application do not include consideration of potential adverse effects associated with decommissioning and abandonment.

3.2 Spatial Boundaries

This Amendment Application applies the same VC-specific methods for identifying the Project Footprint, Local Study Areas (LSAs), and Regional Study Areas (RSAs) as described in Section 3 of the EAC Application. The proposed Groundbirch Connector Footprint is the 100-m-wide band centred on the proposed Groundbirch Connector centreline.

3.3 Characterization of Potential Residual Effects

The assessment of potential residual effects of the proposed Groundbirch Connector determined whether or not there is a material change from the assessment of potential residual effects predicted in the EAC Application for the construction, operations, and decommissioning and abandonment phases. Material change is defined as a change in the characterization of residual effects for a particular VC, using the same assessment criteria that were applied in the EAC Application.

Table 3-2 summarizes the assessment criteria used in the EAC Application to characterize potential residual effects. The effects assessment in this Amendment Application is consistent with the methodology applied in the EAC Application. In accordance with the BC EAA, this Amendment Application does not include significance determinations, as the BC EAO will complete an assessment report that includes significance conclusions. Similarly, a confidence rating for the significance determination is also not provided in this Amendment Application.

Table 3-2. Characterizing Residual Adverse Effects – Assessment Criteria

Assessment Criteria		Definition
Spatial Boundary (that is, the Location of Residual Adverse Effect)		
Project Footprint		The land area directly disturbed by Project construction and cleanup activities, including associated physical works and activities (for example, permanent right-of-way, temporary construction camps, and temporary workspaces for construction)
LSA		An LSA that varies with the VC being considered. The LSA is based on the zone of influence, within which plants, animals, and humans are most likely to be affected by Project construction and operations
RSA		An RSA consists of the area extending beyond the LSA boundary and varies with the VC being considered. For each VC considered, a separate RSA boundary is established in consideration of the Project regional adverse effects on the individual VC
Provincial		The area extending beyond regional or administrative boundaries
National		The area extending beyond BC but confined to Canada
International		The area extending beyond Canada
Temporal Context		
Duration (that is, the period of the event causing the effect)	Immediate	The event is limited to less than or equal to 2 days, during either the construction phase or operations phase
	Short-term	The event occurs during the construction phase or is completed within any 1 year during the operations phase
	Long-term	Ongoing event that is initiated during the construction phase and extends beyond the first year of the operations phase or is initiated during the operations phase and extends for the life of the Project
Frequency (that is, how often would the event that caused the effect occur)	Accidental	Occurs rarely over assessment period
	Isolated	Confined to specified phase of the assessment period

Table 3-2. Characterizing Residual Adverse Effects – Assessment Criteria

Assessment Criteria		Definition
Frequency (that is, how often would the event that caused the effect occur) (cont'd)	Occasional	Occurs intermittently and sporadically over assessment period
	Periodic	Occurs intermittently but repeatedly over the assessment period
	Continuous	Occurs continually over the assessment period
Reversibility - Environmental (that is, the period of time over which the residual adverse effect extends)	Immediate	Residual adverse effect is alleviated in less than or equal to 2 days
	Short-term	Greater than 2 days and less than or equal to 1 year to reverse residual adverse effect
	Medium-term	Greater than 1 year and less than or equal to 10 years to reverse residual adverse effect
	Long-term	Greater than 10 years to reverse residual adverse effect
	Permanent	Residual adverse effect is irreversible
Reversibility – Social, Economic, Heritage and Health (that is, the period of time over which the residual adverse effect extends)	Short-term	Residual adverse effect is limited to the construction phase or to less than any 1 year during the operations phase
	Medium-term	Residual adverse effect extends into the first 2 years of the operations phase
	Long-term	Residual adverse effect extends throughout the remainder of the operations phase
	Permanent	Residual adverse effect is irreversible
Magnitude of the Residual Adverse Effect (that is, the Environment Pillar)		
Negligible		Residual adverse effect is not detectable
Low		Residual adverse effect is detectable, but well within environmental and/or regulatory standards
Medium		Residual adverse effect is detectable and may approach, but are still within the environmental and/or regulatory standards
High		Residual adverse effect is beyond environmental and/or regulatory standards
Magnitude of the Residual Adverse Effect (that is, the Social, Economic, Heritage, and Health Pillars)		
Negligible		No detectable change to the VC from existing (that is, baseline) conditions
Low		Change in the VC is detectable, but has no effect on the social, economic, heritage, or health environment beyond that of an inconvenience or nuisance value
Medium		Change in the VC is detectable and results in moderate modification in the social, economic, heritage, or health environment
High		Change in the VC is large enough to result in a severe modification in the social, economic, heritage, or health environment
Likelihood of the Residual Adverse Effect		
High		Likely
Low		Unlikely

Note:

The assessment period for the effects assessment includes planning, construction, operations, and decommissioning and abandonment phases for the Project. In addition to the phases included in the assessment period of the effects assessment, the assessment period for the cumulative effects assessment includes the planning, construction, and operations phases of activities or projects that have previously occurred and those that are planned (that is, publicly disclosed).

3.4 Cumulative Effects

The cumulative effects assessment evaluates the potential residual adverse effects associated with the Project in combination with potential adverse effects arising from other projects and activities that have been or will be carried out in a VC-specific LSA or RSA. Future projects considered in the assessment do not include proposed or hypothetical projects where formal plans have not been publicly disclosed, as described in the AIR for the Project.

A qualitative analysis was considered appropriate for the assessment of potential cumulative adverse effects, given the scope and context of the proposed Groundbirch Connector.

The inclusion list of reasonably foreseeable projects considered for the cumulative effects assessment in the EAC Application (Appendix 3A) was considered for this Amendment Application and updated to include additional developments that overlap with the largest VC-specific RSA boundary (that is, the Community and Regional Infrastructure RSA Boundary, which is an 80-km band centred on the proposed Groundbirch Connector centreline). Table 3-3 summarizes the reasonably foreseeable future developments considered in the cumulative effects assessment for the proposed Groundbirch Connector.

Table 3-3. Reasonably Foreseeable Future Developments Considered for Cumulative Effects Assessment

Disturbance	Developer	Universal Transverse Mercator Coordinates or Legal Land Locations
Pipeline	NOVA Gas Transmission Ltd.	Groundbirch Mainline Loop (Saturn Section): • Start: 620400E 6202469N Zone 10 • End: 633864E 6188295N Zone 10
Pipeline	NOVA Gas Transmission Ltd.	Groundbirch Mainline Loop (Sunrise Section): • Start: 620400E 6202469N Zone 10 • End: 633864E 6188295N Zone 10
Pipeline	TransCanada PipeLines Limited	Coastal GasLink Pipeline Project: • Start: 632120E 6185441N Zone 10 • End: 520973E 5986596 Zone 9
Pipeline	Shell Canada Limited	Gathering pipeline connected to the certified Wilde Lake Compressor Station: • Start: 02-03-79-19 W6M Zone 10 • End: 06-33-078-19 W6M Zone 10
Pipeline	PETRONAS Energy Canada Ltd.	Transmission pipeline connected to the certified Wilde Lake Compressor Station: • Start: 04-02-79-19 W6M Zone 10 • End: 06-33-78-19 W6M Zone 10
Pipeline	Diamond LNG Canada Ltd.	Transmission pipeline connected to the certified Wilde Lake Compressor Station: • Start: 10-27-78-17 W6M Zone 10 • End: 06-33-78-19 W6M Zone 10
Power Infrastructure	Taylor Wind Project Ltd.	641187E 6210676N Zone 10
Transportation Infrastructure	British Columbia Ministry of Transportation and Infrastructure (BC MTI)	674231E 6181984N Zone 10
Transportation Infrastructure	BC MTI	674256E 6182701N Zone 10
Civil Infrastructure	Mainland Investments Inc.	673163E 6183152N Zone 10

Table 3-3. Reasonably Foreseeable Future Developments Considered for Cumulative Effects Assessment

Disturbance	Developer	Universal Transverse Mercator Coordinates or Legal Land Locations
Civil Infrastructure	Home Hardware	672715E 6183357N Zone 10
Civil Infrastructure	Browns' Chevrolet	674206E 6180631N Zone 10

Sources: BC MTI 2020, British Columbia Oil and Gas Commission (BC OGC) 2020, Canada Energy Regulator 2020, City of Dawson Creek 2020, Province of BC 2020a

4. Environmental Effects Assessment

The environmental direct and indirect effects assessment for the Project is provided in sections 4 to 10 of the EAC Application. Sections 5 to 10 of this Amendment Application assesses the potential positive and negative direct and indirect effects and cumulative effects on the environmental VCs associated with the construction, operations, and decommissioning and abandonment of the proposed Groundbirch Connector and any resulting changes relative to the assessment provided in the EAC Application.

5. Geophysical Environment

The assessment of potential adverse effects of the Project on the geophysical environment is provided in Section 5 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on Soil Capability, Terrain Integrity, and ARD VCs along the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

5.1 Baseline Information

Baseline information for the assessment of Soil Capability, Terrain Integrity, and ARD VCs for the proposed Groundbirch Connector is summarized in this section. Further details on soils information are provided in the Groundbirch Connector Soils Technical Data Report (TDR) (Appendix A in this Amendment Application). Further details on terrain integrity are contained in the Groundbirch Connector Terrain TDR (Appendix B). Existing conditions for Soil Capability, Terrain Integrity, and ARD in the proposed amendment corridor do not result in a material change to the overall setting considered in the EAC Application.

5.1.1 Soil Capability

The Groundbirch Connector is within Agricultural Land Reserve (ALR) lands consisting of agricultural, forested, open water, and disturbed land uses. Refer to Subsection 13.1.4.2 (Agriculture) under Section 13 (Land and Resource Use) for an overview of how ALR lands are regulated by the BC OGC.

Desktop assessment and soil field data collected in conjunction with the 2019 vegetation and terrain field programs were used to determine soil map units (SMUs) along the proposed Groundbirch Connector. Land capability for agriculture on ALR lands was rated for each SMU according to the *Land Capability Classification for Agriculture in BC* (Kenk and Cotic 1983).

A summary is provided in the following subsections for soil classification to soil order, agricultural capability on ALR lands, reclamation suitability ratings, wind and water erosion risk, and compaction and rutting risk. Wind and water erosion, and compaction and rutting are important risk factors for potential effects on soil capability for ALR soils.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the geophysical environment. The mitigation for the Project is detailed in Section 5.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

5.1.1.1 Agricultural Land Capability

The agricultural land capability ratings for the majority of the Groundbirch Connector route length is agriculture land capability Class 4C (96.9 percent). Class 4 indicates that the land is capable of producing cultivated perennial forage crops and specially adapted crops (Kenk and Cotic 1983). Subclass C indicates that the limiting factor for agricultural land capability is the adverse climate, resulting from a shorter growing season. Agriculture land capability Class 5W (1.8 percent route length of the proposed Groundbirch Connector) was mapped in areas where poor- to imperfectly-drained Gleysolic soils and SMUs with organic materials as secondary components were identified. The remaining 1.3 percent route length of the proposed Groundbirch Connector includes disturbed land (that is, not rated) for agricultural land capability. Additional details on agricultural land capability ratings for the proposed Groundbirch Connector, including calculations for land capability, are provided in the Groundbirch Connector Soils TDR (Appendix A in this Amendment Application).

5.1.1.2 Reclamation Suitability Ratings

The criteria used to rate the reclamation suitability of the soils were those proposed by the Soil Quality Criteria Subcommittee of the Alberta Soils Advisory Committee (Alberta Agriculture, Food and Rural Development 2004). Criteria for evaluating the suitability of root zone material in the Eastern Slopes Region were applied to the proposed Groundbirch Connector because of the similarity with BC soils.

Reclamation suitability refers to materials that are best suited for salvage and replacement. Soil was rated in classes as good, fair, poor, or unsuitable, based on soil physical characteristics (that is, parent material type or coarse fragment content) and soil quality parameters (that is, chemical and physical parameters such as fertility and texture). The rooting zone soils (A horizon) along the proposed Groundbirch Connector have a fair (that is, 91.0 percent of the route length) to poor (that is, 7.7 percent of the route length) rating for reclamation suitability. The remaining 1.3 percent route length of the proposed Groundbirch Connector includes open water and disturbed land (that is, not rated) for reclamation suitability. Reclamation suitability ratings are primarily affected by texture and drainage along the proposed Groundbirch Connector. In general, poor reclamation suitability ratings are attributable to soils with high water tables (or “wet” soils) and areas with high clay content leading to soils with low perviousness and/or depth to compact horizons limiting rooting depth. Fair suitability ratings are attributed to the dominant silt loam-textured A horizons. Reclamation suitability rating calculations for root zone soils along the proposed Groundbirch Connector are provided in the Groundbirch Connector Soils TDR (Appendix A in this Amendment Application).

5.1.1.3 Erosion Rating and Compaction and Rutting Rating

Along the proposed Groundbirch Connector route, water erosion potential is moderate for topsoil along 89.6 percent of the route length and moderate for subsoil along 80.6 percent of the route length due to undulating slopes with dominantly silty loam to silty clay loam textures. Water erosion potential is rated as severe in areas of medium- and fine-textured soils with slope gradients greater than 5 percent along 9.1 percent route length of the Groundbirch Connector. Along the length of the Groundbirch Connector under cultivation and in the densely vegetated and forested lands, wind erosion is negligible (23.0 percent route length) to low (75.7 percent route length) for medium-textured mineral topsoil and medium- to fine-textured subsoil. Disturbed land comprising of 1.3 percent route length of the proposed Groundbirch Connector was not rated for erosion risk.

Topsoil compaction risk is rated mostly as low, ranging to moderate to high in areas with high clay content and imperfect to poor drainage along the proposed Groundbirch Connector. Topsoil rutting risk also rated as mostly moderate except for the imperfectly- to very poorly-drained Gleysolic and Organic soils. Approximately 50.3 percent route length of the Groundbirch Connector has a low topsoil compaction risk in areas with moderately well-drained, medium-textured silty loam to loam topsoil. The topsoil compaction risk is rated as moderate for 27.5 percent route length of the proposed Groundbirch Connector in areas with moderately well to imperfectly-drained silt loam-textured soils. Topsoil and subsoil compaction risks are high for 20.9 percent of the route length of the proposed Groundbirch Connector, which correlates to medium- to fine-textured and imperfectly- to poorly-drained soils associated with the Goose SMUs (refer to Figure 4-1 in the Groundbirch Connector Soils TDR [Appendix A in this Amendment Application]).

Rutting risk is moderate for a majority (85.6 percent) of the length of the proposed Groundbirch Connector. Rutting risk is high for 13.1 percent route length of the proposed Groundbirch Connector on poor to imperfectly-drained Gleysols. Organic soils mapped within the Soils LSA (refer to Figure 4-1 in the Groundbirch Soils TDR [Appendix A in this Amendment Application]) are also prone to rutting. Disturbed land comprising of 1.3 percent route length of the proposed Groundbirch Connector was not rated for rutting risk.

Details of the risk ratings for water erosion, wind erosion, compaction, and rutting along the proposed Groundbirch Connector are provided in the Groundbirch Connector Soils TDR (Appendix A in this Amendment Application).

5.1.2 Terrain Integrity

There are no new terrain features identified within the proposed amendment corridor that were not previously identified in the EAC Application. The proposed Groundbirch Connector is situated on the Alberta Plateau Physiographic Division and consists of flat to gently rolling topography generally between 735 and 775 m above sea level (Holland 1976).

A summary is provided in the following subsections for geology and surface materials identified along the proposed Groundbirch Connector based on desktop assessment and field observations during soil and terrain mapping field surveys conducted in August 2019 (refer to the Groundbirch Connector Soils TDR [Appendix A] and Terrain TDR [Appendix B] in this Amendment Application).

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the geophysical environment. The mitigation for the Project is detailed in Section 5.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

5.1.2.1 Geology

The proposed Groundbirch Connector is underlain by the Upper Cretaceous Dunvegan Formation. This formation consists of massive conglomerate, fine to coarse grained sandstone and carboniferous shale (Massey et al. 2005). Additional details on bedrock underlain by the proposed Groundbirch Connector are provided in the Groundbirch Connector Terrain TDR (Appendix B in this Amendment Application).

5.1.2.2 Surficial Materials

Glaciolacustrine deposits are the most common surficial materials in the Terrain LSA, associated with ice-dammed lakes prevalent across the Alberta Plateau (Reimchen and Bouvier 1980). Glaciolacustrine deposits tend to be 1-5 m thick and can be found overlying till (Maxwell 1987) and are generally rich in clay having eroded large areas of dark grey Cretaceous shale (Mathews 1980).

The dominant surficial material in the Terrain LSA is glaciolacustrine (87 percent). Rolling till deposits were mapped along the western portion of the Terrain LSA, accounting for approximately 10 percent of the Terrain LSA. Minor amounts of organic materials cover 2 percent of the Terrain LSA. Glaciolacustrine deposits accounts for 100 percent of the proposed Groundbirch Connector Footprint.

Glaciolacustrine material textures range from clay to sandy silt, although most deposits were found to have a silty clay matrix, with less than 2 percent subrounded and subangular pebble dropstones; coarse fragments are rare. These materials are assumed to be thick (based on literature review and field data), likely in excess of 1 m in depth, and may be interbedded with glaciofluvial and till materials. The glaciolacustrine deposits range from moderately well- to imperfectly-drained along the broad, level- to gently-sloping slopes, and imperfectly- to poorly-drained in small depressions.

Till was mapped in 10 percent of the Terrain LSA and was not directly observed in the 2019 field survey. Till terrain units were mapped in the western portion of the Terrain LSA, associated with more rolling to undulating topography. Textures range from clayey silt to silty clay to clay with up to 5 percent coarse fragments, including subrounded and subangular pebbles and cobbles.

Organic material generally ranges from fibric to mesic, is very poor to poorly-drained and is commonly found overlying glaciolacustrine sediments in shallow depressions.

Additional details on surficial materials mapped along the proposed Groundbirch Connector are provided in the Groundbirch Connector Terrain TDR (Appendix B in this Amendment Application).

5.1.3 Geohazards

This section provides a summary of geohazards as they relate to the proposed Groundbirch Connector. More detail on geohazards can be found in Section 5 of the EAC Application. As the proposed Groundbirch Connector is located approximately 400 m east of the existing Certified Pipeline Corridor, the Terrain LSA defined for the Certified Pipeline Corridor as described in the EAC Application overlaps with the proposed Groundbirch Connector Terrain LSA. As such, geohazards associated with the proposed Groundbirch Connector are considered similar to those identified for area near KP 0 of the Certified Pipeline Corridor of the Project.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the geophysical environment. The mitigation for the Project is detailed in Section 5.6 of the EAC Application, as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

5.1.3.1 Mass Movement Including Landslides

Mass movement hazards with potential to occur in the Groundbirch Connector Terrain LSA are considered low, as no historical mass movement/landslides identified for area near KP 0 of the existing Certified Pipeline Corridor (refer to Table 5-3 in Section 5 of the EAC Application).

5.1.3.2 Seismic and Tectonic Geohazards

The seismic and tectonic hazards for the proposed Groundbirch Connector are considered to range from low to fair (Natural Resources Canada 2010) (as shown on Figure 5-5, Section 5 of the EAC Application) for area near KP 0 of the Certified Pipeline Corridor.

5.1.3.3 Liquefaction Geohazards

Liquefaction can be triggered by earthquakes, periods of heavy rain or heavy loading of unstable saturated terrain in area with surface materials including silts, fine sands, unsaturated flocculated marine clays (those with a card house mineral structure), and thixotropic clays (those with a metastable mineral structure). These types of clays were not observed during soil and terrain field surveys for the proposed Groundbirch Connector (Appendices A and B in this Amendment Application).

5.1.3.4 Hydrologic and Erosion Geohazards

Hydrologic hazards are hazards associated with vertical and lateral scour at watercourses. Erosion hazards are closely related to these hydrologic hazards. The proposed Groundbirch Connector does not intersect any watercourses. Hydrologic and erosion hazards are considered low for the proposed Groundbirch Connector.

5.1.3.5 Karst Geohazards

Areas where karst is likely to occur are limited to where carbonate bedrock occurs. There is no mapped carbonate bedrock in the Groundbirch Connector Terrain LSA (Appendix B in this Amendment Application).

5.1.4 Acid Rock Drainage

Bedrock was not encountered or observed at any of the inspection sites during soil and terrain mapping field surveys conducted in August 2019 (refer to the Groundbirch Connector Soils TDR [Appendix A in this Amendment Application] and Terrain TDR [Appendix B]). Based on desktop analysis and field observations of soil profiles at sampled locations along the proposed Groundbirch Connector, it is assumed that the proposed Groundbirch Connector pipeline trench will be constructed in surficial materials (that is, primarily glaciolacustrine and till). As there appears to be no potential to encounter bedrock, it is anticipated that there are no conditions that will result in ARD. Therefore, the ARD potential has been rated as none for the proposed Groundbirch Connector.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the geophysical environment. The mitigation for the Project is detailed in Section 5.7 of the EAC Application as well as the management plans that have been prepared to meet the conditions (such as Condition 26 – EMP or Condition 5 - Acid Rock Construction Response Plan) of the EAC #E14-03.

5.2 Soil Capability Effects Assessment

The baseline conditions for the proposed Groundbirch Connector, as they relate to the Soil Capability VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions that would result from the proposed Groundbirch Connector are also comparable (see Section 5.5 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Soil Capability VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to soil capability were identified in the EAC Application.

5.3 Terrain Integrity Effects Assessment

The baseline conditions for the proposed Groundbirch Connector, as they relate to the Terrain Integrity VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions that would result from the proposed Groundbirch Connector are also comparable (see Section 5.6 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Terrain Integrity VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to terrain integrity were identified in the EAC Application.

5.4 Acid Rock Drainage Effects Assessment

The baseline conditions for the proposed Groundbirch Connector, as they relate to the ARD VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions that would result from the proposed Groundbirch Connector are also comparable (see Section 5.7 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the ARD VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to acid rock drainage were identified in the EAC Application.

6. Atmospheric Environment

The assessment of potential adverse effects of the Project on the atmospheric environment is provided in Section 6 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on Acoustic Environment, Air Quality, and GHG Emissions VCs for the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

6.1 Baseline Information

The following subsections provide information on baseline conditions for Acoustic Environment, Air Quality, and GHG Emissions VCs, specific to the proposed Groundbirch Connector. Further details on atmospheric environment are provided in the Groundbirch Connector Atmospheric Environment Technical Memorandum (Appendix C in this Amendment Application). While there is updated information provided on the baseline conditions for the atmospheric environment VCs in relation to the proposed Groundbirch Connector, these updated baseline conditions do not result in a material change to the overall atmospheric setting considered in the EAC Application.

6.1.1 Acoustic Environment

The proposed Groundbirch Connector Application Corridor is located in a rural area that is sparsely populated and, as such, is expected to have low ambient noise levels. The BC OGC *British Columbia Noise Control Best Practices Guideline* (BC OGC 2018) prescribes a receptor-based assessment, with noise assessed at seasonally- or permanently-occupied dwellings, and at a distance of 1.5 km from a noise-generating facility.

The prediction results of sound propagation calculations (refer to Appendix C in this Amendment Application, The Groundbirch Connector Atmospheric Environment Technical Memorandum) indicate that a minimal buffer distance of 500 m should be maintained between the pipeline construction activities and residential locations in order to meet the Health Canada mitigation noise level threshold of 47 A-weighted decibels (dBA) day-night sound level (L_{dn}) for L_{dn} measured as dBA (Health Canada 2017). The closest residence is located approximately 776 m east from the proposed Groundbirch Connector Footprint. No industrial facilities have been identified within 5 km of the proposed amendment corridor that could result in cumulative noise effects.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

6.1.2 Air Quality

Sources of emissions in the Air Quality RSA (that is, the 30 km band centred on the proposed Groundbirch Connector Footprint) are typical of agricultural and industrial activities. The proposed Groundbirch Connector is located mainly on agricultural land. The Groundbirch Connector's construction activities that may contribute to air emissions include the operation of vehicles, heavy equipment (for example, excavators, side-booms, graders, hoes, and dozers) and auxiliary equipment (for example, power generators). The proposed Groundbirch Connector does not include components that result in an increase in air emissions during operations. The Groundbirch Connector's construction activities have a potential to result in a change in air quality, however, the effects on air quality as a result of construction are small and short-term. The interaction of these emissions with current and reasonably foreseeable emissions in the vicinity of the Groundbirch Connector is expected to be limited. The Groundbirch Connector is expected to produce negligible criteria air contaminant (CAC) emissions during normal operating conditions; therefore, the effect of operation on air quality is not considered further in the air quality effects assessment.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

6.1.3 Greenhouse Gas Emissions

GHG emissions have been quantified for the construction and operation of the Project and are provided in Section 6 and Appendix 2F (the GHG Emissions TDR) of the EAC Application. Pipeline construction GHG emissions in the EAC Application were estimated based on the length of the construction right-of-way and the duration of construction activities. The proposed Groundbirch Connector will add approximately 3 km to the Certified Pipeline Corridor. This minor difference in length would have no material effect on pipeline construction GHG emissions, because the same equipment and activities are proposed for the construction of the proposed Groundbirch Connector. GHG emissions from construction-related activities for the proposed Groundbirch Connector are estimated to be 1,387.1 tonnes of carbon dioxide equivalent (CO_2e); 66.7 percent of the total are from off-road equipment and 33.3 percent are from on-road equipment. Due to the location of the proposed Groundbirch Connector, primarily on agricultural land, minimal site preparation (that is, land clearing and decay) will be required for construction and GHG emissions from these activities are considered negligible.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.7 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

6.2 Acoustic Environment Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Acoustic Environment VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions that would result from the proposed activities for the proposed Groundbirch Connector are also comparable (see Section 6.5 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Acoustic Environment VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to acoustic environment were identified in the EAC Application.

6.3 Air Quality Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Air Quality VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 6.6 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Air Quality VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to air quality were identified in the EAC Application.

6.4 Greenhouse Gas Emissions Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the GHG Emissions VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 6.7 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the GHG Emissions VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to GHG emissions were identified in the EAC Application.

7. Aquatic Environment

The assessment of potential adverse effects of the Project on the aquatic environment is provided in Section 7 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on Fish and Fish Habitat, Species of Conservation Concern, Surface Water, and Groundwater VCs along the proposed Groundbirch Connector, relative to the information provided in the EAC Application. Baseline conditions of aquatic environment related to wetlands identified along the proposed Groundbirch Connector are summarized in Section 9 of this Amendment Application.

7.1 Baseline Information

The following subsections provide information on baseline conditions for Fish and Fish Habitat including Species of Conservation Concern, Surface Water, and Groundwater VCs, specific to the proposed Groundbirch Connector. Further details on fish and fish habitat information are provided in the Groundbirch Connector Fish Habitat Assessment Technical Memorandum (Appendix D in this Amendment Application). Further details on surface water are contained in the Groundbirch Connector Hydrology Technical Memorandum (Appendix E in this Amendment Application). Further details on groundwater are provided in the Groundbirch Connector Hydrogeology TDR (Appendix F in this Amendment Application).

While there is new information provided on the baseline conditions for the aquatic environment VCs in relation to the proposed Groundbirch Connector, these updated baseline conditions do not result in a material change to the overall aquatic setting considered in the EAC Application.

7.1.1 Fish and Fish Habitat

A field survey was conducted in August 2019 to confirm the presence or absence of fish habitat or hydrologic features along the proposed Groundbirch Connector, and classifying hydrologic features, if present, to the definition of streams detailed within the *Fish-stream Identification Guidebook* (Forest Practices Code of BC 1998. Based on field observations and stream definitions as detailed in the *Fish-stream Identification Guidebook* (Forest Practices Code of BC 1998), the proposed Groundbirch Connector does not cross any watercourses that can be classified as S1 to S6 stream or non-classified drainage that would require permitting under BC's *Oil and Gas Activities Act*. The *Fisheries Act* contains provisions for the prevention of "harmful alteration, disruption, or destruction of fish habitat" (section 35). Fish habitat is defined in Subsection 2(1) of the *Fisheries Act* to include all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes. The proposed Groundbirch Connector has no potential to directly or indirectly interact with fish habitat or species of conservation concern, as no streams are present within the pipeline route or in areas where facilities (for example, launcher/received, access road, or temporary workspace) are planned. No further consideration of the *Fisheries Act* is required for the proposed Groundbirch Connector.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the aquatic environment. The mitigation for the Project is detailed in sections 7.5 and 7.6 the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

7.1.2 Surface Water

The proposed Groundbirch Connector is situated in the Southern Interior Plains hydrologic zone which is also crossed by the Certified Pipeline Corridor. This hydrologic zone is relatively dry, as it is situated within the rain shadow of the Rocky Mountains. Continental air masses dominate the region and impose warm summers and uplift for convective storms that correspond to precipitation maximums during summer months. Characterization of surface water flow attributes for the Southern Interior Plains hydrologic zone are detailed in Coastal GasLink Hydrology TDR for the Project (Appendix 2H of the EAC Application).

Results of desktop study and field verification conducted in August 2019 indicated that the proposed Groundbirch Connector Footprint does not intersect any watercourses. Two non-visible channels with no water present or evidence of channel were identified along proposed Groundbirch Connector (refer to Appendices D and E in this Amendment Application).

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the aquatic environment. The mitigation for the Project is detailed in Section 7.7 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

7.1.3 Groundwater

A desktop review of available hydrogeological data along the proposed Groundbirch Connector produced no new findings compared to the baseline conditions described in Appendix 2I (Hydrogeology TDR) of the EAC Application. Three mapped aquifers (Provincial Aquifer Number 591, 592, and 594) were identified underlying a 2-km corridor of the proposed Groundbirch Connector (refer to Figure 4-1 in the Groundbirch Connector Hydrogeology TDR [Appendix F in this Amendment Application]). These aquifers had been previously identified underlying portions of the Certified Pipeline Corridor and had been described in the Coastal GasLink Hydrogeology TDR (Appendix 2I of the EAC Application). No new groundwater resources, users or quality datasets were reported within a 2 km corridor of the proposed Groundbirch Connector; therefore, the hydrogeologic baseline conditions associated with the proposed Groundbirch Connector are considered generally similar to the conditions assessed in the EAC Application for the Project.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the aquatic environment. The mitigation for the Project is detailed in Section 7.8 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

7.2 Fish and Fish Habitat Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Fish and Fish Habitat VC including Species of Conservation Concern, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 7.5 and 7.6 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Fish and Fish Habitat VC including Species of Conservation Concern, during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to fish and fish habitat were identified in the EAC Application.

7.3 Surface Water Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Surface Water VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 7.7 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Surface Water VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to surface water were identified in the EAC Application.

7.4 Groundwater Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Groundwater VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 7.8 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Groundwater VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to groundwater were identified in the EAC Application.

8. Vegetation

The assessment of potential adverse effects of the Project on vegetation is provided in Section 8 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on Ecological Communities of Concern VC and Plant Species of Concern VC along the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

8.1 Baseline Information

This subsection provides information on baseline conditions for vegetation resources specific to the proposed Groundbirch Connector. Further details on baseline conditions related to vegetation are provided in the Groundbirch Connector Vegetation TDR (Appendix G in this Amendment Application).

The proposed Groundbirch Connector is located in the Boreal Plains Ecoprovince of BC which is also crossed by a portion of the Certified Pipeline Corridor. The Boreal Plains are characterized by flat or undulating terrain with thick Cretaceous shale bedrock with overlaying soil deposits. The Boreal Plains have extensive trembling aspen (*Populus tremuloides*), black spruce (*Picea mariana*), and white spruce (*Picea glauca*) stands with minimal elevation change across the landscape. Extensive natural disturbance is common in the form of fire and insect outbreaks (Demarchi 2011). The proposed Groundbirch Connector is also within the moist warm Boreal White and Black Spruce subzone (BWBSmw) of the Biogeoclimatic Ecosystem Classification system. This subzone is also crossed by a portion of the Certified Pipeline Corridor. The BWBSmw subzone is characterized by short, continental growing seasons and modest precipitation of 424 to 749 mm annually, almost half of which comes as snow. Forest stands within the BWBSmw feature white and black spruce, and trembling aspen, as well as lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), tamarack (*Larix laricina*), balsam poplar (*Populus balsamifera*), and paper birch (*Betula papyrifera*) as the dominant canopy species (BC Ministry of Forests and Range 2011).

Desktop assessment, ecosystem mapping and field surveys were conducted in August 2019 and June 2020 to identify vegetation resources in the proposed Groundbirch Connector Vegetation RSA. The complete results of the desktop assessment, ecosystem mapping, and field surveys for vegetation resources in the Vegetation RSA for the proposed Groundbirch Connector are provided in the Groundbirch Connector Vegetation TDR (Appendix G in this Amendment Application). Vegetation LSA and RSA for the proposed Groundbirch Connector are defined similarly as those for the Certified Pipeline Corridor. As such, the Groundbirch Connector Vegetation LSA and RSA includes a 300-m band and a 2-km band, respectively, centred on the proposed Groundbirch Connector centreline. Key results and findings pertaining to vegetation resources are presented for each of the spatial boundaries of the proposed Groundbirch Connector; however, the proposed Groundbirch Connector Footprint and LSA for vegetation represent the areas where direct and indirect effects on vegetation resources are most likely to occur. In summary, vegetation resources identified for the proposed Groundbirch Connector are as follows.

- Cultivated fields (mainly pastures and hayfields) occupy the largest area within the study areas: 27.3 hectares (ha) (87.9 percent within the proposed Groundbirch Connector Footprint), 97.0 ha (72.5 percent within the LSA), and 524.3 ha (53.4 percent within the RSA).
- Approximately 31.5 ha (23.5 percent) of the LSA is composed of native forested upland plant communities. Upland forest also covers approximately 2.7 ha (8.6 percent) of the proposed Groundbirch Connector Footprint. The forested communities within the LSA are located along the southern portion of the route.
- Native wetland communities occupy approximately 4.6 ha (3.5 percent) of the LSA and approximately 1.0 ha (3.2 percent) of the proposed Groundbirch Connector Footprint. Wetlands are represented by three bogs, one marsh, three swamps, and one shallow open water site. Wetlands occur mainly in the northern portion, and cover only 4.6 ha (3.5 percent) of the LSA.

- No native grasslands were identified within the Vegetation LSA.
- One Blue-listed ecological community (Bebb's willow – Bluejoint) was detected in the proposed Groundbirch Connector Footprint, interacting with approximately 0.8 ha (2.6 percent) of the proposed Groundbirch Connector Footprint. A second blue-listed ecological community (Black spruce – Lingonberry – Peat moss) was documented within the Vegetation RSA, but not the Vegetation LSA or Footprint of the proposed Groundbirch Connector.
- No Red-listed ecological communities at risk were observed.
- The proposed Groundbirch Connector Footprint and the Vegetation LSA and RSA do not cross any legal or non-legal Old-Growth Management Areas (OGMAs).
- No blue- or red-listed species were documented within the LSA or RSA.
- Annual saw-thistle (Sonchus oleraceus) was observed within the LSA during field surveys in 2019. This species is designated as Noxious under the Weed Control Act; however, this species was not observed during field surveys in 2020. No other invasive species and/or Noxious weeds were encountered within the LSA in 2019 or 2020 field surveys.

Baseline conditions for vegetation in relation to the proposed Groundbirch Connector are similar to baseline conditions for vegetation along portions of the Certified Pipeline Corridor and do not result in a material change to the overall vegetation setting considered in the EAC Application.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on vegetation. The mitigation for the Project is detailed in sections 8.5 and 8.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

8.2 Vegetation Effects Assessment

The blue-listed ecosystems have been identified and assessed in accordance with the Project's Red- and Blue-Listed Plants and Ecological Communities Survey and Mitigation Plan (Appendix E.3 of the Coastal GasLink EMP). Site-specific mitigation measures will be assigned in accordance with the plan prior to construction.

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Ecological Communities of Concern VC and Plant Species of Concern VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 8.5 and 8.6 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Ecological Communities of Concern VC and Plant Species of Concern VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to vegetation were identified in the EAC Application.

9. Wetlands

The assessment of potential adverse effects of the Project on wetlands is provided in Section 9 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on the Wetland Function VC along the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

9.1 Baseline Information

A desktop review of existing data sources and literature was conducted to compile baseline information on wetlands along the proposed Groundbirch Connector. Field surveys to identify and document wetlands and wetland function were conducted in August 2019 and June 2020 during the ecosystem mapping field program.

The objectives of the field surveys were to:

- Record detailed vegetation and hydrology data within wetland ecological communities
- Ground-truth wetland mapping
- Collect data on wetland-associated wildlife habitat

The complete results of the desktop assessment and ecosystem mapping field program for wetlands along the proposed Groundbirch Connector are provided in the Groundbirch Connector Wetlands TDR (Appendix H in this Amendment Application). A brief summary of the results for wetlands is provided in the following subsection.

Baseline conditions for wetlands in relation to the proposed Groundbirch Connector are similar to baseline conditions for wetlands along portions of the Certified Pipeline Corridor and do not result in a material change to the overall wetlands setting considered in the EAC Application.

9.1.1 Wetland Function

Results of ecosystem mapping and field surveys show that there are 33.7 ha of wetlands in the Groundbirch Connector Wetlands LSA, with 1.0 ha in the proposed Groundbirch Connector Footprint (refer to Table 4-2 in Appendix H in this Amendment Application). Wetlands LSA for the proposed Groundbirch Connector includes a 2-km band centred on the proposed Groundbirch Connector centreline, similarly as Wetlands LSA defined for the Certified Pipeline Corridor. Four classes of wetlands occur within the proposed Groundbirch Connector Wetlands LSA: bogs, marshes, swamps, and shallow open water. Three classes of wetlands occur within the proposed Groundbirch Connector Footprint: marsh, swamp, and shallow open water.

Two blue-listed wetland site associations occur within the Groundbirch Connector Wetlands LSA, with a total area of 25.9 ha (2.7 percent of the LSA), and include bog Wb03 (Black spruce – lingonberry – peat moss) and swamp Ws03 (Bebb's willow – bluejoint). The Ws03 wetland site association overlaps with the proposed Groundbirch Connector Footprint where it covers 0.8 ha (2.6 percent of the Footprint).

No red- or blue-listed wetland-associated plants species were documented in the Groundbirch Connector Wetlands LSA or RSA (British Columbia Conservation Data Centre [BC CDC] 2020).

Wetlands in the Groundbirch Connector Wetlands LSA provide the following habitat functions, based on data collected during field surveys in August 2019 and June 2020:

- Habitat for one amphibian species, wood frog (*Lithobates sylvaticus*):
  - Wood frog was the only species of amphibian detected at wetlands in the LSA surveyed for amphibians, and wood frog is not listed under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the *Species at Risk Act* (SARA)

- Habitat for at least five waterfowl species (that is, the mallard, green-winged teal, lesser yellowlegs, bufflehead, and Canada goose)
- Habitat for at least nine migratory bird species; however, no species are listed under COSEWIC or SARA were detected
- Habitat for two blue-listed wetland site associations

No protected wetland-associated wildlife species were observed though the potential exists for western toad and other wetland-associated migratory birds to be present in the identified wetlands. Detailed information wetland-associated wildlife habitat and species are provided in the Groundbirch Connector Wildlife and Wildlife Habitat TDR (Appendix I in this Amendment Application).

Wetlands in the Groundbirch Connector LSA provide the following hydrological and biogeochemical functions:

- Peak flow attenuation
- Groundwater recharge
- Carbon sequestration through peat accumulation
- Water quality improvement

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on Wetland Function VC. The mitigation for the Project is detailed in Section 9.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions (such as Condition 26 – Environmental Management Plan or Condition 6 – Wetlands Management Plan) of the EAC #E14-03.

9.2 Wetland Function Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Wetland Function VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 9.5 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Wetland Function VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to wetland function were identified in the EAC Application.

10. Wildlife and Wildlife Habitat

The assessment of potential adverse effects of the Project on wildlife and wildlife habitat is provided in Section 10 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on the Wildlife and Wildlife Habitat VC along the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

10.1 Baseline Information

This section provides a summary of baseline conditions for Wildlife and Wildlife Habitat VC, specific to the proposed Groundbirch Connector. Detailed baseline information is provided in the Groundbirch Connector Wildlife and Wildlife Habitat TDR (Appendix I in this Amendment Application). Baseline information for the proposed Groundbirch Connector was compiled using a desktop and literature review, wildlife surveys, and habitat models. The desktop and literature review included a search of scientific literature, and provincial and federal documents and databases. Wildlife habitat models were developed for wildlife and wildlife habitat Key Indicators (KIs) to support the assessment of potential adverse effects of the proposed Groundbirch Connector on wildlife and wildlife habitat.

Baseline conditions for wildlife and wildlife habitat in relation to the proposed Groundbirch Connector are similar to baseline conditions for wildlife and wildlife habitat along portions of the Certified Pipeline Corridor and do not result in a material change to the overall wildlife setting considered in the EAC Application.

Wildlife surveys were conducted along the proposed Groundbirch Connector, including:

- Breeding bird surveys
- Pond-dwelling amphibian surveys
- Wildlife habitat rating surveys to support development of habitat suitability models

The proposed Groundbirch Connector crosses comparable habitat types and conditions as evaluated in the EAC Application. Given the proximity of the proposed Groundbirch Connector to the Certified Pipeline Corridor, the potential residual effects of the proposed Groundbirch Connector are likely to affect the same regional wildlife populations evaluated in the EAC Application. Therefore, an updated assessment of all wildlife and wildlife habitat KIs from the EAC Application is not necessary to assess the potential residual adverse effects of the proposed Groundbirch Connector on wildlife and wildlife habitat.

During the wildlife surveys conducted in July and August 2019 for the proposed Groundbirch Connector, barn swallow was the only species of conservation concern that was detected (blue-listed in BC and Threatened on Schedule 1 of SARA). There are 16 bird species of conservation concern that have been previously recorded within the Wildlife and Wildlife Habitat RSA for the proposed Groundbirch Connector during annual bird and citizen science surveys (eBird 2020, Province of BC 2020b). There are no historical occurrence records for bird species of conservation concern within the proposed Groundbirch Connector Footprint or Wildlife and Wildlife Habitat LSA (eBird 2020, Province of BC 2020b).

The northern edge of the Wildlife and Wildlife Habitat RSA overlaps with an area that has potential to contain critical habitat for northern myotis. No biophysical attributes of critical habitat for northern myotis were observed within the Wildlife and Wildlife Habitat LSA during the 2019 field surveys.

Wildlife habitat features, such as confirmed breeding locations for species of conservation concern (for example, western toad) are included in ongoing design and construction planning for the proposed Groundbirch Connector. Although western toad was not detected during the 2019 wildlife surveys for the proposed Groundbirch Connector, it is known to occur in the Peace Region and to breed in shallow wetlands, including anthropogenic water features (BC CDC 2020). Applicable mitigation for wildlife habitat features and species such as northern myotis, barn swallow, and western toad are included in the Project's EMP.

There are no material differences between baseline information reported in the EAC Application and baseline information presented in the Groundbirch Connector Wildlife and Wildlife Habitat TDR (Appendix I in this Amendment Application). The bird and amphibian species detected during breeding bird and pond-dwelling amphibian surveys for the proposed Groundbirch Connector and in the areas surveyed for the EAC Application adjacent to the Groundbirch Connector are similar, as was expected based on similarities in habitat. Habitat suitability models developed for the 2014 EAC Application partially overlap the area that was modelled for the proposed Groundbirch Connector.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on Wildlife and Wildlife Habitat VC. The mitigation for the Project is detailed in Section 10.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

10.2 Wildlife and Wildlife Habitat Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Wildlife and Wildlife Habitat VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see sections 10.5 to 10.17 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Wildlife and Wildlife Habitat VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to wildlife and wildlife habitat were identified in the EAC Application.

11. Economic Effects Assessment

The assessment of potential positive and negative direct and indirect effects of the Project on the economy is provided in sections 1.5, 11, and 12 of the EAC Application. Baseline conditions and potential positive and negative direct and indirect effects on the economy for the proposed Groundbirch Connector are comparable to those provided in the EAC Application. Therefore, the proposed Groundbirch Connector does not change the characterization and assessment of potential adverse effects on Economy, and Employment and Labour Force VCs as provided in the EAC Application. Additionally, a summary of benefits (positive direct and indirect effects) for the Project can be found in Section 24.4.1 of this Amendment Application.

12. Social Effects Assessment

The social positive and negative direct and indirect effects assessment is provided in sections 1.5 and 13 to 16 of the EAC Application. Sections 13 to 15 and Section 24.4.1 of this Amendment Application assess the potential positive and negative direct and indirect effects on the social VCs associated with the construction, operations, and decommissioning and abandonment of the proposed Groundbirch Connector that have not been assessed in the EAC Application.

13. Land and Resource Use

The assessment of potential adverse effects of the Project on land and resource use is provided in Section 14 of the EAC Application. The following subsections provide a summary of baseline conditions, as well as any resulting changes to the assessment of potential adverse effects on Current Use of Land and Resources and Domestic Water Supply VCs along the proposed Groundbirch Connector. The summary addresses only the differences in baseline conditions and potential effects when assessing the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on land and resource use. The mitigation for the Project is detailed in sections 14.5 and 14.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

13.1 Baseline Information

This section provides information on baseline conditions for the assessment of the following VCs under the Land and Resource Use topic defined in Section 6 (Social Effects Assessment) of the AIR for the Project:

- Current Use of Land and Resources
- Domestic Water Supply

Detailed baseline information is provided in the Groundbirch Social and Economic Technical Report (Appendix J in this Amendment Application).

While there is new information provided on the baseline conditions for land and resource use in relation to the proposed Groundbirch Connector, these updated baseline conditions do not result in a material change to the overall land and resource use setting considered in the EAC Application.

13.1.1 Current Use of Land and Resources

Baseline information and conditions for the Current Use of Land and Resources VC are comparable to those described in Section 14 of the EAC Application. The proposed Groundbirch Connector crosses a comparable area to the Certified Pipeline Corridor (Appendix 2M of the EAC Application), in terms of land and resource use, and domestic water supply quantity and quality.

Construction and operation of the proposed Groundbirch Connector may interact with existing land and resource use. The proposed Groundbirch Connector crosses freehold cultivated lands. The Land and Resource Use LSA and RSA of the proposed Groundbirch Connector cross Crown lands that support a variety of activities, including forestry, mineral exploration and development, oil and gas activities, range use, trapping, hunting and guide outfitting, fishing, and outdoor recreational use (British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development [BC MFLNRORD] 2020).

The proposed Groundbirch Connector Footprint includes 27.3 ha of cultivated fields that are mostly pasture and hay fields. No Crown lands or federally-owned or administered lands are crossed by the proposed Groundbirch Connector Footprint (BC Ministry of Citizens Services 2020).

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on land and resource use. The mitigation for the Project is detailed in Section 14.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

13.1.2 Land Use Plans

The proposed Groundbirch Connector crosses land owned by a single private landowner, where land use is guided by the Dawson Creek Land and Resource Management Plan (LRMP) and one Official Community Plan (OCP). There are no First Nation land use plans identified as being crossed by the proposed Groundbirch Connector. The proposed Groundbirch Connector does not cross boundaries of any Sustainable Resource Management Plans.

13.1.2.1 Land and Resource Management Plans

The entire length of the proposed Groundbirch Connector crosses the Dawson Creek LRMP, which is also crossed by the Certified Pipeline Corridor. There have been no updates to the Dawson Creek LRMP since being referenced in the EAC Application. The proposed Groundbirch Connector crosses the progress zone designated as settlement type in the Dawson Creek LRMP. Agriculture and settlement predominate within this LRMP zone, with most land being privately-owned and not subject to the guidance in the LRMP. More information on the intent of the Dawson Creek LRMP is provided in Appendix 2M of the EAC Application.

13.1.2.2 Regional District Plans and Bylaws

The proposed Groundbirch Connector crosses the rural OCP (Bylaw 1940 2011) of the PRRD. The proposed Groundbirch Connector crosses one land use designation (that is, agriculture rural use) which is also crossed by the existing Certified Pipeline Corridor at a different location within the OCP boundary. The objectives of the OCP and the management intent of the agricultural land use designation are provided in Appendix 2M of the EAC Application.

13.1.3 Provincial Land Use Designations

The proposed Groundbirch Connector does not cross a legal or non-legal OGMA. No ungulate winter range or wildlife habitat areas are crossed by the proposed Groundbirch Connector, and none occur in the Land and Resource Use LSA or RSA.

13.1.3.1 Old-Growth Management Areas

The proposed Groundbirch Connector does not cross a legal OGMA or non-legal OGMA, and none occur in the Land and Resource Use LSA. Eight legal OGMAs and no non-legal OGMAs were identified in the Land and Resource Use RSA for the proposed Groundbirch Connector. Legal OGMAs have been designated under ministerial order and generally require forest licensees to replace areas designated to protect old-growth forest for an area equivalent to the area that was removed by harvesting or road construction. Non-legal OGMAs are spatially defined areas of old-growth forest that have not yet been legally established. Further information on OGMAs is provided in the EAC Application in Section 10 (Wildlife and Wildlife Habitat) and Appendix 2J (Vegetation TDR) of the EAC Application.

13.1.4 Resource Use

Resource-based activities in the Land and Resource Use RSA for the proposed Groundbirch Connector include oil and gas exploration and development, range use, hunting and trapping, forestry, and recreation. Current uses of the land for the proposed Groundbirch Connector that differ from the EAC Application are described in the following subsections. Detailed information regarding TLRU is presented in Section 15 of this Amendment Application.

The proposed Groundbirch Connector does not cross any of the following: transmission lines, contaminated sites, wind farms or investigative permits, or parks or protected areas.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on land and resource use. The mitigation for the Project is detailed in Section 14.5 the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

13.1.4.1 Mineral and Subsurface Resources

No mineral tenures are crossed by the proposed Groundbirch Connector and none are located in the Land and Resource Use LSA. Seven mineral tenures were identified in the Land and Resource Use RSA. No operating mines are crossed by the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA or RSA.

No aggregate tenures are crossed by the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA. There are four aggregate tenures (that is, sand and gravel quarries) in the Land and Resource Use RSA.

The entire length of the proposed Groundbirch Connector is located in one oil and gas tenure (the tenure type is gas and the tenure holder is Groundbirch). The proposed Groundbirch Connector crosses active oil and gas pipelines seven times (see Table 3-1 in the Groundbirch Connector Social and Economic Technical Report [Appendix J in this Amendment Application]).

13.1.4.2 Agriculture

The proposed Groundbirch Connector crosses land designated as ALR for its entire length. The existing Certified Pipeline Corridor crosses approximately 40 km of ALR land across the entire Project route, and the proposed Groundbirch Connector would add an additional 3 km to the total amount of ALR land crossed by the Project. Land designated as ALR is public or private land where agriculture is the priority land use (Agricultural Land Commission [ALC] 2014). Agricultural lands are designated as an ALR under the *Agricultural Land Commission Act* (ALCA). Under Section 26 of the ALCA, the ALC can enter into an agreement to allow certain governments or authorities to exercise the ALC's power to decide applications for non-farm use. Such agreements may also exempt a non-farm use in a specified area from the requirement of an application for permission for non-farm use on certain conditions. The ALC has exercised power to enter into an agreement with the BC OGC relating to certain oil and gas non-farm uses within the ALR in the Peace River Region (BC OGC 2017), which means the BC OGC acts as the ALC and makes decisions guided by the ALCA and regulations.

13.1.4.3 Range Lands

No Crown range tenures are crossed by the proposed Groundbirch Connector (Province of BC 2020a). There are 24 active Crown range tenures in the Land and Resource Use RSA.

There are nine grazing leases in the Land and Resource Use RSA for the proposed Groundbirch Connector. Range lands support agricultural activity through livestock grazing (Agriculture and Agri-Food Canada 2014). In BC, permission to use public lands for grazing activities is administered through a system of tenures and leases by the Province of BC. More information on range lands is provided in Appendix 2M of the EAC Application.

13.1.4.4 Hunting

The proposed Groundbirch Connector crosses the Omineca/Peace Region in the Peace Natural Resource District for its entire length. It crosses Wildlife Management Unit (WMU) 7-32, which is also crossed by the existing Certified Pipeline Corridor. Species commonly hunted in WMU 7-32 include mule deer, white-tailed deer, moose, elk, black bear, wolf, cougar, coyote, wolverine, lynx, snowshoe hare, grouse, raven, coots, duck, and geese (BC MFLNRORD 2020). A detailed list of hunting seasons for WMU 7-32 is provided in Appendix 2M of the EAC Application. Further information on wildlife and wildlife habitat is provided in Appendix I (Groundbirch Connector Wildlife and Wildlife Habitat TDR) of this Amendment Application.

The proposed Groundbirch Connector is located in the North Peace Game Management Zone. The proposed Groundbirch Connector crosses three Limited Entry Hunt areas: two in WMU 7-32 and one in Peace River Zone A (see Table 3-2 in Appendix J in this Amendment Application, Groundbirch Connector Social and Economic Technical Report), which is also crossed by the existing Certified Pipeline Corridor.

13.1.4.5 Fishing

The proposed Groundbirch Connector crosses the Omineca/Peace Region, which is also crossed by the existing Certified Pipeline Corridor. Game fish commonly found in the region include trout, Arctic grayling, burbot, kokanee, whitefish and white sturgeon, northern pike, inconnu, goldeye, walleye, and yellow perch (Appendix 2M of the EAC Application).

The proposed Groundbirch Connector is located on land owned by a single private landowner and does not cross any watercourses (Appendix D in this Amendment Application, Groundbirch Connector Fish Habitat Assessment Technical Memorandum). No additional popular fishing lakes or rivers were identified as being crossed by the Land and Resource Use LSA for the proposed Groundbirch Connector. Kiskatinaw River is located approximately 14 km east from the proposed Groundbirch Connector Footprint within the Land and Resource Use RSA and is a popular fishing river in the region.

13.1.4.6 Trapping

Specific trapping information as a subsistence activity for TLRU purposes is found in Section 15 of this Amendment Application.

There are two trapper cabins located in the Land and Resource Use RSA. The entire length of the proposed Groundbirch Connector is located in one trapline territory (Trapline Licence TR0732T010) (BC MFLNRORD 2020).

13.1.4.7 Guide Outfitting

The proposed Groundbirch Connector is located entirely in one guide outfitting territory (see Table 3-3 in Appendix J in this Amendment Application, Groundbirch Connector Social and Economic Technical Report).

13.1.4.8 Forestry

The proposed Groundbirch Connector is located in the Dawson Creek Timber Supply Area in the Peace Forest District, which is also crossed by the existing Certified Pipeline Corridor.

The proposed Groundbirch Connector does not cross any active forest tenure cutblocks. There are no active or pending woodlot licences in the Land and Resource Use LSA; however, there are four active woodlot licences in the Land and Resource Use RSA. No community forests or tree farm licences are crossed by the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA; however, there is one tree farm licence in the Land and Resource Use RSA (BC MFLNRORD 2020).

13.1.4.9 Outdoor Recreational Uses

The proposed Groundbirch Connector does not cross any trails or recreation sites, and none occur in the Land and Resource Use LSA and RSA (Province of BC 2020a).

13.1.5 Visual Quality and Aesthetics

The proposed Groundbirch Connector crosses an unclassified area in visual quality objective polygon Number 2249 in the Dawson Creek LRMP area (BC Ministry of Forests, Lands and Natural Resource Operations 2020).

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on land and resource use. The mitigation for the Project is detailed in Section 14.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

13.1.6 Domestic Water Supply

The proposed Groundbirch Connector does not cross any community watersheds, and no community watersheds were identified in the Land and Resource Use LSA and RSA. The proposed Groundbirch Connector does not encroach upon any registered water wells. There are 97 registered water wells identified in the Land and Resource Use RSA (BC Ministry of Environment - Water Protection and Sustainability 2020a). Of these wells, 57 are private domestic wells, 2 are commercial and industrial wells, 8 are water supply system wells, and 30 are unknown use. No points of diversion overlap with the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA. There are 24 points of diversion identified in the Land and Resource Use RSA for the proposed Groundbirch Connector (BC Ministry of Forests, Lands and Natural Resource Operations - Water Management 2020a).

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on land and resource use. The mitigation for the Project is detailed in Section 14.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

13.2 Current Use of Land and Resources Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Current Use of Land and Resources VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 14.5 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Current Use of Land and Resources VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to current use of land and resources were identified in the EAC Application.

13.3 Domestic Water Supply Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Domestic Water Supply VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 14.6 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Domestic Water Supply VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to domestic water supply were identified in the EAC Application.

14. Community and Regional Infrastructure and Services

The assessment of potential positive and negative direct and indirect effects of the Project on community and regional infrastructure and services is provided in sections 1.5 and 15 of the EAC Application. Baseline conditions and potential positive and negative direct and indirect effects on community and regional infrastructure and services for the proposed Groundbirch Connector are comparable to those provided in the EAC Application. Therefore, the proposed Groundbirch Connector does not change the characterization and assessment of potential adverse effects on Community Utilities and Services, Transportation Infrastructure and Services, and Community Quality of Life VCs as provided in the EAC Application. In addition, a summary of benefits (positive direct and indirect effects) for the Project can be found in Section 24.4.1 of this Amendment Application.

The EAC for the Project contains conditions adopted to address Project-specific concerns, as raised by Indigenous groups, local communities, and resource management agencies. Condition 24 of the EAC for the Project describes the requirement to develop a Socio-economic Effects Management Plan (SEEMP). The SEEMP is a consolidated, stand-alone document that identifies actions to monitor and report direct effects of the construction phase of the Project on regional and community infrastructure and services. The SEEMP was approved by the BC EAO on May 13, 2016 and will be implemented during construction.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on community and regional infrastructure and services. The mitigation for the Project is detailed in sections 15.5, 15.6, and 15.7 of the EAC Application as well as the SEEMP and other management plans that have been prepared to meet the conditions of the EAC #E14-03.

15. Traditional Land and Resource Use

The assessment of potential adverse effects of the Project on TLRU is provided in Section 16 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on Current Use of Land and Resources for Traditional Purposes, and Cultural Sites VCs along the proposed Groundbirch Connector. The summary addresses only the differences in baseline conditions and potential effects when assessing the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on TLRU. The mitigation for the Project is detailed in sections 16.6 and 16.7 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

15.1 Baseline Information

In the EAC Application the term ‘Aboriginal’ was used to describe Aboriginal groups; however, since 2015, “Indigenous” has been used for consistency with the United Nations Declaration of the Rights of Indigenous Peoples. Since filing the EAC Application in March 2014, Coastal GasLink has continued to engage with Indigenous groups that might be affected by the Project or that might have an interest in the Project based on the proximity of their community and their assertion of traditional and cultural use of the land in the Project area. Additionally, Coastal GasLink has engaged with the following Indigenous groups who are potentially affected by the construction and operation of the proposed Groundbirch Connector:

- Blueberry River First Nations
- Doig River First Nation
- Halfway River First Nation
- Horse Lake First Nation
- McLeod Lake Indian Band
- Saulteau First Nations
- West Moberly First Nations

In the process of preparing the EAC Application for the Project, Coastal GasLink facilitated the collection of TLRU information with Indigenous groups that focused on the current use of Crown lands for traditional activities, including associated physical works and activities. The proposed Groundbirch Connector is located on land owned by a single private landowner and engagement is ongoing to identify potential values or interests in the area. A summary of interests and concerns raised to date are summarized in Section 20 of this amendment.

Due to the Groundbirch Connector’s location and that it is on cultivated freehold lands where landowners control access, there is no material change in the overall setting for current use of land and resources for traditional purposes and cultural sites considered in the EAC Application.

15.2 Current Use of Land and Resources for Traditional Purposes Effects Assessment

The baseline conditions for the proposed Groundbirch Connector, as they relate to the Current Use of Land and Resources for Traditional Purposes VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 16.6 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Current Use of Land and Resources for Traditional Purposes VC during the construction, operations, and decommissioning and abandonment phases of the

Project. No positive effects to current use of land and resources for traditional purposes were identified in the EAC Application.

15.3 Cultural Sites Effects Assessment

The baseline conditions for the proposed Groundbirch Connector, as they relate to the Cultural Sites VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 16.7 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Cultural Sites VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to cultural sites were identified in the EAC Application.

16. Heritage Effects Assessment

The heritage direct and indirect effects assessment is provided in sections 17 and 18 of the EAC Application. Section 17 of this Amendment Application assesses the potential positive and negative direct and indirect adverse effects on the heritage VCs associated with the construction, operations, and decommissioning and abandonment phases of the proposed Groundbirch Connector that have not been assessed in the EAC Application.

17. Heritage Resources

The assessment of potential adverse effects of the Project on heritage resources is provided in Section 18 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on Archaeological Sites, Historic Sites, Palaeontological Sites, and Architectural Sites VCs along the proposed Groundbirch Connector. The summary addresses only the differences in baseline conditions and potential effects when assessing the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

17.1 Baseline Information

The following subsections provide information on baseline conditions for the Archaeological Sites, Historic Sites, Palaeontological Sites, and Architectural Sites VCs, specific to the proposed Groundbirch Connector.

While there is new information provided on the baseline conditions for heritage resources in relation to the proposed Groundbirch Connector, these updated baseline conditions do not result in a material change to the overall heritage resources setting considered in the EAC Application.

An Archaeological Impact Assessment (AIA) for the proposed Groundbirch Connector was completed in May and June 2020 with the assistance of members of the Blueberry River First Nations, Halfway River First Nation, and Saulteau First Nations under BC *Heritage Conservation Act* (HCA) Permit 2020-0120. Approximately 1 km of the west portion of the proposed Groundbirch Connector was previously assessed in 2014 and 2015 under BC HCA Permit 2014-0114. The Assessment Area of the AIAs conducted in 2014, 2015, and 2020 includes the proposed Groundbirch Connector Footprint and has been previously subject to agricultural activities including clearing and surficial ploughing. No HCA-protected culturally modified trees were identified within the Groundbirch Connector Footprint. One archaeological site was identified within the Groundbirch Connector Footprint during the AIAs conducted in 2014, 2015 and 2020. The AIA Final Reports were submitted to the BC MFLNRORD Archaeology Branch for review and approval.

As a result of the AIAs, it is recommended that the identified site be avoided and flagged with an appropriate buffer in advance of any planned land-altering construction activities within 100 m of the site. If avoidance is not feasible due to construction constraints, an HCA Section 12.4 Permit will be required prior to any land-altering construction activities occurring within the recorded site boundary. No further archaeological work is recommended for the remainder of the proposed Groundbirch Connector.

17.2 Archaeological Sites Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Archaeological Sites VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 17 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Archaeological Sites VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to archaeological sites were identified in the EAC Application.

17.3 Historic Sites Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Historic Sites VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential interactions for proposed activities for the proposed Groundbirch Connector are also comparable, there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Historic Sites VC during the construction, operations, and decommissioning and abandonment phases of the Project.

17.4 Palaeontological Sites Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Palaeontological Sites VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 17 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Palaeontological Sites VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to palaeontological sites were identified in the EAC Application.

17.5 Architectural Sites Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Architectural Sites VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential direct and indirect interactions for proposed activities for the proposed Groundbirch Connector are also comparable (see Section 17 of the EAC Application for a summary of direct and indirect adverse effects identified for the Project), there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Architectural Sites VC during the construction, operations, and decommissioning and abandonment phases of the Project. No positive effects to architectural sites were identified in the EAC Application.

18. Health Effects Assessment

The health direct and indirect effects assessment is provided in sections 19 and 20 of the EAC Application. Section 19 of this Amendment Application assesses the potential positive and negative direct and indirect adverse effects when assessing the proposed Groundbirch Connector on the health VCs associated with the construction, operations, and decommissioning and abandonment phases of the Project that have not been assessed in the EAC Application.

19. Human and Ecological Health

The assessment of potential adverse effects of the Project on health is provided in Section 20 of the EAC Application. The following subsections provide a summary of baseline conditions and any resulting changes to the assessment of potential adverse effects on Human Health and Ecological Health VCs along the proposed Groundbirch Connector. The summary addresses only the differences in baseline conditions and potential effects when assessing the proposed Groundbirch Connector, relative to the assessment provided in the EAC Application.

19.1 Baseline Information

Baseline air quality conditions and noise levels along the proposed Groundbirch Connector are predicted to be comparable to those discussed in the EAC Application. While there is new information provided on the baseline conditions for human and ecological health in relation to the proposed Groundbirch Connector, these updated baseline conditions do not result in a material change to the overall human and ecological health setting considered in the EAC Application.

19.1.1 Human Health

The EAC Application assessed human health effects from inhalation exposure of emissions from compressor station operations. The potential effects of noise on residents along the Certified Pipeline Corridor were also assessed.

Compared to the baseline conditions described for human health in the EAC Application, there is no appreciable difference in the baseline air quality and noise conditions for the area around the proposed Groundbirch Connector. The background concentrations of CACs are all below the applicable BC ambient air quality objectives. Baseline noise levels are consistent with those associated with rural areas, and generally associated with natural noises (for example, wildlife and weather conditions, such as wind and precipitation). The area is rural, with little or no human development, and there are no nearby human receptors (that is, permanent or seasonally occupied human dwellings). There is no material change in the baseline conditions for human health described in the EAC Application.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on health. The mitigation for the Project is detailed in Section 20.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

19.1.2 Ecological Health

The EAC Application assessed ecological health effects based on wildlife exposure to CACs and noise.

Compared to the baseline conditions described for ecological health in the EAC Application, there is no material difference in the baseline air quality and noise conditions for the area around the proposed Groundbirch Connector. Baseline noise levels are consistent with those associated with rural areas, and generally associated with natural noises (for example, wildlife and weather conditions, such as wind and precipitation), which would not adversely affect ecological health. The predicted conditions for air quality associated with the proposed Groundbirch Connector are comparable to those conditions described in the EAC Application. Noise levels along the right-of-way during construction would be comparable to those described in the EAC Application. Therefore, there is no material change in the baseline conditions for ecological health described in the EAC Application.

No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on health. The mitigation for the Project is detailed in Section 20.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.

19.2 Human Health Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Human Health VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential interactions for proposed activities for the proposed Groundbirch Connector are also comparable, there is no material change to the assessment of potential adverse effects, mitigation, or residual effects for the Human Health VC during the construction, operations, and decommissioning and abandonment phases of the Project.

19.3 Ecological Health Effects Assessment

Baseline conditions for the proposed Groundbirch Connector, as they relate to the Ecological Health VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential interactions for proposed activities for the proposed Groundbirch Connector are also comparable, there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Ecological Health VC during the construction, operations, and decommissioning and abandonment phases of the Project.

20. Indigenous Groups Information Requirements

This section considers the potential Indigenous interests that may be affected by the construction and operations of the Groundbirch Connector. The understanding of Indigenous interests is informed by Traditional Land Use (TLU) studies and traditional knowledge gathering completed for the Project (sections 16 and 23 of the EAC Application and Section 14 of the SHAR Amendment), as well as records of engagement presented in the Aboriginal Consultation Reports for the Project and in this Amendment Application. The information collected for the proposed Groundbirch Connector builds on the information presented in the EAC Application where applicable.

Subsection 20.1 summarizes the Indigenous engagement Coastal GasLink has conducted with the potentially affected Indigenous groups and provides a table of Coastal GasLink's understanding of each Indigenous groups' issues and concerns. Subsection 20.2 considers the potential Indigenous interests that may be affected by the construction and operations of the Groundbirch Connector.

20.1 Indigenous Engagement

Coastal GasLink follows the objectives and process for engagement as outlined in the Coastal GasLink Pipeline Project Aboriginal Consultation Plan (Coastal GasLink 2013). Coastal GasLink has been engaging with Treaty 8 Indigenous groups on the Project since 2012, with the exception of Horse Lake First Nation, which was included as an Indigenous group potentially affected by the proposed Groundbirch Connector amendment.

Since June 2020, Coastal GasLink has engaged with the following Indigenous groups who are potentially affected by the construction and operation of the proposed Groundbirch Connector:

- Blueberry River First Nations
- Doig River First Nation
- Halfway River First Nation
- Horse Lake First Nation
- McLeod Lake Indian Band
- Saulteau First Nations
- West Moberly First Nations

In addition to consulting with these seven Indigenous groups, Coastal GasLink notified all Indigenous groups in the Project area of its intent to file an EAC Amendment Application to the BC EAO and a permit application to the BC OGC for the proposed Groundbirch Connector.

The issues and concerns raised and potential adverse effects on Indigenous interests identified for the proposed Groundbirch Connector are consistent with those presented in the EAC Application. A summary of interests and concerns by Indigenous group are provided in Table 20-1. A more detailed summary by community is presented in subsections 20.1 and 20.2.

Table 20-1. Indigenous Group Interests and Concerns Summary

Indigenous Group	Interest, Issue or Concern	Coastal Gas Link Response	Status
Blueberry River First Nations	No information on interests, issues or concerns has been received from Blueberry River First Nations	N/A	N/A
Doig River First Nation	Timing of when the additional scope for the Groundbirch Connector amendment was first contemplated, formalized, and communicated.	Connections to upstream sources of natural gas were always contemplated and reflected in the original Project Description and Environmental Assessment Application for the Coastal GasLink Project. Although the specific design and location had not yet been determined at the time of the EAC Application, Coastal GasLink and its customers now have sufficient certainty to advance this connection.	Resolved: • Coastal GasLink provided the timeline and list of communications specific to the proposed Groundbirch Connector in an email dated August 14, 2020.
	Suggested that, on a go-forward basis, Coastal GasLink take a more proactive approach for earlier engagement on projects as it is problematic to respond in a meaningful way, especially with the time constraints within a BC OGC process.	Coastal GasLink will endeavor to engage with Doig River First Nation as early as possible moving forward.	Ongoing: • Coastal GasLink acknowledges that having sufficient time to review an application and participate in the regulatory process is a common concern of many Indigenous groups. Coastal GasLink continues to refine its internal processes to ensure that Indigenous groups are engaged as soon as possible once the requirement for an application has been confirmed.
Halfway River First Nation	No information on interests, issues or concerns has been received from Halfway River First Nation.	N/A	N/A
Horse Lake First Nation	Cumulative effects in relation to the number of additional connections to the Project and number of other non-pipeline development in the region.	The EAC Application addresses concerns consistent with Horse Lake First Nation's regarding cumulative effects. For the proposed Groundbirch Connector, Coastal GasLink conducted a careful evaluation of route options to seek the least impactful route. The route selection process for the proposed Groundbirch Connector included collaboration with experts from various disciplines, including land, environment, engineering and construction. The route selection process resulted in a pipeline route that is entirely located on private freehold land that is actively used for agricultural purposes. No provincial lands or federally-owned or administered lands are crossed by the proposed Groundbirch Connector.	Ongoing: • Coastal GasLink provided a table of interests and concerns Identified by Horse Lake First Nation and links to the relevant EAC Application section in email dated September 15, 2020, and will continue to engage with Horse Lake First Nation regarding cumulative effects.

Table 20-1. Indigenous Group Interests and Concerns Summary

Indigenous Group	Interest, Issue or Concern	Coastal Gas Link Response	Status
Horse Lake First Nation (cont'd)	Coastal GasLink's process for addressing the cumulative effects between the proposed Groundbirch Connector with Horse Lake First Nation's exercise of Treaty and Aboriginal rights.	Coastal GasLink's process for addressing cumulative effects between the Project and Treaty 8 Indigenous groups exercise of Treaty and Aboriginal rights is described in Section 16.6.7 of the EAC Application. Coastal GasLink notes Horse Lake First Nation's concerns about the cumulative effects on people, plants, animals, water, and roads are consistent with the values and concerns that have been raised throughout the planning and previous regulatory reviews of the Project, and these concerns have informed a comprehensive Project design and mitigation planning process. The EAC Application addresses these concerns in detail and describes the overall cumulative effects as well as the Project's contributions to these effects on relevant topics to the concerns raised by Horse Lake First Nation.	Ongoing: • Coastal GasLink provided a response to concerns around cumulative effects on September 15, 2020 and will continue to engage with Horse Lake First Nation regarding cumulative effects.
	Lack of availability of locations for Horse Lake First Nation members to exercise their section 35 rights and other interests.	Coastal GasLink acknowledges that Horse Lake First Nation members require locations to exercise their section 35 rights and other interests. The proposed Groundbirch Connector is located on cultivated freehold lands. The lands will only be unavailable for use during and for a short period following construction activities. Most of the pipeline route will return to its previous land capacity and can then be used as it was prior to construction.	Coastal GasLink defers to the Province of BC to continue to engage with Horse Lake First Nation regarding its section 35 rights and interests within the Treaty 8 area.
McLeod Lake Indian Band	Employment opportunities	A McLeod Lake Indian Band contractor was included in the Coastal GasLink business directory and will continue to receive contracting opportunities that align with the services they provide.	Resolved
	Concern about the potential for conflict between the single strand electric fence along the southern and eastern edges and the pipeline.	Coastal GasLink will ensure the fence is left as is or returned to current condition after construction, to the satisfaction of the landowner.	Resolved

Table 20-1. Indigenous Group Interests and Concerns Summary

Indigenous Group	Interest, Issue or Concern	Coastal Gas Link Response	Status
McLeod Lake Indian Band (cont'd)	Concern with the removal of the thin wall of trees surrounding a specific wetland which would increase visibility for wildlife migrating through this area, and potentially increase predation, particularly with smaller mammals that would become easier prey for raptors and may no longer use the area after completion and reclamation.	Coastal GasLink is continuing to review design and construction planning to reduce the removal of the line of trees and the potential resulting effects of increased predation to the extent possible. Security and shelter habitat characteristics will be retained as the smaller tree patch to the east and the larger tree patch to the west of the Groundbirch Connector Footprint will either be unaffected by the proposed amendment or will retain their intactness but with a small reduction in size.	Resolved
	Requested that any larger poplar trees with evidence of wildlife use (for example, evidence of denning or bores) be retained and placed in the area to retain them to maintain wildlife habitat.	During the 2019 wildlife baseline field program, Coastal GasLink determined that no wildlife habitat features requiring mitigation were identified (for example, evidence of denning and bores). Mitigation measures for wildlife habitat features are included in the Project EMP and will be applicable to the proposed Groundbirch Connector. Should any wildlife habitat features that were not identified during the 2019 wildlife baseline field program be identified prior to clearing, Coastal GasLink advised that the appropriate mitigation measures will be discussed with the landowner and upon agreement, applied accordingly while maintaining safety and access.	Resolved
Saulteau First Nations	Saulteau First Nations have informed Coastal GasLink that they would not be able to engage with Coastal GasLink on the proposed Groundbirch Connector until pre-existing economic issues have been resolved.	It is Coastal GasLink's understanding that these outstanding economic issues are related to a business agreement between Saulteau First Nations and Coastal GasLink. Once this issue has been resolved, Coastal GasLink will continue engagement on the proposed Groundbirch Connector.	Ongoing
West Moberly First Nations	No information on interests, issues or concerns has been received from West Moberly First Nations.	N/A	N/A

Coastal GasLink sent a letter by email to all potentially affected Indigenous groups on June 26, 2020, regarding its planning and engagement activities for the proposed Groundbirch Connector. Coastal GasLink provided information regarding the location, scope, and anticipated timelines of the proposed Groundbirch Connector and advised of its plans to file an application to the BC OGC and an EAC Amendment Application to the EAO. In this letter, Coastal GasLink also expressed interest in initiating engagement activities with each Indigenous group and suggested a meeting to:

- Discuss the proposed Groundbirch Connector
- Understand how the proposed Groundbirch Connector may affect the Indigenous group's land use
- Identify any potential new effects of the proposed Groundbirch Connector on that Indigenous group

A Fact Sheet of the proposed Groundbirch Connector and map accompanied the letter, and shapefiles were uploaded to an online repository accessible by each Indigenous group. To support participation in the regulatory processes and to conducted consultation and engagement activities related to the proposed Groundbirch Connector, Coastal GasLink advised each Indigenous group that it had allocated capacity funding in a recent letter of agreement (dated May 5, 2020) to carry out these activities (where applicable). If an Indigenous group did not have a letter of agreement in place (that is, Horse Lake First Nation), Coastal GasLink made an initial offer of capacity funding to support their participation. To date, capacity funding agreements have been finalized with Doig River First Nation, Halfway River First Nation, McLeod Lake Indian Band, Saulteau First Nations, and West Moberly First Nations

Additional engagement activities specific to each of the potentially affected Indigenous groups regarding the proposed Groundbirch Connector are outlined in subheadings 20.1.1 to 20.1.7.

20.1.1 Blueberry River First Nations

As a follow-up to the June 26, 2020 letter sent by Coastal GasLink to Blueberry River First Nations, Coastal GasLink sent an email to Blueberry River First Nations on June 29, 2020, inquiring whether Blueberry River First Nation had any questions or required any additional information regarding the proposed Groundbirch Connector and requesting a meeting to discuss the proposed Groundbirch Connector in detail.

Coastal GasLink sent an email to Blueberry River First Nations on September 1, 2020, following up on previous correspondence regarding the proposed Groundbirch Connector, inquiring whether Blueberry River First Nations had any questions, concerns or comments regarding the proposed Groundbirch Connector and offering to schedule a meeting to address any questions.

Blueberry River First Nations sent an email to Coastal GasLink on September 9, 2020, suggesting a meeting to discuss the proposed Groundbirch Connector the following week. Coastal GasLink responded by email on September 10, 2020, asking for Blueberry River First Nations to provide a suggested date and time for the meeting.

Coastal GasLink sent an email to Blueberry River First Nations on September 14, 2020, inquiring as to whether a meeting could be scheduled for that week and suggesting potential dates and times. As of September 22, 2020, Coastal GasLink has not yet received a response from Blueberry River First Nations, however, Coastal GasLink will continue with its attempts to engage Blueberry River First Nations regarding the proposed Groundbirch Connector.

20.1.2 Doig River First Nation

In follow-up to the June 26, 2020, letter sent by Coastal GasLink to Doig River First Nation, Coastal GasLink sent an email to Doig River First Nation on July 9, 2020, inquiring whether Doig River First Nation had any questions or required any additional information regarding the proposed Groundbirch Connector and requesting a meeting to discuss the proposed Groundbirch Connector in detail. Through email correspondence, a meeting was originally scheduled for July 15, 2020, which was then rescheduled for July 24, 2020.

Coastal GasLink met with Doig River First Nation on July 24, 2020, to discuss the proposed Groundbirch Connector. Coastal GasLink provided an overview of the proposed Groundbirch Connector, including information regarding the regulatory applications, scope and schedule. Coastal GasLink reviewed the proposed Groundbirch Connector construction plan map and advised that the location of the proposed Groundbirch Connector falls on private, agricultural land where landowner agreements are in place. Doig River First Nation asked how long Coastal GasLink has been planning for the proposed Groundbirch Connector. Coastal GasLink advised that the proposed Groundbirch Connector was contemplated in 2014 and that approval to proceed came from LNG Canada in late 2019 when the proposed Groundbirch Connector was added to Coastal GasLink's scope. Doig River First Nations requested confirmation on

when the additional scope was contemplated, formalized and communicated and Coastal GasLink committed to providing this information. Coastal GasLink asked Doig River First Nation if they are using the land in in the area of the proposed Groundbirch Connector. Doig River First Nation advised that they have not yet reviewed TLU information or spoke to membership in this regard and requested shapefiles of the proposed Groundbirch Connector to support their assessment of land use in the area. Coastal GasLink committed to providing shapefiles. Doig River First Nation inquired as to the closest parcels of Crowns Land in proximity to the proposed Groundbirch Connector location and stated that they would review the shapefiles for this information. In response to Doig River First Nation's questions regarding the environmental field programs for the proposed Groundbirch Connector, Coastal GasLink committed to confirming when the field programs for the proposed Groundbirch Connector were completed and to sharing more information about the field programs.

Coastal GasLink sent an email to Doig River First Nation on July 27, 2020 providing shapefiles of the proposed Groundbirch Connector.

Coastal GasLink sent an email to Doig River First Nation on August 14, 2020, providing responses to the questions raised by Doig River First Nation during the July 24, 2020, meeting. In response to the question regarding when the additional scope of the proposed Groundbirch Connector was contemplated, formalized and communicated, Coastal GasLink advised that connections to upstream sources of natural gas were always contemplated and reflected in the original Project Description and Environmental Assessment Application for the Coastal GasLink Project. Coastal GasLink stated that although the specific design and location had not yet been determined at the time of the Application, Coastal GasLink and its customers now have sufficient certainty to advance this connection. Coastal GasLink provided the timeline and list of communications specific to the proposed Groundbirch Connector that have been sent to Doig River First Nation. Coastal GasLink asked that Doig River First Nation provide clarification as to the specific information it is looking for regarding the environmental field programs.

Doig River First Nation sent an email to Coastal GasLink on August 17, 2020, acknowledging receipt of the responses provided on August 14, 2020. Doig River First Nation suggested that, on a go-forward basis, Coastal GasLink take a more proactive approach for earlier engagement on projects as it is problematic to respond in a meaningful way, especially with the time constraints within a BC OGC process.

Coastal GasLink sent an email to Doig River First Nation on September 10, 2020, expressing appreciation for Doig River First Nation's engagement and feedback on the proposed Groundbirch Connector and acknowledging Doig River First Nation's concerns regarding proactive, earlier engagement, especially when regulatory processes are involved. Coastal GasLink stated that it will endeavor to engage with Doig River First Nation as early as possible moving forward. Coastal GasLink asked that Doig River First Nation advise whether they have any additional questions or concerns regarding the proposed Groundbirch Connector.

20.1.3 Halfway River First Nation

In follow-up to the June 26, 2020, letter sent by Coastal GasLink to Halfway River First Nation, Coastal GasLink sent an email to Halfway River First Nation on July 20, 2020, inquiring whether Halfway River First Nation had any questions or required any additional information regarding the proposed Groundbirch Connector and requesting a meeting to discuss the proposed Groundbirch Connector in detail.

Coastal GasLink sent an email to Halfway River First Nation on September 1, 2020, following up on previous correspondence regarding the proposed Groundbirch Connector and inquiring whether Halfway River First Nation would like any additional information or a meeting to discuss the proposed Groundbirch Connector to address any questions. Halfway River First Nation responded by email on the same date requesting the map of the propose Project. Coastal GasLink responded by email on the same date attaching the construction plan map, shapefiles and Fact Sheet for the proposed Groundbirch Connector.

As of September 22, 2020, Coastal GasLink not yet received a response from Halfway River First Nation, however, Coastal GasLink will continue with its attempts to engage Halfway River First Nation regarding the proposed Groundbirch Connector.

20.1.4 Horse Lake First Nation

As a follow-up to the June 26, 2020 letter sent by Coastal GasLink to Horse Lake First Nation, Coastal GasLink sent an email to Horse Lake First Nation on June 29, 2020, inquiring whether Horse Lake First Nation had any questions or required any additional information regarding the proposed Groundbirch Connector and requesting a meeting to discuss the proposed Groundbirch Connector in detail. Through email correspondence, a meeting date was set for July 13, 2020.

Coastal GasLink met with Horse Lake First Nation on July 13, 2020 to discuss the proposed Groundbirch Connector. Coastal GasLink provided an overview of the proposed Groundbirch Connector, including information regarding the regulatory applications, construction scope and schedule, and contracting opportunities. Horse Lake First Nation inquired as to whether Coastal GasLink had considered cumulative effects of the proposed Groundbirch Connector and Coastal GasLink committed to following up with a response.

Immediately following the July 13, 2020 meeting, Coastal GasLink re-sent the Project letter and attachments that had originally been provided on June 26, 2020 and requested that Horse Lake First Nation advise as to whether they would like any additional information or maps. Coastal GasLink also provided the list of attendees from the July 13, 2020 meeting and acknowledged that it would be following up on Horse Lake First Nation's inquiry regarding cumulative effects.

Coastal GasLink sent an email to Horse Lake First Nation on July 22, 2020, requesting clarification regarding Horse Lake First Nation's question regarding cumulative effects which was raised during the July 13, 2020, meeting.

Coastal GasLink sent an email to Horse Lake First Nation on August 31, 2020, reiterating its interest in clarifying Horse Lake First Nation's question regarding cumulative effects so that it can provide a response.

Horse Lake First Nation sent an email to Coastal GasLink on September 1, 2020, providing clarification regarding their cumulative effects question. Horse Lake First Nation advised that the question was asked in relation to how Coastal GasLink is addressing cumulative effects with respect to not only the number of additional connections to the Coastal GasLink Project, but also with respect to the number of developments (that is, agriculture, forestry, hydro, mining, oil and gas) in the region overall. Horse Lake First Nation inquired as to how Coastal GasLink proposes to address the cumulative effects between the proposed Groundbirch Connector with Horse Lake First Nation's exercise of Treaty and Indigenous rights. In relation to this concern about development conducted by multiple parties in multiple economic sectors in the area, Horse Lake First Nation stated that its Elders and Knowledge Holders express concern that there is nowhere else to go to exercise their constitutionally protected section 35 rights and other interests, and expressed interest in protecting Horse Lake First Nation's traditional mode of life. Horse Lake First Nation sent an additional email to Coastal GasLink on the same date adding that the question regarding cumulative effects includes all activity in the area that the proposed Groundbirch Connector will affect, starting with industry selling gas to TC Energy. Horse Lake First Nation stated that the proposed Groundbirch Connector will result in more drilling in the territory which affects the people, animals, plants, water, roads.

Coastal Gaslink sent an email to Horse Lake First Nation on September 9, 2020, acknowledging receipt of Horse Lake First Nation's clarification regarding cumulative effects and advising that it will be providing a response. Coastal GasLink followed up with an email to Horse Lake First Nation on September 15, 2020, attaching a letter providing responses to Horse Lake First Nation's questions regarding cumulative effects. In the letter Coastal GasLink acknowledges that Horse Lake First Nation's concerns about the cumulative effects on people, plants, animals, water, and roads are consistent with the values and concerns that have been raised throughout the planning and previous regulatory reviews of the Project,

and these concerns have informed a comprehensive Project design and mitigation planning process. The letter describes how the EAC Application addresses these concerns in detail and describes the overall cumulative effects as well as the Project's contributions to these effects on relevant topics to the concerns raised by Horse Lake First Nation. Coastal GasLink provides information and links to where these are addressed in the EAC Application.

20.1.5 McLeod Lake Indian Band

As a follow-up to the June 26, 2020 letter sent by Coastal GasLink to McLeod Lake Indian Band, Coastal GasLink sent a second email to McLeod Lake Indian Band on June 29, 2020, inquiring whether McLeod Lake Indian Band had any questions or required any additional information regarding the proposed Groundbirch Connector and requesting a meeting to discuss the proposed Groundbirch Connector in detail. Through email correspondence, a meeting date was set for July 22, 2020.

Coastal GasLink met with McLeod Lake Indian Band on July 22, 2020, to discuss the proposed Groundbirch Connector. Coastal GasLink provided an overview of the proposed Groundbirch Connector, including information regarding the regulatory applications, construction scope and schedule, contracting opportunities, and a review of the construction plan map. Coastal GasLink asked McLeod Lake Indian Band whether they have historically or are currently using the land in in the area of the proposed Groundbirch Connector. McLeod Lake Indian Band advised that there are historic travelways in the area and that they would review the shapefiles provided by Coastal GasLink to confirm if the travelways interact with the proposed Groundbirch Connector. McLeod Lake Indian Band asked whether a specific McLeod Lake Indian Band contractor was included in the Coastal GasLink approved vendor list and Coastal GasLink committed to follow up. McLeod Lake Indian Band asked whether Coastal GasLink could accommodate a follow-up video meeting and Coastal GasLink confirmed that this would be possible.

Coastal GasLink sent an email to McLeod Lake Indian Band on July 22, 2020, attaching the proposed Groundbirch Connector letter and attachments originally provided on June 26, 2020, as well as the construction plan map that was reviewed during the meeting held earlier that day. Coastal GasLink provided the list of attendees from the meeting and the key points of the discussion. Coastal GasLink attached the shapefile of the proposed Groundbirch Connector to support further discussions regarding historic and current use of the land by McLeod Lake Indian Band. Coastal GasLink asked that McLeod Lake Indian Band advise as to whether they have any concerns regarding the proposed Groundbirch Connector. Coastal GasLink also confirmed that a McLeod Lake Indian Band contractor was included in the Coastal GasLink business directory and will continue to receive contracting opportunities that align with the services they provide. McLeod Lake Indian Band responded by email on the same date acknowledging receipt of the information and committing to follow up if further information is needed for their review.

McLeod Lake Indian Band sent an email to Coastal GasLink on July 23, 2020, with comments and questions regarding the proposed Groundbirch Connector. McLeod Lake Indian Band advised that the nearest Historic Trails are over 4 km away from the proposed Groundbirch Connector and that they would confirm with Coastal GasLink the following week whether there are any other TLU sites. Upon review of the mapping provided by Coastal GasLink, McLeod Lake Indian Band advised that there is "not a lot of concern" regarding potential additional effects on Treaty Rights as the proposed Groundbirch Connector is within cleared agricultural land and the new cut is minimal. McLeod Lake Indian Band expressed concern with the removal of the thin wall of trees surrounding a specific wetland which would increase visibility for wildlife migrating through this area, and potentially increase predation, particularly with smaller mammals that would become easier prey for raptors and may no longer use the area after completion and reclamation. McLeod Lake Indian Band referenced the single strand electric fence along the southern and eastern edges and asked whether there is there any potential for conflict with the fence and the pipeline. McLeod Lake Indian Band asked if there are any larger poplar trees with evidence of wildlife use (for example, evidence of denning or bores), can these trees be retained and placed in the area to retain them to maintain wildlife inhabitance. McLeod Lake Indian Band advised that they would respond the

following week with any additional questions. Coastal GasLink replied by email on the same date confirming receipt of the trail information and advising that it looks forward to receiving any TLU information that McLeod Lake Indian Band may share. Coastal GasLink committed to providing responses to McLeod Lake Indian Band's questions, as outlined in their email, and asked whether a meeting should be scheduled to review the questions and responses.

Coastal GasLink sent another email to McLeod Lake Indian Band on August 4, 2020, providing responses to the questions raised in McLeod Lake Indian Band's July 23, 2020 email. Coastal GasLink acknowledged that the removal of the line of trees running north-south provides a visual screen or line-of-sight break within a large agricultural field; as such, the loss of this line of trees may deter ungulates from entering into or crossing the field or, once in the field, an individual's predation risk may be greater than it was at baseline at this location. Additionally, for smaller wildlife species (for example, fox, coyote, woodchuck, mice, and voles) the loss of the line of trees may result in a loss of security cover and habitat for some individuals and potentially a slight increase in predation risk. Given these potential effects, Coastal GasLink is continuing to review design and construction planning to potentially reduce the removal of the line of trees to the extent possible. Coastal GasLink noted that the Project area will retain security and shelter habitat characteristics as the smaller tree patch to the east and the larger tree patch to the west of the Project Footprint will either be unaffected by the proposed Project or will retain their intactness but with a small reduction in size.

In response to the question regarding potential conflict between the electric fence and the pipeline, Coastal GasLink advised that it will ensure the fence is left as is or returned to current condition after construction, to the satisfaction of the landowner. In response to the question regarding evidence of wildlife use in poplar trees, Coastal GasLink advised that during the 2019 wildlife baseline field program, it was determined that no wildlife habitat features requiring mitigation were identified (for example, evidence of denning and bores). Mitigation measures for wildlife habitat features are included in the Project EMP and will be applicable to the proposed Groundbirch Connector. Should any wildlife habitat features be identified prior to clearing, that were not identified during the 2019 wildlife baseline field program, Coastal GasLink advised that the appropriate mitigation measures will be discussed with the landowner and upon agreement, applied accordingly while maintaining safety and access.

Coastal GasLink inquired as to whether McLeod Lake Indian Band have had the opportunity to review whether there are any TLU sites that may be potentially affected by the proposed Groundbirch Connector and expressed interest in scheduling a meeting to discuss the responses provided.

Coastal GasLink sent an email to McLeod Lake Indian Band on September 2, 2020, following up on whether McLeod Lake Indian Band had any feedback regarding TLU in area of the proposed Groundbirch Connector. McLeod Lake Indian Band responded by email on the same date stating that the elbow section is on disturbed private agricultural tenure and that sort of activity would have erased any cultural values. McLeod Lake Indian Band added that because the elbow connector seems to be all on agricultural tenure, McLeod Lake people would not have access. Coastal GasLink responded by email on the same date advising that the proposed Groundbirch Connector is located on land owned by a single private landowner and in the ALR but wanted to confirm whether any historic use may still exist or if the area has cultural or spiritual significance, or if there were current access agreements with the landowner in place. Coastal GasLink acknowledged McLeod Lake Indian Band's confirmation that the historic significance of the area has been changed by its current use and that McLeod Lake Indian Band does not currently use the area of the proposed Groundbirch Connector. Coastal GasLink advised that contracting opportunities regarding the proposed Groundbirch Connector have been shared with McLeod Lake Indian Band and asked that McLeod Lake Indian Band advise whether they would like to discuss any other matters related to the proposed Groundbirch Connector.

20.1.6 Saulteau First Nations

As a follow-up to the June 26, 2020 letter sent by Coastal GasLink to Saulteau First Nations, Coastal GasLink sent an email to Saulteau First Nations on July 9, 2020, inquiring whether Saulteau First Nations had any questions or required any additional information regarding the proposed Groundbirch Connector and requesting a meeting to discuss the proposed Groundbirch Connector in detail.

Saulteau First Nations telephoned Coastal GasLink on July 22, 2020, to advise Coastal GasLink that due to unrelated outstanding issues they would not be able to engage with Coastal GasLink on the proposed Groundbirch Connector until the existing issues have been resolved. Coastal GasLink understands that these outstanding issues are related to a business opportunity and is in the process of resolving this issue with Saulteau First Nations. Once this has been resolved, Coastal GasLink will continue engagement on the proposed Groundbirch Connector.

Coastal GasLink sent an email to Saulteau First Nations on August 27, 2020, resending the proposed Groundbirch Connector letter and attachments originally provided on June 26, 2020. Coastal GasLink provided a regulatory update advising that it had filed the application to the BC OGC for the proposed Groundbirch Connector and intends to file the EAC Amendment Application to the EAO in the fall. Coastal GasLink advised that it remains interested in receiving feedback from Saulteau First Nations and offered to provide any additional information or address any questions that Saulteau First Nations may have. As of September 22, 2020, Coastal GasLink not yet received a response from Saulteau First Nations, however, Coastal GasLink will continue with its attempts to engage Saulteau First Nations regarding the proposed Groundbirch Connector.

20.1.7 West Moberly First Nations

As a follow-up to the June 26, 2020 letter sent by Coastal GasLink to West Moberly First Nations, Coastal GasLink sent an email to West Moberly First Nations on June 29, 2020, inquiring whether West Moberly First Nations had any questions or required any additional information regarding the proposed Groundbirch Connector and requesting a meeting to discuss the proposed Groundbirch Connector in detail. Through email correspondence, a meeting date was set for July 14, 2020.

Coastal GasLink met with West Moberly First Nations on July 14, 2020, to discuss the proposed Groundbirch Connector. Coastal GasLink provided an overview of the proposed Groundbirch Connector, including information regarding the regulatory applications, construction scope and schedule, contracting opportunities, and that Coastal GasLink's existing management plans would be implemented for the proposed Groundbirch Connector. Coastal GasLink reviewed the proposed Groundbirch Connector construction plan map and advised that the location of the proposed Groundbirch Connector falls on private, agricultural land where landowner agreements are in place. West Moberly First Nations indicated that they would provide information regarding the proposed Groundbirch Connector during the Chief and Council meeting later that day and committed to follow up with Coastal GasLink should any concerns or questions be raised.

Coastal GasLink sent an email to West Moberly First Nations on July 14, 2020, attaching the proposed Groundbirch Connector letter and attachments originally provided on June 26, 2020 as well as the construction plan map that was reviewed during the meeting held earlier that day. Coastal GasLink provided the list of attendees from the July 14, 2020, meeting and the key points of the discussion. Coastal GasLink asked that West Moberly First Nations advise as to whether they have any concerns regarding the proposed Groundbirch Connector.

Coastal GasLink sent an email to West Moberly First Nations on July 20, 2020, inquiring as to whether West Moberly First Nations leadership had any questions regarding the proposed Groundbirch Connector and offering to provide any requested information by email or meeting. West Moberly First Nations responded by email on the same day advising that the Chief and Council meeting was postponed due to the passing of a community member and the offices were closed and would be reopening on July 27, 2020.

Coastal GasLink sent an email to West Moberly First Nations on September 1, 2020, inquiring as to whether West Moberly First Nations would like to schedule a follow-up meeting to discuss the proposed Groundbirch Connector. West Moberly First Nations responded by email on the same date asking whether Coastal GasLink had discussed the proposed Groundbirch Connector with Chief and Council. Coastal GasLink responded by email on the same date confirming that the June 26, 2020, proposed Groundbirch Connector notification letter and attachments were sent to West Moberly Chief and Council and that the planned Chief and Council meeting scheduled for July had been postponed. Coastal GasLink offered to provide a presentation on the proposed Groundbirch Connector to Chief and Council and re-attached the proposed Groundbirch Connector information previously provided (June 26, 2020, letter, Fact Sheet, shapefiles).

Coastal GasLink sent an email to West Moberly First Nations on September 10, 2020, inquiring whether it should resend the proposed Groundbirch Connector information to Chief and Council and offer a meeting. Coastal GasLink attached the proposed Groundbirch Connector information (June 26, 2020, letter, Fact Sheet, shapefiles).

20.1.8 Future Consultation Activities

Coastal GasLink will continue to consult and engage with Indigenous groups that are potentially affected by the Project in accordance with the Aboriginal Consultation Plan and regulatory requirements. This will include the sharing of Project information with Indigenous groups through construction and operation of the Project. Coastal GasLink will continue to consider feedback from Indigenous groups, where appropriate and when made available, as construction planning and detailed engineering design advances.

20.2 Assessment of Effects on Indigenous Interests

The Indigenous groups listed in Subsection 20.1 may have interests in the proposed Groundbirch Connector. The understanding of these interests is informed by Coastal GasLink's engagement with these Indigenous groups for the proposed Groundbirch Connector (see Subsection 20.1) as well as previous engagement, TLU studies and traditional knowledge gathering completed as part of the Project (Section 15.0 of the EAC Application). The information collected during these activities for the Groundbirch Connector builds on the information presented in the EAC Application, including its addenda and investigations completed in collaboration with the Indigenous groups potentially affected by the Project. As indicated in subheadings 20.1.1 to 20.1.7, Coastal GasLink has initiated engagement with the Indigenous groups who may have interests in the proposed Groundbirch Connector and has requested information regarding those potential interests. Coastal GasLink will continue to engage with Indigenous groups to address any outstanding interests that may arise.

The interests, issues and concerns raised and potential adverse effects on Indigenous interests identified for the proposed Groundbirch Connector are similar to concerns considered in the original EAC Application. Potential positive direct and indirect effects as a result of the proposed Groundbirch Connector are summarized in Section 24.4.1. No potential interactions have been identified regarding the proposed Groundbirch Connector that were not already considered in the following sections of the original EAC Application:

- Section 16.6, which discusses current use of lands and resources for traditional purposes
- Section 16.7, which discusses cultural sites
- Section 23, which discusses Aboriginal interests for each affected Aboriginal group of the Certified Project

Indigenous interests considered in this assessment are those identified in the EAC Application and include hunting, trapping, fishing, plant gathering, and ability to practice cultural activities. Applicable mitigation of the potential adverse effects on Indigenous interests is presented in Table 23-44 of the EAC Application.

The proposed Groundbirch Connector is located on cultivated freehold lands with private access and is therefore not anticipated to contribute to effects on Indigenous interests not already considered in the EAC Application. The assessment of effects for each Indigenous group considered for the proposed Groundbirch Connector is considered in section 20.2 of this application.

20.2.1 Blueberry River First Nations

Section 15 of this EAC Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. In the absence of new information from Blueberry River First Nations since the EAC Application regarding Indigenous interests in the area and given the proposed Groundbirch Connector is on fee simple private land that is primarily used for agricultural purposes, the baseline conditions for the proposed Groundbirch Connector as they relate to Indigenous interests are comparable to those assessed for the Project. As a result, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on Blueberry River First Nations' Indigenous interests.

20.2.2 Doig River First Nation

Section 15 of this EAC Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. In the absence of new information from Doig River First Nation since the EAC Application regarding Indigenous interests in the area and given the proposed Groundbirch Connector is on fee simple private land that is primarily used for agricultural purposes, the baseline conditions for the proposed Groundbirch Connector as they relate to Indigenous interests are comparable to those assessed for the Project. As a result, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on Doig River First Nations' Indigenous interests.

20.2.3 Halfway River First Nation

Section 15 of this EAC Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. In the absence of new information from Halfway River First Nation since the EAC Application regarding Indigenous interests in the area and given the proposed Groundbirch Connector is on fee simple private land that is primarily used for agricultural purposes, the baseline conditions for the proposed Groundbirch Connector as they relate to Indigenous interests are comparable to those assessed for the Project. As a result, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on Halfway River First Nations' Indigenous interests.

20.2.4 Horse Lake First Nation

Section 15 of this EAC Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. During engagement activities for the proposed Groundbirch Connector, Horse Lake First Nation indicated to Coastal GasLink that they have are concerned regarding availability of lands for the exercise of section 35 rights given development by multiple parties in the area, and that due to development generally they have nowhere else to go to exercise their constitutionally protected section 35 rights and other interests; and they expressed interest in protecting Horse Lake First Nation's traditional mode of life. Horse Lake First Nation has not provided further information on the section 35 rights it has exercised in the past, currently exercises, or anticipates exercising in the future for the proposed Groundbirch Connector. Coastal GasLink will continue to engage with Horse Lake First Nation to determine specific rights associated with this interest.

In the absence of information from Horse Lake River First Nation on the section 35 rights it exercises in relation to the proposed Groundbirch Connector, and given the proposed Groundbirch Connector is on fee simple private land that is primarily used for agricultural purposes, the baseline conditions for the proposed Groundbirch Connector as they relate to Indigenous interests are comparable to those assessed for the Project. As a result, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on Halfway River First Nations' Indigenous interests.

20.2.5 McLeod Lake Indian Band

Section 15 of this EAC Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. During engagement activities for the proposed Groundbirch Connector, McLeod Lake Indian Band informed Coastal GasLink that any historic TLU sites in the area would no longer be used due to the agriculturally-developed state of the land. In addition, McLeod Lake Indian Band advised that there is "not a lot of concern" regarding potential additional effects on Treaty rights as the proposed Groundbirch Connector is almost entirely within cleared agricultural land.

In the absence of information from McLeod Lake Indian Band on the section 35 rights it exercises in relation to the proposed Groundbirch Connector, and given the proposed Groundbirch Connector is on fee simple private land that is primarily used for agricultural purposes, the baseline conditions for the proposed Groundbirch Connector as they relate to Indigenous interests are comparable to those assessed for the Project. As a result, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on Halfway River First Nations' Indigenous interests.

20.2.6 Saulteau First Nations

Section 15 of this EAC Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. In the absence of new information from Saulteau First Nations since the EAC Application regarding Indigenous interests in the area and given the proposed Groundbirch Connector is on fee simple private land that is primarily used for agricultural purposes, the baseline conditions for the proposed Groundbirch Connector as they relate to Indigenous interests are comparable to those assessed for the Project. As a result, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on Saulteau First Nations' Indigenous interests.

20.2.7 West Moberly First Nations

Section 15 of this EAC Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. In the absence of new information from West Moberly First Nations since the EAC Application regarding Indigenous interests in the area and given the proposed Groundbirch Connector is on fee simple private land that is primarily used for agricultural purposes, the baseline conditions for the proposed Groundbirch Connector as they relate to Indigenous interests are comparable to those assessed for the Project. As a result, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on West Moberly First Nations' Indigenous interests.

20.3 Summary

Section 15 of this Amendment Application presents the assessment of the proposed Groundbirch Connector on TLRU, and concludes that there is no material change to the assessment of potential adverse effects, mitigation or residual effects. The baseline conditions for the proposed Groundbirch Connector, as they relate to Indigenous interests, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential interactions for proposed activities for the proposed Groundbirch Connector are also comparable, there is no material change to the assessment of potential adverse effects, mitigation or residual effects on Indigenous interests during the construction, operations, and decommissioning and abandonment phases of the Project. Accordingly, there is no material change to the assessment of potential adverse effects, mitigation, or residual effects on Indigenous interests.

21. Public Consultation

The Public Consultation Plan developed for the EAC Application outlines Coastal GasLink's principles, approach, and communication methods for public consultation. These principles and methods will be applied to the proposed amendment throughout the BC EAO amendment process, including pre-filing of this Amendment Application, BC EAO review of this Amendment Application, and post-EAC Amendment stages. Engagement on the proposed amendment before submitting this proposed amendment to the BC EAO allowed Coastal GasLink to provide public stakeholders with information on the proposed amendment and collect feedback on key issues and concerns. In addition to meeting regulatory requirements, the Public Consultation Plan developed for the EAC Application is intended to promote long-term relationships with stakeholders that are based on mutual respect.

Through public consultation, Coastal GasLink is committed to:

- Providing clear information about the proposed amendment and the BC EAO process
- Encouraging early information sharing
- Providing opportunities for community leaders and members to identify and document their comments or concerns
- Incorporating feedback and knowledge from stakeholders into planning the proposed amendment

21.1 Stakeholder Groups Targeted for Consultation

The following stakeholders have been identified for engagement on the proposed amendment:

- **Regional Districts:** PRRD Chief Administrative Officer (CAO) and Board
- **Local Municipal Governments:**
  - City of Fort St. John CAO and Mayor
  - City of Dawson Creek CAO and Mayor
  - District of Chetwynd CAO and Mayor
  - Fort St. John Chamber of Commerce
  - Dawson Creek Chamber of Commerce
  - Chetwynd Chamber of Commerce
- **Other stakeholders:**
  - Local RCMP contacts in Fort St. John, Dawson Creek and Chetwynd
  - Local Fire Chiefs in Fort St. John, Dawson Creek and Chetwynd

21.2 Consultation to Date

Table 21-1 provides a summary of consultation and engagement activities between Coastal GasLink and the potentially affected stakeholder groups regarding the proposed Groundbirch Connector. No comments have been received from stakeholders as of July 6, 2020.

Table 21-1. Summary of Consultation Activities

Date	Method of Contact	Stakeholder Name	Description
April 24, 2020	Email	• PRRD CAO and Board • City of Fort St. John CAO and Mayor • City of Dawson Creek CAO and Mayor • District of Chetwynd CAO and Mayor	Coastal GasLink provided a Notification on the proposed Groundbirch Connector, Groundbirch Connector factsheet, as well as "Your safety, Our Integrity" brochure and "Engaging with Stakeholders" brochure. Feedback and interest in a meeting were solicited.
May 7, 2020	Email	• PRRD CAO and Board • City of Fort St. John CAO and Mayor • City of Dawson Creek CAO and Mayor • District of Chetwynd CAO and Mayor	Coastal GasLink sent a follow-up email containing the same information as the April 24, 2020 notification, and soliciting feedback and interest in a meeting to review the proposed Groundbirch Connector.
May 7, 2020	Email	• Fort St. John Chamber of Commerce • Dawson Creek Chamber of Commerce • Chetwynd Chamber of Commerce	To gather further public feedback on the proposed Groundbirch Connector, Coastal GasLink sent the Fact Sheet and notification email to local Chambers of Commerce in the Peace River region with the intention of them sharing the information through to their networks. The Chetwynd Chamber of Commerce shared the content of the Fact Sheet on their Facebook page in mid-May 2020.
June 29, 2020	Email	• PRRD CAO and Board • City of Fort St. John CAO and Mayor • City of Dawson Creek CAO and Mayor • District of Chetwynd CAO and Mayor • Fort St. John Chamber of Commerce • Dawson Creek Chamber of Commerce • Chetwynd Chamber of Commerce • Local RCMP contacts in Fort St. John, Dawson Creek and Chetwynd • Local Fire Chiefs in Fort St. John, Dawson Creek and Chetwynd	Coastal GasLink provided an updated version of the Notification on the proposed Groundbirch Connector and solicited feedback. Local first responders were also included in the email distribution of the notification. The updated notification included revised regulatory timelines and information on Coastal GasLink's intention to file an Amendment Application with the BC EAO to amend the Environmental Assessment Certificate, which applies to the Coastal GasLink Pipeline Project. This notification also included an updated Fact Sheet.

21.3 Future Consultation Activities

Coastal GasLink continues to engage with stakeholders to provide updated Project information, including the amendments, and to address any questions or concerns that arise. Coastal GasLink will continue to engage with regulatory agencies, as appropriate, regarding municipal, provincial and federal environmental management objectives.

21.4 Summary

No comments have been received from stakeholders as of July 6, 2020. Ongoing engagement with stakeholders will continue through the planning and construction phases of the Project, including the amendments. Throughout the engagement process, Coastal GasLink will work with stakeholders to address questions or concerns that may arise and collaborate on potential solutions. Stakeholder engagement activities for the Project will be transitioned to the TransCanada's existing Public Awareness Program and the regional community relations resources for operations.

22. Disproportionate Effects on Distinct Human Populations

22.1 Regulatory and Policy Setting

A revitalized BC EAA received royal assent in November 2018 and Section 25.2 of the BC EAA lists additional assessment including consideration of disproportionate effects on distinct human populations, that was not previously included in the 2015 version of the BC EAA under which the Project was approved.

The BC EAO Effects Assessment Policy states that:

> "The effects of a project may not affect all members of the population in the same way. Some individuals and subgroups may be more vulnerable to adverse effects; others may be better positioned to experience positive effects. Section 25(2)(d) of the EAA requires that every assessment consider the disproportionate effects on distinct human populations, including populations identified by gender" (BC EAO 2020a).

22.2 Assessment Methodology

The analysis of disproportionate effects on distinct human populations is focused on developing an understanding of unique socio-economic circumstances of subpopulations within the study area that may result in disproportionate effects as the result of the proposed amendment. The study area for this analysis includes communities where it can be reasonably expected that direct and identifiable effects from the proposed amendment will occur.

The assessment used available baseline information to identify and describe potential subpopulations within the study area. The potential residual effects identified in the EAC Application that apply to the proposed amendment were also analyzed for potential socio-economic effects that may interact with distinct subpopulations. Engagement with key stakeholders and Indigenous groups was a critical component to augmenting gaps in existing data. Qualitative information collected through engagement was used to further identify existing socio-economic patterns and the potential for Project-specific interactions, as they relate to distinct subpopulations within the host communities.

This approach was guided by the following questions.

- What anticipated adverse residual effects of the proposed Groundbirch Connector could interact differently with distinct populations?
- What are the distinct populations within the study area that could experience a disproportionate effect with regard the identified residual effects?
- Which distinct populations might experience which effects?
- Do the effects assessment conclusions change with regard the potential residual effect when viewed through the lens of distinct populations?
- What mitigation or management strategies are in place to address the effects as they pertain to distinct populations?

22.2.1 Baseline Data Collection

For setting information to support the assessment of disproportionate effects on distinct human populations as required under Section 25 of the 2018 BC EAA, the Social Technical Report and the Economic Technical Report of the EAC Application provided various background and demographic information that contributes to understanding distinct human populations that may be affected by the Project, including Indigenous women and children. The information included in the Social Technical Report and the Economic Technical Report of the EAC Application outlined the local and regional economic context, biological gender identification (for example, male/female), Indigenous identification, age group, income, labour force participation, and educational attainment. Information on local and regional labour force activity, educational attainment, as well as income and earnings for the regional districts, municipalities, and Indigenous communities considered in the EAC Application do not materially change for the proposed Groundbirch Connector. For instance, major sources of government revenue and labour force activity for communities and the District in the Economic RSA have not materially changed from those described in the EAC Application, although revenues change annually. Educational attainment in the PRRD has increased slightly from counts of 13,520 in 2012 to 15,065 in 2016 for high school diplomas or equivalent, and from counts of 8,105 in 2012 to 8,415 in 2016 for college or other non-university certificates or diplomas (Statistics Canada 2017).

Baseline conditions for the Community Utilities and Services and Community Quality of Life VCs under the Community and Regional Infrastructure and Services topic for the proposed Groundbirch Connector are comparable to those presented in Appendix 2M of the EAC Application. For instance, emergency services, health care, social support services, waste management, recreational facilities and services, educational services, government services, and accommodation are comparable to what was originally assessed in the EAC Application. Community quality of life is reflected in areas such as traffic, air quality, surface and groundwater quality, overall sound levels, employment and training opportunities, accidents and malfunctions, housing and commercial accommodation, TLRU and human health. Upon review, it is understood that these areas for community quality of life are comparable to what was originally assessed in the EAC Application.

22.2.2 Summary of Engagement

In the EAC Application, several Treaty 8 First Nations provided third-party socio-economic baseline data that was considered. The Social Technical Report and the Economic Technical Report provided various background and demographic information which contributes to understanding distinct human populations that may be impacted by the Project, including Indigenous women and children. The information included in the Technical Reports included biological gender identification, Indigenous identification, age group, income, labour force participation, and educational attainment.

EAC Condition 24, the SEEMP, identifies Coastal GasLink's approach to implementing mitigation during construction to avoid or reduce potential adverse effects on economy, community infrastructure, and community services. The process for how Coastal GasLink will monitor and report on the effectiveness of the mitigation includes engagement with SEEMP contacts a minimum of twice a year on potential adverse effects and mitigation effectiveness. SEEMP engagement includes monitoring potential adverse effects on distinct human populations. The SEEMP also includes an adaptive management process for situation where monitoring results indicate that outcomes are not as predicted.

22.3 Conclusion

Upon review of the proposed Groundbirch Connector and using the methodology presented in Section 22.2, the assessment found that no distinct human populations are impacted by the proposed Groundbirch Connector.

23. Biophysical Factors that Support Ecosystem Function

Biophysical factors that support ecosystem function was added as a required assessment matter in the revitalized BC EAA. The 2018 BC EAA was adopted subsequent to the submission of the EAC Application but prior to the submission of this Amendment Application. The assessment draws from reported information in the EAC Application and this Amendment Application (specifically, sections 5 to 10, and Section 20). The assessment of biophysical factors that support ecosystem function is focused on the proposed amendment and summarizes the existing conditions and assessment of Project-level direct and indirect effects of each VC. No positive effects on biophysical factors that support ecosystem function were identified.

For this Amendment Application, the scope of the assessment for biophysical factors that support ecosystem function only applies to the proposed amendment and a re-assessment of the Certified Pipeline Corridor for biophysical factors that support ecosystem function of the Project overall is not required.

23.1 Scoping

The Effects Assessment Policy includes 10 categories of biophysical factors that support ecosystem function (BC EAO 2020a). The 10 categories presented below support an Ecosystem Function Scoping Tool (see Table 23-1) that was developed by the BC EAO in their Effects Assessment Policy (BC EAO 2020a). According to the BC EAO guidance, the Ecosystem Function Scoping Tool can be used to identify the topics that may be relevant for an effective assessment of biophysical factors that support ecosystem function. For each of the 10 biophysical factors, the assessment team evaluated whether there was potential for an interaction with the proposed amendment. The following list is included for guidance purposes and is taken from the Effects Assessment Policy (BC EAO 2020a). The list is generic and does not represent interactions of the proposed Groundbirch Connector amendment with biophysical factors that support ecosystem function.

1) **Habitats Supporting Ecosystem Function:** At a landscape or regional level, unique or critical habitats that disproportionately support ecosystem function and are of special value, especially areas that integrate the flow of water, nutrients, energy, and biota such as wetlands, and tend to be biodiversity hotspots.
2) **Habitat Patches:** Pattern, quantity, size, and connectivity of habitat patches that support the movement of species and the transfer of materials. Fragmentation of habitat into disconnected and isolated patches can disrupt ecological integrity. Edge effects can further reduce the ecological function of habitat patches.
3) **Natural Disturbance Regime:** The type, magnitude, and frequency of disturbances that could occur within a landscape in the absence of human intervention. Disruption of the natural disturbance regime could be through activities like controlling stream water levels, fire suppression in grasslands or forests, or forest clearing, and can result in impacts to the natural disturbance regime by suppressing disturbances or causing abnormally large disturbances.
4) **Structural Complexity:** Physical features that increase structural complexity and provides for a greater variety of unique niches for species, such as snags and multiple layers in a forest or coarse woody debris in a stream. Examples that may result in a change in structural complexity are clearcutting of a forest or channelization of a stream.
5) **Hydrologic or Oceanographic Patterns:** Movement of freshwater, groundwater, and saline waters within and through ecosystems. Examples that may lead to a change in these patterns include a change in water availability for organisms, changes in physical structures for habitats, and the change in transfer of biotic and abiotic materials through an ecosystem.

6) **Nutrient Cycling:** Nutrient flow in and out of an ecosystem (that is, nitrogen, phosphorus, or carbon). Examples of this are Project inputs of nutrients into the natural nutrient cycle through waste discharges, or the loss of future nutrients into soils through the removal of vegetation.
7) **Purification Services:** Physical, chemical, and biological mechanisms of removing, sequestering, assimilating, and changing chemicals in an ecosystem. An example of a change in purification services is waste discharges that are beyond the ability of an ecosystem to manage and that leads to an accumulation of waste or chemicals in an ecosystem.
8) **Biotic Interactions:** Antagonistic or symbiotic interactions among organisms, which can include competition for resources, predation, parasitism, and mutualism. Keystone and foundation species have strong interactions with other organisms and often provide vital functions in the ecosystem. Examples of effects on biotic interactions are:
    a) A disruption of predator-prey dynamics
    b) Disruption to pollinators or seed distributors, or plants that support pollinators or seed distributors
    c) Impacts to species that modify habitat that may lead to a reduction in habitat modifications that support entire communities
    d) An introduction or facilitation of invasive species
9) **Population Dynamics:** Populations and subpopulations are the units for species success in an area. For example, changes in habitat for a critical life stage or on a population behaviour may affect the success of a wildlife population to the point where it can no longer sustain itself.
10) **Genetic Diversity:** Genetic diversity enables a population to respond to natural selection, helping it adapt to changes in selective regimes. An example of potential effects on genetic diversity might include an increase in mortality of a distinct fish population leading to the potential reduction in the species' genetic diversity.

All biophysical VCs and KIs, including their potential and residual effects from the EAC Application and proposed amendments were reviewed to inform a summary of biophysical factors that support ecosystem function. A combination of existing VCs, KIs, and residual effects was chosen to best inform each of the 10 ecosystem function categories. A summary is provided of each VC for each ecosystem function category at the Project scale since this was not included in the EAC Application. Changes from the amendment are then considered to inform whether they may affect the interpretation of ecosystem function. Biophysical factors that support ecosystem function were interpreted at the ecosystem, landscape, or watershed scale. This was informed using information from each VC at the RSA scale.

As stated in the Effects Assessment Policy (BC EAO 2020a), 'the function of an ecosystem depends upon the long-term integrity of its physical, chemical and biological element'. Upon review, it is determined that adverse effects to the cultivated lands (agricultural capability and reclamation suitability) and the physical, chemical and biological elements associated with these lands will be reversed in the short to medium-term. As a result, this assessment of biophysical factors that support ecosystem function will focus on the natural ecological area crossed by the proposed amendment.

Table 23-1 addresses Objective 1 to 4 in Section 5.3.1 of the Effects Assessment Policy (BC EAO 2020a), namely the following statements:

- Objective 1: "identify how the project interacts with biophysical factors that support ecosystem function using the Ecosystem Function Scoping Tool."
    - The Ecosystem Function Scoping Tool was modified for the Project, however, maintains its key components including using its biophysical factors as a guide, identifying potential interactions and reviewing appropriate key considerations as they are relevant to the proposed amendment.
- Objective 2: "Consider relevant biophysical factors in the selection of VCs and KIs, which will be reflected in the Application Information Requirements."

- Objective 3: “Assess the biophysical factors that support ecosystem function, as appropriate under the relevant VC, which should also consider potential effects on landscapes, watersheds and ecosystems”.
- Objective 4: “Develop a summary of biophysical factors that support ecosystem function chapter that collectively describes how these factors were assessed in the EA; provides an overview of the current ecosystem function in the vicinity of the project at a landscape and watershed level; what the potential positive and negative effects are, including adverse cumulative effects, on biophysical factors that support ecosystem function, and any new mitigation that has been proposed; and provides a summary of any predicted changes to ecosystem function as a result of the project.”

Table 23-1. Biophysical Factors that Support Ecosystem Function Scoping Tool

Possible Interaction	Valued Components	Key Indicators	Potential Residual Effects Assessed in the EAC Application	Biophysical Factor Level[a]	Effects Assessment Summary
Habitats Supporting Ecosystem Function					
Yes	Soil Capability	Reclamation Suitability	Soil compaction and rutting.	Ecosystem	Habitats that are limited at the landscape scale or provide unique or critical functions are important for maintaining ecosystem function. Examples include wetlands, old forest, and riparian communities, which provide habitat critical for life stages of various species. Several biophysical factors contribute to maintenance of these habitats including soil, freshwater and groundwater and vegetation. VCs included in the interpretation of habitats supporting ecosystem function for the Project include Soil Capability, Ecological Communities of Concern, Plant Species of Concern, Wetlands, Wildlife and Wildlife Habitat VCs. At the Project scale, short-term localized effects are anticipated resulting from changes in soil texture. Mitigation for soil handling, erosion control and restoration are expected to reduce these effects to allow for vegetation development. Direct and indirect effects to unique vegetation communities at the RSA scale are predicted to be minimal with 2.7 ha (8.6 percent) of the footprint crossing upland forest and 0.8 ha (2.6 percent) of the footprint crossing one blue-listed ecological community (Bebb's willow – Bluejoint). Upland forest to the south of the proposed Groundbirch Connector will be avoided to the extent possible. Recovery of all vegetation communities is anticipated within the medium to long-term and localized extent of the disturbance. Full recovery of wetland function is expected in the short to medium-term following construction. Wetlands affected by the proposed amendment are generally expected to be resilient to alterations in habitat function and of biogeochemical function when appropriate mitigation is implemented. Pond-dwelling amphibians are sensitive to ecosystem change and can be considered an indicator or wetland ecosystem function. Re-establishment of herbaceous and shrub vegetation on the disturbed Groundbirch Connector Footprint is expected to occur in the short to medium-term following reclamation; however, potential residual adverse effects on treed wetland habitats and adjacent terrestrial amphibian habitats will extend over the long-term. The reversibility of combined potential adverse effects on pond-dwelling amphibians such as wood frog (Conservation Framework Priority rating of 2). as identified in field surveys, is constrained by the long-term timeline for reclamation of treed habitats (that is, greater than 10 years following construction of the proposed Groundbirch Connector). Collectively, these residual effects indicate a reduction in habitats that support ecosystem function that is considered localized given the state of the surrounding land use (privately-owned and cultivated) and temporary in nature. These effects are expected to be limited to the Groundbirch Connector Footprint and full recovery is expected over the medium to long-term following construction. Given that additional wetland and treed habitat will be present on either side of the footprint during and following construction, it does not appear the ecological community would act as a refuge to wildlife species. As a result, there is expected to be a minimal effect on habitats supporting ecosystem function.
	Ecological Communities of Concern	Native vegetation communities Ecological communities at risk Plant species at risk Traditionally important plant species	Potential combined adverse effects on native vegetation communities (common plant communities) resulting from clearing, invasive plants and forest pests. Potential combined adverse effects on ecological communities at risk resulting from clearing, invasive plants and forest pests.	Ecosystem	
	Wetlands	Wetland Function	Loss or alteration of wetland hydrologic function following activities in each Project phase until grade and natural flow patterns are restored or until loss is mitigated through compensation. Loss or alteration of wetland habitat function during and following activities in each Project phase or until loss is mitigated through compensation. Loss or alteration of wetland biogeochemical function during and following activities in each Project phase or until loss is mitigated through compensation.	Watershed	
	Wildlife and Wildlife Habitat	Pond-Dwelling Amphibians	Combined potential Project adverse effects on pond-dwelling amphibians resulting from changes in habitat, movement and mortality risk.	Ecosystem	
Habitat Patches					
Yes	Wildlife and Wildlife Habitat	Pond-dwelling Amphibians Wetland Bird Community	Combined potential Project adverse effects on pond-dwelling amphibians resulting from changes in habitat, movement and mortality risk. Combined potential Project adverse effects on the wetland bird community resulting from changes in habitat, movement and mortality risk.	Ecosystem	Overall, the Groundbirch Connector amendment is expected to have minimal impacts on habitat patchiness. It is primarily located within an area of existing disturbance from farming activities and is not expected to have a meaningful effect on the size and distribution of habitat patches across the landscape compared to current conditions. Movement for some species may be temporarily affected, especially during construction, but these effects will be short-term for most species, with movement returning to preconstruction levels in the short-term after the completion of construction. As a result, minor effects to ecosystem function associated with habitat patches is expected as a result of construction and operation of the proposed Groundbirch Connector.
Natural Disturbance Regime					
No	N/A	N/A	N/A	N/A	There is no potential interaction whereby the amendment could alter natural disturbance regimes. Changes that could affect natural process causing changes to natural disturbance regimes include, for example, fires, invasive insects and forest clearing. The amendment location is located on cultivated lands owned by a single private landowner. Forest clearing will be minimal and woody debris will be disposed of. There is no mechanism for the construction and operation activities associated with the proposed Groundbirch Connector to alter invasive insect distribution.

Table 23-1. Biophysical Factors that Support Ecosystem Function Scoping Tool

Possible Interaction	Valued Components	Key Indicators	Potential Residual Effects Assessed in the EAC Application	Biophysical Factor Level[a]	Effects Assessment Summary
Structural Complexity					
Yes	Ecological Communities of Concern Plant Species of Concern	Native vegetation communities Ecological communities at risk	Potential combined adverse effects on native vegetation communities (common plant communities) resulting from clearing, invasive plants and forest pests. Potential combined adverse effects on ecological communities at risk resulting from clearing, invasive plants and forest pests.	Ecosystem	VCs from the EAC Application that inform potential changes to structural complexity include Ecological Communities of Concern and Wetlands. The amendment will require clearing of 2.7 ha (8.6 percent of the footprint) of upland forest and 0.8 ha (2.6 percent of the footprint) of a shrubby wetland (the blue-listed Bebb's willow – Bluejoint ecological community). Structural complexity will be reduced in these areas through the removal of trees and shrubby vegetation, replacing these communities with early seral stage vegetation. Structural complexity is an important habitat component for some wildlife species and, at the landscape scale, helps to support biodiversity. Disturbed areas will be reclaimed following construction. Shrubby and graminoid vegetation communities and wetland areas are expected to recover to similar structural complexity in the short to medium-term, while forested communities will remain in early seral habitat structure for the long-term. As minimal wetland and forest habitat will be affected at the RSA scale, negligible ecosystem-level effects to structural complexity are anticipated.
	Wetlands	Wetland Function	Loss or alteration of wetland hydrologic function following activities in each Project phase until grade and natural flow patterns are restored or until loss is mitigated through compensation. Loss or alteration of wetland habitat function during and following activities in each Project phase or until loss is mitigated through compensation. Loss or alteration of wetland biogeochemical function during and following activities in each Project phase or until loss is mitigated through compensation.	Watershed	
Hydrologic Patterns					
Yes	Wetlands	Wetland Function	Loss or alteration of wetland hydrologic function following activities in each Project phase until grade and natural flow patterns are restored or until loss is mitigated through compensation.	Watershed	Wetland hydrologic function will be altered temporarily during construction of the proposed Groundbirch Connector and potentially for intermittent maintenance activities during operation. Effects are expected to be limited to the area within and directly adjacent to the proposed amendment footprint. Full recovery of wetland hydraulic function is expected in the short to medium-term after construction. No change to hydrologic patterns that would affect ecosystem function are expected.
Nutrient Cycling					
Yes	Soil Capability	Reclamation Suitability	Soil compaction and rutting.	Ecosystem	Nutrient cycling refers to the biological, geological, and chemical processes that move and exchange organic and inorganic matter to produce living matter. For the proposed Groundbirch Connector, changes to nutrient flows into or out of the ecosystem could occur through interactions with soils and wetlands. Contributions to air emissions from the construction and operation of the amendment are expected to be short-term in duration and negligible at the RSA scale. The Soil Capability and Wetlands VC were used to inform an assessment of potential changes to nutrient cycling. A minor amount of soil compaction and rutting within the proposed amendment footprint is expected to temporarily reduce nutrients available for vegetation growth, but this effect is expected to be short-term in duration, localized to the amendment footprint, and mitigated to have minimal impact with standard construction best practices. Within wetlands, phosphorous storage is expected to be relatively unaffected. Changes to carbon storage within wetlands is expected to be limited to the disturbed proposed amendment footprint; a return to baseline levels of carbon stored by the wetland and vegetation may be medium (that is, shrubby wetland) to long-term (that is, forested area) in duration. Residual effects related to nutrient cycling are expected to be minimal, limited to the proposed amendment footprint and short- to medium-term in duration. As a result, no effects to nutrient cycling that affect ecosystem function are expected as a result of construction and operation of the proposed Groundbirch Connector.
	Wetlands	Wetland Function	Loss or alteration of wetland biogeochemical function during and following activities in each Project phase or until loss is mitigated through compensation.	Watershed	
Purification Services					
Yes	Wetlands	Wetland Function	Loss or alteration of wetland hydrologic function following activities in each Project phase until grade and natural flow patterns are restored or until loss is mitigated through compensation. Loss or alteration of wetland biogeochemical function during and following activities in each Project phase or until loss is mitigated through compensation.	Watershed	Wetland hydrologic and biogeochemical function will be altered during construction of the proposed Groundbirch Connector and potentially for intermittent maintenance activities during operation. Effects to water purification services that could result from these changes are expected to be limited to the area within and directly adjacent to the proposed amendment footprint. The overall purification capacity of the wetland crossed by the amendment footprint are not expected to be measurably altered. Full restoration of wetland hydrologic and biogeochemical function is expected in the short to medium-term. No ecosystem-level effects to purification services associated with wetland hydrologic and biogeochemical function are anticipated.

Table 23-1. Biophysical Factors that Support Ecosystem Function Scoping Tool

Possible Interaction	Valued Components	Key Indicators	Potential Residual Effects Assessed in the EAC Application	Biophysical Factor Level[a]	Effects Assessment Summary
Biotic Interactions					
Yes	Ecological Communities of Concern Plant Species of Concern	Native vegetation communities Ecological communities at risk Traditionally important plant species	Potential combined adverse effects on native vegetation communities (common plant communities) resulting from clearing, invasive plants and forest pests. Potential combined adverse effects on ecological communities at risk resulting from clearing, invasive plants and forest pests.	Ecosystem	Consideration of potential effects on biotic interactions that effect ecosystem function included interpretation of the Ecological Communities of Concern, Plant Species of Concern, and Wildlife and Wildlife Habitat VCs. Project construction and operation could affect biotic interactions if there are impacts to species that play a key role in the ecosystem, such as a keystone or foundational species. These could be expressed through changes to predator/prey dynamics or increased spread of invasive species. There is limited potential for altering predator/prey dynamics due to the limited amount of clearing that will create habitat openings or edges where some species may be more vulnerable to predation or parasitism (for example, from brown-headed cowbirds). Clearing of vegetation cover has the potential to create conditions for the spread of invasive species by providing suitable growing conditions. Further, construction machinery and personnel can facilitate the introduction of invasive species. However, with the effective application of mitigation measures, ecosystem-level effects to biotic interactions supporting ecosystem function are not expected.
	Wildlife and Wildlife Habitat	Pond-dwelling Amphibians Wetland Bird Community	Combined potential Project adverse effects on pond-dwelling amphibians resulting from changes in habitat, movement and mortality risk. Combined potential Project adverse effects on the wetland bird community resulting from changes in habitat, movement and mortality risk.		
Population Dynamics					
No	N/A	N/A	N/A	N/A	Given the amendment location (completely on private lands and 97.4 percent of the route crosses cultivated land) and that the ecosystem being disturbed is limited in extent and will be reclaimed to natural vegetation consistent with the adjacent communities, the proposed Groundbirch Connector is not expected to impact wildlife species populations and subpopulations chances of success in an area.
Genetic Diversity					
No	N/A	N/A	N/A	N/A	The amendment will not create barriers to movement and reclamation is expected to re-establish natural vegetation species. Mitigation will be implemented to prevent introduction and spread of invasive species that could alter the diversity of the ecosystem. Therefore, ecosystem-level effects to genetic diversity supporting ecosystem function are not expected.

[a] Scale at which biophysical factors affecting ecosystem function were considered.

23.2 Conclusion

A review of biophysical factors that support ecosystem function was conducted for the proposed amendment. The Ecosystem Function Scoping Tool was used as a guide and focused on potential interactions between the proposed amendment and biophysical factors that support ecosystem function. The scoping exercise found that seven of the ten biophysical factors that support ecosystem function interacted with the proposed amendment. Where interactions occurred, the proposed amendment is not expected to have a negative effect on biophysical factors that support ecosystem.

24. Effects on Current and Future Generations

24.1 Regulatory and Policy Setting

The revitalized Act was adopted subsequent to the submission of the EAC Application but prior to the submission of this proposed amendment. This section considers the positive and negative direct and indirect effects of the proposed amendment on current and future generations and draws on outcomes as described in the EAC Application and existing information made available during key stages of decision making for the Project. This section tests the principles identified in the Effects Assessment Policy as they relate to this Amendment Application (BC EAO 2020a).

The subsequent sections review potential impacts and benefits of the proposed Groundbirch Connector to current and future generations by providing an approach and scoping summary, identifying potential effects and interactions, and providing an effects summary where there may be effects on future generations.

24.2 Approach

The assessment of potential residual effects for the proposed amendment on VCs is included in sections 5 to 20. This section will review the potential positive and negative effects on current and future generations as they relate to this Amendment Application. The Effects Assessment Policy stipulates that only residual effects (that is, those effects that persist after mitigation measures are implemented) that are relevant to the consideration of effects to current and future generations will be considered in the assessment and that the scope of the discussion should be consistent with the scope of the Project assessment as well as should focus on those Project-specific issues and concerns identified through the EA.

The potential residual effects that were assessed to have a duration that extends into the “long-term” were considered in the assessment of effects to the future generation, see Table 23-1. A “long-term” potential residual effect is defined in Section 3 of the EAC Application as an “ongoing event that is initiated during the construction phase and extends beyond the first year of the operations phase or is initiated during the operations phase and extends for the life of the proposed Groundbirch Connector”. For VCs that have residual effects with a “long-term” temporal characterization and have a potential interaction with future generations, an effects assessment summary that reviews the potential impact to future generations was provided.

During the scoping, AIR development and identification of potential adverse effects for the Project Application, the assessment team relied on baseline setting information from the present time to consider the current generation. Potential residual effects were described as having immediate, short- or long-term durations. The majority of potential residual effects were assessed to have immediate or short-term durations and, therefore, impacting the current generation. Five VCs had residual effects with long-term durations which, therefore, could impact future generations and were carried forward into this assessment. Once the duration of these effects on future generations were identified, reversibility (that is, environmental and socio-economic) were then considered to identify the period of time over which the residual effect identified extends (Table 23-1). The definitions for the characterization of residual effects including duration and reversibility are described in Section 3 of the EAC Application.

When considering the proposed amendment, it is anticipated that the Project benefits will meet or exceed those described in Subsection 1.5 of the EAC Application. Overall, the potential residual adverse effects identified in the EAC Application have not changed as a result of the proposed amendment. A review of how these effects were determined were made are provided in the subsequent sections.

24.3 Scoping

This section reviews how the proposed amendment may interact with current and future generations.

24.4 Potential Effects on Future Generations

This section will identify potential effects and interactions to future generations. Interests raised during engagement that may be relevant to future generations will also be considered in this section.

24.4.1 Positive Socio-Economic Effects

As stated in Section 1.5 of the EAC Application, the Project will contribute approximately 4.2 billion dollars in construction-related expenditures, labour income, employment and taxes to the municipal, provincial and federal governments, which will benefit all Canadians for more than 30 years of life. Given the length of time that has passed since filing the EAC Application, the dollar value of construction-related expenditures is now estimated to be approximately 6.6 billion dollars.

The Certified Pipeline Corridor, along with the addition of the proposed Groundbirch Connector, will involve the construction and operation of a buried pipeline to transport natural gas from northeast BC to the proposed LNG Canada export facility near Kitimat, BC. The proposed Groundbirch Connector will open new markets for BC resources, generating employment opportunities and revenues for BC and Canadian residents. The proposed Groundbirch Connector is expected to generate direct, indirect and induced economic benefits.

Project benefits will be generated during the planning, construction, operations, and decommissioning and abandonment phases of the proposed Groundbirch Connector. While the decommissioning and abandonment phase will be conducted to meet all regulatory requirements at that time, those phases are not expected to occur for 30 years or more.

The energy sector is an important component of the Canadian economy. Adequate and reliable pipeline infrastructure supports the viability of the energy sector and maintains the stream of economic benefits to Canadians. With the expanding demand for LNG, competition from other countries to supply the resource to global markets is also increasing.

Since the proposed Groundbirch Connector was made public in 2012, Coastal GasLink has procured goods and services from local, provincial, and Canadian-based companies as part of the Application process, including field investigations led by BC and Alberta-based consulting firms.

During the lifespan of the proposed Groundbirch Connector, it is expected that in this time, tax revenue will flow to municipalities and regional districts crossed by the proposed route, as well as provincial and federal governments. The proposed Groundbirch Connector will help support the upstream exploration and production sector that will generate substantial royalty revenue for the provincial government and create employment. This revenue can be used to support public services, such as health care, education, and infrastructure.

The proposed Groundbirch Connector will generate employment and contracting opportunities for Indigenous and non-Indigenous community members and businesses. The construction phase will require a large workforce and provide the most employment opportunities for local businesses and community members. Coastal GasLink will continue to engage with local communities to understand available services and personnel and to identify training needs.

24.4.2 Predicted Social and Economic Benefits of the Project

Project expenditures, government revenues or employment will meet or exceed what was stated in the EAC Application for the Project. The results of the economic analysis which formed the basis of the EAC Application are not anticipated to change as a result of the proposed amendment. For information on Project expenditures, government revenues, employment and contracting strategies and social benefits of the Project, see Subsection 1.5 of the EAC Application. Additionally, benefits considered in the Ministers' decision for the Project include the following.

> "We are aware of the importance of the Project to the local, regional, and provincial economy. The Project will have an estimated capital cost of $4.7 billion for the 3-4 year construction period, with $2 billion spent in BC. Annual operating expenditures will be $26.3 million per year, with $21 million in BC. Carbon taxes are estimated to be $8 million per year for initial capacity, and up to $89 million per year at full build out. Direct labour income for Project construction will be $1.1 billion over the construction period, with two thirds going to BC jobs." (Reasons for Ministers Decision 2014)

Coastal GasLink understands that the benefits of the Project to future generations would be sustained for the life of the Project and into the future and that these economic benefits were accurately assessed in the EAC Application; therefore, social and economic benefits will not be carried forward into the effects on future generations.

24.4.3 Potential Residual Effects and Interactions

Table 24-1 identifies potential effects and interaction on future generations as they relate to the proposed amendment. The potential residual effects that were assessed to have a duration that extends into the "long-term" were considered in the assessment of effects to the future generation. An effects overview as it relates to the proposed amendment is then provided with a summary of whether or not there is a potential interaction on future generations. Following Table 24-1, an effects summary will be provided where there are potential interactions with future generations, as required.

Existing conditions and potential adverse effects on Indigenous interests, including section 35 rights are comparable to those provided in the EAC Application. While these interests related to anticipated future use of subsistence and cultural areas were considered in the EAC Application, effects on future generations were not considered in the context of the Section 25(2)(f) of the 2018 Act requirements (BC EAO 2020a).

Further analysis of potential effects on future generations are described in Table 24-1, including a summary of Indigenous interests as they relate to the proposed amendment and how they may affect future generations.

Table 24-1. Potential Effects to Future Generations

Potential Residual Effect	Temporal Characterization and Rationale	Amendment Effects Overview	Potential Effects to Future Generations (Communities and Indigenous Groups)
GHG Emissions			
Project emission contributions to GHGs (operations)	**Duration (long-term):** the proposed Groundbirch Connector will emit GHGs over the full operations phase (in excess of 30 years). **Reversibility (long-term):** GHGs persist in the atmosphere because of their chemical nature and take many years to break down (20 to more than 100 years).	GHG emissions have been quantified for the construction and operation of the Project and are provided in Section 6 and Appendix 2F (GHG Emissions TDR) of the EAC Application. Pipeline construction GHG emissions in the EAC Application were estimated based on the length of the construction right-of-way and the duration of construction activities. The proposed Groundbirch Connector will add approximately 3 km to the Certified Pipeline Corridor. This minor difference in length would have no material effect on pipeline construction GHG emissions, because the same equipment and activities are proposed for the construction of the proposed Groundbirch Connector. GHG emissions from construction-related activities for the proposed Groundbirch Connector are estimated to be 1,387.1 tonnes of CO_2e; 66.7 percent of the total are from off-road equipment and 33.3 percent are from on-road equipment. Due to the location of the Groundbirch Connector, primarily on agricultural land, minimal site preparation (land clearing and decay) will be required for construction and GHG emissions from these activities are considered negligible. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.7 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.	Community: • No additional effects Indigenous Nations: • No additional effects
Wetland Function			
Incremental increase in loss or alteration of wetland hydrologic function until grade and natural flow patterns are restored Incremental increase in loss or alteration of wetland habitat function until vegetation is re-established Incremental increase in loss or alteration of wetland biogeochemical function until replaced substrate has recovered and hydrologic regime is restored	**Duration (long-term):** Potential additive adverse effects of the proposed Groundbirch Connector with other existing or future development could occur throughout the life of the proposed Groundbirch Connector (in excess of 30 years). **Reversibility (long-term):** With the implementation of appropriate mitigation, recovery of wetland hydrologic function is expected in the medium-term, which reflects the minimum time period for which potential cumulative adverse effects may be considered reversible. Because potential cumulative adverse effects might have a lag, the potential reversibility of hydrologic function is estimated to be long-term. The potential incremental adverse effects of the proposed compressor stations on wetland functions are considered to be reversible in the medium-term with the completion of additional mitigation through the Postconstruction Monitoring Program or wetland compensation efforts.	Results of ecosystem mapping and field surveys show that there are 33.7 ha of wetlands in the Groundbirch Connector Wetlands LSA, with 1.0 ha in the proposed Groundbirch Connector Footprint. Four classes of wetlands occur within the Groundbirch Connector LSA. Two blue-listed wetland site associations occur within the Groundbirch Connector Wetlands LSA, with total area of 25.9 ha (2.7 percent of the LSA) and include bog Wb03 (Black spruce – lingonberry – peat moss) and swamp Ws03 (Bebb's willow – bluejoint). The Ws03 wetland site association overlaps with the proposed Groundbirch Connector Footprint where it covers 0.8 ha (2.6 percent of the Footprint). No red- or blue-listed wetland-associated plants species were identified in the Groundbirch Connector Wetlands LSA or RSA (BC CDC 2020). Baseline conditions for the proposed Groundbirch Connector, as they relate to the Wetland Function VC, are comparable to those assessed for the Certified Pipeline Corridor in the EAC Application. Because the baseline conditions are comparable, and the potential interactions for proposed activities for the proposed Groundbirch Connector are also comparable, there is no material change to the assessment of potential adverse effects, mitigation or residual effects for the Wetland Function VC during the construction, operations, and decommissioning and abandonment phases of the Project. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on Wetland Function VC. The mitigation for the Project is detailed in Section 9.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.	Community: • No additional effects Indigenous Nations: • No additional effects
Community Quality of Life			
Change in community quality of life – operations phase	**Duration (long-term):** the change in community quality of life extends over the operations phase. **Reversibility (long-term):** the operations phase change in community quality of life will extend throughout the operations phase.	Baseline conditions and potential effects on community and regional infrastructure and services for the proposed Groundbirch Connector are comparable to those provided in the EAC Application. Therefore, the proposed Groundbirch Connector does not change the characterization and assessment of potential adverse effects on Community Utilities and Services, Transportation Infrastructure and Services, and Community Quality of Life VCs as provided in the EAC Application. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on community and regional infrastructure and services. The mitigation for the Project is detailed in Section 15.7 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.	Community: • No additional effects Indigenous Nations: • No additional effects
Health: Human Health			
Air quality health effects on human health: degraded air quality leading to inhalation health risks in people during operations	**Duration (long-term):** emissions would be released throughout operational life of the proposed compressor stations. **Reversibility (long-term):** identified health risks would apply for the duration of the operation phase.	Sources of emissions in the Air Quality RSA (that is, 30 km band centred on the proposed Groundbirch Connector Footprint) are typical of agricultural and industrial activities. The proposed Groundbirch Connector is located mainly on agricultural land. The Groundbirch Connector's construction activities that may contribute to air emissions include the operation of vehicles, heavy equipment (for example, excavators, side-booms, graders, hoes, and dozers) and auxiliary equipment (for example, power generators). The proposed Groundbirch Connector does not include components that result in an increase in air emissions during operations. The Groundbirch Connector's construction activities have a potential to result in a change in air quality, however, the effects on air quality as a result of construction are small and short-term. The interaction of these emissions with current and reasonably foreseeable emissions in the vicinity of the Groundbirch Connector will be limited. The Groundbirch Connector will produce negligible CAC emissions during normal operating conditions; therefore, the effect of operation on air quality is not considered further in the air quality effects assessment. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.	Community: • No additional effects Indigenous Nations: • No additional effects

Table 24-1. Potential Effects to Future Generations

Potential Residual Effect	Temporal Characterization and Rationale	Amendment Effects Overview	Potential Effects to Future Generations (Communities and Indigenous Groups)
Noise disturbance effects on people: increased noise levels leading to disturbance to people during operations	**Duration (long-term):** operation of the proposed compressor stations will occur through the operations phase for the life of the Project). **Reversibility (short-term):** following cessation of operations activity, noise emissions and disturbance, if present, would be reversed.	The prediction results of sound propagation calculations (refer to Appendix C in this Amendment Application, Groundbirch Connector Atmospheric Environment Technical Memorandum) indicate that a minimal buffer distance of 500 m should be maintained between the pipeline construction activities and residential locations in order to meet the Health Canada mitigation noise level threshold of 47 dBA L_{dn} for L_{dn} measured as dBA (Health Canada 2017). The closest residence is located approximately 776 m from the proposed Groundbirch Connector Footprint. No industrial facilities have been identified within 5 km of the proposed amendment corridor that could result in cumulative noise effects. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.	Community: • No additional effects Indigenous Nations: • No additional effects
Health: Ecological Health			
Air quality effects: degraded air quality leading to adverse inhalation health effects in wildlife during operations	**Duration (long-term):** the emissions would be released throughout operational life of the proposed compressor stations. **Reversibility (long-term):** identified health risks would apply through the operations phase.	Sources of emissions in the Air Quality RSA (that is, 30-km band centred on the proposed Groundbirch Connector Footprint) are typical of agricultural and industrial activities. The proposed Groundbirch Connector is located mainly on agricultural land. The Groundbirch Connector's construction activities that may contribute to air emissions include the operation of vehicles, heavy equipment (for example, excavators, side-booms, graders, hoes, and dozers) and auxiliary equipment (for example, power generators). The proposed Groundbirch Connector does not include components that result in an increase in air emissions during operations. The Groundbirch Connector's construction activities have a potential to result in a change in air quality, however, the effects on air quality as a result of construction are small and short-term. The interaction of these emissions with current and reasonably foreseeable emissions in the vicinity of the Groundbirch Connector will be limited. The Groundbirch Connector will produce negligible CAC emissions during normal operating conditions; therefore, the effect of operation on air quality is not considered further in the air quality effects assessment. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.6 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.	Community: • No additional effects Indigenous Nations: • No additional effects
Noise effects to ecological receptors: increased noise levels leading to ecological health risks during operations	**Duration (long-term):** activity will occur during operations phase for the life of the proposed Groundbirch Connector. **Reversibility (medium-term):** following cessation of operations activity, noise effects on ecological receptors would cease, and populations would recover from localized disturbance.	The prediction results of sound propagation calculations (refer to Appendix C in this Amendment Application, The Groundbirch Connector Atmospheric Environment Technical Memorandum) indicate that a minimal buffer distance of 500 m should be maintained between the pipeline construction activities and residential locations in order to meet the Health Canada mitigation noise level threshold of 47 dBA L_{dn} for L_{dn} measured as dBA (Health Canada 2017). No industrial facilities have been identified within 5 km of the proposed amendment corridor that could result in cumulative noise effects. No additional mitigation is required for the proposed Groundbirch Connector for potential adverse effects on the atmospheric environment. The mitigation for the Project is detailed in Section 6.5 of the EAC Application as well as the management plans that have been prepared to meet the conditions of the EAC #E14-03.	Community: • No additional effects Indigenous Nations: • No additional effects

24.5 Conclusion

An assessment of effects on current and future generations was conducted for the proposed amendment. The majority of potential residual effects were assessed to have immediate or short-term durations and, therefore, impacting the current generation. The potential residual effects that were assessed to have a duration that extends into the “long-term” were considered in the assessment of effects to the future generation. Five VCs had residual effects with long-term durations which, therefore, could impact future generations and were carried forward into this assessment.

For all five VCs, the conditions for the proposed amendment are comparable to the existing conditions assessed in the EAC Application; therefore, the proposed amendment do not result in any material change to the assessment of potential adverse effects, mitigation, or residual effects for the VCs during any phase of the Project. As a result, there are no anticipated potential effects to community or Indigenous future generations. The Project, including the proposed amendment will provide positive benefits by means of employment, government revenues, and economic development and diversification for the regional and local communities. Coastal GasLink understands that the benefits of the Project to future generations would be sustained for the life of the Project and into the future and that these economic benefits were accurately assessed in the EAC Application.

25. Conclusions

Overall, the potential residual adverse effects identified in the EAC Application have not changed as a result of the proposed amendment. In addition to the assessment of potential adverse effects, the proposed amendment do not result in any material change effects of the environment on the Project. It is concluded that the effects of the environment on the Project identified in the EAC Application remain the same.

The BC EAA 2018 was enacted in December 2019 and Section 25.2 includes additional assessment matters that were not previously included in the *2002 Act* under which the Project was approved.

This Amendment Application assesses three additional Section 25 required assessment matters for the proposed amendment relative to the Project:

- Disproportionate effects on distinct human populations, including populations identified by gender
- Effects on biophysical factors that support ecosystem function
- Effects on current and future generations

The disproportionate effects on distinct human population assessment conducted for the proposed amendment identified a list of socio-economic factors and potential subgroups that may interact with the proposed amendment. The assessment reviewed the potential adverse effects, mitigation measures, and residual adverse effects of each proposed amendment on the identified distinct human populations. The assessment found no change to effects assessment conclusions compared to general population assessed in the EAC Application.

An assessment of biophysical factors that support ecosystem function was conducted for the proposed amendment. The Ecosystem Function Scoping Tool was completed and focused on potential interactions between the proposed amendment and biophysical factors that support ecosystem function. The scoping exercise found that all the 10 biophysical factors that support ecosystem function did not interact with the proposed amendment. As a result, the proposed amendment activities are not expected to have a negative effect on ecosystem function.

An assessment of effects on current and future generations was conducted for the proposed amendment. The majority of potential residual effects were assessed to have immediate or short-term durations and, therefore, impacting the current generation. The potential residual effects that were assessed to have a duration that extends into the “long-term” were considered in the assessment of effects to the future generation. Five VCs had residual effects with long-term durations which, therefore, could impact future generations and were carried forward into this assessment. Once the duration of these effects on future generations were identified, reversibility (environmental and socio-economic) were then considered to identify the period of time over which the residual effect identified extends (Table 24-1).

For all five VCs, the conditions for the proposed amendment are comparable to the existing conditions assessed in the EAC Application; therefore, the proposed amendment do not result in any material change to the assessment of potential adverse effects, mitigation, or residual effects for the VCs during any phase of the Project. As a result, there are no anticipated potential effects to community or Indigenous future generations. The Project, including the proposed amendment will provide positive benefits by means of employment, government revenues, and economic development and diversification for the regional and local communities. Coastal GasLink understands that the benefits of the Project to future generations would be sustained for the life of the Project and into the future and that these economic benefits were accurately assessed in the EAC Application.

26. References

26.1 Literature Cited

Alberta Agriculture, Food and Rural Development. 2004. *Soil Quality Criteria Relative to Disturbance and Reclamation.* Prepared by the Soil Quality Criteria Working Group Soil Reclamation Subcommittee, Alberta Soils Advisory Committee, Alberta Agriculture. 46 pp. https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag9469/$FILE/sq_criteria_relative_to_disturbance_reclamation.pdf.

Agricultural Land Commission. 2014. *ALR & Maps.* Accessed July 2020. http://www.alc.gov.bc.ca/alc/content/alr-maps.

Agriculture and Agri-Food Canada. 2014. *Land management through grazing*. Accessed July 2020. https://www.agr.gc.ca/eng/agriculture-and-climate/agricultural-practices/soil-and-land/land-management-through-grazing/?id=1242752035499.

British Columbia Conservation Data Centre. 2020. *BC Species & Ecosystems Explorer.* B.C. Ministry of Environment. Victoria, B.C. Accessed July 2020. http://a100.gov.bc.ca/pub/eswp/.

British Columbia Environmental Assessment Office. 2013. *Coastal GasLink Pipeline Project: Application Information Requirements for an Environmental Assessment Certificate*. Accessed June 2020. https://projects.eao.gov.bc.ca/api/public/document/5e41882e74d1830021b67709/download/CGL%20-%20Application%20Information%20Requirements%20-%2020130523.pdf.

British Columbia Environmental Assessment Office. 2020a. *EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018)*. Version 1.01. March 2020. p. 53.

British Columbia Environmental Assessment Office. 2020b. *Guide to Indigenous Knowledge in Environmental Assessments*. Version 1.0. April 2020. p. 20.

British Columbia Ministry of Citizens Services. 2020. *BC Parcel Fabric* (digital file). Accessed June 15, 2020. https://catalogue.data.gov.bc.ca/dataset/parcelmap-bc-parcel-fabric.

British Columbia Ministry of Environment - Water Protection and Sustainability. 2020a. *Ground Water Well Capture Zones* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/ground-water-well-capture-zones.

British Columbia Ministry of Environment - Water Protection and Sustainability. 2020b. *Ground Water Wells* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/e4731a85-ffca-4112-8caf-cb0a96905778.

British Columbia Ministry of Forests and Range. 2011. *A Field Guide to Ecosystem Identification for the Boreal White and Black Spruce Zone of British Columbia.* Land Management Handbook Number 65. Victoria, BC.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Hunting & Trapping Regulations Synopsis 2020–2022*. pp. 97.

British Columbia Ministry of Transportation and Infrastructure. 2020. *Transportation & Infrastructure Projects.* Accessed July 2020. https://www2.gov.bc.ca/gov/content/transportation-projects.

British Columbia Oil and Gas Commission. 2017. *Agreement between the Provincial Agricultural Land Commission and the Oil and Gas Commissions*. Accessed July 2020. https://www.bcogc.ca/files/application-manuals/Oil-and-Gas-Activity-Application-Manual/Supporting-Documents/alcogcdelegationagreement2017update.pdf.

British Columbia Oil and Gas Commission. 2018. *British Columbia Noise Control Best Practices Guideline*. Version 2.1. December 2018. Accessed July 2020.https://www.bcogc.ca/files/operations-documentation/Oil-and-Gas-Operations-Manual/Supporting-Documents/bc-noise-control-best-practices-guideline-december-release-v21-2018.pdf#:~:text=The%20BC%20Noise%20Control%20Best%20Practices%20Guideline%20%28the,jurisdiction%20of%20the%20Oil%20and%20Gas%20Activities%20Act.

British Columbia Oil and Gas Commission. 2020. *BC Oil and Gas Commission Open Data Portal – Pipeline.* Accessed October 2020. https://data-bcogc.opendata.arcgis.com/search?tags=OD_Pipeline.

Canada Energy Regulator. 2020. *REGDOCS - NOVA Gas Transmission Ltd.* Accessed July 2020. https://apps.cer-rec.gc.ca/REGDOCS/Item/View/554112.

City of Dawson Creek. 2020. *Current Development Applications*. Accessed July 2020. http://www.dawsoncreek.ca/departments/development-and-regulatory-services/development-applications/current-development-applications/.

Coastal GasLink Aboriginal Consultation Plan. 2013. https://www.projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/certificates;currentPage=1;pageSize=10;sortBy=+displayName;ms=1599857053580

Demarchi, D. A. 2011. *An Introduction to the Ecoregions of British Columbia*. Third Edition. Ecosystem Information Section, Ministry of Environment. Victoria, British Columbia. Accessed July 2020. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/ecosystems/broad-ecosystem/an_introduction_to_the_ecoregions_of_british_columbia.pdf?bcgovtm=CSMLS.

eBird. 2020. *An Online Database of Bird Distribution and Abundance.* eBird, Cornell Lab of Ornithology, Ithaca, New York. Accessed July 2020. http://www.ebird.org.

Forest Practices Code of British Columbia. 1998. *Fish-stream Identification Guidebook.* Version 2.1. Accessed July 2020. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/fish-data-information/fishstream.pdf.

Health Canada. 2017. *Guidance for Evaluating Human Health Impacts in Environmental Assessment: NOISE*. 2017. Accessed July 2020. https://iaac-aeic.gc.ca/050/documents/p80054/119378E.pdf.

Holland, S.S., 1976. *Landforms of British Columbia, a Physiographic Outline.* Bulletin No. 48. BC Ministry of Mines and Petroleum Resources, Victoria. 138 pp.

Kenk E. and I. Cotic. 1983. *Land Capability Classification for Agriculture in BC*. Surveys and Resource Mapping Branch, Ministry of Environment and Soils Branch, Ministry of Agriculture and Food. MOE Manual 1. Kelowna, BC.

Massey, N.W.D., D.G. MacIntyre, J.W. Haggart, P.J. Desjardins, C.L. Wagner and R.T. Cooney. 2005. *Digital Geology Map of British Columbia: Tile NN8-9 North Coast and Queen Charlotte Islands/Haida Gwaii.* Ministry of Energy and Mines, British Columbia Geological Survey, Geofile 2005-5. 1:250,000. Victoria, BC.

Mathews, W.H. 1980. *Retreat of the last ice sheets in northeastern British Columbia and adjacent Alberta.* Geological Survey of Canada, Bulletin 331, 22 pp.

Maxwell, R. 1987. *Biophysical Soil Resources and Land Evaluation of the Northeast Coal Study Area, 1977—1978 Jarvis Creek—Morkill River Area.* Wildlife Branch British Columbia Ministry of Environment and Parks. British Columbia Soil Survey, Report No. 41. Victoria, BC.

Natural Resources Canada. 2010. *Simplified Seismic Hazard Map for Canada.*

Province of British Columbia. 2020a. *BC iMAP - Major Projects Inventory.* Accessed July 2020. https://maps.gov.bc.ca/ess/hm/imap4m/.

Province of British Columbia. 2020b. *HabitatWizard.* Accessed July 2020. https://maps.gov.bc.ca/ess/hm/habwiz/.

Reasons for Ministers Decision – Coastal GasLink Pipeline Project. 2014. Accessed July 2020. https://www.projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/certificates;currentPage=1;pageSize=10;sortBy=+displayName;ms=1599857053580

Reimchen, T.H. and Bouvier, G.C. 1980. *Surficial geology, Dawson Creek, British Columbia*. Geological Survey of Canada, Map 1467A, scale 1: 250 000.

Statistics Canada. 2017. *Peace River, RD [Census division], British Columbia and British Columbia [Province]* (table). *Census Profile*. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released November 29, 2017. Accessed July 2020. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.

26.2 GIS Data and Mapping References

This subsection includes references cited on the figures accompanying this report.

British Columbia Ministry of Energy, Mines and Petroleum Resources. 2020. *Oil and Gas Tenure Areas* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/oil-and-gas-tenure-areas.

British Columbia Ministry of Energy, Mines and Petroleum Resources - Mineral Titles. 2020. *MTA - Mineral, Placer and Coal Tenure Spatial View* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/mta-mineral-placer-and-coal-tenure-spatial-view.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2020. Tantalis Crown Tenures (digital file). Accessed February 2020. https://catalogue.data.gov.bc.ca/dataset/3544ad91-0cf2-4926-a08a-bfe42d9a031d. Record Last Modified: January 10, 2020.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2019a. *Recreational Features Inventory* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/4cadfc5b-a19b-4d49-8a20-48747c28209c.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2019b. *Section 58 Recreation Orders - Polygons* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/77ca3d95-a3b4-4069-9599-3959b9481c33.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2020a. *Recreation Polygons* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/263338a7-93ee-49c1-83e8-13f0bde70833.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2020b. *Recreation Line* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/7fcb21f7-e51c-4342-a5e1-445a6c42128e.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2020c. *Section 58 Recreation Orders - Lines* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/b05ae99e-b4ce-49c5-8d09-fc59c84e7bf9.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Resource Practices. 2020. *Visual Landscape Inventory* (digital file). Accessed March 10, 2020. https://catalogue.data.gov.bc.ca/dataset/4e941067-20ec-4b5d-bca3-8831c9b2e4db.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020a. *Water Rights Licences* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/5549cae0-c2b1-4b96-9777-529d9720803c.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020b. *Water Rights Applications* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/f3a53d7f-da09-4726-ac83-f0032e4bd490.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020c. *Water Licence Works - Lines* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/water-licensed-works-lines.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020d. *Water Licensed Works - Points* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/water-licensed-works-points#edc-pow.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020a. *Indian Reserves and Band Names - Administrative Boundaries* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/c2ce81af-78c1-467c-b47e-c392cd0a771f.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020b. *FADM - Tree Farm License (TFL) Addition* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/fadm-tree-farm-license-tfl-addition.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020c. *FADM - Tree Farm License (TFL) Deletion* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/fadm-tree-farm-license-tfl-deletion.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020d. *Forest Tenure Managed Licence* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/forest-tenure-managed-licence.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020e. *Guide Outfitter Areas* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/guide-outfitter-areas.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020f *TANTALIS - Crown Tenures* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/tantalis-crown-tenures.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020g. *Transmission Lines* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/bc-transmission-lines.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020h. *Traplines of British Columbia* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/traplines-of-british-columbia.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020i. *Tree Farm License Agreement Boundary (TFL)* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/fadm-tree-farm-license-agreement-boundary-tfl-.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020j. *Wildlife Management Units* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/wildlife-management-units.

Coastal GasLink Pipeline Ltd. 2020. *First Nation Traditional Territory* (digital file). Calgary, AB. Accessed June 17, 2020.

Midwest Surveys Land Surveying Ltd. (Midwest Surveys). 2020. *Coastal GasLink Project – Groundbirch Connector Construction Plan. Revision 0*. Document No. CGE4703-MSI-G-MP-1531. May 15.

Ministry of Community, Sport and Cultural Development. 2020. *Municipalities - Legally Defined Administrative Areas of BC* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/e3c3c580-996a-4668-8bc5-6aa7c7dc4932.

Ministry of Forests, Lands and Natural Resource Operations - Resource Management Objectives. 2020. *Strategic Land and Resource Plans - Current* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/4b142d4c-83d6-4ecc-b66c-66601ae65992.

Appendix A
Groundbirch Connector
Soils Technical Data Report

Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3) Appendix A Groundbirch Connector Soils Technical Data Report

CGL80373-STC-ENV-RP-007

October 13, 2020

Revision 1

Issued for Use

Stantec

Authorization Page

Stantec Consulting Ltd.

Prepared by: Mel Zwierink Digitally signed by Mel Zwierink Date: 2020.10.09 12:35:15 -06'00' Date: _____

Name: Melvin Zwierink

Title: Author

Endorsed by: Natalie Tashe Digitally signed by Natalie Tashe Date: 2020.10.08 13:34:29 -07'00' Date: _____

Name: Natalie Tashe

Title: Technical Quality Review

Endorsed by:  Digitally signed by Ward Prystay, R.P.Bio. Date: 2020.10.09 12:52:55 -07'00' Date: _____

Name: Ward Prystay

Title: Independent Senior Review, Vice President Environmental Services

Approved by: Catherine Meyer Digitally signed by Catherine Meyer Date: 2020.10.10 11:46:48 -06'00' Date: _____

Name: Catherine Meyer

Title: Project Manager, Environmental Services

Authorization Page

Coastal GasLink Pipeline Project

Endorsed by: _____ Date: _____

Name: Jeffery Quennelle

Title: Environmental Advisor, Coastal GasLink

Endorsed by: _____ _____

Name: Adair Rigney

Title: Environmental Team Lead, Coastal GasLink

Accepted by: _____ Date: _____

Name: Craig Losos

Title: Environment and Regulatory Manager, Coastal GasLink

Revision Log

Rev	Section	Revision Description
0	All	Issued for Use
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1.0 INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at: https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Soils Technical Data Report includes relevant baseline information for the proposed Groundbirch Connector.

Traditional Land and Resource Use (TLRU) is presented in Section 15.0 of the Amendment Application. The Groundbirch Connector crosses exclusively private land, so no Traditional Ecological Knowledge was collected during field programs.

Abbreviations and acronyms used in this TDR are described in Appendix A-1.

1.1 OBJECTIVES

This Soils TDR considers the direction of the EAC Application Information Requirements issued by the EAO (BC EAO 2013a). Section 25 required assessment matters under the revitalized BC *Environmental Assessment Act* (refer to Section 1.2 of the Amendment Application), and references the guidance contained in the following documents:

- EAO User Guide (BC EAO 2020a)
- Guide to Indigenous Knowledge in Environmental Assessments (BC EAO 2020b)

The objectives of this TDR are to describe the baseline soils conditions along the proposed Groundbirch Connector using methods that are consistent with the 2013 approved Application Information Requirements for the Project and provide the data needed to facilitate the assessment of potential effects and potential cumulative effects on soils within the Agricultural Land Reserve (ALR). These objectives were achieved by compiling and synthesizing information from existing information sources and completing field surveys.

The desktop assessment and field survey results were then interpreted to determine soil map units (SMUs), agricultural land capability classifications, reclamation suitability ratings, soil wind and water erosion potential (within the ALR) and combined wind and water erosion potential (outside the ALR), and compaction and rutting risks (i.e., constraints). Other potential soils constraints, such as trench stability, wetness, coarse fragment content, and depth to bedrock are also presented here.

Mitigation for soils be found in Section 5.5 of the EAC Application (Coastal GasLink 2014a). No additional mitigation is required for the proposed Groundbirch Connector for potential effects on soil capability.

1.2 STUDY AREA BOUNDARIES

Soil and soil productivity study area boundaries are described below and presented in Figure 1-1.

1.2.1 Groundbirch Connector Footprint

The Groundbirch Connector Footprint is the area potentially affected by physical works and activities, such as clearing, construction and cleanup. The Groundbirch Connector Footprint is delineated by a 50-m wide buffer on each side of the pipeline centreline, and encompasses the construction ROW, the permanent ROW, an access road, temporary workspace, and tie-in locations.

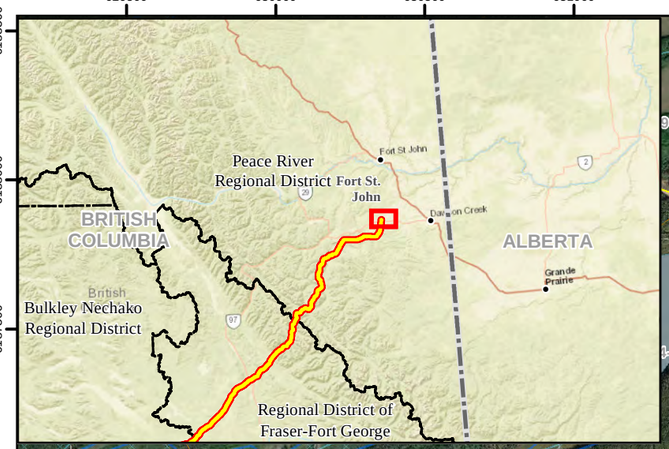
The Groundbirch Connector Application Corridor varies in width from approximately 175 m to 245 m to account for temporary workspace, but is not used in assessment analysis within this report.

1.2.2 Local Study Area

The soils local study area (LSA) is the area in which Groundbirch Connector activities and facilities could affect soil capability. The soils LSA includes the Groundbirch Connector Footprint plus a 200 m buffer on each side of the proposed pipeline centerline. This soils LSA is approximately 135.47 ha.

1.2.3 Regional Study Area

A regional study area (RSA) has not been identified for soils because any adverse effects would be restricted to the Groundbirch Connector Footprint and soils LSA.



ALR

(Entire map extent falls within ALR)

N
W E
S

Coastal GasLink Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station
Land Ownership
Private Land
Crown Provincial Land
Groundbirch Connector Application Corridor
Groundbirch Connector Project Footprint
Soils Local Study Area
Existing Pipeline
Existing Road
Railway
TRIM Contour (20 m Interval)
TRIM Watercourse
BC Township System-Quarter Section Grid (NE-34-78-19 W 6M)
Blue-Listed Community
Flooded Land (i.e. swamps/marshes)
Water Body

REVISION	DESCRIPTION: xxxxx
0	Review

1:20,000 0 165 330 660 990 1,320 Metres

Coastal GasLink Pipeline Project
TC Energy

Figure 1-1 Soils Technical Data Report - Groundbirch Connector Project Soils Study Area Overview

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513287-0007	Connector

STANTEC: W:\Clients\TransCanada\Coastal_GasLink\Figures\Soils_Terrain\123513287_0007_Soils.mxd

2.0 GROUNDBIRCH CONNECTOR PROJECT SETTING

This section provides an overview of the physical setting, geology and Quaternary history, and topography and landforms traversed by the Groundbirch Connector. The information presented in this section is from a review of published and publicly available data and field studies undertaken by Coastal GasLink.

2.1 PHYSICAL SETTING

The Groundbirch Connector is located within the Great Plains physiographic region of BC which is characterized by flat-lying or gently dipping sandstones and shales and generally flat to gently rolling surfaces with minimal relief variations.

The Groundbirch Connector is in the Boreal Plains Ecoprovince and the Boreal Black and White Spruce Biogeoclimatic Ecosystem (BEC) zone and has a continental climate. Ecoprovinces are areas with consistent climate and are part of the ecoregion classification system. Precipitation in this Ecoprovince is light and steady throughout the year, with convective storms bringing rain during the summer and the southwest airflow bringing snow during winter storms. This area experienced long cold winters and warm but short growing season. Arctic air frequently dominates during the winter and early spring.

The mean annual precipitation within Boreal Black and White Spruce zone varies from areas with approximately 330 to 570 mm per year with mean annual temperatures of ranging from approximately -2.9 °C to approximately 2°C (Meidinger and Pojar 1991).

Soil formation over time is controlled by the biophysical setting of a given area, specifically by the parent or surficial material type and geomorphological processes, topography, vegetation and drainage. Soil association names are further delineated by BEC zones across the Groundbirch Connector. The physical setting within the Groundbirch Connector Footprint is further described below in context of physiographic regions and Ecoprovinces.

The Groundbirch Connector is within ALR lands and consists of agricultural, forested, open water and disturbed land uses.

2.2 GEOLOGY AND QUATERNARY HISTORY

The soils LSA is underlain by the Upper Cretaceous Dunvegan Formation. This formation consists of massive conglomerate, fine to coarse grained sandstone and carboniferous shale (Massey et al. 2005).

The Laurentide ice sheet advanced on to the Alberta Plateau from the northeast and east three times during the Pleistocene with the most recent being the Late Wisconsinan when ice reached the Rocky Mountain Foothills, leaving till veneer to blanket deposits and scattered boulder erratics (Catto et al. 1996).

When ice retreated from the area, meltwater was impounded against the retreating Laurentide ice sheet forming Glacial Lake Peace. At its maximum, the lake was thought to extend westward to Portage Mountain, covering the Hudson Hope area north of Chetwynd (Mathews 1980), including the soils LSA. The lake drained in stages (Mathews 1980), with the post-glacial shoreline being east of Fort St John before 10,770 years BP (Fladmark et al. 1988). The lake is thought to have covered the area for some time during its Bessborough stage, depositing thick layers of clay, up to 30 m thick and forming sand and gravel beaches (Mathews 1980).

2.3 TOPOGRAPHY AND LANDFORMS

Topography in the soils LSA is generally flat to gently rolling with slopes ranging between 0 to 15%. Topography and landforms are often attributed to factors such as underlying bedrock, thickness of surficial material deposits and geomorphological processes. Glaciolacustrine deposits) are the most common surficial materials in the soils LSA, associated with ice-dammed lakes prevalent across the Alberta Plateau (Reimchen and Bouvier 1980). Glaciolacustrine deposits tend to be 1 m to 5 m thick and can be found overlying till (Maxwell 1987) and are generally rich in clay having eroded large areas of dark grey cretaceous shale (Mathews 1980).

3.0 METHODS

The following section provides a description of the methods used to collect baseline soil information within the Groundbirch Connector Footprint and soils LSA. To assess baseline conditions, a review of background information, preliminary soils mapping, field surveys and final soils mapping was completed for the soils LSA.

Detailed soils and Terrestrial Ecosystem Mapping (TEM) mapping was completed for the portions of the Groundbirch Connector study areas that were not mapped for the 2014 EAC Application (Coastal GasLink 2014a) and two ALR soils mapping projects (Coastal GasLink 2014b,c). The previous soil mapping activities did not include field inspection sites within the Groundbirch Connector Footprint.

The TEM and soils mapping for the 2014 EAC Application (Coastal GasLink 2014a) and adjacent soils mapping data were used as a basis for desktop review, preliminary terrain and soil mapping, and field survey planning.

In 2019 and 2020 detailed soils mapping was completed using recent imagery, and 2019 field survey information. Details on methods are provided below.

3.1 DESKTOP ASSESSMENT

A desktop assessment was conducted to compile soil baseline information and support field survey planning. Existing background information related to regional terrain conditions was reviewed, including the following reports and datasets:

- Adjacent terrain, soils and vegetation projects:
  - Terrestrial Ecosystem Mapping (TEM) and soil mapping for the original 2014 EAC Coastal GasLink Pipeline Project Application (Coastal GasLink 2014a).
  - Schedule A Report for the Proposed Wilde Lake Compressor Station (Coastal GasLink 2014b)
  - Schedule A Report for Construction Section 1 of the Proposed Pipeline Construction Corridor (Coastal GasLink 2014c)
  - Schedule A Report for RE-620.A (Coastal GasLink 2020)
- Existing BC Soil Survey Report - Soils of the Fort St. John -Dawson Creek area, British Columbia. Report No.42 (Lord and Green 1986)
- Digital Bedrock Geology Map of British Columbia (Massey et al. 2005)
- BC Government 1:50,000 TRIM and Digital Elevation Model (DEM)
- BC Government Fresh Water Atlas, Watershed Atlas and Wetland Data

- BC Government spatial files (shape files, Google Earth ®, .kmz files) from the BC Soil Information Center (BC Ministry of Environment and Climate Change Strategy 2018) including existing BC soil survey information (Lord and Green 1986) and existing agricultural capability mapping
- 2014 BING imagery (Department of Natural Resources Canada, 2014) viewed via ESRI ® ArcMap program
- Google Earth ® imagery (10/26/2018) for general overview
- Client provided Light Detecting and Ranging (LiDAR) received in 2020, derived from DEM for slope and elevation interpretation
- Client provided coloured orthophotographs, received in 2012

Additionally, the vegetation and wetlands assessments for the Groundbirch Connector were also reviewed as part of the desktop assessment (see Appendix G Proposed Groundbirch Connector Wetlands Technical Data Report, and Appendix H Proposed Groundbirch Connector Vegetation Technical Data Report).

3.2 SOILS MAPPING

All soils mapping was performed using standards presented in the following documents:

- Canadian System of Soil Classification (SCWG 1998)
- Resources Inventory Committee. 1998. Standard for digital terrain data capture in British Columbia: Terrain technical standard and database manual. Terrain Data Working Committee. 111 pp.
- Field Manual for Describing Terrestrial Ecosystems (BC MOE & BC MOFR 2010)

Soils mapping consists of delineating SMUs for the preliminary and final soil maps. A soil map unit is a defined and named repetitive group of soil bodies occurring together in an individual and characteristic pattern over the soil landscape (Gregorich et al. 2001). Soils mapped for the Groundbirch Connector soils LSA were delineated into SMUs and assigned a dominant soil series, agriculture land capability classification (Section 3.4), surface drainage (Section 3.2.3), and slope classes (Section 3.2.4). Slope and drainage classes were assigned to each soil map unit for the purposes of characterizing SMUs and predicting the potential for soil erosion compaction and rutting.

Preliminary and final soils mapping (including both linework and classification) was reviewed by a Stantec qualified professional soil scientist to confirm mapping adheres to provincial standards, following quality control processes and the standards listed above.

3.2.1 Preliminary Mapping

Imagery obtained by Coastal GasLink, publicly available imagery, LiDAR and DEM were used with existing terrain and soils datasets (Coastal GasLink 2014a,b,c) to classify SMUs within the soils LSA. Digital files were overlain on the spatial boundaries for the assessment using ESRI ® ArcMap programs and tools.

Soils mapping was completed at 1:5,000 scale. Mapping is presented at a scale of 1:12,000.

Soils mapping was completed using ESRI ® ArcMap program and tools utilizing topographic and imagery data. The existing BC soil survey mapping (Lord and Green 1986) was used in combination with the existing digital TEM line-work (Coastal GasLink 2014a) and adjacent soils mapping as a basis for the preliminary field soil survey planning and final soils map unit mapping. The existing digital data were overlain on the proposed Groundbirch Connector to correlate with information collected from the 2019 field surveys.

Soil map units consist of a dominant soil (series, association or variant) and inclusions (10% to 20% of the soil map unit) of other soils (series, associations or variants) where warranted. Soils map units were delineated based on dominant soils as well as terrain mapping units, drainage (e.g., well drained, poorly drained), and slope range (class).

3.2.2 Final Mapping

The purpose of the final soils mapping was to modify any of the preliminary linework and classification by incorporating the site-specific data from the field program. Final soils mapping was based on the field observations and the laboratory results.

3.2.3 Soil Drainage Classification

Soil drainage was determined in the field with visual indicators (i.e., nearby wetlands, open water, seepage in horizon, soil mottling) and compared to existing soil series information reviewed in the desktop assessment. General surface flow directions are assumed by the topographic contour lines (base map data) and slope and topography observations in the field.

Soil drainage was classified following the guidelines presented in the Canadian Soil Information Services (CanSIS) under the National Soil Data Base (NSDB) for soil drainage class (CanSIS 2018). Table 3-1 presents a summary of Soil Drainage Class Descriptions.

A desktop review of publicly available data using the BC Freshwater Atlas (GeoBC 2020) and field observations were used to identify potential watercourse crossing associated with the proposed Groundbirch Connector Footprint.

Table 3-1: Soil Drainage Class Descriptions

Code	Class	Description
VR	Very rapidly drained	Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall provided there is a steep gradient. Soils have very low available water storage capacity (usually less than 2.5 cm) within the control section and are usually coarse textured, or shallow, or both. Water source is precipitation.
R	Rapidly drained	Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity (2.5-4 cm) within the control section, and are usually coarse textured, or shallow, or both. Water source is precipitation.
W	Well drained	Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Soils have intermediate available water storage capacity (4-5 cm) within the control section and are generally intermediate in texture and depth. Water source is precipitation. On slopes subsurface flow may occur for short durations, but additions are equaled by losses.
MW	Moderately well drained	Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity (5-6 cm) within the control section and are usually medium to fined textured. Precipitation is the dominant water source in medium to fine textured soils; precipitation and significant additions by subsurface flow are necessary in coarse textured soils.
I	Imperfectly drained	Water is removed from the soil sufficiently slowly in relation to supply, to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is the major supply. If subsurface water or groundwater, or both, is the main source, the flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface flow or groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed phases of well drained subgroups.
P	Poorly drained	Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow, or both, in addition to precipitation are the main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Soils have a wide range in available water storage capacity, texture, and depth, and are gleyed subgroups, Gleysols, and Organic soils.

Table 3-1: Soil Drainage Class Descriptions

Code	Class	Description
VP	Very poorly drained	Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are the major water sources. Precipitation is less important except where there is a perched water table with precipitation exceeding evapotranspiration. Soils have a wide range in available water storage capacity, texture, and depth, and are either Gleysolic or Organic.
-	Not applicable	Drainage not applicable (i.e., rock, waterbody, disturbed ground)
Source: CanSIS (2018)		

3.2.4 Slope Classes

Slope classes were assigned to each soil map unit for the purposes of predicting the potential for water erosion and rutting (Section 3.6 and 3.7). Slope classes were assigned based on the class limits used in the Canadian System of Soil Classification (SCWG, 1998). Slope classes and related descriptions are provided in Table 3-2.

Table 3-2: Slope Class Descriptions

Slope Class Ranges		
Class	**Description**	**Range of Slope Gradients (%)**
1	Level	<0.5
2	Nearly level	>0.5 to 2
3	Very gentle slopes	>2 to 5
4	Gentle slopes	>5 to 10
5	Moderate slopes	>10 to 15
6	Strong slopes	>15 to 30
7	Very strong slopes	>30 to 45
8	Extreme slopes	>45 to 70
9	Steep slopes	>70 to 100
Source: SCWG (1998)		

3.3 FIELD SURVEYS

Soil field data were collected in conjunction with the 2019 vegetation and terrain field programs, carried out between August 1 - 5, 2019. The purpose of the field surveys was to ground truth the preliminary mapping and to collect detailed field data on the soils, drainage and slopes to support the final mapping and analysis phase of the Soil TDR for the Groundbirch Connector.

Soil surveys on ALR lands generally followed the same methods as those used for the Coastal GasLink EAC Application (Coastal GasLink 2014a). ALR soil surveys within the Groundbirch Connector Footprint were designed to meet site assessment requirements specified in Schedule A of the Delegation Agreement between the Provincial Agricultural Land Commission and Oil and Gas Commission (ALC- OGC 2017). Soil data were collected according to the standards in the Field Manual for Describing Terrestrial Ecosystems (BC MOE & BC MOFR 2010), and The Canadian System of Soil Classification (SCWG 1998). For the Groundbirch Connector Footprint, a Survey Intensity Level (SIL)1 was completed with one inspection site for every 1 to 5 ha (Mapping System Working Group 1981). For the soils LSA, the SIL 2 was completed, with at least one soil inspection in over 90% of the delineations (2 to 30 ha represented by one ground inspection) (Mapping System Working Group 1981).

Photographs were taken of the soil inspection sites and the surrounding landscape. Sketch diagrams of key landscape features were drawn.

Site description requirements (as specified in Schedule A requirements for ALR lands) include the following:

- Brief description of surficial geology (i.e., parent material)
- Dominant soil types and associated soil characteristics, modified based on field and laboratory data
- Agricultural land capability ratings from published resource inventory maps, modified based on field and laboratory data
- Current land use
- Rating of the surface drainage and location of any existing natural water courses
- Description of the site topography indicating gradient and aspect of slopes

For the Groundbirch Connector, soil inspection sites were selected based on desktop review, preliminary imagery interpretation and consideration of land use, vegetation patterns, and topography.

Adjustments to soil inspection site locations were made in the field as necessary, based on the judgement of the qualified specialist. Global Positioning System (GPS) coordinates and soil data for each soil inspection were collected using a soil survey data form and a handheld GPS unit. Soil profiles were inspected to a maximum depth of 1.0 m below ground surface.

Soil inspection sites were selected on the Groundbirch Connector Footprint every 250 m or as many sites as necessary considering specific conditions. Supplemental soil inspection at predetermined vegetation field inspection sites were completed for characterization purposes.

The following landform information was collected at each soil inspection site:

- slope class, length and gradient
- aspect
- surface expression
- parent material
- site drainage
- depth to water table, where observed
- depth to seepage, where observed
- contrast between topsoil and subsoil
- land use

The following information was collected for each soil horizon:

- depth
- texture
- structure
- consistency
- colour
- coarse fragment content
- rooting depth
- presence of mottles and/or gleying

3.3.1 Soil Sampling and Laboratory Analysis

Soil samples were collected from A horizons (topsoil), B horizons (subsoil) and C horizons (parent material) at select soil inspection sites to either aid in soil characterization and/or assess final agricultural capability classifications.

Soil samples were collected in plastic bags supplied by Bureau Vertias, stored at cold temperatures and sent to Bureau Vertias for laboratory analyses. Laboratory analyses include particle size/texture by hydrometer, moisture content, calcium carbonate equivalent, total organic carbon, total nitrogen, nutrients (available nitrate, available nitrite, phosphorus, potassium, and sulphur), theoretical gypsum requirement, and pH (soluble and 1:2 calcium chloride extract). Analytical methods and quality assurance reports are provided on the Bureau Vertias Certificate of Analyses (Appendix A-2).

3.4 AGRICULTURAL LAND CAPABILITY CLASSIFICATION

Land capability for agriculture on ALR lands was rated for each SMU according to the Kenk and Cotic (1983) method (see Tables 3-3 and 3-4).

This method rates land quality from Classes 1 to 7, with subclasses according to soil texture, drainage, fertility, water holding capacity, topographic position, local site temperature, evapotranspiration and related agricultural productivity. Class 1 is rated as the best and most productive soil while Class 7 is non-productive land.

Table 3-3: Agricultural Capability Class Descriptions

Class	Description
Class 1	Class 1 land is capable of producing the very widest range of crops. Soil and climate conditions are optimum, resulting in easy management.
Class 2	Class 2 land is capable of producing a wide range of crops. Minor restrictions of soil or climate may reduce capability but pose no major difficulties in management.
Class 3	Class 3 land is capable of producing a fairly wide range of crops under good management practices. Soil and climate limitations are somewhat restrictive.
Class 4	Class 4 land is capable of producing a restricted range of crops. Soil and climate conditions require special management considerations.
Class 5	Class 5 land is capable of producing cultivated perennial forage crops and specially adapted crops. Soil and climate conditions severely limit capability.
Class 6	Class 6 land is important in its natural state as grazing land. These lands cannot be cultivated because of soil or climate limitations.
Class 7	Class 7 land has no capability for soil-bound agriculture.
Source: Adapted from Kenk and Cotic (1983)	

Table 3-4: Agriculture Capability Subclass Descriptions

Subclass	Description
A	Soil moisture deficiency
C	Adverse climate (excluding precipitation)
D	Undesirable soil structure
E	Erosion
F	Low fertility
I	Inundation (e.g., flooding by streams)
N	Salinity
P	Stoniness
R	Shallow soil over bedrock or bedrock outcroppings
T	Topography
W	Excess water (groundwater)
Source: Adapted from Kenk and Cotic (1983)	

3.5 RECLAMATION SUITABILITY RATINGS

The criteria used to rate the reclamation suitability of the soils were those proposed by the Soil Quality Criteria Subcommittee of the Alberta Soils Advisory Committee (AAFRD 2004). Criteria for evaluating the suitability of root zone material in the Eastern Slopes Region were applied to the Groundbirch Connector because of the similarity with BC soils.

Where no soil analytical data were available, professional judgment was used to rate reclamation suitability for soil orders and parent geologic materials.

Reclamation suitability refers to materials that are best suited for salvage and replacement. Soil was rated in classes as good, fair, poor or unsuitable, based on soil physical characteristics (i.e., parent material type, coarse fragment content) and soil quality parameters (i.e., chemical and physical parameters such as fertility and texture). Table 3-5 provides a description of the suitability ratings criteria.

Table 3-5: Reclamation Suitability Ratings Descriptions

Suitability Ratings	Criteria [1]
Good (G)	None to slight soil limitations that affect use as a plant growth medium
Good (G) - Wetlands	Organic material associated with wetlands
Fair (F)	Moderate soil limitations that affect use, but which can be overcome by proper planning and good management
Poor (P)	Severe soil limitations that can make use questionable. This does not mean the soil cannot be used, but rather carefully planning and very good management are required.
Unsuitable (U)	Chemical or physical properties of the soil are so severe reclamation would not be economically feasible or in some cases impossible.

Table 3-5: Reclamation Suitability Ratings Descriptions

Suitability Ratings	Criteria [1]
Non-classified	n/a
NOTE: [1] Criteria from AAFRD 2004	

3.6 SOIL EROSION POTENTIAL

For this assessment, erosion refers to surface soil erosion due to wind and water. Wind erosion risk classes were determined using the methods outlined by of Coote and Pettapiece (1989).

Water erosion risk classes were determined for each soil polygon using the Revised Universal Soil Loss Equation for Application in Canada (RUSLEFAC) method (Wall et al. 2002). The RUSLEFAC was developed to predict average soil loss by water erosion, taking into account rainfall, soil and landscape characteristics, and management practices.

3.7 COMPACTION AND RUTTING RISKS

Compaction and rutting ratings and risk matrices were adapted from two compaction systems that were designed for forestry applications, including the Soil Compaction and Puddling Hazard Key (BC MOF 1999) and table of Compaction and Rutting Hazard for Soils in Ontario (Archibald et al. 1997).

Rutting ratings and risk matrices were modified from the Forest Soils Conservation Report (AFPA/LFS 1996) and adapted to nomenclature from the Canadian Soil Information System to allow for standardization.

3.8 OTHER SOILS CONSTRAINTS

Constraints in addition to erosion, compaction, and rutting identified, reviewed for this assessment, include the potential for trench wall instability, high coarse fragment content and high water tables (i.e. wetness).

4.0 RESULTS

In general, high risk areas are primarily associated with the Goose Soil Map Units located primarily in the central portion of the Groundbirch Connector Footprint and along low-lying areas in the soils LSA. The high risk areas are associated with compacting and rutting potential, as well as wet areas that will need to be mitigated.

Refer to Figure 4-1 for locations of Goose (GOS) Soil Map Units.

4.1 SOIL MAPPING

A summary of the SMUs dominant parent (surficial) materials and slope class by area and percent within the soils LSA and Groundbirch Connector Footprint is provided in Table 4-2 and presented on Figure 4-1. A summary of the soil map units along the route length of the Groundbirch Connector Footprint is provided in Table 4-3.

4.2 FIELD SURVEYS

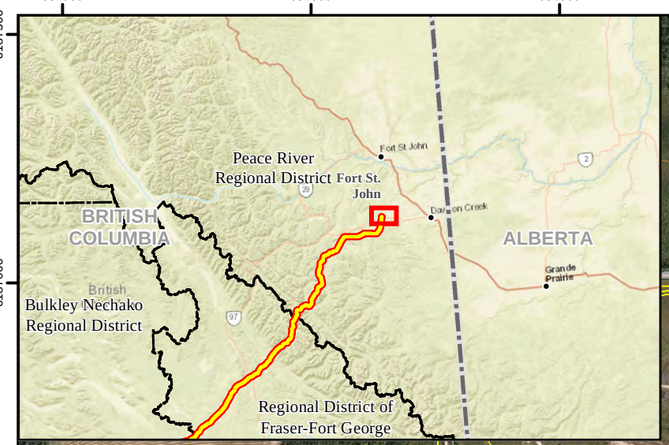
A summary of field inspection sites within the Soil study areas are presented in Table 4-1 and shown on Figure 4-1.

Table 4-1: Soil Study Areas Field Survey Inspection Site Summary

Study Area	2019 Field Inspections (number of sites)	Previous Field Inspections (for EAC, Coastal GasLink 2014a)	Total Number of Field Inspections	Total Number of Soil Map Units	Total Number of Soil Map Units Intersecting All Field Plots	Total Area (ha)	Field Inspection/ Soil Map Unit (%)	Field Inspections per Hectare
Groundbirch Connector Footprint	28	1	29	26	13	31.04	50%	0.9/ha
Soils LSA	37	5	42	43	23	135.47	53%	0.3/ha

For the Groundbirch Connector Footprint, 14 soil samples were collected from A, B, and C horizons from nine field inspection sites representing all SMUs. Laboratory results confirmed field findings of soil texture and characterization and aided in identifying soil quantity (salvage and replacement) and quality (topsoil to equivalent agricultural land capabilities) for reclamation purposes. Refer to Appendix A-2 for laboratory certificate of analysis and results.

A SIL2 detailed assessment was completed for the soils LSA with three to four inspection sites per hectare. A SIL2 is an assessment with one inspection for every 2 to 30 ha (Mapping System Working Group 1981). A SIL1 assessment has been achieved in the Groundbirch Connector Footprint at approximately one inspection site per hectare.



631000 631500 632000 632500 633000 633500 634000 634500 635000 635500

6187500 6187000 6186500 6186000 6185500 6185000 6184500

N S E W

3-79-19 W 6M
2-79-19 W 6M
1-79-19 W 6M
34-78-19 W 6M
35-78-19 W 6M
33-78-19 W 6M
32-78-19 W 6M
2-78-19 W 6M
28-78-19 W 6M
27-78-19 W 6M

Rd 260
Rd 265
Rd 269
760
740
780

SOIL_12
KTH, 4, A, 4CT3D
KTH, 4, F, 4C3DT
KTH, 3-4, A, 4C
KTH, 3, A, 4C
SOIL_29
SOIL_11
SOIL_13
BYL-MLY, 3, F, 4C
VEG_14
VEG_16
KTH, 3-4, A, 4C
SOIL_28
SOIL_10
SOIL_27
KTH, 3, F, 4C
EAG, 2, F, 6W4C
VEG_07
VEG_08
ZWA, 2, F, NA
GOS, 2, F, 5W3D
KTH, 3, F, 4C
SOIL_9
KTH, 3, A, 4C
SOIL_26
VEG_4
SOIL_25
GOS, 3, F, 5W4C
KTH, 3, F, 4C
VEG_6
VEG_31
GOS, 3, F, 5W4C
VEG_02
EAG, 3, F, 6W4C
KTH, 3, F, 4C3W
VEG_5
VEG_15
SOIL_8
GOS, 3, F, 5W4C
ZWA, 2, WATER, NA
GOS, 3-4, A, 4C3W
KTH, 3, A, 4C2D
BYL-MLY, 3, F, 4CD2T
BYL-MLY, 4, A, 4C3T
KTH, 3, A, 4C
SOIL_7
SOIL_23
KTH, 3, A, 4C
BYL-MLY, 3, F, 4C
GOS, 3-4, A, 4C3W
GOS, 3, A, 4C2W
KTH-MLY, 3, A, 4C
KTH, 3, A, 4C
ZWA, 3, WATER, NA
Wilde Lake C/S
SOIL_15
GOS, 3, A, 4C2W
SOIL_3
SOIL_6
SOIL_14
KTH-MLY, 3, A, 4C
VEG_17
GOS, 5, F, 5W4CT
SOIL_17
SOIL_22
Sin Lake
SOIL_1
ZWA, 4, WATER, NA
BYL, 3, A, 4C
VEG_11
BYL-MLY, 3, F, 4C
BYL-GOS, 3, A, 4C
KTH-GOS, 4, F, 4C3T
VEG_13
SOIL_4
SOIL_18
SOIL_5
SOIL_2
KTH-GOS, 5, F, 4CT
SOIL_21
SOIL_16
KTH, 3, A, 4C
VEG_12
SOIL_20
BYL-GOS, 6, F, 5T4C
KTH, 4, F, 4C3T
VEG_18
KTH-BYL, 3, F, 4C
VEG_19
KTH-GOS, 5, F, 4CT
ZDL, 3-4, ZDL,
KTH, 3, A, 4C
SOIL_19

2019 Field Survey Inspection Site
Previous EAC Inspection Site
Coastal GasLink Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Soil Map Unit (SMU) Boundary
Soil Local Study Area
Project Footprint
Existing Pipeline
Existing Road
Railway
TRIM Contour (20 m Interval)
TRIM Watercourse
BC Township System- Quarter Section Grid (NE-34-78-19 W 6M)
Blue-Listed Community
Flooded Land (i.e. swamps/marshes)
Water Body

Soil Map Unit (SMU) Symbol — Soil Association/Variant **BYL1**, Slope Class - **3**, Landuse - **A**, Land Capability Classification **4CST**

Soil Associations
BYL- Beryl
EAG - Eaglesham
GOS - Goose
KTH - Kathleen
MLY - Moberly
ZDL - Disturbed Land
ZWA - Open Water

Soil Variants
fi = fine
gl = gleyed
pt = peaty
zz = non-modal

Slope Class Ranges (Gradient)
2: Nearly level (>0.5-2%)
3: Very Gentle Slopes (>2 to 5%)
4: Gentle Slopes (>5 to 10%)
5: Moderate Slopes (>10 to 15%)
6: Strong Slopes (>15-30%)

Landuse
A – Agriculture
F - Forested

Agricultural Land Capability Classification
1- No or only very slight limitations that restrict use for the production of common agricultural crops.
2 - Minor limitations that require good ongoing management practices or slightly restrict the range of crops or both.
3 - Limitations require moderately intensive management practice or moderately restrict range of crops or both.
4 - Capable of producing a restricted range of crops. Soil and climate conditions require special management considerations.
5 - Capable of producing cultivated perennial forage crops and specially adapted crops. Soil and climate conditions severely limit capability.
6 - Nonarable, capable of producing native and/or uncultivated perennial forage crops.
7 - No capability for arable culture or sustained natural grazing.

Subclass
C - Adverse climate (excluding precipitation)
D - Undesirable soil structure
F - Fertility
T - Topography
W - Excess water (groundwater)

Sources: Base Data:GeoBC, Geogratis, Department of Natural Resources Canada, All rights reserved. GeoLOGIC systems Ltd., Imagery: 2014, Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,

REVISION	DESCRIPTION: xxxxx
0	Review

1:12,000 — 0 275 550 1,100 1,650 2,200 Metres

Coastal GasLink Pipeline Project

TC Energy

Figure 4-1 Soil Map Units and Soil Inspection Sites for the Groundbirch Connector

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513105-002	Connector

STANTEC: W:\Clients\TransCanada\Coastal_GasLink\Figures\Soils_Terrain\123513105-0002_Connector_Soils.mxd

Table 4-2: Groundbirch Connector Footprint and Soils LSA Soil Map Unit Summary

Soil Map Unit	Soil Series Name-Variant	Soil	Associated Parent (Surficial) Material	Drainage	Slope Class	Groundbirch Connector Footprint		Soils LSA	
						Area (ha)	Percent (%)	Area (ha)	Percent (%)
BYL	Beryl	Brunisolic Gray Luvisols (BR.GL)	Glaciofluvial	Well	3	1.89	6.1	3.60	2.7
BYL-GOS	Beryl – Goose	Orthic Gray Luvisol (O.GL); Orthic Gleysol (O.G) and Orthic Humic Gleysols (O.HG)	Glaciolacustrine/ Glaciofluvial	Moderately Well to Poor	3,4	0	0	3.42	5.9
BYL-MLY	Beryl - Moberly	Orthic Gray Luvisol (O.GL)	Glaciolacustrine/ Glaciofluvial-Morainal	Moderately Well to Imperfect	3,4	0	0	7.02	5.2
EAG	Eaglesham	Terric Mesisol (T.M)	Organic	Very Poor to Poor	2,3	0.0014	0.0	0.95	0.7
GOS	Goose	Orthic Gray Luvisol (O.G) and Orthic Humic Gleysols (O.HG)	Glaciolacustrine (up to 30% Organic)	Imperfect to Poor	2,3	4.32	13.9	14.22	10.5
KTH	Kathleen	Orthic Gray Luvisol (O.GL)	Glaciolacustrine	Moderately Well to Imperfect	3,4	16.83	54.2	65.57	48.4
KTH-BYL	Kathleen-Beryl	Orthic Gray Luvisol (O.GL); BR.GL	Glaciolacustrine-Glaciofluvial	Moderately Well	3,4	0.83	2.7	7.87	5.8
KTH-GOS	Kathleen-Goose	Orthic Gray Luvisol (O.GL); Orthic Gleyson (O.G) and Orthic Humic Gleysols (O.HG)	Glaciolacustrine	Moderately Well to Poor	3-6	0.74	2.4	11.09	8.2
KTH-MLY	Kathleen-Moberly	Orthic Gray Luvisol (O.GL)	Glaciolacustrine-Morainal	Moderately Well to Imperfect	3,4	5.14	16.6	18.03	13.3
ZWA	Open Water	-	-	-	-	0.19	0.6	0.45	0.33

Table 4-2: Groundbirch Connector Footprint and Soils LSA Soil Map Unit Summary

Soil Map Unit	Soil Series Name-Variant	Soil	Associated Parent (Surficial) Material	Drainage	Slope Class	Groundbirch Connector Footprint		Soils LSA	
						Area (ha)	Percent (%)	Area (ha)	Percent (%)
ZDL	Disturbed Land	-	-	-	-	1.08	3.5	3.3	2.4
Total Area						**31.04**	**100**	**135.47**	**100**

NOTE:
The totals presented in the table may not add up fully, due to rounding

Kathleen (KTH) soils were the dominant soils within the Groundbirch Connector Footprint (54.2%). These soils were classified as Orthic Gray Luvisols developed on moderately well to well drained glaciolacustrine deposits. Mapped variances of the Kathleen soils include gleyed (KTHgl), fine (KTHfi) and gleyed:peaty (KTHglpt). With the exception of GOS soils, colour change between topsoil and upper subsoil is generally fair to poor in all SMUs in the Groundbirch Connector Footprint.

Kathleen-Moberly soils (KTH-MLY) occupied 16.6% of the Groundbirch Connector Footprint and were classified as well to moderately drained Orthic Gray Luvisols. Kathleen-Moberly (KTH-MLY) SMUs represent soils developed on transition areas with both glaciolacustrine and till deposits. These soils are similar to Kathleen; however, they typically have less clay content.

Goose (GOS) soils occupy 13.9% of the Groundbirch Connector Footprint and were primarily classified as Orthic Gleysols developed on imperfect to poorly drained glaciolacustrine deposits. Less common peaty variants (GOSpt) and areas with high water tables were observed at two inspection sites. In general, topsoil for this soil map unit are rich in organic carbon; colour change between topsoil and upper subsoil was generally observed to be good.

Beryl (BYL) soils occupied 6.1% of the Groundbirch Connector Footprint and were classified as Brunisolic Gray Luvisols having developed on well drained glaciofluvial deposits adjacent to glaciolacustrine and till derived soils. Hummocky landforms were commonly observed in this map unit, primarily outside of the Groundbirch Connector Footprint and soils LSA, further east.

Kathleen - Beryl (KTH-BYL) soils occupied 2.7 % of the Groundbirch Connector Footprint and were classified as well drained Orthic and Brunisolic Gray Luvisols having developed on transition areas with both glaciolacustrine and glaciofluvial deposits.

Kathleen - Goose (KTH-GOS) soils occupied 2.4 % of the Groundbirch Connector Footprint and were classified as moderately well to imperfectly drained Orthic and Gleyed Gray Luvisols and imperfectly to poorly drained Gleysols having developed on glaciolacustrine deposits.

Organic soils mapped as Eaglesham occupy less than 1% of the Groundbirch Connector Footprint. Eaglesham soils are typically fen peat that are dominantly Terric Mesisols. Eaglesham soils are found in lower landscape positions and depressions associated with very poorly drained soils. Mineral deposits underlying the fen peat in the Eaglesham soils were observed as glaciolacustrine.

Known disturbances were also mapped and occupy 3.5% of the Groundbirch Connector Footprint. Disturbances include existing roads and a well pad mapped as Anthropogenic (A) surficial material for the Groundbirch Connector Terrain TDR (Appendix B of the Amendment Application), and the soil map unit Disturbed Land (ZDL).

Table 4-3: Soil Map Unit Summary along the Groundbirch Connector Route Length

Soil Map Unit Symbol	Dominant Soil Series	Dominant Soil Subgroup	Other Soil Associated Subgroups	Parent Material	Texture	Length (km)			
						Agricultural	Forested	Open Water (ZDL)	Total
Luvisols									
BYL	Beryl	Brunisolic Gray Luvisol	n/a	Glaciofluvial	L, SiL, SiCL	0.27	-	-	0.27
KTH (includes modal, fi, gl, variants)	Kathleen	Orthic Gray Luvisol	Gleyed Gray Luvisol	Glaciolacustrine	SiL, SiCL, SiC, C	1.77	0.03	-	1.80
KTH-MLY	Kathleen-Moberly	Orthic Gray Luvisol		Glaciolacustrine-Morainal	SiL, SiCL	0.57	-	-	0.57
Luvisolic Total Length (km)						*2.61*	*0.03*	*-*	*2.64*
Luvisolic Total Length (%)						*84.2%*	*0.1%*	*-*	*85.2*
Gleysols									
GOS (includes modal, Pt)	Goose	Orthic Gleysol, Orthic Humic Gleysol	Rego- Gleysol. Terric Humisol	Glaciolacustrine	SiCL, SiC, HC	0.35	0.06	-	0.41
Gleysols Total Length (km)						*0.35*	*0.06*	*-*	*0.41*
Gleysols Total Length (%)						*11.3%*	*1.80%*	*-*	*13.1*
Open Water (ZWA) and Disturbed Land (ZDL)									
ZWA - Open Water								*0*	*0*
ZDL - Disturbed Land								*0.04*	*1.3*
Total						***2.96***	***0.09***	***0.04***	***3.1***

NOTES:
Soil Textures: L – Loam, SiL – Silty Loam, SiC – Silty Clay, SiCL – Silty Clay Loam, C – Clay, HC – Heavy Clay
Soil Phase: fi – fine, gl – gleyed, pt – peaty, zz- atypical
The totals presented in the table may not add up fully, due to rounding

4.3 AGRICULTURAL LAND CAPABILITY

A summary of agricultural land capability classifications is presented in Table 4-4. The details of agricultural land capability ratings are based on horizon and site data, and laboratory analytical data.

The agricultural land capability ratings for the majority of the Groundbirch Connector route length is agriculture land capability Class 4C (96.9%). Class 4 indicates that the land is capable of producing cultivated perennial forage crops and specially adapted crops (Kenk and Cotic 1983). Subclass C indicates that the limiting factor for agricultural land capability is the adverse climate, resulting from a shorter growing season. Subclass D indicates an undesirable soil structure and/or low perviousness. Subclass W indicates limitations due to excess water. Agriculture land capability Class 5W (1.8%) was mapped in areas where poor to imperfectly drained Gleysolic soils and SMUs with organic materials as secondary components were identified. Table 4-4 summarizes the agricultural land capability along the Groundbirch Connector.

Table 4-4: Groundbirch Connector Agricultural Land Capability Classification Summary

CLI Class	Length (km)	Length (%)
4C	2.41	77.8
4C2D	0.24	7.7
4C2W	0.10	3.2
4C3W	0.25	8.2
Class 4 Total	**3.00**	**96.9**
5W4C	0.06	1.8
Class 5 Total	**0.06**	**1.8**
Not Rated*	***0.04***	***1.3***
Total	**3.0**	**100.0**

NOTES:
*Applies to disturbed land for Agricultural Land Capability
The totals presented in the table may not add up fully, due to rounding

4.4 RECLAMATION SUITABILITY

Table 4-5 summarizes the reclamation suitability along the length of the Groundbirch Connector. The rooting zone soils (O/LFH – A horizon) within the Groundbirch Connector have a fair (91.0%) to poor (7.7%) rating for reclamation suitability (Table 4-5). The reclamation suitability ratings are primarily affected by texture and drainage within the Groundbirch Connector. In general, poor reclamation suitability ratings are attributable to soils with high water tables (or 'wet' soils) and areas with high clay content leading to soils with low perviousness and/or depth to compact horizons limiting rooting depth. Fair suitability ratings are attributed to the dominant silt loam textured A horizons. Laboratory results for pH were generally between 5.05 and 5.86 (Appendix A-2) and coarse fragments content was noted to be less than 10 % in all the SMUs.

Table 4-5: Reclamation Suitability Ratings of Root Zone Material along the Groundbirch Connector Route

Reclamation Suitability Rating	Length (km)	Length (%)
Good	-	-
Fair	2.82	91.0
Poor	0.24	7.7
Unsuitable	-	-
Not Rated*	0.04	1.3
Total	**3.0**	**100.0**

NOTES:
*applies to open water and disturbed land for reclamation suitability
The totals presented in the table may not add up fully, due to rounding

4.5 SOIL EROSION POTENTIAL

Water erosion and wind erosion potential of soils along the Groundbirch Connector route are summarized in Table 4-6. Calculations for wind and water erosion are shown in Appendix C.

Water erosion potential is moderate for topsoil along 89.6% route length of the Groundbirch Connector and moderate for subsoil along 80.6% route length of the Groundbirch Connector due to undulating slopes with dominantly silty loam to silty clay loam textures. Water erosion potential is rated as severe in areas of medium and fine textured soils with slope gradients greater than 5% along 9.1% route length of the Groundbirch Connector route.

Wind erosion is negligible (23.0%) to low (75.7%) along the route length of the Groundbirch Connector for medium textured mineral topsoil and medium to fine textured subsoil under cultivation and in the densely vegetated and forested lands.

Disturbed land comprising of 1.3% route length of the Groundbirch Connector was not rated for erosion risk.

4.6 COMPACTION AND RUTTING RISKS

Calculations for compaction and rutting risk are shown in Appendix D. Compaction and rutting risks of soils along the route length of the Groundbirch Connector are summarized in Table 4-6. Refer to Figure 4-1 for an overview of SMUs discussed below.

In general, topsoil compaction risk is rated mostly as low, ranging to moderate to high in areas with high clay content and imperfect to poor drainage. Topsoil rutting risk also rated as mostly moderate except for the imperfect to very poorly drained Gleysolic and Organic soils. Approximately 50.3% route length of the Groundbirch Connector has a low topsoil compaction risk in areas with moderately well drained, medium textured silty loam to loam topsoil. The topsoil compaction risk is rated as moderate for 27.5% route length of the Groundbirch Connector in areas with moderately well to imperfect drained silt loam textured soils. Topsoil and subsoil compaction risks are high for 20.9% route length of the Groundbirch Connector which correlates to medium to fine textured imperfectly to poorly drained soils associated with the GOS SMUs (refer to Figure 4-1).

Rutting risk is moderate for a majority (85.6%) of the route length of the Groundbirch Connector. Rutting risk is high for 13.1% route length of the Groundbirch Connector on poor to imperfect drained Gleysols. Organic soils mapped within the soils LSA (refer to Figure 4-1) are also prone to rutting. Disturbed land comprising of 1.3% route length of the Groundbirch Connector was not rated for rutting risk.

Table 4-6: Summary of Soil Water and Wind Erosion Potential, and Compaction and Rutting Risks along the Groundbirch Connector

Water Erosion (Topsoil / Subsoil)			Wind Erosion (Topsoil / Subsoil)			Compaction (Topsoil / Subsoil)			Rutting (Topsoil / Subsoil)		
Rating	**Length (km)**	**Length (%)**	**Rating**	**Length (km)**	**Length (%)**	**Rating**	**Length (km)**	**Length (%)**	**Rating**	**Length (km)**	**Length (%)**
Very Low	-	-	Negligible	0.71	23.0	Low	1.56 / 0.27	50.3 / 8.9	Low		
Low	-	-	Low	2.34	75.7	Moderate	0.85 / 1. 28	27.5/ 41.4	Moderate	2.65/ 2.65	85.6/ 85.6
Moderate	2.77 / 2.50	89.6 / 80.6	Moderate	-	-	High	0.65 / 1.50	20.9 / 48.3	High	0.41/0.45	13.1/14.4
High	- / 0.28	- / 8.9	High	-	-	Not Rated*	0.04 / 0.04	1.3/ 1.3	Not Rated*	0.04 / 0.00	1.3 / 0.0
Severe	0.28 / 0.28	9.1 / 9.1	Severe	-	-	-	-	-	-	-	-
Not Rated*	0.04 / 0.04	1.3 / 1.3	Not Rated*	0.04	1.3	-	-		-	-	-
Total	**3.1 / 3.1**	**100.0 / 100.0**	**Total**	**3.1 / 3.1**	**100.0 / 100.0**	**Total**	**3.1 / 3.1**	**100.0 / 100.0**	**Total**	**3.1 / 3.1**	**100.0 / 100.0**

NOTES:
* Refers to open water and disturbed land
The totals presented in the table may not add up fully, due to rounding

4.7 OTHER SOIL CONSTRAINTS

Other soil constraints in addition to erosion, compaction, and rutting for soils along the Groundbirch Connector are provided in Table 4-7. High water tables or wetness (i.e., impeded drainage and high water tables) was identified within the Groundbirch Connector Footprint. Wetness refers to soils where drainage is generally poor with high water tables and saturated soil conditions. Trench wall instability was also identified in these areas. The constraint of wetness and trench instability occurs over about 13.6% of the Groundbirch Connector route length.

Field survey results did not observe the presence of high coarse fragment content, shallow bedrock or marine clay in the soil.

Table 4-7: Summary of Other Constraints along the Groundbirch Connector Route

Constraint	Length (km)	Length (%)
High Water Table - Wetness (Gleysolic soils) and Trench Wall Instability	0.41	13.6
High Coarse Fragment Content	-	-
Shallow Bedrock	-	-
Marine Clay	-	-
Total	**3.0**	**100.0**

5.0 KEY FINDINGS AND CONCLUSIONS

Most of the Soils in the Groundbirch Connector Footprint and soils LSA are under agriculture or forested land uses. The most common soils are well to moderately well drained Orthic Gray Luvisols that developed on glaciolacustrine surficial material, overlying rolling and undulating till deposits. Gleyed and fine textured variants are less common in the Groundbirch Connector Footprint and soils LSA.

The agricultural land capability in the Groundbirch Connector Footprint is primarily Class 4C, which is capable of supporting perennial forage crops. Agricultural capability is mainly limited by climatic factors although excess water limits agricultural land capability on Gleysols. Reclamation suitability of the soil within the root zone along the length of the Groundbirch Connector is rated as fair (91.0%) and the rest of the soils are rated as poor (7.7%).

Water erosion is rated as moderate, high and severe; wind erosion is rated as negligible to low. These ratings are primarily associated with soil texture and slope gradient. Topsoil compaction risk is rated mostly as low, ranging to moderate to high in areas with high clay content and imperfect to poor drainage. Topsoil rutting risk also rated as mostly moderate except for the imperfect to very poorly drained Gleysolic and Organic soils.

Soils baseline information reported in the 2014 EAC Application for the Project (Coastal GasLink 2014a) and baseline information reported in this Groundbirch Connector Soils TDR correlate. Mitigation for soil handling can be found in Section 5.5 of the EAC Application (Coastal GasLink 2014a). No additional mitigation is required for the proposed Groundbirch Connector for potential effects on soil capability.

6.0 REFERENCES

AAFRD (Alberta Agriculture, Food and Rural Development). 2004. Soil Quality Criteria Relative to Disturbance and Reclamation. Prepared by the Soil Quality Criteria Working Group Soil Reclamation Subcommittee, Alberta Soils Advisory Committee, Alberta Agriculture. https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag9469/$FILE/sq_criteria_relative_to_disturbance_reclamation.pdf.

AFPA/LFS (Alberta Forest Products Association/Land and Forest Service). 1996. Forest Soils Conservation. Alberta Forest Products Association/Land & Forest Service Task Force Report.

ALC-OGC (Agricultural Land Commission and Oil and Gas Commission). 2017, Delegation Agreement, December 2017. https://www.bcogc.ca/node/5759/download (accessed July 2019-August 2020)

Archibald, D.J., W.B. Wiltshire, D.M. Morris, and B.D. Batchelor. 1997. *Forest management guidelines for the protection of the physical environment.* Version 1. Report MNR #51032. Ontario Ministry of Natural Resources.

BC EAO. 2013. Coastal GasLink Pipeline Project Application Information Requirements (AIR) For an Environmental Assessment Certificate.

BC EAO. 2014a. Coastal GasLink Pipeline Project Environmental Assessment Certificate # E14-03. Website: http://a100.gov.bc.ca/appsdata/epic/documents/p392/1414168837008_ZXZPJKQpsCJ7p994vTQyyJhsM8TBWSnzlv34wMyC67yCBwdyhKHr!-351597226!1414168702186.pdf

BC EAO. 2020a. EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018). Version 1.01. March 2020. p. 53.

BC EAO. 2020b. Guide to Indigenous Knowledge in Environmental Assessments. Version 1.0. April 2020. p. 20.

BC Ministry of Environment and Climate Change Strategy. 2018. BC Soil Information Finder Tool. Province of British Columbia. https://www2.gov.bc.ca/gov/content/environment/air-land-water/land/soil/soil-information-finder

BC MOE & BC MOFR (British Columbia Ministry of Environment and British Columbia Ministry of Forests and Range). 2010. Field Manual for Describing Terrestrial Ecosystems. Second edition. Victoria: BC MOE Resources Inventory Branch and BC MOFR Research Branch.

BC MOF (British Columbia Ministry of Forests). 1999. *Hazard assessment keys for evaluating site sensitivity to soil degrading processes guidebook.* 2nd ed. Version 2.1. For. Proc. Br., BC Ministry of Forests, Victoria, BC. Forest Practices Code of British Columbia Guidebook.

CanSIS (Canadian Soil Information Service). 2018. http://sis.agr.gc.ca/cansis/.

Catto, N.R., Liverman, D.G.E., Bobrowsky, P.T. and Rutter, N.W. 1996. Laurentide, Cordilleran, and Montane glaciation in the West Peace River- Grande Prairie Region, Alberta and British Columbia, Canada. Quaternary International, 32: 21-32. British Columbia. Geological Survey of Canada, Bulletin 273, 31 pp.

Coastal GasLink (Coastal GasLink Pipeline Limited). 2014a. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate. Website: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_392_37367.html.

Coastal GasLink. 2014b. Schedule A Report for the Proposed Wilde Lake Compressor Station. Prepared by Stantec Consulting Ltd. for Coastal GasLink Pipeline Limited.

Coastal GasLink. 2014c. Schedule A Report for Construction Section 1 of the Proposed Pipeline Construction Corridor. Prepared by Stantec Consulting Ltd. for Coastal GasLink Pipeline Limited.

Coastal GasLink. 2018. Environmental Management Plan. TransCanada.

Coastal GasLink. 2020. Schedule A Report for the Proposed Access Road RE-620.A. Prepared by Stantec Consulting Ltd. for Coastal GasLink Pipeline Limited.

Coote, D.R. and Pettapiece, W.W. 1989. Wind Erosion Risk, Alberta. Land Resource Research Centre, Research Branch, Agriculture Canada. Publication 5255/B. Contribution Number 87-08. Department of Natural Resources Canada. 2014. Coloured BING imagery from: Base Data:GeoBC, Geogratis, Department of Natural Resources Canada, All rights reserved.GeoLOGIC systems Ltd., Imagery: 2014 (6/20/2014).

Fladmark, K.R., Driver, J.C., and Alexander, D. 1988. The Paleo-Indian Component at Charlie Lake Cave (HbRf-39), British Columbia. American Antiquity, 53: 371-384. doi:10.2307/ 281025.

GeoBC. *BC Freshwater Atlas*. https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-stream-network. Accessed August 2019 August 2020).

Gregorich, E.G., L.W. Turchenek, M.R. Carter and D.A. Angers (eds). 2001. *Soil and Environmental Science Dictionary*. CRC Press, Inc. Boca Raton, FL, USA.

Kenk E. and I. Cotic. 1983. *Land Capability Classification for Agriculture in BC*. Surveys and Resource Mapping Branch, Ministry of Environment and Soils Branch, Ministry of Agriculture and Food. MOE Manual 1. Kelowna, BC.

Lord, T.M. and A.J. Green. 1986. *Soils of the Fort St. John -Dawson Creek area, British Columbia*. Report No.42. Research Branch, Agriculture Canada.

Mapping System Working Group. 1981. A soil mapping system for Canada: revised. Report submitted to the Expert Committee on Soil Survey. Land Resource Research Institute Contribution Number 142. Research Branch of Agriculture Canada.

Massey, N.W.D., D.G. MacIntyre, J.W. Haggart, P.J. Desjardins, C.L. Wagner and R.T. Cooney. 2005. Digital Geology Map of British Columbia: Tile NN8-9 North Coast and Queen Charlotte Islands/Haida Gwaii. Ministry of Energy and Mines, British Columbia Geological Survey, Geofile 2005-5. 1:250,000. Victoria, BC.

Mathews, W.H. 1980. Retreat of the last ice sheets in northeastern British Columbia and adjacent Alberta. Geological Survey of Canada, Bulletin 331, 22 pp.

Maxwell, R. 1987. Biophysical Soil Resources and Land Evaluation of the Northeast Coal Study Area, 1977—1978 Jarvis Creek—Morkill River Area. Wildlife Branch British Columbia Ministry of Environment and Parks. British Columbia Soil Survey, Report No. 41. Victoria, BC.

Meidinger, D.V. and J. Pojar 1991. Ecosystems of British Columbia. Special Report Series No. 6. Victoria, BC.

Reimchen, T.H. and Bouvier, G.C. 1980. Surficial geology, Dawson Creek, British Columbia. Geological Survey of Canada, Map 1467A, scale 1: 250 000.

Resources Inventory Committee. 1998. Standard for digital terrain data capture in British Columbia: Terrain technical standard and database manual. Terrain Data Working Committee. 111 pp.

SCWG (Soil Classification Working Group). 1998. *The Canadian System of Soil Classification*. Agriculture and Agri-Food Canada Publication 1646. 3rd Edition (revised).

Wall, G.L., D.R. Coote, E.A. Pringle and I.J. Shelton (eds.). 2002. *RUSLEFAC — Revised Universal Soil Loss Equation for Application in Canada: A Handbook for Estimating Soil Loss from Water Erosion in Canada*. Research Branch, Agriculture and Agri-Food Canada. Ottawa. Contribution No. AAFC/AAC2244E.

Appendix A-1: Abbreviations and Acronyms

Abbreviation	Definition
Units of Measurement	
°C	degrees Celsius
%	percent
cm	centimetre
ha	hectare
km	kilometre = 1000 metres
m	metre
mm	millimetre
Other Terms	
AAFRD	Alberta Agriculture, Food and Rural Development
AFPA/LFS	Alberta Forest Products Association/Land and Forest Service
ALC - OGC	Provincial Agricultural Land Commission and Oil and Gas Commission
ALR	Agricultural Land Reserve
BC	British Columbia
BC EAO	BC Environmental Assessment Office
BC FLNRO	BC Forests, Lands, Natural Resource Operations and Rural Development
BC MOE	BC Ministry of Environment
BC MOF	BC Ministry of Forests
BC MOFR	BC Ministry of Forests and Range
BC OGC	BC Oil and Gas Commission
BEC	Biogeoclimatic Ecosystem Classification
BP	Before Present
CanSIS	Canadian Soil Information Services
CLI	Canadian Land Inventory
Coastal GasLink	Coastal GasLink Pipeline Limited
DEM	Digital Elevation Model
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
ESRI	Environmental Systems Research Institute
GPS	Global Positioning System
LiDAR	Light Detecting and Ranging
LSA	local study area
NPS	Nominal Pipe Size
NSDB	National Soil Data Base
pH	power of hydrogen
Project	Coastal GasLink Pipeline Project

Abbreviation	Definition
ROW	right-of-way
RSA	regional study area
RUSLEFAC	Revised Universal Soil Loss Equation for Application in Canada
SCWG	Soil Classification Working Group
SIL	soil survey intensity
SMU	soil map unit
TDR	Technical Data Report
TEM	Terrestrial Ecosystem Mapping

Appendix A-2: Bureau Vertias Certificate of Analysis and Results

Your Project #: 123513105/200-111
Site Location: CHETWYND,BC

Attention: Wanda Miller

STANTEC CONSULTING LTD
11-2042 Mills Road
Sidney, BC
CANADA V8L 5X4

Your C.O.C. #: M083006, M083009, M083011, M083012, M083010

Report Date: 2019/09/06
Report #: R2777476
Version: 1 - Partial

CERTIFICATE OF ANALYSIS – PARTIAL RESULTS

BV LABS JOB #: B972997
Received: 2019/08/29, 16:15

Sample Matrix: Soil
Samples Received: 15

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Cation/EC Ratio	1	N/A	2019/09/04		Auto Calc
Cation/EC Ratio	5	N/A	2019/09/05		Auto Calc
Cation/EC Ratio	8	N/A	2019/09/06		Auto Calc
Calcium Carbonate Equivalent	4	N/A	2019/09/05	AB SOP-00019	Carter 2nd ed 20.2 m
Chloride (Soluble)	1	2019/09/04	2019/09/04	AB SOP-00033 / AB SOP-00020	SM 23 4500-Cl-E m
Chloride (Soluble)	5	2019/09/04	2019/09/05	AB SOP-00033 / AB SOP-00020	SM 23 4500-Cl-E m
Chloride (Soluble)	8	2019/09/05	2019/09/06	AB SOP-00033 / AB SOP-00020	SM 23 4500-Cl-E m
Conductivity @25C (Soluble)	1	2019/09/04	2019/09/04	AB SOP-00033 / AB SOP-00004	SM 23 2510 B m
Conductivity @25C (Soluble)	5	2019/09/04	2019/09/05	AB SOP-00033 / AB SOP-00004	SM 23 2510 B m
Conductivity @25C (Soluble)	8	2019/09/05	2019/09/06	AB SOP-00033 / AB SOP-00004	SM 23 2510 B m
Sum of Cations, Anions	1	N/A	2019/09/04		Auto Calc
Sum of Cations, Anions	5	N/A	2019/09/05		Auto Calc
Sum of Cations, Anions	8	N/A	2019/09/06		Auto Calc
Moisture	8	N/A	2019/09/05	AB SOP-00002	CCME PHC-CWS m
Nitrite and Nitrate Available (10:1) Wet	8	2019/09/05	2019/09/05	AB SOP-00027 / AB SOP-00023	SM 23 4110 B m
NO2 + NO3 Available (10:1 Wet)	8	2019/09/03	2019/09/06		Auto Calc
pH @25C (1:2 Calcium Chloride Extract)	11	2019/09/05	2019/09/05	AB SOP-00033 / AB SOP-00006	SM 23 4500 H+B m
pH @25C (1:2 Calcium Chloride Extract)	3	2019/09/06	2019/09/06	AB SOP-00033 / AB SOP-00006	SM 23 4500 H+B m
pH @25C (Soluble)	6	2019/09/04	2019/09/04	AB SOP-00033 / AB SOP-00006	SM 23 4500 H+B m

Bureau Veritas Laboratories Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Your Project #: 123513105/200-111
Site Location: CHETWYND,BC

Attention: Wanda Miller

STANTEC CONSULTING LTD
11-2042 Mills Road
Sidney, BC
CANADA V8L 5X4

Your C.O.C. #: M083006, M083009, M083011, M083012, M083010

Report Date: 2019/09/06
Report #: R2777476
Version: 1 - Partial

CERTIFICATE OF ANALYSIS – PARTIAL RESULTS

BV LABS JOB #: B972997
Received: 2019/08/29, 16:15

Sample Matrix: Soil
Samples Received: 15

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
pH @25C (Soluble)	8	2019/09/05	2019/09/05	AB SOP-00033 / AB SOP-00006	SM 23 4500 H+B m
Sodium Adsorption Ratio	1	N/A	2019/09/04		Auto Calc
Sodium Adsorption Ratio	5	N/A	2019/09/05		Auto Calc
Sodium Adsorption Ratio	8	N/A	2019/09/06		Auto Calc
Soluble Ions	6	2019/09/04	2019/09/04	AB SOP-00033 / AB SOP-00042	EPA 6010d R5 m
Soluble Ions	8	2019/09/05	2019/09/05	AB SOP-00033 / AB SOP-00042	EPA 6010d R5 m
Soluble Paste	6	2019/09/04	2019/09/04	AB SOP-00033	Carter 2nd ed 15.2m
Soluble Paste	8	2019/09/05	2019/09/05	AB SOP-00033	Carter 2nd ed 15.2m
Soluble Ions Calculation	6	N/A	2019/09/04		Auto Calc
Soluble Ions Calculation	8	N/A	2019/09/05		Auto Calc
Texture by Hydrometer	8	N/A	2019/09/05	AB SOP-00030	Carter 2nd ed 55.3 m
Texture Class	8	N/A	2019/09/05		Auto Calc
Theoretical Gypsum Requirement (1)	1	N/A	2019/09/04		Auto Calc
Theoretical Gypsum Requirement (1)	5	N/A	2019/09/05		Auto Calc
Theoretical Gypsum Requirement (1)	8	N/A	2019/09/06		Auto Calc
Organic Carbon and Organic Matter	1	2019/09/04	2019/09/04	AB SOP-00012	MMFSPA Ch6 1991 m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied.

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Your Project #: 123513105/200-111
Site Location: CHETWYND,BC

Attention: Wanda Miller

STANTEC CONSULTING LTD
11-2042 Mills Road
Sidney, BC
CANADA V8L 5X4

Your C.O.C. #: M083006, M083009, M083011, M083012, M083010

Report Date: 2019/09/06
Report #: R2777476
Version: 1 - Partial

CERTIFICATE OF ANALYSIS – PARTIAL RESULTS

BV LABS JOB #: B972997
Received: 2019/08/29, 16:15

BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) TGR calculation is based on a theoretical SAR of 4. Salt Contamination and Assessment and remediation guideline 2001 recommended SAR is ranging 4-8. TGR is reported in tonnes/ha.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Geraldlyn Gouthro, Key Account Specialist
Email: geraldlyn.gouthro@bvlabs.com
Phone# (403)735-2230

==========

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: B972997
Report Date: 2019/09/06

STANTEC CONSULTING LTD
Client Project #: 123513105/200-111
Site Location: CHETWYND,BC
Sampler Initials: SB

BV Labs - Partial/Rush Results

RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		WK2495		WK2496			WK2497		
Sampling Date		2019/08/23		2019/08/23			2019/08/23		
COC Number		M083006		M083006			M083006		
	UNITS	SOILS 3-1-AN	RDL	SOILS 3-2-AN	RDL	QC Batch	SOILS 3-3-AN	RDL	QC Batch
Calculated Parameters									
Anion Sum	meq/L	0.68	N/A	0.34	N/A	9572915	0.30	N/A	9572915
Cation Sum	meq/L	1.6	N/A	0.96	N/A	9572915	3.2	N/A	9572915
Cation/EC Ratio	N/A	10	0.10	16	0.10	9572911	11	0.10	9572911
Calculated Calcium (Ca)	mg/kg	9.6	1.2	2.4	0.99	9572922	20	0.85	9572922
Calculated Magnesium (Mg)	mg/kg	1.7	0.81	1.1	0.66	9572922	3.9	0.56	9572922
Calculated Sodium (Na)	mg/kg	13	2.0	7.9	1.6	9572922	10	1.4	9572922
Calculated Potassium (K)	mg/kg	3.6	1.1	3.0	0.86	9572922	0.86	0.73	9572922
Calculated Chloride (Cl)	mg/kg	6.8	4.0	5.3	3.3	9572922	<2.8	2.8	9572922
Calculated Sulphate (SO4)	mg/kg	17	4.0	3.4	3.3	9572922	8.2	2.8	9572922
Nutrients									
Available (KCl) Nitrate plus Nitrite (N)	mg/kg	2.4	2.0	<2.0	2.0	9572961			
Available (KCl) Nitrite (N)	mg/kg	<2.0	2.0	<2.0	2.0	9576888			
Available (KCl) Nitrate (N)	mg/kg	2.4	2.0	<2.0	2.0	9576888			
Soluble Parameters									
Soluble Chloride (Cl)	mg/L	8.5	5.0	8.1	5.0	9577720	<5.0	5.0	9575734
Soluble Conductivity	dS/m	0.15	0.020	0.062	0.020	9576932	0.28	0.020	9575758
Soluble pH	pH	5.54	N/A	5.30	N/A	9576285	7.11	N/A	9574898
Soluble (CaCl2) pH	pH	5.05	N/A	5.05	N/A	9576067	7.00	N/A	9576827
Sodium Adsorption Ratio	N/A	1.1	0.10	1.3	0.10	9572917	0.74	0.10	9572917
Soluble Calcium (Ca)	mg/L	12	1.5	3.7	1.5	9576836	36	1.5	9575284
Soluble Magnesium (Mg)	mg/L	2.1	1.0	1.7	1.0	9576836	6.9	1.0	9575284
Soluble Sodium (Na)	mg/L	16	2.5	12	2.5	9576836	18	2.5	9575284
Soluble Potassium (K)	mg/L	4.5	1.3	4.5	1.3	9576836	1.5	1.3	9575284
Saturation %	%	81	N/A	66	N/A	9575508	56	N/A	9574457
Soluble Sulphate (SO4)	mg/L	21	5.0	5.2	5.0	9576836	15	5.0	9575284
Theoretical Gypsum Requirement	tonnes/ha	<0.20	0.20	<0.20	0.20	9572923	<0.20	0.20	9572923
Soil Properties									
Calcium Carbonate Equivalent	%						2.0	0.60	9574777

RDL = Reportable Detection Limit
N/A = Not Applicable

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BV Labs Job #: B972997
Report Date: 2019/09/06

STANTEC CONSULTING LTD
Client Project #: 123513105/200-111
Site Location: CHETWYND,BC
Sampler Initials: SB

BV Labs - Partial/Rush Results

RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		WK2498			WK2512		WK2513		
Sampling Date		2019/08/23			2019/08/20		2019/08/20		
COC Number		M083006			M083011		M083011		
	UNITS	SOILS 3-3-FD	RDL	QC Batch	SOIL 7-1-AN	RDL	SOIL 7-2-AN	RDL	QC Batch
Calculated Parameters									
Anion Sum	meq/L	3.4	N/A	9572915	0.57	N/A	0.29	N/A	9572915
Cation Sum	meq/L	3.5	N/A	9572915	1.7	N/A	0.50	N/A	9572915
Cation/EC Ratio	N/A	8.8	0.10	9572911	12	0.10	12	0.10	9572911
Calculated Calcium (Ca)	mg/kg	23	0.91	9572922	10	1.1	<0.79	0.79	9572922
Calculated Magnesium (Mg)	mg/kg	4.2	0.60	9572922	4.0	0.76	0.60	0.53	9572922
Calculated Sodium (Na)	mg/kg	14	1.5	9572922	8.3	1.9	3.9	1.3	9572922
Calculated Potassium (K)	mg/kg	0.91	0.79	9572922	4.2	0.99	1.7	0.69	9572922
Calculated Chloride (Cl)	mg/kg	64	3.0	9572922	6.1	3.8	3.3	2.6	9572922
Calculated Sulphate (SO4)	mg/kg	13	3.0	9572922	13	3.8	2.8	2.6	9572922
Nutrients									
Available (KCl) Nitrate plus Nitrite (N)	mg/kg				<2.0	2.0	<2.0	2.0	9572961
Available (KCl) Nitrite (N)	mg/kg				<2.0	2.0	<2.0	2.0	9576888
Available (KCl) Nitrate (N)	mg/kg				<2.0	2.0	<2.0	2.0	9576888
Soluble Parameters									
Soluble Chloride (Cl)	mg/L	110	5.0	9574820	7.9	5.0	6.3	5.0	9577720
Soluble Conductivity	dS/m	0.40	0.020	9574896	0.14	0.020	0.043	0.020	9576932
Soluble pH	pH	7.85	N/A	9574496	5.94	N/A	6.25	N/A	9576285
Soluble (CaCl2) pH	pH	7.47	N/A	9575507	5.38	N/A	5.91	N/A	9576067
Sodium Adsorption Ratio	N/A	0.89	0.10	9572917	0.64	0.10	1.5	0.10	9572917
Soluble Calcium (Ca)	mg/L	38	1.5	9574763	14	1.5	<1.5	1.5	9576836
Soluble Magnesium (Mg)	mg/L	6.9	1.0	9574763	5.2	1.0	1.1	1.0	9576836
Soluble Sodium (Na)	mg/L	23	2.5	9574763	11	2.5	7.4	2.5	9576836
Soluble Potassium (K)	mg/L	1.5	1.3	9574763	5.5	1.3	3.2	1.3	9576836
Saturation %	%	60	N/A	9574048	76	N/A	53	N/A	9575508
Soluble Sulphate (SO4)	mg/L	21	5.0	9574763	17	5.0	5.3	5.0	9576836
Theoretical Gypsum Requirement	tonnes/ha	<0.20	0.20	9572923	<0.20	0.20	<0.20	0.20	9572923

RDL = Reportable Detection Limit
N/A = Not Applicable

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BV Labs Job #: B972997
Report Date: 2019/09/06

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Client Project #: 123513105/200-111
Site Location: CHETWYND,BC
Sampler Initials: SB

BV Labs - Partial/Rush Results

RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		WK2514			WK2515			WK2516		
Sampling Date		2019/08/20			2019/08/20			2019/08/20		
COC Number		M083011			M083011			M083011		
	UNITS	SOIL 7-3-AN	RDL	QC Batch	SOIL 8-1-AN	RDL	QC Batch	SOIL 8-2-AN	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	0.29	N/A	9572915				2.2	N/A	9572915
Cation Sum	meq/L	2.5	N/A	9572915				3.0	N/A	9572915
Cation/EC Ratio	N/A	9.3	0.10	9572911				10	0.10	9572911
Calculated Calcium (Ca)	mg/kg	18	1.1	9572922				25	1.1	9572922
Calculated Magnesium (Mg)	mg/kg	6.6	0.76	9572922				6.7	0.74	9572922
Calculated Sodium (Na)	mg/kg	10	1.9	9572922				9.2	1.8	9572922
Calculated Potassium (K)	mg/kg	1.3	0.99	9572922				1.0	0.96	9572922
Calculated Chloride (Cl)	mg/kg	4.7	3.8	9572922				<3.7	3.7	9572922
Calculated Sulphate (SO4)	mg/kg	4.4	3.8	9572922				78	3.7	9572922
Misc. Inorganics										
Organic Matter	%				57	0.35	9574142			
Total Organic Carbon (C)	%				33	0.20	9574142			
Nutrients										
Available (KCl) Nitrate plus Nitrite (N)	mg/kg							<2.0	2.0	9572961
Available (KCl) Nitrite (N)	mg/kg							<2.0	2.0	9576888
Available (KCl) Nitrate (N)	mg/kg							<2.0	2.0	9576888
Soluble Parameters										
Soluble Chloride (Cl)	mg/L	6.1	5.0	9575734				<5.0	5.0	9577720
Soluble Conductivity	dS/m	0.27	0.020	9575758				0.30	0.020	9576932
Soluble pH	pH	7.69	N/A	9574898				7.78	N/A	9576285
Soluble (CaCl2) pH	pH	7.34	N/A	9576827				7.59	N/A	9577366
Sodium Adsorption Ratio	N/A	0.61	0.10	9572917				0.49	0.10	9572917
Soluble Calcium (Ca)	mg/L	23	1.5	9575284				34	1.5	9576836
Soluble Magnesium (Mg)	mg/L	8.7	1.0	9575284				9.0	1.0	9576836
Soluble Sodium (Na)	mg/L	13	2.5	9575284				12	2.5	9576836
Soluble Potassium (K)	mg/L	1.7	1.3	9575284				1.4	1.3	9576836
Saturation %	%	76	N/A	9574457				74	N/A	9575508
Soluble Sulphate (SO4)	mg/L	5.7	5.0	9575284				110	5.0	9576836
Theoretical Gypsum Requirement	tonnes/ha	<0.20	0.20	9572923				<0.20	0.20	9572923
Soil Properties										
Calcium Carbonate Equivalent	%	6.2	0.60	9574777						

RDL = Reportable Detection Limit
N/A = Not Applicable

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BV Labs Job #: B972997
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RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		WK2517			WK2540			WK2544		
Sampling Date		2019/08/20			2019/08/20			2019/08/20		
COC Number		M083011			M083012			M083010		
	UNITS	SOIL 8-3-AN	RDL	QC Batch	19-103-TC COMP	RDL	QC Batch	SOILS 12-1-AN	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	2.1	N/A	9572915	0.53	N/A	9572915	0.0000	N/A	9572915
Cation Sum	meq/L	3.4	N/A	9572915	1.6	N/A	9572915	0.55	N/A	9572915
Cation/EC Ratio	N/A	10	0.10	9572911	11	0.10	9572911	12	0.10	9572911
Calculated Calcium (Ca)	mg/kg	37	1.4	9572922	9.6	0.95	9572922	<0.70	0.70	9572922
Calculated Magnesium (Mg)	mg/kg	8.6	0.91	9572922	2.1	0.64	9572922	0.48	0.47	9572922
Calculated Sodium (Na)	mg/kg	12	2.3	9572922	7.7	1.6	9572922	4.0	1.2	9572922
Calculated Potassium (K)	mg/kg	1.3	1.2	9572922	2.1	0.83	9572922	0.98	0.61	9572922
Calculated Chloride (Cl)	mg/kg	<4.6	4.6	9572922	4.0	3.2	9572922	<2.3	2.3	9572922
Calculated Sulphate (SO4)	mg/kg	92	4.6	9572922	11	3.2	9572922	<2.3	2.3	9572922
Nutrients										
Available (KCl) Nitrate plus Nitrite (N)	mg/kg				5.8	2.0	9572961	<2.0	2.0	9572961
Available (KCl) Nitrite (N)	mg/kg				<2.0	2.0	9576888	<2.0	2.0	9576888
Available (KCl) Nitrate (N)	mg/kg				5.8	2.0	9576888	<2.0	2.0	9576888
Soluble Parameters										
Soluble Chloride (Cl)	mg/L	<5.0	5.0	9575734	6.4	5.0	9577720	<5.0	5.0	9577720
Soluble Conductivity	dS/m	0.34	0.020	9575758	0.15	0.020	9576932	0.044	0.020	9576932
Soluble pH	pH	7.86	N/A	9574898	6.06	N/A	9576285	4.40	N/A	9576285
Soluble (CaCl2) pH	pH	7.57	N/A	9576067	5.86	N/A	9576067	4.29	N/A	9577366
Sodium Adsorption Ratio	N/A	0.47	0.10	9572917	0.74	0.10	9572917	1.8	0.10	9572917
Soluble Calcium (Ca)	mg/L	41	1.5	9575284	15	1.5	9576836	<1.5	1.5	9576836
Soluble Magnesium (Mg)	mg/L	9.5	1.0	9575284	3.3	1.0	9576836	1.0	1.0	9576836
Soluble Sodium (Na)	mg/L	13	2.5	9575284	12	2.5	9576836	8.5	2.5	9576836
Soluble Potassium (K)	mg/L	1.4	1.3	9575284	3.4	1.3	9576836	2.1	1.3	9576836
Saturation %	%	91	N/A	9574457	64	N/A	9575508	47	N/A	9575508
Soluble Sulphate (SO4)	mg/L	100	5.0	9575284	17	5.0	9576836	<5.0	5.0	9576836
Theoretical Gypsum Requirement	tonnes/ha	<0.20	0.20	9572923	<0.20	0.20	9572923	<0.20	0.20	9572923
Soil Properties										
Calcium Carbonate Equivalent	%	6.8	0.60	9574777						

RDL = Reportable Detection Limit
N/A = Not Applicable

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BV Labs Job #: B972997
Report Date: 2019/09/06

STANTEC CONSULTING LTD
Client Project #: 123513105/200-111
Site Location: CHETWYND,BC
Sampler Initials: SB

BV Labs - Partial/Rush Results

RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		WK2545			WK2546			WK2547		
Sampling Date		2019/08/20			2019/08/20			2019/08/20		
COC Number		M083010			M083010			M083010		
	UNITS	SOILS 12-1-FD	RDL	QC Batch	SOILS 12-2-AN	RDL	QC Batch	SOILS 12-3-AN	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	0.12	N/A	9572915	0.38	N/A	9572915	18	N/A	9572915
Cation Sum	meq/L	0.67	N/A	9572915	1.0	N/A	9572915	20	N/A	9572915
Cation/EC Ratio	N/A	14	0.10	9572911	12	0.10	9572911	13	0.10	9572911
Calculated Calcium (Ca)	mg/kg	1.1	0.72	9572922	1.5	0.73	9572922	140	1.2	9572922
Calculated Magnesium (Mg)	mg/kg	0.50	0.48	9572922	0.85	0.49	9572922	81	0.78	9572922
Calculated Sodium (Na)	mg/kg	4.1	1.2	9572922	7.0	1.2	9572922	31	2.0	9572922
Calculated Potassium (K)	mg/kg	1.3	0.62	9572922	1.1	0.63	9572922	1.6	1.0	9572922
Calculated Chloride (Cl)	mg/kg	<2.4	2.4	9572922	<2.4	2.4	9572922	26	3.9	9572922
Calculated Sulphate (SO4)	mg/kg	2.8	2.4	9572922	8.9	2.4	9572922	640	3.9	9572922
Nutrients										
Available (KCl) Nitrate plus Nitrite (N)	mg/kg				<2.0	2.0	9572961			
Available (KCl) Nitrite (N)	mg/kg				<2.0	2.0	9576888			
Available (KCl) Nitrate (N)	mg/kg				<2.0	2.0	9576888			
Soluble Parameters										
Soluble Chloride (Cl)	mg/L	<5.0	5.0	9575734	<5.0	5.0	9577720	33	5.0	9575734
Soluble Conductivity	dS/m	0.049	0.020	9575758	0.085	0.020	9576932	1.6	0.020	9575758
Soluble pH	pH	4.44	N/A	9574898	4.31	N/A	9576285	7.36	N/A	9574898
Soluble (CaCl2) pH	pH	4.08	N/A	9576827	4.07	N/A	9577366	7.35	N/A	9576827
Sodium Adsorption Ratio	N/A	1.2	0.10	9572917	1.6	0.10	9572917	0.59	0.10	9572917
Soluble Calcium (Ca)	mg/L	2.3	1.5	9575284	3.0	1.5	9576836	190	1.5	9575284
Soluble Magnesium (Mg)	mg/L	1.0	1.0	9575284	1.7	1.0	9576836	100	1.0	9575284
Soluble Sodium (Na)	mg/L	8.5	2.5	9575284	14	2.5	9576836	40	2.5	9575284
Soluble Potassium (K)	mg/L	2.7	1.3	9575284	2.3	1.3	9576836	2.1	1.3	9575284
Saturation %	%	48	N/A	9574457	49	N/A	9575508	78	N/A	9574457
Soluble Sulphate (SO4)	mg/L	5.8	5.0	9575284	18	5.0	9576836	820	5.0	9575284
Theoretical Gypsum Requirement	tonnes/ha	<0.20	0.20	9572923	<0.20	0.20	9572923	<0.20	0.20	9572923
Soil Properties										
Calcium Carbonate Equivalent	%							3.1	0.60	9574777

RDL = Reportable Detection Limit
N/A = Not Applicable

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BV Labs Job #: B972997
Report Date: 2019/09/06

STANTEC CONSULTING LTD
Client Project #: 123513105/200-111
Site Location: CHETWYND,BC
Sampler Initials: SB

PHYSICAL TESTING (SOIL)

BV Labs ID		WK2495	WK2496			WK2497			WK2512		
Sampling Date		2019/08/23	2019/08/23			2019/08/23			2019/08/20		
COC Number		M083006	M083006			M083006			M083011		
	UNITS	SOILS 3-1-AN	SOILS 3-2-AN	RDL	QC Batch	SOILS 3-3-AN	RDL	QC Batch	SOIL 7-1-AN	RDL	QC Batch
Physical Properties											
% sand by hydrometer	%	24	6.3	2.0	9574735	19	2.0	9574735			
% silt by hydrometer	%	56	53	2.0	9574735	41	2.0	9574735			
Clay Content	%	20	41	2.0	9574735	40	2.0	9574735			
Texture	N/A	SILT LOAM	SILTY CLAY	N/A	9572957	SLTY CL LO	N/A	9572957			
Moisture	%	27	20	0.30	9574953				27	0.30	9574953

RDL = Reportable Detection Limit
N/A = Not Applicable

BV Labs ID		WK2513			WK2514			WK2516		
Sampling Date		2019/08/20			2019/08/20			2019/08/20		
COC Number		M083011			M083011			M083011		
	UNITS	SOIL 7-2-AN	RDL	QC Batch	SOIL 7-3-AN	RDL	QC Batch	SOIL 8-2-AN	RDL	QC Batch
Physical Properties										
% sand by hydrometer	%	13	2.0	9574735	11	2.0	9574735			
% silt by hydrometer	%	35	2.0	9574735	37	2.0	9574735			
Clay Content	%	53	2.0	9574735	52	2.0	9574735			
Texture	N/A	CLAY	N/A	9572957	CLAY	N/A	9572957			
Moisture	%	18	0.30	9574953				22	0.30	9574953

RDL = Reportable Detection Limit
N/A = Not Applicable

BV Labs ID		WK2517			WK2540	WK2544		
Sampling Date		2019/08/20			2019/08/20	2019/08/20		
COC Number		M083011			M083012	M083010		
	UNITS	SOIL 8-3-AN	RDL	QC Batch	19-103-TC COMP	SOILS 12-1-AN	RDL	QC Batch
Physical Properties								
% sand by hydrometer	%	7.7	2.0	9574735				
% silt by hydrometer	%	27	2.0	9574735				
Clay Content	%	65	2.0	9574735				
Texture	N/A	HEAVY CLAY	N/A	9572957				
Moisture	%				24	20	0.30	9574953

RDL = Reportable Detection Limit
N/A = Not Applicable

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PHYSICAL TESTING (SOIL)

BV Labs ID		WK2545			WK2546			WK2547		
Sampling Date		2019/08/20			2019/08/20			2019/08/20		
COC Number		M083010			M083010			M083010		
	UNITS	SOILS 12-1-FD	RDL	QC Batch	SOILS 12-2-AN	RDL	QC Batch	SOILS 12-3-AN	RDL	QC Batch
Physical Properties										
% sand by hydrometer	%	17	2.0	9574735				19	2.0	9574735
% silt by hydrometer	%	29	2.0	9574735				36	2.0	9574735
Clay Content	%	54	2.0	9574735				45	2.0	9574735
Texture	N/A	CLAY	N/A	9572957				CLAY	N/A	9572957
Moisture	%				19	0.30	9574953			

RDL = Reportable Detection Limit
N/A = Not Applicable

BV Labs Job #: B972997
Report Date: 2019/09/06

STANTEC CONSULTING LTD
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GENERAL COMMENTS

Sample WK2497 [SOILS 3-3-AN] : SLTY CL LO = SILTY CLAY LOAM

Results relate only to the items tested.

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BV Labs - Partial/Rush Results

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9574048	BMU	QC Standard	Saturation %	2019/09/04		101	%	75 - 125
9574048	BMU	RPD	Saturation %	2019/09/04	0.51		%	12
9574048	BMU	RPD [WK2498-01]	Saturation %	2019/09/04	1.9		%	12
9574142	ACZ	QC Standard	Organic Matter	2019/09/04		100	%	75 - 125
			Total Organic Carbon (C)	2019/09/04		100	%	75 - 125
9574142	ACZ	Method Blank	Organic Matter	2019/09/04	<0.35		%	
			Total Organic Carbon (C)	2019/09/04	<0.20		%	
9574142	ACZ	RPD	Organic Matter	2019/09/04	0.18		%	30
			Total Organic Carbon (C)	2019/09/04	0.18		%	30
9574457	KPR	QC Standard	Saturation %	2019/09/04		100	%	75 - 125
9574457	KPR	RPD [WK2545-01]	Saturation %	2019/09/04	4.5		%	12
9574496	CMX	QC Standard	Soluble pH	2019/09/04		100	%	97 - 103
9574496	CMX	Spiked Blank	Soluble pH	2019/09/04		100	%	97 - 103
9574496	CMX	RPD [WK2498-01]	Soluble pH	2019/09/04	0		%	N/A
9574735	LX	QC Standard	% sand by hydrometer	2019/09/05		97	%	75 - 125
			% silt by hydrometer	2019/09/05		101	%	75 - 125
			Clay Content	2019/09/05		101	%	75 - 125
9574735	LX	RPD [WK2545-01]	% sand by hydrometer	2019/09/05	12		%	30
			% silt by hydrometer	2019/09/05	2.5		%	30
			Clay Content	2019/09/05	4.7		%	30
9574763	MSD	Matrix Spike	Soluble Calcium (Ca)	2019/09/04		102	%	75 - 125
			Soluble Magnesium (Mg)	2019/09/04		104	%	75 - 125
			Soluble Sodium (Na)	2019/09/04		104	%	75 - 125
			Soluble Potassium (K)	2019/09/04		102	%	75 - 125
9574763	MSD	QC Standard	Soluble Calcium (Ca)	2019/09/04		88	%	75 - 125
			Soluble Magnesium (Mg)	2019/09/04		87	%	75 - 125
			Soluble Sodium (Na)	2019/09/04		93	%	75 - 125
			Soluble Potassium (K)	2019/09/04		103	%	75 - 125
			Soluble Sulphate (SO4)	2019/09/04		86	%	75 - 125
9574763	MSD	Spiked Blank	Soluble Calcium (Ca)	2019/09/04		97	%	80 - 120
			Soluble Magnesium (Mg)	2019/09/04		97	%	80 - 120
			Soluble Sodium (Na)	2019/09/04		97	%	80 - 120
			Soluble Potassium (K)	2019/09/04		94	%	80 - 120
9574763	MSD	Method Blank	Soluble Calcium (Ca)	2019/09/04	<1.5		mg/L	
			Soluble Magnesium (Mg)	2019/09/04	<1.0		mg/L	
			Soluble Sodium (Na)	2019/09/04	<2.5		mg/L	
			Soluble Potassium (K)	2019/09/04	<1.3		mg/L	
			Soluble Sulphate (SO4)	2019/09/04	<5.0		mg/L	
9574763	MSD	RPD	Soluble Calcium (Ca)	2019/09/04	16		%	30
			Soluble Magnesium (Mg)	2019/09/04	17		%	30
			Soluble Sodium (Na)	2019/09/04	2.8		%	30
			Soluble Potassium (K)	2019/09/04	2.4		%	30
			Soluble Sulphate (SO4)	2019/09/04	17		%	30
9574777	ACZ	QC Standard	Calcium Carbonate Equivalent	2019/09/05		118	%	75 - 125
9574777	ACZ	Spiked Blank	Calcium Carbonate Equivalent	2019/09/05		106	%	80 - 120
9574777	ACZ	Method Blank	Calcium Carbonate Equivalent	2019/09/05	<0.60		%	
9574777	ACZ	RPD [WK2497-01]	Calcium Carbonate Equivalent	2019/09/05	5.4		%	35
9574820	MRD	Matrix Spike	Soluble Chloride (Cl)	2019/09/04		112	%	75 - 125
9574820	MRD	QC Standard	Soluble Chloride (Cl)	2019/09/04		104	%	75 - 125
9574820	MRD	Spiked Blank	Soluble Chloride (Cl)	2019/09/04		106	%	80 - 120
9574820	MRD	Method Blank	Soluble Chloride (Cl)	2019/09/04	<5.0		mg/L	
9574820	MRD	RPD	Soluble Chloride (Cl)	2019/09/04	2.3		%	30
9574896	BMU	QC Standard	Soluble Conductivity	2019/09/04		88	%	75 - 125

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9574896	BMU	Spiked Blank	Soluble Conductivity	2019/09/04		99	%	90 - 110
9574896	BMU	Method Blank	Soluble Conductivity	2019/09/04	<0.020		dS/m	
9574896	BMU	RPD	Soluble Conductivity	2019/09/04	10		%	20
9574898	CMX	QC Standard	Soluble pH	2019/09/04		101	%	97 - 103
9574898	CMX	Spiked Blank	Soluble pH	2019/09/04		100	%	97 - 103
9574898	CMX	RPD [WK2545-01]	Soluble pH	2019/09/04	0.90		%	N/A
9574953	ARW	Method Blank	Moisture	2019/09/05	<0.30		%	
9574953	ARW	RPD	Moisture	2019/09/05	1.5		%	20
9575284	REL	Matrix Spike	Soluble Calcium (Ca)	2019/09/04		95	%	75 - 125
			Soluble Magnesium (Mg)	2019/09/04		96	%	75 - 125
			Soluble Sodium (Na)	2019/09/04		96	%	75 - 125
			Soluble Potassium (K)	2019/09/04		94	%	75 - 125
9575284	REL	QC Standard	Soluble Calcium (Ca)	2019/09/04		86	%	75 - 125
			Soluble Magnesium (Mg)	2019/09/04		84	%	75 - 125
			Soluble Sodium (Na)	2019/09/04		88	%	75 - 125
			Soluble Potassium (K)	2019/09/04		94	%	75 - 125
			Soluble Sulphate (SO4)	2019/09/04		83	%	75 - 125
9575284	REL	Spiked Blank	Soluble Calcium (Ca)	2019/09/04		97	%	80 - 120
			Soluble Magnesium (Mg)	2019/09/04		97	%	80 - 120
			Soluble Sodium (Na)	2019/09/04		96	%	80 - 120
			Soluble Potassium (K)	2019/09/04		94	%	80 - 120
9575284	REL	Method Blank	Soluble Calcium (Ca)	2019/09/04	<1.5		mg/L	
			Soluble Magnesium (Mg)	2019/09/04	<1.0		mg/L	
			Soluble Sodium (Na)	2019/09/04	<2.5		mg/L	
			Soluble Potassium (K)	2019/09/04	<1.3		mg/L	
			Soluble Sulphate (SO4)	2019/09/04	<5.0		mg/L	
9575284	REL	RPD [WK2545-01]	Soluble Calcium (Ca)	2019/09/04	16		%	30
			Soluble Magnesium (Mg)	2019/09/04	8.4		%	30
			Soluble Sodium (Na)	2019/09/04	16		%	30
			Soluble Potassium (K)	2019/09/04	11		%	30
			Soluble Sulphate (SO4)	2019/09/04	15		%	30
9575507	CMX	QC Standard	Soluble (CaCl2) pH	2019/09/05		99	%	97 - 103
9575507	CMX	Spiked Blank	Soluble (CaCl2) pH	2019/09/05		99	%	97 - 103
9575507	CMX	RPD	Soluble (CaCl2) pH	2019/09/05	1.3		%	N/A
9575508	KPR	QC Standard	Saturation %	2019/09/05		100	%	75 - 125
9575508	KPR	RPD	Saturation %	2019/09/05	3.0		%	12
			Saturation %	2019/09/05	2.9		%	12
9575734	CH7	Matrix Spike	Soluble Chloride (Cl)	2019/09/05		114	%	75 - 125
9575734	CH7	QC Standard	Soluble Chloride (Cl)	2019/09/05		100	%	75 - 125
9575734	CH7	Spiked Blank	Soluble Chloride (Cl)	2019/09/05		107	%	80 - 120
9575734	CH7	Method Blank	Soluble Chloride (Cl)	2019/09/05	<5.0		mg/L	
9575734	CH7	RPD [WK2545-01]	Soluble Chloride (Cl)	2019/09/05	NC		%	30
9575758	BMU	QC Standard	Soluble Conductivity	2019/09/05		87	%	75 - 125
9575758	BMU	Spiked Blank	Soluble Conductivity	2019/09/05		99	%	90 - 110
9575758	BMU	Method Blank	Soluble Conductivity	2019/09/05	<0.020		dS/m	
9575758	BMU	RPD [WK2545-01]	Soluble Conductivity	2019/09/05	15		%	20
9576067	CMX	QC Standard	Soluble (CaCl2) pH	2019/09/05		99	%	97 - 103
9576067	CMX	Spiked Blank	Soluble (CaCl2) pH	2019/09/05		99	%	97 - 103
9576067	CMX	RPD	Soluble (CaCl2) pH	2019/09/05	0.13		%	N/A
9576285	CMX	QC Standard	Soluble pH	2019/09/05		99	%	97 - 103
9576285	CMX	Spiked Blank	Soluble pH	2019/09/05		99	%	97 - 103
9576285	CMX	RPD	Soluble pH	2019/09/05	1.1		%	N/A
9576827	CMX	QC Standard	Soluble (CaCl2) pH	2019/09/05		99	%	97 - 103

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9576827	CMX	Spiked Blank	Soluble (CaCl2) pH	2019/09/05		99	%	97 - 103
9576827	CMX	RPD [WK2545-01]	Soluble (CaCl2) pH	2019/09/05	0.74		%	N/A
9576836	REL	Matrix Spike	Soluble Calcium (Ca)	2019/09/05		99	%	75 - 125
			Soluble Magnesium (Mg)	2019/09/05		102	%	75 - 125
			Soluble Sodium (Na)	2019/09/05		104	%	75 - 125
			Soluble Potassium (K)	2019/09/05		103	%	75 - 125
9576836	REL	QC Standard	Soluble Calcium (Ca)	2019/09/05		94	%	75 - 125
			Soluble Magnesium (Mg)	2019/09/05		95	%	75 - 125
			Soluble Sodium (Na)	2019/09/05		105	%	75 - 125
			Soluble Potassium (K)	2019/09/05		110	%	75 - 125
			Soluble Sulphate (SO4)	2019/09/05		97	%	75 - 125
9576836	REL	Spiked Blank	Soluble Calcium (Ca)	2019/09/05		103	%	80 - 120
			Soluble Magnesium (Mg)	2019/09/05		106	%	80 - 120
			Soluble Sodium (Na)	2019/09/05		108	%	80 - 120
			Soluble Potassium (K)	2019/09/05		107	%	80 - 120
9576836	REL	Method Blank	Soluble Calcium (Ca)	2019/09/05	<1.5		mg/L	
			Soluble Magnesium (Mg)	2019/09/05	<1.0		mg/L	
			Soluble Sodium (Na)	2019/09/05	<2.5		mg/L	
			Soluble Potassium (K)	2019/09/05	<1.3		mg/L	
			Soluble Sulphate (SO4)	2019/09/05	<5.0		mg/L	
9576836	REL	RPD	Soluble Calcium (Ca)	2019/09/05	NC		%	30
			Soluble Magnesium (Mg)	2019/09/05	NC		%	30
			Soluble Sodium (Na)	2019/09/05	1.7		%	30
			Soluble Potassium (K)	2019/09/05	4.0		%	30
			Soluble Sulphate (SO4)	2019/09/05	NC		%	30
9576888	CAR	Matrix Spike	Available (KCl) Nitrite (N)	2019/09/05		97	%	75 - 125
			Available (KCl) Nitrate (N)	2019/09/05		101	%	75 - 125
9576888	CAR	Spiked Blank	Available (KCl) Nitrite (N)	2019/09/05		93	%	80 - 120
			Available (KCl) Nitrate (N)	2019/09/05		96	%	80 - 120
9576888	CAR	Method Blank	Available (KCl) Nitrite (N)	2019/09/05	<2.0		mg/kg	
			Available (KCl) Nitrate (N)	2019/09/05	<2.0		mg/kg	
9576888	CAR	RPD	Available (KCl) Nitrite (N)	2019/09/05	NC		%	30
			Available (KCl) Nitrate (N)	2019/09/05	NC		%	30
9576932	KPE	QC Standard	Soluble Conductivity	2019/09/06		93	%	75 - 125
9576932	KPE	Spiked Blank	Soluble Conductivity	2019/09/06		101	%	90 - 110
9576932	KPE	Method Blank	Soluble Conductivity	2019/09/06	<0.020		dS/m	
9576932	KPE	RPD	Soluble Conductivity	2019/09/06	8.7		%	20
9577366	CMX	QC Standard	Soluble (CaCl2) pH	2019/09/06		100	%	97 - 103
9577366	CMX	Spiked Blank	Soluble (CaCl2) pH	2019/09/06		100	%	97 - 103
9577366	CMX	RPD	Soluble (CaCl2) pH	2019/09/06	0.26		%	N/A
9577720	CH7	Matrix Spike	Soluble Chloride (Cl)	2019/09/06		115	%	75 - 125
9577720	CH7	QC Standard	Soluble Chloride (Cl)	2019/09/06		102	%	75 - 125
9577720	CH7	Spiked Blank	Soluble Chloride (Cl)	2019/09/06		111	%	80 - 120
9577720	CH7	Method Blank	Soluble Chloride (Cl)	2019/09/06	<5.0		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9577720	CH7	RPD	Soluble Chloride (Cl)	2019/09/06	NC		%	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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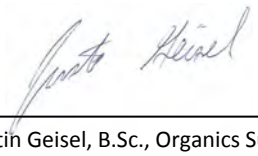
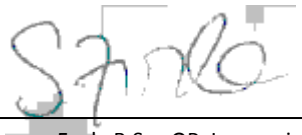
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Justin Geisel, B.Sc., Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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Appendix A-3: Water and Wind Erosion Potential Calculations

Water Erosion Calculator

Soil Map Unit	Slope Gradient Class	Slope Length Class	R Factor	Slope %	Slope (Radians)	Slope Length	LS Factor Model Selection	m coefficient	Series 1		Series 5		Final Numerical Rating for Topsoil(Weighted Average)	Final Rating for Topsoil	Final Rating for Subsoil	Notes
									Topsoil Texture	Subsoil Texture	Topsoil 5 Weighted	Subsoil 5 Weighted				
KTH	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiC	**0.00**	**0.00**	21.39	Moderate	Moderate	
KTH	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiL	**0.00**	**0.00**	21.39	Moderate	High	
KTH	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiCL	**0.00**	**0.00**	21.39	Moderate	Moderate	
KTH	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiC	**0.00**	**0.00**	41.92	Severe	High	
KTH	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiL	**0.00**	**0.00**	41.92	Severe	Severe	
KTH	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiCL	**0.00**	**0.00**	41.92	Severe	Severe	
KTH-GOS	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiCL	**0.00**	**0.00**	21.39	Moderate	Moderate	
KTH-GOS	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiCL	**0.00**	**0.00**	41.92	Severe	Severe	
KTH-GOS	5 (>9 to 15%)	4 (100 to 500 m)	425	12	0.119	100	4	0.71	SiL	SiCL	**0.00**	**0.00**	91.22	Severe	Severe	
KTH-GOS	6 (>15 to 30%	4 (100 to 500 m)	425	25	0.245	100	4	0.78	SiL	SiCL	**0.00**	**0.00**	241.42	Severe	Severe	
KTH_MLY	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiCL	**0.00**	**0.00**	21.39	Moderate	Moderate	
KTH_MLY	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiCL	**0.00**	**0.00**	41.92	Severe	Severe	
KTHfi	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	C	C	**0.00**	**0.00**	12.22	Moderate	Moderate	
KTHfi	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	C	C	**0.00**	**0.00**	23.96	High	High	
KTHgl	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiCL	**0.00**	**0.00**	41.92	Severe	Severe	
BYL	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	L	SiL	**0.00**	**0.00**	16.59	Moderate	High	
BYLglpt	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiCL	**0.00**	**0.00**	21.39	Moderate	Moderate	
BYL-MLY	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiCL	**0.00**	**0.00**	21.39	Moderate	Moderate	
BYL-MLY	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiCL	**0.00**	**0.00**	41.92	Severe	Severe	
EAG1	2 (>0.5 to 2%)	4 (100 to 500 m)	425	1	0.010	100	3	0.26	ORG	ORG	**0.00**	**0.00**	0.00	Very Low	Very Low	
EAG1	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	ORG	ORG	**0.00**	**0.00**	0.00	Very Low	Very Low	
EAG2	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	ORG	ORG	**0.00**	**0.00**	0.00	Very Low	Very Low	
GOS1	2 (>0.5 to 2%)	4 (100 to 500 m)	425	1	0.010	100	3	0.26	SiL	SiCL	**0.00**	**0.00**	4.25	Very Low	Very Low	
GOS1	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	SiCL	**0.00**	**0.00**	21.39	Moderate	Moderate	
GOS1	2 (>0.5 to 2%)	4 (100 to 500 m)	425	1	0.010	100	3	0.26	SiL	C	**0.00**	**0.00**	4.25	Very Low	Very Low	
GOS1	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiL	C	**0.00**	**0.00**	21.39	Moderate	Moderate	
GOS2	4 (>5 to 9%)	4 (100 to 500 m)	425	7	0.070	100	3	0.625	SiL	SiCL	**0.00**	**0.00**	41.92	Severe	Severe	
GOSpt	2 (>0.5 to 2%)	4 (100 to 500 m)	425	1	0.010	100	3	0.26	SiCL	HC	**0.00**	**0.00**	3.47	Very Low	Very Low	
GOSpt	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiCL	SiC	**0.00**	**0.00**	17.46	Moderate	Moderate	
GOSpt	2 (>0.5 to 2%)	4 (100 to 500 m)	425	1	0.010	100	3	0.26	SiC	SiCL	**0.00**	**0.00**	2.95	Very Low	Very Low	
GOSpt	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiCL	HC	**0.00**	**0.00**	17.46	Moderate	Low	
GOSpt	2 (>0.5 to 2%)	4 (100 to 500 m)	425	1	0.010	100	3	0.26	SiCL	SiC	**0.00**	**0.00**	3.47	Very Low	Very Low	
GOSpt	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	SiC	SiCL	**0.00**	**0.00**	14.84	Moderate	Moderate	
GOSpt2	3 (>2 to 5%)	4 (100 to 500 m)	425	4	0.040	100	3	0.53	ORG	SiCL	**0.00**	**0.00**	0.00	Very Low	Moderate	

Wind Erosion Calculator

Soil Map Unit	Topsoil/Subsoil (TS/SS)	Land Use	Weather Station Location	Series 1											
				Soil Series 1	Texture 1	Wind speed at 2 m off the ground			Drag Velocity $V_* = (27.78V_2)/(5.75\log(2/k)$			Equation for E - a dimensionless index $E = KC(V_*^2-\gamma W^2)^{1.5}$			
						V_h	H = 10.1m	V_2	V_2	k = 0.00025m	V_*	K	C	V_*	γ = 5000
KTH	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTH	SS	Agricultural	Chetwynd A		SiC	59	10.1	45.767	45.767	0.00025	56.652	0.500	0.00277	56.7	5000
KTH	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTH	SS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTH	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTH	SS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
KTH	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
KTH	SS	Forested	Chetwynd A		SiC	59	10.1	23.600	23.600	0.00025	29.212	0.500	0.00277	29.2	5000
KTH	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
KTH	SS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
KTH	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
KTH	SS	Forested	Chetwynd A		SiCL	59	10.1	23.600	23.600	0.00025	29.212	0.190	0.00309	29.2	5000
KTH-GOS	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTH-GOS	SS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
KTH-GOS	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
KTH-GOS	SS	Forested	Chetwynd A		SiCL	59	10.1	23.600	23.600	0.00025	29.212	0.190	0.00309	29.2	5000
KTH-MLY	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTH-MLY	SS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
KTH-MLY	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
KTH-MLY	SS	Forested	Chetwynd A		SiCL	59	10.1	23.600	23.600	0.00025	29.212	0.190	0.00309	29.2	5000
KTHfi	TS	Agricultural	Chetwynd A		C	59	10.1	45.767	45.767	0.00025	56.652	0.600	0.00245	56.7	5000
KTHfi	SS	Agricultural	Chetwynd A		C	59	10.1	45.767	45.767	0.00025	56.652	0.600	0.00245	56.7	5000
KTHfi	TS	Agricultural	Chetwynd A		Si	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTHfi	SS	Agricultural	Chetwynd A		C	59	10.1	45.767	45.767	0.00025	56.652	0.600	0.00245	56.7	5000
KTHfi	TS	Agricultural	Chetwynd A		Si	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTHfi	SS	Agricultural	Chetwynd A		C	59	10.1	45.767	45.767	0.00025	56.652	0.600	0.00245	56.7	5000
KTHgl	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
KTHgl	SS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
BYL	TS	Agricultural	Chetwynd A		L	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00357	56.7	5000
BYL	SS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
BYLglpt	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
BYLglpt	SS	Forested	Chetwynd A		SiCL	59	10.1	23.600	23.600	0.00025	29.212	0.190	0.00309	29.2	5000
BYL-MLY	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
BYL-MLY	SS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
BYL-MLY	TS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
BYL-MLY	SS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
EAG	TS	Forested	Chetwynd A		ORG	59	10.1	23.600	23.600	0.00025	29.212	0.000	0	29.2	5000
EAG	SS	Forested	Chetwynd A		ORG	59	10.1	23.600	23.600	0.00025	29.212	0.000	0	29.2	5000
GOS1	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
GOS1	SS	Forested	Chetwynd A		SiCL	59	10.1	23.600	23.600	0.00025	29.212	0.190	0.00309	29.2	5000
GOS1	TS	Agricultural	Chetwynd A		SiL	59	10.1	45.767	45.767	0.00025	56.652	0.200	0.00361	56.7	5000
GOS1	SS	Agricultural	Chetwynd A		C	59	10.1	45.767	45.767	0.00025	56.652	0.600	0.00245	56.7	5000
GOS2	TS	Forested	Chetwynd A		SiL	59	10.1	23.600	23.600	0.00025	29.212	0.200	0.00361	29.2	5000
GOS2	SS	Forested	Chetwynd A		SiCL	59	10.1	23.600	23.600	0.00025	29.212	0.190	0.00309	29.2	5000
GOSpt	TS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
GOSpt	SS	Agricultural	Chetwynd A		HC	59	10.1	45.767	45.767	0.00025	56.652	0.650	0.00197	56.7	5000
GOSpt	TS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000
GOSpt	SS	Agricultural	Chetwynd A		SiC	59	10.1	45.767	45.767	0.00025	56.652	0.500	0.00277	56.7	5000
GOSpt	TS	Forested	Chetwynd A		SiC	59	10.1	23.600	23.600	0.00025	29.212	0.500	0.00277	29.2	5000
GOSpt	SS	Forested	Chetwynd A		SiCL	59	10.1	23.600	23.600	0.00025	29.212	0.190	0.00309	29.2	5000
GOSpt2	TS	Agricultural	Chetwynd A		ORG	59	10.1	45.767	45.767	0.00025	56.652	0.000	0	56.7	5000
GOSpt2	SS	Agricultural	Chetwynd A		SiCL	59	10.1	45.767	45.767	0.00025	56.652	0.190	0.00309	56.7	5000

							Series 2									
of wind erosion risk							Wind speed at 2 m off the ground			Drag Velocity			Equation for E - a dim		
							$V_2 = 0.777V_h/(0.233+0.656\log(H+4.75))$			$V_* = (27.78V_2)/(5.75\log(2/k))$					
W	E	Rating	Decile	Weighted Average 1	Soil Series 2	Texture 2	V_h	H = 10.1m	V_2	V_2	k = 0.00025m	V_*	K	C	V_*
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.24	219	Low	10	219			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.24	19	Negligible	10	19			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	9	Negligible	10	9			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	9	Negligible	10	9			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	9	Negligible	10	9			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.24	232	Low	10	232			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.24	232	Low	10	232			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.09	129	Low	10	129			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.24	232	Low	10	232			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	124	Low	10	124			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	9	Negligible	10	9			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.00	0	Negligible	10	0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.00	0	Negligible	10	0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	9	Negligible	10	9			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.14	125	Low	10	125			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.24	232	Low	10	232			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.14	15	Negligible	10	15			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	9	Negligible	10	9			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.26	197	Low	10	197			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.24	219	Low	10	219			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.24	19	Negligible	10	19			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.21	9	Negligible	10	9			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2
0.00	0	Negligible	10	0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7
0.21	96	Negligible	10	96			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7

nensionless index of wind erosion risk $E = KC(V_*^2-\gamma W^2)^{1.5}$				Decile 2	Weighted Average 2	Soil Series 3	Texture 3	Series 3 Wind speed at 2 m off the ground $V_2 = 0.777V_h/(0.233+0.656\log(H+4.75))$			Drag Velocity $V_* = (27.78V_2)/(5.75\log(2/k))$			Equ	
γ = 5000	W	E	Rating					V_h	H = 10.1m	V_2	V_2	k = 0.00025m	V_*	K	C
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A
5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A

															Series 4
uation for E - a dimensionless index of wind erosion risk $E = KC(V_*^2-\gamma W^2)^{1.5}$					Decile 3	Weighted Average 3			Wind speed at 2 m off the ground $V_2 = 0.777V_h/(0.233+0.656\log(H+4.75))$			Drag Velocity $V_* = (27.78V_2)/(5.75\log(2/k))$			
V_*	γ = 5000	W	E	Rating			Soil Series 4	Texture 4	V_h	H = 10.1m	V_2	V_2	k = 0.00025m	V_*	K
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
29.2	5000	#N/A	#N/A			0			59	10.1	23.600	23.600	0.00025	29.212	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A
56.7	5000	#N/A	#N/A			0			59	10.1	45.767	45.767	0.00025	56.652	#N/A

Equation for E - a dimensionless index of wind erosion risk $E = KC(V_*^2 - \gamma W^2)^{1.5}$						Decile 4	Weighted Average 4	Soil Series 5	Texture 5	Wind sp $V_2 = 0.777$
C	V_*	$\gamma = 5000$	W	E	Rating					V_h
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	29.2	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59
#N/A	56.7	5000	#N/A	#N/A			0			59

Series 5															
eed at 2 m off the ground $V_h/(0.233+0.656\log(H+4.75))$		Drag Velocity $V_* = (27.78V_2)/(5.75\log(2/k)$			Equation for E - a dimensionless index of wind erosion risk $E = KC(V_*^2-\gamma W^2)^{1.5}$							Decile 5	Weighted Average 5	Final Numerical Rating	Final Rating
H = 10.1m	V_2	V_2	k = 0.00025m	V_*	K	C	V_*	γ = 5000	W	E	Rating				
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	219	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	19	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	9	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	9	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	9	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	232	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	232	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	129	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	232	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	124	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	9	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	0	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	0	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	9	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	125	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	232	Low
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	15	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	9	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	197	Low
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	219	Low
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	19	Negligible
10.1	23.600	23.600	0.00025	29.212	#N/A	#N/A	29.2	5000	#N/A	#N/A			0	9	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	0	Negligible
10.1	45.767	45.767	0.00025	56.652	#N/A	#N/A	56.7	5000	#N/A	#N/A			0	96	Negligible

Appendix A-4: Compaction and Rutting Risk Calculations

Compaction and Rutting Calculator

Soil Map Unit	Slope Gradient Class	Series 1							
		Soil Series 1	Drainage 1	Topsoil Texture 1	Subsoil Texture 1	Topsoil Compaction Risk 1	Subsoil Compaction Risk 1	Topsoil Rutting Risk 1	Subsoil Rutting Risk 1
KTH	**3**	KTH	MW	SiL	SiC	Low	Moderate	Moderate	Moderate
	3	KTH	mw	SiL	SiL	Low	Low	Moderate	Moderate
	3	KTH	mw	SiL	SiCL	Low	Moderate	Moderate	Moderate
	4	KTH	mw	SiL	SiC	Low	Moderate	Moderate	Moderate
	4	KTH	mw	SiL	SiL	Low	Low	Moderate	Moderate
	4	KTH	mw	SiL	SiCL	Low	Moderate	Moderate	Moderate
KTH-GOS	**4**	KTH-GOS	MW-P	SiL	SiCL	High	High	Moderate	Moderate
	3	KTH-GOS	MW-P	SiL	SiCL	High	High	Moderate	Moderate
	5	KTH-GOS	MW-P	SiL	SiCL	High	High	Moderate	Moderate
	6	KTH-GOS	MW-P	SiL	SiCL	High	High	Moderate	Moderate
KTH-MLY	**3**	KTH-MLY	MW-I	SiL	SiCL	Moderate	High	Moderate	Moderate
	4	KTH-MLY	MW-I	SiL	SiCL	Moderate	High	Moderate	Moderate
KTH-BYL	**3**	KTH-BYL	MW	SiL	SiCL	Low	Moderate	Moderate	Moderate
	4	KTH-BYL	MW	SiL	SiCL	Low	Moderate	Moderate	Moderate
KTHfi	**3**	KTHfi	MW-I	C	C	High	High	Moderate	Moderate
	4	KTHfi	MW-I	C	C	High	High	Moderate	Moderate
KTHgl	**4**	KTHgl	MW-I	SiL	SiCL	Moderate	High	Moderate	Moderate
BYL	**3**	BYL	MW-W	L	SiL	Low	Low	Moderate	Moderate
BYLglpt	**3**	BYLglpt	I-P	SiL	SiCL	High	High	Moderate	Moderate
BYL-MLY	**3**	BYL-MLY	MW-I	SiL	SiCL	High	High	Moderate	Moderate
	3	BYL-MLY	MW-I	SiL	SiCL	High	High	Moderate	Moderate
EAG1	**2**	EAG1	VP	ORG	ORG	High	High	High	Moderate
	3	EAG1	P-VP	ORG	ORG	High	High	High	Moderate
GOS	**2-3**	GOS1	I-P	SiL	SiCL	High	High	High	Moderate
	2-3	GOS1	I-P	SiL	C	High	High	High	Moderate
GOS	**4**	GOS2	P	SiL	SiCL	High	High	High	Moderate
GOSpt	**2-3**	GOSpt	I-P	SiCL	HC	High	High	HIgh	Moderate
	2-3	GOSpt	I-P	SiCL	SiC	High	High	HIgh	Moderate
	2-3	GOSpt	I-P	SiC	SiCL	High	High	HIgh	Moderate
GOSpt2	**3**	GOSpt2	P	ORG	SiCL	High	High	High	Moderate

Appendix B
Groundbirch Connector
Terrain Technical Data Report

Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3) Appendix B Groundbirch Connector Terrain Technical Data Report

CGL80373-STC-ENV-RP-003

October 13, 2020

Revision 1

Issued for Use

Stantec

Authorization Page

Stantec Consulting Ltd.

Prepared by:	 Name: Wanda Miller Title: Author	Date:	September 8, 2020
Endorsed by:	Tsang, Sid Digitally signed by Tsang, Sid Date: 2020.10.08 10:43:29 -07'00' Name: Sid Tsang Title: Technical Quality Review	Date:	
Endorsed by:	 2020.10.08 16:45:15 -03'00' Name: Chris Blair Title: Independent Senior Review	Date:	
Approved by:	Catherine Meyer Digitally signed by Catherine Meyer Date: 2020.10.10 11:47:25 -06'00' Name: Catherine Meyer Title: Technical Project Manager	Date:	

Authorization Page

Coastal GasLink Pipeline Project

Endorsed by: _____ Date: _____

Name: Jeff Quennelle

Title: Environmental Advisor,
Coastal GasLink

Endorsed by: _____ Date: _____

Name: Adair Rigney

Title: Environmental Team Lead,
Coastal GasLink

Accepted by: _____ Date: _____

Name: Craig Losos

Title: Manager, Environmental
Planning and Permitting,
Coastal GasLink

Revision Log

Rev	Section	Revision Description
0	All	Issued for Use
1	All	Issued for Use

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1.0 INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at: https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Terrain Technical Data Report includes relevant baseline information for the proposed Groundbirch Connector.

A geohazards assessment is not included in this TDR, as it was completed as part of the engineering investigation for the proposed Groundbirch Connector. Traditional Land and Resource Use (TLRU) is presented in Section 15.0 of the Amendment Application. The Groundbirch Connector crosses exclusively private land, no Traditional Ecological Knowledge was collected during field programs.

Abbreviations and acronyms used in this report are described in Appendix B-1.

1.1 OBJECTIVES

This Terrain TDR considers the directives presented in the EAC Application Information Requirements issued by the EAO (BC EAO 2013), the Section 25 required assessment matters under the revitalized BC *Environmental Assessment Act* (refer to Section 1.2 of the Amendment Application), and references the guidance contained in the following documents:

- EAO User Guide (BC EAO 2020a)
- Guide to Indigenous Knowledge in Environmental Assessments (BC EAO 2020b)

The objectives of this TDR are to describe the baseline terrain conditions and acid rock drainage (ARD) potential conditions within the proposed Groundbirch Connector study areas using methods that are consistent with the 2013 approved Application Information Requirements for the Project and provide the data needed to facilitate the assessment of potential effects and potential cumulative effects. These objectives were achieved for terrain by compiling and synthesizing information from existing literature sources, developing detailed terrain mapping at a 1:10,000 scale and completing field surveys in the local study area (LSA).

Mitigation for Terrain and ARD can be found in Sections 5.6 and 5.7, respectively, in the 2014 EAC Application (Coastal GasLink 2014a). No additional mitigation is required for the Groundbirch Connector for potential effects on terrain integrity and effects of ARD potential as there are no substantial differences between the baseline information reported in the EAC Application for the Project (Coastal GasLink 2014a) and baseline information reported in this TDR.

1.2 STUDY AREA BOUNDARIES

Terrain study area boundaries include the Groundbirch Connector Footprint and the LSA. These areas are discussed below and presented on Figure 1-1.

1.2.1 Groundbirch Connector Footprint

The Groundbirch Connector Footprint is the area potentially affected by physical works and activities, such as clearing, construction and cleanup. The Groundbirch Connector Footprint is delineated by a 50-m wide buffer on each side of the pipeline centreline, and encompasses the construction ROW, the permanent ROW, an access road, temporary workspace, and tie-in locations.

The Groundbirch Connector Application Corridor varies in width from approximately 175 m to 245 m to account for temporary workspace, but is not used in assessment analysis within this report.

1.2.2 Local Study Area

The terrain (LSA) is defined by the area in which Groundbirch Connector project activities and facilities could affect terrain. The terrain LSA (Figure 1-1) includes the Groundbirch Connector Footprint and a 1 km buffer on each side of the centerline.

1.2.3 Regional Study Area

A regional study area (RSA) has not been identified for terrain because any adverse effects would be restricted to the Groundbirch Connector Footprint and terrain LSA.

- Proposed Groundbirch Connector Route
- Coastal GasLink Route
- Certified Pipeline Corridor
- Certified Wilde Lake Compressor Station
- Groundbirch Connector Application Corridor
- Project Footprint
- Terrain Local Study Area
- Existing Pipeline
- Existing Road
- Railway
- TRIM Contour (20 m Interval)
- TRIM Watercourse
- BC Township System-Sections Grid (34-78-19 W6M)
- Blue-Listed Community
- Flooded Land (i.e. swamps/marshes)
- Water Body

REVISION	DESCRIPTION: xxxxx
0	Review

1:15,000 0 125 250 500 750 1,000 Metres

Coastal GasLink Pipeline Project

TC Energy

Figure 1-1: Terrain TDR Study Area Boundaries

Route Reference: Groundbirch Connector Pipeline Route	10/9/2020
Document No.: 123513287_Connector_Terrain	Connector

STANTEC: W:\Clients\TransCanada\Coastal_GasLink\Figures\Soils_Terrain\123513287_Connector_Terrain.mxd

2.0 GROUNDBIRCH CONNECTOR PROJECT SETTING

This section provides an overview of the physical setting of the proposed Groundbirch Connector including the physiography, geology, Quaternary history, topography, and landforms traversed by the proposed route. The information presented in this section is from a review of published and publicly available data and field studies undertaken by Coastal GasLink.

2.1 PHYSIOGRAPHY

The terrain LSA is located in the Alberta Plateau Physiographic Division (Holland 1976) and consists of flat to gently rolling topography generally between 735 and 775 metres above sea level (masl).

2.2 GEOLOGY AND QUATERNARY HISTORY

The terrain LSA is underlain by the Upper Cretaceous Dunvegan Formation. This formation consists of massive conglomerate, fine to coarse grained sandstone and carboniferous shale (Massey et al. 2005). The Laurentide ice sheet advanced on to the Alberta Plateau from the northeast and east three times during the Pleistocene with the most recent being the Late Wisconsinan when ice reached the Rocky Mountain Foothills, leaving a veneer (less than 1 m thick) of till and scattered boulder erratics (Catto et al. 1996).

When ice retreated from the area, meltwater was impounded against the retreating Laurentide ice sheet forming Glacial Lake Peace. At its maximum, the lake was thought to extend westward to Portage Mountain, covering the Hudson Hope area north of Chetwynd (Mathews 1980), including the terrain LSA. The lake drained in stages (Mathews 1980), with the post-glacial shoreline being east of Fort St John before 10,770 years BP (Fladmark et al. 1988). The lake is thought to have covered the area for some time during its Bessborough stage, depositing thick layers of clay (Mathews 1980), up to 30 m thick and forming sand and gravel beaches (Clague 1989).

2.3 TOPOGRAPHY AND LANDFORMS

Topography in the terrain LSA is generally flat to gently rolling with slopes ranging between 0 to 15%. Topography and landforms in the terrain LSA are likely attributed to underlying bedrock, surficial material deposits and geomorphological processes. Glaciolacustrine deposits are the most common surficial materials in the terrain LSA, associated with ice-dammed lakes prevalent across the Alberta Plateau (Reimchen and Bouvier 1980). Glaciolacustrine deposits tend to be 1-5 m thick and can be found overlying till (Maxwell 1987) and are generally rich in clay having eroded large areas of dark grey cretaceous shale (Mathews 1980).

3.0 METHODS

The following section provides a description of the methods used to collect baseline terrain information along the Groundbirch Connector. To assess baseline conditions, a review of background information, preliminary terrain mapping, field surveys and final terrain mapping was completed for the terrain LSA.

Most of the terrain LSA is within the boundary of the Project's EAC Application Terrestrial Ecosystem Mapping (TEM) study area (Coastal GasLink 2014a) and partially overlaps and is adjacent to two Agricultural Land Reserve (ALR) soils mapping projects (Coastal GasLink 2014b,c). The existing digital TEM linework for the EAC Application (Coastal GasLink 2014a) and adjacent soils mapping data were used as a basis for desktop review, preliminary terrain mapping and field survey planning, and final terrain mapping.

New 2019 terrain mapping was completed along the eastern boundary of the terrain LSA where the original 2014 mapping did not extend. This new mapping was 'edge-matched' to the existing 2014 TEM mapping terrain units. The original TEM terrain units were updated during preliminary and final terrain mapping using newer imagery, adjacent terrain/soils datasets, and 2019 field survey information.

Details on methods are provided below.

3.1 REVIEW OF BACKGROUND INFORMATION

Existing background information related to regional terrain conditions was reviewed, including the following reports and datasets:

- Adjacent terrain and soils projects:
  - Terrestrial Ecosystem Mapping (TEM) for the original EAC Application (Coastal GasLink 2014a).
  - Schedule A Report for the Proposed Wilde Lake Compressor Station (Coastal GasLink 2014b)
  - Schedule A Report for Construction Section 1 of the Proposed Pipeline Construction Corridor (Coastal GasLink 2014c)
  - Schedule A Report for RE-620.0 (Coastal GasLink 2020)
  - Soils of the Fort St. John -Dawson Creek area, British Columbia. Report No.42 (Lord and Green 1986).
- Digital Bedrock Geology Map of British Columbia (Massey et al. 2005).
- BC Government 1:50,000 TRIM and Digital Elevation Model (DEM)
- Light Detecting Radar (LiDAR) derived from DEM for slope and elevation interpretation

- BC Government Fresh Water Atlas, Watershed Atlas and Wetland Data
- BC Government spatial files (Google Earth ®, .kmz files) from existing BC soil survey information (Lord and Green 1986) and existing agricultural capability mapping accessed from the BC Soil Information Center (Province of British Columbia - BC Soil Information Finder Tool, Accessed August-September 2019)

3.2 TERRAIN MAPPING

All mapping was performed using standards presented in the following documents:

- Howes, D.E. and E. Kenk. 1997. Terrain classification system for British Columbia. Surveys and Resource Mapping Branch: Victoria. 102 pp.
- Resources Inventory Committee. 1998. Standard for digital terrain data capture in British Columbia: Terrain technical standard and database manual. Terrain Data Working Committee. 111 pp.
- Resources Inventory Committee. 1996. Guidelines and standards to terrain mapping in British Columbia. Surficial Geology Task Group. 131 pp.

Preliminary and final terrain mapping (including both linework and classification) was reviewed by a qualified Stantec senior terrain scientist to confirm mapping adheres to provincial standards, following quality control processes and the standards listed above.

3.2.1 Preliminary Mapping

Available imagery from 2018 and DEM were used with existing terrain and soils datasets (Coastal GasLink 2014a,b,c) to classify terrain units within the terrain LSA. Digital files were overlain on the client-provided proposed spatial boundaries using Environmental Systems Research Institute (ESRI) ® ArcMap programs and tools.

Preliminary terrain mapping was completed at 1:10,000 scale. Relatively homogenous terrain units were delineated at scales ranging from 1:10,000 to 1:1,000 during the mapping process; however, for presentation purposes mapping is provided at a scale of 1:15,000.

Terrain mapping was completed using ESRI ® ArcMap program and tools utilizing topographic and imagery data. Terrain units were delineated based on surficial material texture, surficial geology (e.g., glaciolacustrine, till, organic), surface expression (e.g., blanket, undulating, veneer), drainage (e.g., well drained, poorly drained), slope range (class), and geomorphological process (e.g., surface seepage, gullying).

3.2.2 Final Mapping

The purpose of the final mapping was to modify any of the preliminary linework and classification by incorporating the site-specific data from the field program. Final mapping and classification were reviewed by a senior terrain scientist to confirm compliance with provincial standards and to confirm that the linework and classification properly reflected the nature of the terrain in the terrain LSA.

3.3 FIELD SURVEYS

Terrain field data were collected in conjunction with the 2019 TEM and Soils TDR programs, carried out from August 1 to August 5, 2019. Terrain mapping field surveys followed Terrain Survey Intensity Levels (TSILs) outlined in *Mapping and Assessing Terrain Stability Guidebook* (BC MOF 1999).

The purpose of the field surveys was to ground truth the preliminary mapping and to collect detailed field data on the parent materials, surface expression, depth to bedrock, slopes, drainage and geomorphological processes. The field surveys completed focused on the Groundbirch Connector Footprint.

The following data was recorded for each inspection site:

- global positioning system (GPS) coordinates
- elevation
- slope and aspect
- surficial (parent) material (e.g., glaciolacustrine)
- surface expression (e.g., undulating, steep, etc.)
- depth to bedrock (where practical)
- clast content, size and angularity (coarse fragment content)
- sorting and structure of sediment (e.g., matrix or clast supported)
- matrix texture (e.g., gravelly sandy silt)
- drainage (e.g., well, poor, etc.)
- geomorphological processes (e.g., seepage, gullying)
- notes and supporting documentation (e.g., land use, vegetation type, landforms, boulders on the surface, etc.)

Photographs were taken of the inspection sites and the surrounding landscape. Sketch diagrams of key landscape features were drawn.

Additionally, 14 soil samples were collected from select A (topsoil), B (subsoil), and C (parent material) horizons from nine inspection sites and sent for laboratory analysis (refer to Appendix A Groundbirch Connector Soils TDR for details). Applicable results were used for further terrain mapping delineation.

3.4 ACID-ROCK DRAINAGE POTENTIAL

Desktop analysis was used to determine ARD potential for the Groundbirch Connector Footprint. Data were gathered from an area extending up to 5 km on each side of the Groundbirch Connector Footprint to account for regional perspective of geological (bedrock) units, drainage paths from known mine sites, and other directional features of the Groundbirch Connector. No sampling or quantitative tests, such as acid-base accounting was completed.

The following provincial and federal government regulations and guidelines related to ARD were reviewed as part of the desktop assessment:

- Policy for Metal Leaching (ML) and ARD at Minesites in British Columbia (BC Ministry of Energy and Mines and Ministry of Environment, Lands and Parks 1998)
- Guidelines for ML and ARD at Minesites in British Columbia (Price and Errington 1998)
- Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia (Price 1997)
- ML and ARD Assessment and Mitigation at the Johnny Mountain Gold Mine (Price and Yaeger 2004)
- List of Potential Information Requirements in Metal Leaching/Acid Rock Drainage Assessment and Mitigation Work (Price 2005)
- Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009)
- Community Watershed Guidebook (BC MOF 1996)
- Forest Road Engineering Guidebook, Second Edition (BC MOF 2002)
- Aggregate Operators Best Management Practices Handbook for British Columbia (BC Ministry of Energy and Mines 2002)

The exposure and subsequent weathering of some types of bedrock can cause ARD. In most cases, ARD is associated with the mineralization of iron sulfides (i.e., pyrite, chalcopyrite and pyrrhotite) that are naturally occurring within certain rock formations, being exposed to weathering agents such as air and water, resulting in the generation of an acid. The acid can be neutralized when other minerals such as carbonates (i.e., calcite or dolomite) are present in the same rock. However, if the

acid is not neutralized or diluted, ARD will occur, lowering the pH of runoff water and possibly leading to indirect adverse effects on the receiving environment. The objective of the ARD component of this TDR is to determine and define areas at potential risk of ARD along the Groundbirch Connector.

Evaluation of potential of ARD along the Groundbirch Connector involved reviewing existing bedrock mapping and incorporating terrain mapping information to determine the type of bedrock underlaying the Groundbirch Connector and assess the approximate depth to bedrock. Mapped bedrock along the Groundbirch Connector was assessed for ARD potential and rated as None, Low, Medium and High based on estimated Neutralization Potential Ratio (NPR) values which is used as the basis for identifying areas with ARD potential, as describe in Price (2009). As part of initial screening of pipeline route conditions, NPR was estimated from existing bedrock maps, terrain mapping and assumed depth to bedrock.

4.0 RESULTS

4.1 TERRAIN MAPPING

A summary of dominant parent (surficial) materials within the Groundbirch Connector Footprint and terrain LSA is provided in Table 4-1 and presented on Figure 4-1.

Table 4-1: Parent Materials in the Groundbirch Connector Footprint and Terrain LSA within the Alberta Plateau

Dominant Parent (Surficial) Materials	Groundbirch Connector Footprint		Terrain LSA	
	Area (ha)	Area Percent (%)	Area (ha)	Area Percent (%)
Anthropogenic	-	-	8	1%
Glaciolacustrine	31	100	826	86%
Morainal (till)	-	-	95	10%
Organic	-	-	35	4%
Total	31	100	963	100%
NOTE: Numbers are approximate due to rounding				

The dominant surficial material in the terrain LSA is glaciolacustrine (86%). Rolling till deposits were mapped along the western portion of the terrain LSA, accounting for approximately 10% of the terrain LSA. Minor amounts of organic materials cover 2% of the terrain LSA. Glaciolacustrine deposits accounts for 100% of the Groundbirch Connector Footprint.

Glaciolacustrine material textures range from clay to sandy silt, although most deposits were found to have a silty clay matrix, with less than 2% subrounded and subangular pebble dropstones; coarse fragments are rare. These materials are assumed to be thick (based on literature review and field data), likely in excess of 1 m in depth, and may be interbedded with glaciofluvial and till materials. The glaciolacustrine deposits range from moderately well to imperfectly drained along the broad, level to gently sloping slopes, and imperfectly to poorly drained in small depressions.

Till was mapped in 10% of the terrain LSA and was not directly observed in the 2019 field survey. Till terrain units were mapped in the western portion of the terrain LSA, associated with more rolling to undulating topography. Textures range from clayey silt (cz) to silty clay (zc) to clay (c) with up to 5% coarse fragments, including subrounded and subangular pebbles and cobbles (Coastal GasLink 2014a).

Organic material generally ranges from fibric to mesic, is very poor to poorly drained and is commonly found overlying glaciolacustrine sediments in shallow depressions.

4.2 FIELD SURVEYS

A summary of field inspection sites within the study areas is presented in Table 4-2 and shown on Figure 4-1.

Table 4-2: Terrain Study Areas Field Survey Inspection Site Summary

Study Area	2019 Field Inspections (number of sites)	Previous Field Inspections (for EAC, Coastal GasLink 2014a)	Total Number of Terrain Units (polygons)	Total Number of Terrain Units Intersecting All Field Plots
Groundbirch Connector Footprint	28	0	20	9
Terrain LSA	50	5	106	26

TSIL C was achieved with 25% of terrain polygons checked by foot traverses (BC MOF 1999); approximately equivalent to 50% of all terrain units delineated in the terrain LSA.

4.3 ACID-ROCK DRAINAGE

Bedrock was not encountered or observed at any of the inspection sites. Based on desktop analysis and field observations, it is assumed that the Groundbirch Connector pipeline trench will be constructed in surficial materials (primarily glaciolacustrine and till). As there appears to be no potential to encounter bedrock, it is anticipated that there are no conditions that will result in ARD. Therefore, the ARD potential of the Groundbirch Connector has been deemed negligible (i.e., rated as none).

630500 631000 631500 632000 632500 633000 633500 634000 634500 635000 635500 636000

6188000 6187500 6187000 6186500 6186000 6185500 6185000 6184500

N W E S

2-79-19 W6M

4-79-19 W6M

3-79-19 W6M

1-79-19 W6M

Rd 271

Rd 212

33-78-19 W6M

35-78-19 W6M

32-78-19 W6M

34-78-19 W6M

Rd 265

Wilde Lake C/S

Sin Lake

Conbio Creek

760 780 800 820

2019 Field Survey Inspection Sites
Previous EAC Inspection Sites
Coastal GasLink Pipeline
Certified Project Corridor
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Terrain Local Study Area (LSA) - 1 km buffer
Groundbirch Connector Project Footprint
Existing Pipeline
Existing Road
Railway
TRIM Contour (20 m Interval)
Water Course
BC Township System- Sections Grid (34-78-19 W6M)
Flooded Land (i.e. swamps/marshes)
Water Body

Dominant Surficial Materials

- A -Anthropogenic (disturbed)
- LG - Glaciolacustrine
- M - Moraine (Till)
- O - Organic

Note: Data sets sourced on this map are available from the CGP PDP Metadata System

REVISION	
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1:15,000 0 250 500 1,000 Metres

Coastal GasLink Pipeline Project

TC Energy

Figure 4-1: Proposed Connector - Dominant Surficial Material

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513287_0006	

STANTEC: W:\Clients\TransCanada\Coastal_GasLink\Figures\Soils_Terrain\123513287_0006.mxd

5.0 KEY FINDINGS AND CONCLUSIONS

There are no substantial differences between the baseline information reported in the EAC Application for the Project (Coastal GasLink 2014a) and baseline information reported in this TDR.

Thick (more than 1 m) glaciolacustrine deposits are the most common surficial-material accounting for 87% of the terrain LSA and 100% of the Groundbirch Connector Footprint. The ARD potential of the Groundbirch Connector has been deemed negligible (i.e., rated as None) as it is anticipated that bedrock will not be encountered in the proposed pipeline trench. However, if bedrock is encountered during construction it is recommended that rock samples be assessed for ARD potential.

6.0 REFERENCES

BC Ministry of Energy and Mines and Ministry of Environment, Lands and Parks. 1998. Policy for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia. Website Accessed August – September 2019: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/gwbc/index.html

BC EAO 2013 (British Columbia Environmental Assessment Office). Coastal GasLink Pipeline Project Application Information Requirements (AIR) For an Environmental Assessment Certificate.

BC EAO. 2014. Coastal GasLink Pipeline Project Environmental Assessment Certificate # E14-03.

BC EAO. 2020a. EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018). Version 1.01. March 2020. p. 53.

BC EAO. 2020b. Guide to Indigenous Knowledge in Environmental Assessments. Version 1.0. April 2020. p. 20.

BC MOF (British Columbia Ministry of Forests). 1996. Community Watershed Guidebook.

BC MOF. 1999. Forest Practices Code – Mapping and assessing terrain stability guidebook. Second Edition. Ministry of Forests. 43 pp.

BC MOF. 2002. Forest Road Engineering Guidebook.

BC Ministry of Energy and Mines. 2002. Aggregate Operators Best Management Practices Handbook for British Columbia.

Catto, N.R., Liverman, D.G.E., Bobrowsky, P.T. and Rutter, N.W. 1996. Laurentide, Cordilleran, and Montane glaciation in the West Peace River- Grande Prairie Region, Alberta and British Columbia, Canada. Quaternary International, 32: 21-32. British Columbia. Geological Survey of Canada, Bulletin 273, 31 pp.

Clague, J.J., 1989. Cordilleran ice sheet. In: Fulton, R.J. (Ed.), Quaternary Geology of Canada and Greenland, Vol. 1. Geological Survey of Canada, Geology of Canada, Ottawa, Ontario, pp. 40–42 (also Geological Society of America, The Geology of North America, Vol. K-1) Boulder, CO

Coastal GasLink (Coastal GasLink Pipeline Limited). 2014a. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate. Website: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_392_37367.html.

Coastal GasLink. 2014b. Schedule A Report for the Proposed Wilde Lake Compressor Station. Prepared by Stantec Consultants Ltd. for the client Coastal GasLink Limited.

Coastal GasLink. 2014c. Schedule A Report for Construction Section 1 of the Proposed Pipeline Construction Corridor. Prepared by Stantec Consultants Ltd. for the client Coastal GasLink Limited.

Coastal GasLink. 2020. Schedule A Report for the Proposed Access Road RE-620.A. Prepared by Stantec Consulting Ltd. for Coastal GasLink Pipeline Limited.

Fladmark, K.R., Driver, J.C., and Alexander, D. 1988. The Paleo-Indian Component at Charlie Lake Cave (HbRf-39), British Columbia. American Antiquity, 53: 371–384. Doi:10.2307/ 281025.

Holland, S.S., 1976. Landforms of British Columbia, a Physiographic Outline. Bulletin No. 48. BC Ministry of Mines and Petroleum Resources, Victoria. 138 pp.

Howes, D.E. and E. Kenk. 1997. Terrain Classification System for British Columbia, Version 2. Ministry of Environment and Ministry of Crown Lands Province of British Columbia MOE Manual 10.

Lord, T.M. and A.J. Green. 1986. Soils of the Fort St. John -Dawson Creek area, British Columbia. Report No.42. Research Branch, Agriculture Canada. 140pp.

Massey, N.W.D., D.G. MacIntyre, J.W. Haggart, P.J. Desjardins, C.L. Wagner and R.T. Cooney. 2005. Digital Geology Map of British Columbia: Tile NN8-9 North Coast and Queen Charlotte Islands/Haida Gwaii. Ministry of Energy and Mines, British Columbia Geological Survey, Geofile 2005-5. 1:250,000. Victoria, BC.

Mathews, W.H. 1980. Retreat of the last ice sheets in northeastern British Columbia and adjacent Alberta. Geological Survey of Canada, Bulletin 331, 22 pp.

Maxwell, R. 1987. Biophysical Soil Resources and Land Evaluation of the Northeast Coal Study Area, 1977—1978 Jarvis Creek—Morkill River Area. Wildlife Branch British Columbia Ministry of Environment and Parks. British Columbia Soil Survey, Report No. 41. Victoria, BC.

Price, W.A. 1997. Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia

Price, W.A. 2005. List of Potential Information Requirements in Metal Leaching/Acid Rock Drainage and Mitigation Work. MEND Report 5.10e

Price, W.A. 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. Draft report prepared for MEND. Report 1.20.1.

Price, W.A and D. Yeager. 2004. ML/ARD Assessment and Mitigation at the Johny Mountain Gold Mine. MEND Report 9.1a

Price, W.A and J.C. Errington. 1998. Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia.

Reimchen, T.H. and Bouvier, G.C. 1980. Surficial geology, Dawson Creek, British Columbia. Geological Survey of Canada, Map 1467A, scale 1: 250 000.

Resources Inventory Committee. 1996. Guidelines and standards to terrain mapping in British Columbia. Surficial Geology Task Group. 131 pp.

Resources Inventory Committee. 1998. Standard for digital terrain data capture in British Columbia: Terrain technical standard and database manual. Terrain Data Working Committee. 111 pp.

Appendix B-1: Abbreviations and Acronyms

Abbreviation	Definition
Units of Measurement	
km	kilometre = 1000 metres
m	metre
%	percent
Other Terms	
ARD	acid rock drainage
ALR	Agricultural Land Reserve
BEC	Biogeoclimatic Ecological Classification
BC	British Columbia
Coastal GasLink	Coastal GasLink Pipeline Limited
DEM	Digital Elevation Model
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
ESRI	Environmental Systems Research Institute
GPS	global positioning system
LiDAR	Light Detecting Radar
LSA	local study area
Masl	metres above sea level
ML	Metal leaching
MOE	Ministry of Environment
NPR	Neutralization Potential Ratio
NPS	Nominal Pipe Size
Project	Coastal GasLink Pipeline Project
ROW	right-of-way
RSA	regional study area
TDR	Technical Data Report
TEM	Terrestrial Ecosystem Mapping
TLRU	Traditional Land and Resource Use
TSIL	Terrain Survey Intensity Levels

Appendix C
Groundbirch Connector
Atmospheric Environment
Technical Memorandum

Stantec

Memo

To:	Jeff Quennelle, Environmental Advisor Coastal GasLink Pipeline Limited	From:	April Hauk, Air Quality Scientist Stantec Consulting Ltd.
File:	123513287 Coastal GasLink Groundbirch Connector Project	Date:	October 13, 2020

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix C Groundbirch Connector Atmospheric Environment Technical Memorandum

INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at:
https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Atmospheric Environment Technical Memorandum includes relevant baseline information for the proposed Groundbirch Connector.

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix C Groundbirch Connector Atmospheric Environment Technical Memorandum

PROJECT UNDERSTANDING

The Groundbirch Connector construction activities have a potential to result in a change in air quality, however, the effects on air quality as a result of construction are small and short-term. The interaction of these emissions with current and reasonably foreseeable emissions in the vicinity of the Groundbirch Connector will be limited. As a result, construction emissions of Criteria Air Contaminants (CACs) are not considered in the atmospheric assessment. Further, the Groundbirch Connector will produce negligible CAC emissions during normal operating conditions; therefore, the effect of operation on air quality is not considered further in the Assessment.

The Groundbirch Connector construction activities will emit greenhouse gas (GHG) emissions through use of off-road and on-road equipment. During operation, the Groundbirch Connector may emit fugitive GHG emissions. As the length of pipeline is relatively small, at approximately 3 km, and the implementation of mitigation measures applied through Coastal GasLink's Leak Detection and Repair Program, fugitive emissions are expected to be negligible during operation. Therefore, GHG emissions from the operation of the Groundbirch Connector pipeline segment are not considered further in the atmospheric assessment.

The noise assessment considers construction phase noise emissions only. Noise from operation of the Groundbirch Connector is considered negligible because the pipeline will be underground and the aboveground facilities (e.g., launcher and receiver) are not noise emitting. Operation phase noise emissions are not considered further in the atmospheric assessment.

GHG EMISSIONS

A GHG can be any atmospheric gas that absorbs and re-emits infrared radiation, thereby acting as a thermal blanket for the planet and warming the lower levels of the atmosphere. GHGs are released to the atmosphere from a number of natural and anthropogenic (human activity) sources (IPCC 2013). The GHGs expected to be released from the Groundbirch Connector are carbon dioxide (CO_2), methane (CH_4) and Nitrous oxide (N_2O).

GHGs mix and disperse well in the atmosphere (IPCC 2013); in addition, the environmental effects related to GHGs are global and not limited to any spatial boundaries. Therefore, the focus of the Assessment will be on the source of emissions, such as the physical works.

Emissions of each of the specific GHGs are multiplied by their 100-year global warming potential (GWP) and are reported as carbon dioxide equivalent (CO_2e). On this basis, carbon dioxide equivalents (CO_2e) for the Groundbirch Connector are calculated as:

$$CO_2e = (\text{mass } CO_2 \times 1.0) + (\text{mass } CH_4 \times 25) + (\text{mass } N_2O \times 298)$$

Construction activities, including site preparation, trenching and installation of the pipeline, mechanical, electrical, and instrumental installations as well as transportation of construction personnel and supplies will emit GHGs. GHG emissions from these various construction activities are categorized into site preparation (land clearing and decay), off-road, and on-road equipment emissions.

Due to the location of the Groundbirch Connector, primarily on agricultural land, minimal site preparation (land clearing and decay) will be required for construction. GHG emissions from these activities will be negligible, and are therefore not considered further in this atmospheric assessment. The atmospheric assessment is limited to emissions from off-road, and on-road equipment.

Pipeline construction equipment emissions are calculated using fuel use estimates, and published emission factors for equipment type (off-road, on-road), such as bulldozers, graders, pipe layers, excavators and fuel type (ECCC 2020). Total construction-related GHG emissions amount to approximately 1,387.1 tonnes CO_2e. Emissions related to off-road equipment represent approximately 66.7% of the total construction GHG emissions and on-road equipment represents 33.3% of the total construction GHG emissions. Quantities of GHGs released during construction of the Groundbirch Connector are summarized in Table 1 and are based on inputs and assumptions provided by Coastal GasLink.

Table 1 Summary of Construction GHG Emissions Estimate for the Groundbirch Connector

Emission Source	GHG Emissions (tonnes CO_2e)			Total	
	CO_2	CH_4	N_2O	CO_2e (tonnes)	Percent (%)
Off-Road Equipment	921.5	1.3	2.2	925.0	66.7
On-Road Equipment	457.3	0.5	4.3	462.1	33.3
Total GHG emissions from Construction	**1,378.7**	**1.9**	**6.6**	**1,387.1**	**100.0**
NOTE: Totals and individual row numbers might not add up due to rounding.					
SOURCE: (ECCC 2020)					

Mitigation measures contained within Coastal GasLink's approved Environmental Management Plan (EMP) (Coastal GasLink 2018) will be implemented to reduce the release of GHGs during construction activities.

NOISE

The following section addresses the noise effect due to pipeline construction activities associated with the Groundbirch Connector. The thresholds for short-term activities such as pipeline construction are based on the Health Canada noise guidance (Health Canada 2017). Compliance is measured according to the Health Canada 2017 recommendations, where the Heath Canada noise guidance recommends that noise from short-term (less than one year) construction activities at residential receptors be limited to the basic Mitigated Noise Level (MNL) value of 47 A-weighted decibel scale (dBA) day-night average sound level (L_{dn}). An adjustment of +10 dB to MNL is applicable if the construction activity duration is less than two months. An adjustment of +5 dB to the MNL is applicable if there is negligible tone (i.e., backup alarm) or impulsive noise.

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix C Groundbirch Connector Atmospheric Environment Technical Memorandum

The noise emissions for pipeline construction activities associated with the Groundbirch Connector are based on sound power levels predicted in the original EAC Application for the Project (Coastal GasLink 2014), which is considered conservative. The sound power level and assessment methods are consistent with the Noise Assessment completed for the Project (Coastal GasLink 2014). For pipeline construction, maximum noise emissions were set at 86 dBA sound power per 1 metre (m) of pipeline (BC OGC, 2018). The estimated noise emissions are based on daily intensity of construction activities corresponding to 3000 horsepower (hp) of equipment (e.g., bulldozers, graders, pipe layers, excavators) per 1-km section of construction operating with a utilization rate of 75%, confirmed by Coastal GasLink. The total noise emissions from each 1-km long section of the pipeline were estimated at 116 dBA. Construction equipment was assumed to have standard engine exhaust mufflers and be well maintained. The assessment assumed that construction activities occur during the daytime period of 7:00 AM to 10:00 PM.

Table 2 shows the construction noise emission levels for the Groundbirch Connector.

Table 2 Sound Power Level for Construction Activities of the Groundbirch Connector

Octave Band Center Frequency (Hz)	**Pipeline construction Sound Power Level per 1 m [a] of pipeline route (dBA)**
31.5	81
63	85
125	90
250	83
500	80
1000	83
2000	77
4000	72
8000	66
dBA[b]	**86**

NOTES:

[a] inclusive of all construction equipment sources

[b] For pipeline construction, maximum noise emissions were set at 86 dBA sound power per 1 metre (m) of pipeline route

Sound propagation calculations used in this assessment were in accordance with ISO 9613 Standard (ISO 1993; 1996). ISO 9613 is commonly used among noise practitioners and is accepted by the British Columbia Oil and Gas Commission (BC OGC; BCOGC 2018). Calculations under ISO 9613 account for mild inversion and/or downwind condition (winds from source to receiver of 3 to 11.4 km/h). ISO 9613 standards are recognized by Health Canada.

Propagation calculations were performed using Cadna/A computer program from DataKustik, a noise modeling software package incorporating ISO 9613 algorithms. The model accounted factors such as geometric spreading, air and ground absorption, screening effects, noise sources directivity, atmospheric effects of downwind conditions and/or mild temperature inversion.

The prediction results indicate that a minimal buffer distance of 500 m should be maintained between the pipeline construction activities and residential locations in order to meet the noise threshold of 47 dBA L_{dn}. A review of the Groundbirch Connector Footprint indicates that there are no residential dwellings within 500 m of the proposed route. However, the closest residence is approximately 780 m east of the Groundbirch Connector Footprint, and an additional residence within 890m southeast of the proposed route. Therefore, the construction noise effect is predicted to meet the Health Canada noise threshold of 47 dBA L_{dn} at these residences, within 1.5 km of the Groundbirch Connector Footprint.

KEY FINDINGS AND CONCLUSIONS

Effects on air quality as result of construction of the Groundbirch Connector are small and short-term. In operation, the Groundbirch Connector will emit negligible CAC emissions.

The Groundbirch Connector construction activities will emit GHG emissions through use of off-road and on-road equipment. GHG emissions from construction related activities are estimated to be 1,387.1 tonnes of CO_2e; 66.7% of the total are from off-road equipment and 33.3% are from on-road equipment. Mitigation measures contained within Coastal GasLink's approved Environmental Management Plan (EMP) (Coastal GasLink 2018) will be implemented to reduce the release of GHGs during construction activities.

The noise assessment considered noise emissions during construction only. Pipeline construction activities should maintain a minimum buffer distance of 500 m from known residential dwellings. Review of the Groundbirch Connector route indicates that there are no residential dwellings within 500 m of the Groundbirch Connector, however, known residences are located within 1.5 km of the Groundbirch Connector Footprint. The construction noise effect is predicted to meet the Health Canada noise threshold of 47 dBA L_{dn} at these residences, within 1.5 km of the Groundbirch Connector Footprint.

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix C Groundbirch Connector Atmospheric Environment Technical Memorandum

CLOSURE

Stantec has prepared this memo for Coastal GasLink to support the development of an EAC Amendment application to include the Groundbirch Connector. Stantec trusts that the information contained within meets this requirement.

Should additional information become available, which differs significantly from our understanding of conditions presented in this report, we request that this information be brought to our attention, so that we may reassess the conclusions provided herein.

This report was, prepared by April Hauk, B.Sc., EP, and Jonathan Chui, P.Eng., INCE, quality reviewed by Lina Wang, B.Sc., independently reviewed by Chris Blair. Should Coastal GasLink have questions or require additional information, please contact the undersigned at your convenience.

Regards,

Stantec Consulting Ltd.

Digitally signed by April Hauk
Date: 2020.10.08 12:41:32 -07'00'

April Hauk B.Sc., EP
Senior Environmental Atmospheric Specialist
Phone: 250-852-5921
april.hauk@stantec.com

Chui, Jonathan

Digitally signed by Chui, Jonathan
Date: 2020.10.08 13:33:16 -06'00'

Jonathan Chui P.Eng., INCE
Senior Associate - Acoustics
Phone: 403-750-2337
Jonathan.chui@stantec.com

REFERENCES

BC OGC (BC Oil and Gas Commission). 2018. British Columbia Noise Control Best Practices Guideline, 2018.

Coastal GasLink (Coastal GasLink Pipeline Limited) 2014. Coastal GasLink Pipeline Project. Noise Technical Data Report. March 2014

Coastal GasLink Pipeline Project. 2018. Environmental Management Plan. TransCanada, Canada.

ECCC. 2020. Strategic Assessment of Climate Change. Available online: https://www.strategicassessmentclimatechange.ca. Accessed August 2020.

Health Canada 2017. Guidance for Evaluating Human Health Impacts in EA: Noise. 2017.

IPCC. 2013. Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Appendix D
Groundbirch Connector
Fish Habitat Assessment
Technical Memorandum

Stantec

Memo

To:	Jeff Quennelle, Environmental Advisor Coastal GasLink Pipeline Ltd.	From:	Erin Cameron, Aquatic Biologist Stantec Consulting Ltd.
File:	123513287 Coastal GasLink Groundbirch Connector Project	Date:	October 13, 2020

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix D Groundbirch Connector Fish Habitat Assessment Technical Memorandum

INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

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https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Fish Habitat Assessment Technical Memorandum includes relevant baseline information for the proposed Groundbirch Connector.

FIELD PROGRAM RESULTS

A two-person crew assessed the proposed Groundbirch Connector route on August 5 and August 6, 2019. The majority of the Groundbirch Connector route is within cultivated lands or pasture resulting in high visibility for the detection of hydrologic features and high confidence in the results of the assessment.

In addition to the cultivated lands and pastures, the Groundbirch Connector route crosses a forested area, which was identified with the potential to contain streams (Figure 1-1). Through review of the Terrain Resource Information Management (TRIM) database during the desktop review of the Groundbirch Connector route, one potential stream was identified (Site ID 1660). Stantec field crews assessed the area and, although some hydrophytic vegetation (e.g., willow, moss) was identified, no waterbody or stream channel was evident.

A second potential stream was identified on the Groundbirch Connector survey plans; however, field assessments determined this crossing to be a dry swale and is not connected to fish habitat (see Attachment 1, Site ID 1661).

Therefore, based on the field assessment, no streams have been identified within the Groundbirch Connector Footprint. The results of the assessment are presented in Table 1-1 and Site Photos are presented in Attachment 1. Watercourse crossings are shown on Figure 1-1.

Table 1-1 Groundbirch Connector Route Aquatic Assessment Results

Site Number	Associated TRIM Line	Location	Stream Class [1]	Assessment Notes
1660	No	10U 634196E, 6186246N	NVC[2]	Treed area in between cultivated land (hay field). Abundance of willows and moss in this area, lower lying area, likely wet seasonally. No water present or evidence of channel.
1661	Yes	10U 634200E, 6186172 N	NVC[2]	Dry swale within cultivated land (hay field). Some wetland species present. This area was dry at time of assessment. Water would appear to drain to this area via a field ditch located to the west. No evidence of a channel within the right-of-way. The dugout located on east side of the right-of-way may receive water from this area through diffuse flow. No connectivity to fish habitat.

NOTES:

[1] Forest Practices Code of British Columbia. 1998. Fish-stream Identification Guidebook. Version 2.1. Available at: https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/fish/FishStream.pdf. Accessed July 2020

[2] Non-visible Channel

632000 632500 633000 633500 634000 634500 635000

6187000 6186500 6186000 6185500

SW-3-79-19-W6
SE-3-79-19-W6
Rd 212
SW-2-79-19-W6
SE-2-79-19-W6
SW-1-79-19-W6
N
W
E
S
NW-35-78-19-W6
NE-34-78-19-W6
NW-33-78-19-W6
NE-33-78-19-W6
NW-34-78-19-W6
NE-32-78-19-W6
Rd 205
1660 - NVC
1661 - NVC
SE-33-78-19-W6
SW-34-78-19-W6
SE-34-78-19-W6
SW-35-78-19-W6
Sin Lake
0+000
NE-28-78-19-W6
NW-27-78-19-W6

Kilometre Post
Watercourse Crossing
Coastal Gaslink Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Groundbirch Connector Project Footprint
Quarter Section
Road
TRIM Watercourse

Note: Data sets sourced on this map are available from the CGP PDP Metadata System

REVISION	DESCRIPTION: xxxxx
0	Review

1:8,000 0 65 130 260 390 520 Metres

Coastal GasLink Pipeline Project
TC Energy

Figure 1-1:
Watercourse Crossings on the Proposed Groundbirch Connector Project Route

Route Reference: Groundbirch COnnector Pipeline Project	10/9/2020
Document No.: 123513287-0017	Groundbirch Connector

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix D Groundbirch Connector Fish Habitat Assessment Technical Memorandum

KEY FINDINGS

During the survey no streams were identified during field assessments that met the definition of a stream (i.e., S1 to S6 stream or non-classified drainage) detailed in the Fish Stream Identification Guidebook (Forest Practices Code of British Columbia, 1998) that would require permitting under British Columbia's *Oil and Gas Activities Act*. The *Fisheries Act* contains provisions for the prevention of 'harmful alteration, disruption, or destruction of fish habitat' (Section 35). Fish habitat is defined in subsection 2(1) of the *Fisheries Act* to include all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes.

The Groundbirch Connector has no potential to directly or indirectly interact with fish habitat, as no streams are present within the proposed Groundbirch Connector route or in areas where facilities (e.g., launcher/received, access road, temporary workspace) are planned. No further consideration of the *Fisheries Act* is required for the Groundbirch Connector.

CLOSURE

We trust that this meets your current requirements for assessment of potential effects on the aquatic environment and stream permitting requirements. Please feel free to contact the undersigned with any questions you may have.

Stantec Consulting Ltd.

Digitally signed by Erin Cameron
Date: 2020.10.10 16:26:52 -06'00'

Erin Cameron B.Sc., P.Biol., RP.Biol.
Aquatic Biologist
Phone: 587-926-7237
erin.cameron@stantec.com

Attachment: Attachment 1 – Site Photos

REFERENCES

BC EAO (British Columbia Environmental Assessment Office). 2014. Coastal GasLink Pipeline Project Environmental Assessment Certificate # E14-03. Available at: http://a100.gov.bc.ca/appsdata/epic/documents/p392/1414168837008_ZXZPJKQpsCJ7p994vTQyyJhsM8TBWSnzlv34wMyC67yCBwdyhKHr!- 351597226!1414168702186.pdf. Accessed August 2020.

Coastal GasLink. 2014a. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate. Available at: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_392_37367.html. Accessed August 2020.

Forest Practices Code of British Columbia. 1998. Fish-stream Identification Guidebook. Version 2.1. Available at: https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/fish/FishStream.pdf.Accessed July 2020.

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix D Groundbirch Connector Fish Habitat Assessment Technical Memorandum

ATTACHMENT 1 SITE PHOTOS

Stantec

Photographic Log

Client:	**Coastal GasLink Pipeline Ltd.**	**Project:**	**Fish Habitat Assessment**
Site Name:	**Coastal GasLink Pipeline**	**Site Location:**	**Groundbirch Connector**

Photograph ID: 1 **Photo Location:** Site 1660 **Direction:** Overview **Survey Date:** 8/6/2019 **Comments:** Note that no defined channel or evidence of drainage is visible.	
Photograph ID: 2 **Photo Location:** Site 1660 **Direction:** Viewing ground conditions **Survey Date:** 8/6/2019 **Comments:** Note that no defined channel or evidence of drainage is visible.	

Client:	**Coastal GasLink Pipeline Ltd.**	**Project:**	**Fish Habitat Assessment**
Site Name:	**Coastal GasLink Pipeline**	**Site Location:**	**Groundbirch Connector**

Photograph ID: 3 **Photo Location:** NVC Site 1661 **Direction:** Viewing east towards dugout **Survey Date:** 8/6/2019 **Comments:** Note dugout. No defined channel or evidence of drainage is visible at crossing location.	
Photograph ID: 4 **Photo Location:** NVC Site 1661 **Direction:** Viewing west across field **Survey Date:** 8/6/2019 **Comments:** Note wetland vegetation. No defined channel or evidence of drainage is visible at crossing location.	

Appendix E
Groundbirch Connector
Hydrology Technical Memorandum

Stantec

Memo

To:	Jeff Quennelle, Environmental Advisor Coastal GasLink Pipeline Ltd.	From:	Matthew Friend and David Luzi, Hydrologists Stantec Consulting Ltd.
File:	123513287 Coastal GasLink Groundbirch Connector Project	Date:	October 13, 2020

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): Appendix E Groundbirch Connector Hydrology Technical Memorandum

INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at:
https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Hydrology Technical Memorandum includes relevant baseline information for the proposed Groundbirch Connector.

STUDY AREA BOUNDARIES

The Groundbirch Connector Footprint is the area potentially affected by physical works and activities, such as clearing, construction and cleanup. The Groundbirch Connector Footprint is delineated by a 50-m wide buffer on each side of the pipeline centreline, and encompasses the construction ROW, the permanent ROW, an access road, temporary workspace, and tie-in locations.

The LSA was used to assess surface water quality data and water license Points of Diversion. It is based on the area in which Groundbirch Connector project activities and facilities could potentially affect hydrology. The LSA includes the Groundbirch Connector Footprint plus a broader 5 km buffer centred on the Groundbirch Connector Footprint.

The RSA is established to evaluate potential effects of the proposed Groundbirch Connector on hydrology on a landscape scale. Baseline data in the RSA also facilitates an assessment of potential Groundbirch Connector project-related adverse effects on hydrology, with consideration of effects from other projects and ongoing activities that could act cumulatively on hydrology. The RSA includes the Groundbirch Connector Footprint plus the area where direct or indirect influence of other land uses and activities could overlap with Groundbirch Connector project activities. Accordingly, the RSA includes any sub-basin crossed by the Groundbirch Connector.

METHODS

Information from the Coastal GasLink Hydrology Technical Data Report (TDR) for the Project (Appendix 2H of the EAC Application; Coastal GasLink 2014) was reviewed during this desktop assessment of hydrological conditions for the Groundbirch Connector. This memo provides a summary of the hydrological setting, the databases accessed during the desktop study, an overview of the methods used for assessing the hydrological conditions for the Groundbirch Connector, and summary of study results.

The methods used to assess the hydrological conditions along the Groundbirch Connector are consistent with those used to assess the baseline conditions for the Project in the 2014 EAC Application, and follow the guidance of the Application Information Requirements for Coastal GasLink's Application for an Environmental Assessment Certificate (BC EAO 2013).

Database searches for existing information on surface water quantity and quality resources were conducted using the Groundbirch Connector study area boundaries (Figure E-1), which are the Groundbirch Connector Footprint, the local study area (LSA), and the regional study area (RSA). The Groundbirch Connector hydrological desktop assessment evaluated the potential surface water quality and quantity attributes from publicly available resources.

Surface water quantity is characterized based on watercourse crossings that intersect the Groundbirch Connector Footprint. Potential watercourse crossings were identified using stream network data from the British Columbia Freshwater Atlas (DataBC 2011) overlaid with the Groundbirch Connector Footprint. Field verification by Stantec on August 5 and August 6, 2019 was completed to confirm whether any potential watercourses or waterbodies identified in the Freshwater Atlas were within the Groundbirch Connector Footprint, and if any unidentified watercourses were present. The catchment areas for each watercourse crossing were then used to determine mean monthly flows, return period peak flows, and probable frozen periods.

If watercourses were confirmed to interact with the Groundbirch Connector Footprint, surface water quality is characterized based on historical laboratory analytical results obtained from the BC MOE Environmental Monitoring System (EMS) database (BC MOE and CC 2019) and a review of existing water users using the Northeast Water Tool (NEWT 2019).

625000 630000 635000 640000

6190000 6185000 6180000

Wangler Creek
Willow Valley Rd
Foresman Rd
Willow Valley
Coulee Creek
Sunset Prairie
Kiskatinaw River
N W E S
Rd 267
Rd 214
T79R18W6
Braden Rd
T79R19W6
Rd 212 A
Rd 265
Sloane Slough
Rd 212
Rd 275
1660
Wilde Lake C/S
Wetherill Rd
Sin Lake
RE-620.0
0+000
1+000
2+000
Groundbirch
RE-630.5
RE-630.3
Hwy 97
Rd 255
Livingston Subdiv
3+000
RE-630.2
Rd 271
T78R19W6
Rd 263
T78R18W6
Rd 257
4+000
RE-630.0
Rd 273
Rd 277
Rd 261
Rd 259
Fox Creek
Harris Rd
5+000
Rd 269
RE-630.1
Rd 208
6+000
RE-640.0

Kilometre Post
Watercourse Crossing
Coastal Gaslink Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Local Study Area
Access Road
Existing Pipeline
Railway
Road
Watercourse
Township Grid
Waterbody

Note: Data sets sourced on this map are available from the CGP PDP Metadata System

REVISION	DESCRIPTION
0	Issued

1:50,000 0 0.25 0.5 1 1.5 2 Kilometres

Coastal GasLink Pipeline Project

TC Energy

Figure E-1 - Connector Hydrology Inventory

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513287-0003	REV: 0

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RESULTS

While the Freshwater Atlas (DataBC 2011) did indicate the potential for one watercourse crossing (Site ID 1660), the field verification determined that the Groundbirch Connector Footprint does not intersect any watercourses. The one wet area associated with Site ID 1660 was identified and classified as a as non-visible channel; NVC (see Photo E-1; Figure E-1).

As a result, the Groundbirch Connector has no interactions with surface water quantity and therefore no additions or changes to the Coastal GasLink Hydrology TDR for the Project (Appendix 2H of the EAC Application) (Coastal GasLink 2014) are required.

No surface water users or quality datasets were reported within the RSA of the proposed Groundbirch Connector, and therefore no data was available to characterize baseline surface water quality. However, since there were no surface water features identified along the Groundbirch Connector Footprint, no interactions with surface water quality are anticipated.

Photo E-1 Freshwater Atlas stream crossing. No surface water or channel was observed at the time of the field verification (August 5 and August 6, 2019)

Reference: Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3): **Appendix E** Groundbirch Connector Hydrology Technical Memorandum

CONCLUSIONS

The Groundbirch Connector Footprint intersects no identified surface water bodies, and local hydrologic conditions assessed in the 2014 EAC Application for the Project are anticipated to be representative of conditions associated with the proposed Groundbirch Connector. Additional details are provided in Appendix H Wetlands TDR.

We trust that this meets your current requirements for assessment of potential effects on the hydrological conditions for the Groundbirch Connector. Please feel free to contact the undersigned with any questions you may have.

Stantec Consulting Ltd.

Prepared by:

2020.10.11
16:14:39 -07'00'

Matthew Friend B.Sc.
Water Resources Specialist
Phone: (604) 412-3037
Matthew.Friend@stantec.com

Reviewed by:

Digitally signed by David Luzi
Date: 2020.10.13 10:06:26 -07'00'

David Luzi Ph.D., P.Geo
National Technical Leader, Senior Hydrologist
Phone: (604) 412-3276
David.Luzi@stantec.com

REFERENCES

BC EAO (British Columbia Environmental Assessment Office). 2013. Application Information Requirements (AIR) for the Proposed Coastal GasLink Pipeline Project. Available at: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_392_35620.html. Accessed: November 2019

BC MOE & CC (British Columbia Ministry of Environment and Climate Change Strategy). 2019. Environmental Monitoring System Web Reporting (EMS WR). Available at https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/tools-databases/surface-water-monitoring-sites. Accessed: November 2019

Coastal GasLink (Coastal GasLink Pipeline Limited). 2014. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate.

DataBC. 2011. Freshwater Atlas. Available at https://www2.gov.bc.ca/gov/content/data/geographic-data-services/topographic-data/freshwater. Accessed: November 2019

NEWT (Northeast Water Tool). 2019. Available at https://water.bcogc.ca. Accessed: November 2019

Appendix F
Groundbirch Connector
Hydrogeology Technical Data Report

Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3) Appendix F Groundbirch Connector Hydrogeology Technical Data Report

CGL80373-STC-ENV-RP-002

October 13, 2020

Revision 1

Issued for Use

Stantec

Authorization Page

Stantec Consulting Ltd.

Prepared by: Dan Yoshisaka signing Rev 1 on behalf of Date: _____
Name: Ryan Shao
Title: Hydrogeologist

(Rev 0 originally signed by Ryan Shao)

Endorsed by: _____ Date: _____
Name: Dan Yoshisaka
Title: Technical Quality Review

Endorsed by: _____ Date: _____
Name: Chris Blair
Title: Independent Senior Review

Approved by: _____ Date: _____
Name: Catherine Meyer
Title: Technical Project Manager

Authorization Page

Coastal GasLink Pipeline Project

Endorsed by: _____ Date: _____

Name: Jeff Quennelle

Title: Environmental Advisor, Coastal GasLink

Endorsed by: _____ Date: _____

Name: Adair Rigney

Title: Environmental Team Lead, Coastal GasLink

Accepted by: _____ Date: _____

Name: Craig Losos

Title: Manager, Environmental Planning and Permitting, Coastal GasLink

Revision Log

Rev	Section	Revision Description
0	All	Issued for Use
1	All	Issued for Use

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1.0 INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at: https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Hydrogeology Technical Data Report includes relevant baseline information for the proposed Groundbirch Connector.Traditional Land and Resource Use (TLRU) is presented in Section 15.0 of the Amendment Application. The Groundbirch

Connector crosses exclusively private land, so no Traditional Ecological Knowledge was collected during the field programs.

Abbreviations and acronyms used in this report are provided in Appendix F-1.

1.1 OBJECTIVES

This Hydrogeology TDR considers the directives presented in the EAC Application Information Requirements (AIR) issued by the EAO (BC EAO 2013a), the Section 25 required assessment matters under the revitalized BC *Environmental Assessment Act* (refer to Section 1.2 of the Amendment Application) and references the guidance contained in the following documents:

- EAO User Guide (BC EAO 2020a)
- Guide to Indigenous Knowledge in Environmental Assessments (BC EAO 2020b).

The objectives of this TDR are:

- Identify potential groundwater resources along the Groundbirch Connector, if present
- Identify potential groundwater users along the Groundbirch Connector
- Characterize baseline groundwater quantity and quality attributes

The evaluation of the proposed Groundbirch Connector does not identify any new mitigation measures. The mitigation measures included in the Project's EAC Application (Coastal GasLink 2014) applies and is appropriate based on the assessment and findings of the field programs.

1.2 STUDY AREA BOUNDARIES

The criteria for determining study area boundaries are consistent with Coastal GasLink Hydrogeology TDR (Appendix 2I of the EAC Application)

1.2.1 Groundbirch Connector Footprint

The Groundbirch Connector Footprint is the area potentially affected by physical works and activities, such as clearing, construction and cleanup. The Groundbirch Connector Footprint is delineated by a 50-m wide buffer on each side of the pipeline centreline, and encompasses the construction ROW, the permanent ROW, an access road, temporary workspace, and tie-in locations.

The Groundbirch Connector Application Corridor varies in width from approximately 175 m to 245 m to account for temporary workspace, but is not used in assessment analysis within this report.

1.2.2 Local Study Area

The local study area (LSA) is the area in which Groundbirch Connector project activities and facilities would most likely influence either groundwater quantity or groundwater quality. The LSA is defined as a 2 km wide band centred on the Groundbirch Connector centreline (i.e., 1 km buffer on each side).

1.2.3 Regional Study Area

The regional study area (RSA) is the area where the direct and indirect influence of other land uses and activities could overlap with Groundbirch Connector project-specific effects and cause cumulative effects on the hydrogeology indicators (Coastal GasLink 2014a). Accordingly, the hydrogeology RSA includes the full mapped extents of an aquifer that is partially within the LSA.

2.0 GROUNDBIRCH CONNECTOR PROJECT SETTING

The Province of BC has been divided into regional-scale hydrologic zones that were delineated through correlative analyses of regional-scale physiography and hydrology (Obedkoff and Coulson 1998; Obedkoff 2000; Obedkoff 2001). The Groundbirch Connector is located within the McGregor Basin, which is situated roughly between Prince George and Dawson Creek. This hydrologic zone is generally characterized by mountainous terrain, although the western flank is delineated by the Rocky Mountain Trench and Nechako Plateau. Precipitation is dependent on altitude within this zone. Limited precipitation occurs at lower elevations in the Rocky Mountain Trench, whereas relatively heavy precipitation occurs in the mountains.

Mean annual precipitation along the Groundbirch Connector range from approximately 330 to 570 mm in relatively dry areas to more than 4,000 mm in relatively wetter areas, with approximately 20% to 75% of precipitation occurring as snowfall. Long-term records from climate stations located along the Groundbirch Connector indicate the mean annual temperatures range from approximately -4°C to approximately 8°C (Meidinger and Pojar 1991).

3.0 METHODS

The methods used to characterize the baseline hydrogeology to support the assessment of the potential effects of the Groundbirch Connector on groundwater quantity and quality follow the guidance of the AIR for the Project's EAC Application (BC EAO, 2013a). These methods are consistent with those used to assess the hydrogeologic baseline condition of other sections of the Coastal GasLink Pipeline Project and include selecting key indicators and reviewing and compiling baseline data pertinent to the key indicators.

3.1 SELECTION OF KEY INDICATORS

Key indicators (KI) were selected for the assessment of hydrogeology as a valued component (VC), based on their potential to interact with, and be adversely affected by, the Groundbirch Connector. Direct effects from the Groundbirch Connector construction and operations were considered, as well as indirect effects arising from the direct effects on other VCs or KIs.

The KIs considered for the hydrogeology assessment were:

- Groundwater quantity
- Groundwater quality

3.2 BASELINE DATA REVIEW AND COMPILATION

The groundwater quantity within the LSA and RSA was characterized through reviewing and compiling provincial aquifer mapping and classifications, and creating an inventory of groundwater wells from information available through the BC MOE Water Resources Atlas (BC MOE 2019a).

The groundwater quality within the LSA and RSA was characterized through reviewing and compiling historical laboratory analytical results obtained from the BC MOE Environmental Monitoring System (EMS) database (BC MOE 2019b).

4.0 RESULTS

4.1 GROUNDWATER QUANTITY

Three mapped aquifers (Provincial Aquifer Numbers: 591, 592, 594) partially underlie the Groundbirch Connector hydrogeology LSA (refer to Figure 4-1). The combined mapped aquifer area within the LSA is approximately 14.1 square kilometres ($km^{2)}$. The full mapped extents of these aquifers (RSA) had been previously described in the Coastal GasLink Hydrogeology TDR (Appendix 2I of the EAC Application) for the Project (Coastal GasLink 2014a).

A search of the BC well records returned two wells (Well Tag Number: 102568, 17930) located within the LSA.

The identified aquifers and the corresponding BC MOE classification are summarized in Table 4-1 (BC MOE 2002). The locations of the identified aquifers and wells in relation to the LSA boundaries are presented in Figure 4-1. The BC MOE aquifer factsheet and reports are presented in Appendix F-2. Well records are presented in Appendix F-3.

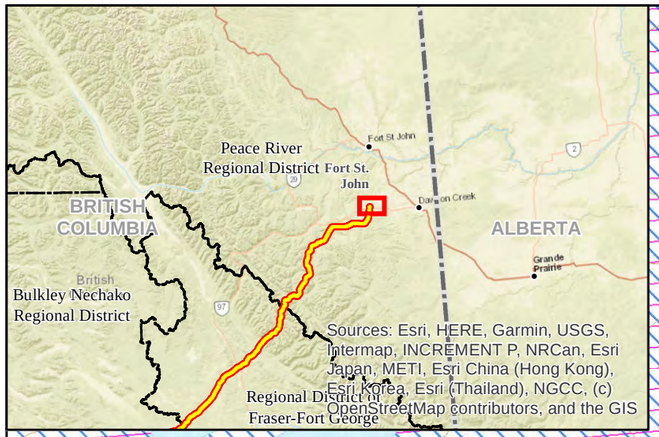

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Table 4-1: Mapped Aquifers underlying the LSA

BC MOE Aquifer Number	Aquifer Material	BC MOE Classification[1]	Vulnerability Sub-Class	Productivity	Demand	Aquifer Area (km^2)	Aquifer Area within LSA (km^2)	Number of Registered Water Supply Wells within the LSA
591	Bedrock	IIIC	Low	Moderate	Low	519.7	9.42	0
592	Sand and Gravel	IIIC	Low	Moderate	Low	63.9	3.74	0
594	Sand and Gravel	IIIC	Low	Moderate	Low	53.1	0.97	2[2]

NOTE:
[1] IIIC = classified lightly developed, low vulnerability aquifer (BC MOE 2002).
[2] Includes well tags 17930 and 102568
BC MOE Water Resources Atlas (BC MOE 2019a)

4.1.1 Aquifer 591

Aquifer 591 is a regional-scale bedrock aquifer. The mapped extent of the aquifer covers an area of approximately 519.7 km^2, of which approximately 9.42 km^2 is within the LSA.

Aquifer 591 is classified as IIIC with moderate productivity, low demand and low vulnerability. Well records showed that this aquifer is covered by a laterally continuous layer of low-permeability clay of up to 55 m (180 ft) thickness, which was interpreted to be the primary basis for the low vulnerability ranking (Coastal GasLink 2014a).

The BC Water Resources Atlas did not show any water wells screened in Aquifer 591 within the LSA (BC MOE 2019a). A water supply well located northeast of the Groundbirch Connector within the LSA (Well Tag Number: 102595) was inferred to have been screened in Aquifer 591 based on well construction record. A summary of the well record is presented in Table 4-2.

Table 4-2: Aquifer 591 Well outside of the LSA

Well Tag Number	Well Id Plate	Construction Date	Aquifer	Well Depth (m)	Depth to Water (m)	Estimated Well Yield (L/m)	Location
102595	12120	1/21/2009	591[1]	67.06	50.60	56.9	In LSA

NOTE:
[1] Inferred from well construction record
BC MOE Water Resources Atlas (BC MOE 2019a)

4.1.2 Aquifer 592

Aquifer 592 is an unconsolidated aquifer comprised of sand and gravel deposits, and partially overlies Aquifer 591. The mapped extent of the aquifer covers an area of approximately 63.9 km^2, of which approximately 3.74 km^2 is within the LSA.

BC MOE's Aquifer Classification Database indicates Aquifer 592 is classified as IIIC with moderate productivity, low demand and low vulnerability, and is used for multiple applications.

The BC Water Resources Atlas indicates that no recorded water wells screened in Aquifer 592 are present within the LSA (BC MOE 2019a).

4.1.3 Aquifer 594

Aquifer 594 is an unconsolidated aquifer comprised of sand and gravel deposits. The mapped extent of the aquifer covers an area of approximately 53.1 km^2, of which approximately 0.97 km^2 is within the LSA.

Aquifer 594 is classified as IIIC with moderate productivity, low demand, and low vulnerability, and is used for multiple applications. The BC Water Resources Atlas shows that a private domestic well (Well Tag Number: 102568) within the LSA is screened in Aquifer 594, approximately 0.8 km from the Groundbirch Connector Footprint. Another well (Well Tag Number: 17930) was inferred to have been screened in this aquifer based on well construction record. An additional three wells screened in this aquifer (Well Tag Number: 19067, 22824, 52925) are located close to but outside of the LSA.

A summary of recorded wells screened in Aquifer 594 within and close to the LSA are presented in Table 4-3.

Table 4-3: Aquifer 594 Wells within and close to the LSA

Well Tag Number	Well Id Plate	Construction Date	Aquifer	Well Depth (m)	Depth to Water (m)	Estimated Well Yield (L/min)	Location
17930	-	1/1/1963	594[1]	13.72	13.41	-	**In LSA**
102568	12251	1/23/2007	594	118.26	22.25	75.8	**In LSA**
19067	-	1/1/1965	594	91.44	47.24	15.2	Outside of LSA
22824	-	9/20/1969	594	163.68	53.95	-	Outside of LSA
52925	35907	10/21/1983	594	91.44	45.72	19.0	Outside of LSA

NOTE:
[1] Inferred from well construction record.
BC MOE Water Resources Atlas (BC MOE 2019a)

4.2 GROUNDWATER QUALITY

A search of the provincial EMS database did not return any EMS sites within the LSA. Outside the LSA, the closest EMS site (E292827) is located at approximately 1.4 km southeast of the Groundbirch Connector route alignment. The location and description of this monitoring site match those of a groundwater well (Well Tag Number: 52925) screened in Aquifer 594. The EMS database did not contain any water quality results associated with this site (BC MOE 2019b).

All EMS sites within the RSA have been previously identified and described in the Coastal GasLink Hydrogeology TDR (Appendix 2I of the EAC Application).

5.0 KEY FINDINGS AND CONCLUSIONS

Based on the review of provincial hydrogeologic data, three mapped aquifers (Provincial Aquifer Number 591, 592, 594) underlying the LSA were identified. These aquifers had been previously identified underlying portions of the Coastal GasLink Pipeline and had been described in the Coastal GasLink Hydrogeology TDR (Appendix 2I of the EAC Application) for the Project (Coastal GasLink 2013). As such, it is concluded that the hydrogeologic baseline conditions associated with the Groundbirch Connector are generally similar to the conditions assessed in the EAC Application for the Project.

6.0 REFERENCES

BC EAO (British Columbia Environmental Assessment Office) 2013a. Coastal GasLink Pipeline Project Application Information Requirements (AIR) For an Environmental Assessment Certificate. Accessed July 2020. https://projects.eao.gov.bc.ca/api/public/document/5e41882e74d1830021b67709/download/CGL%20-%20Application%20Information%20Requirements%20-%2020130523.pdf.

BC EAO. 2013b. Guide to Involving Proponents when Consulting First Nations in the Environmental Assessment Process.

BC EAO. 2014. Coastal GasLink Pipeline Project Environmental Assessment Certificate # E14-03.

BC EAO. 2018. Environmental Assessment Office User Guide.

BC EAO. 2020a. EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018). Version 1.01. March 2020. p. 53.

BC EAO 2020b: Guide to Indigenous Knowledge in Environmental Assessments. Version 1.0. April 2020. p. 20.

BC MOE (British Columbia Ministry of Environment). 2002. Guide to Using BC Aquifer Classification Maps. Retrieved from: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/aquifers/reports/aquifer_maps.pdf#page=15.

BC MOE. 2019a. Retrieved from BC Water Resources Atlas: http://maps.gov.bc.ca/ess/hm/wrbc/

BC MOE. 2019b. Environmental Monitoring System (EMS). Retrieved from https://a100.gov.bc.ca/pub/ems/mainmenu.do?userAction=mainmenu

Coastal GasLink (Coastal GasLink Pipeline Limited). 2014a. Coastal Gaslink Pipeline Project Hydrogeology Technical Data Report.

Coastal GasLink. 2014b. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate.

Meidinger, D.V. and J. Pojar 1991. Ecosystems of British Columbia. Special Report Series No. 6. Victoria, BC.

Obedkoff, W. and C.H. Coulson. 1998. British Columbia Streamflow Inventory. Water Inventory Section, Resources Inventory Branch, British Columbia Ministry of Environment, Lands, and Parks. 56p

Obedkoff, W. 2000. Streamflow in the Omineca-Peace Region. Water Inventory Section, Resources Inventory Branch, British Columbia Ministry of Environment, Lands, and Parks. 26p

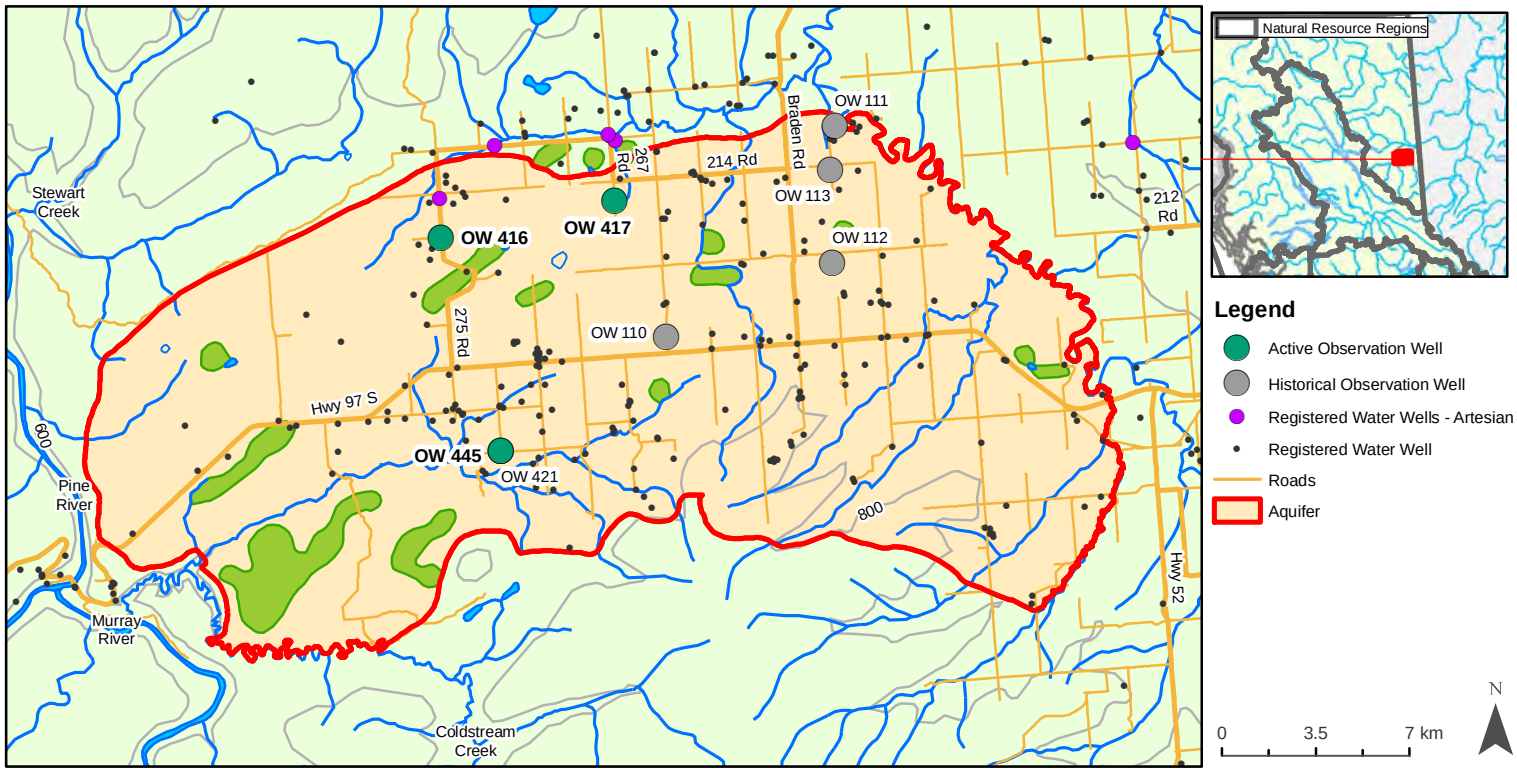
Obedkoff, W. 2001. Streamflow in the Skeena Region. Water Inventory Section, Resources Inventory Branch, British Columbia Ministry of Environment, Lands, and Parks. 116p

Appendix F-1: Abbreviations and Acronyms

Abbreviation	Definition
Units of Measurement	
km	kilometre = 1000 metres
m	metre
km²	square kilometre
°C	Degree Celsius
%	percent
Other Terms	
AIR	Application Information Requests
BC	British Columbia
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
KI	key indicator
KP	Kilometre Post
LSA	local study area
MOE	Ministry of Environment
OGC	Oil and Gas Commission
Project	Coastal GasLink Pipeline Project
ROW	right-of-way
RSA	regional study area
TDR	Technical Data Report
VC	valued component

Appendix F-2: Aquifer Factsheet and Reports

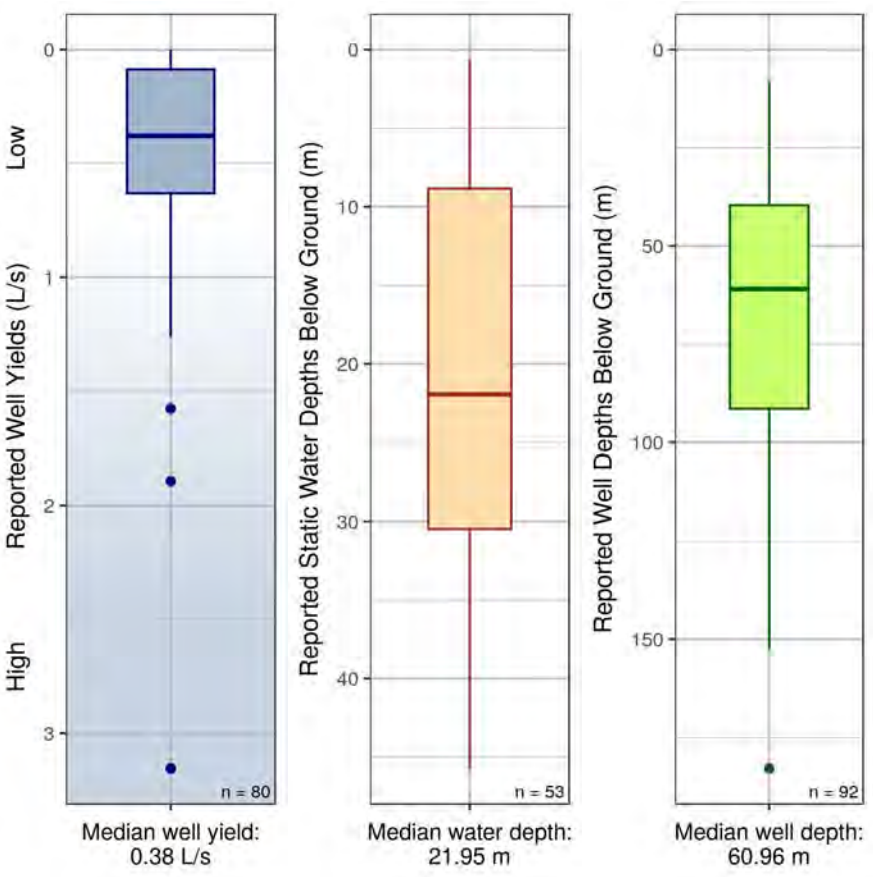
Aquifer #591



Aquifer Description (Mapping Report): Fractured sedimentary rock aquifers primarily found in association with old sedimentary basins (subtype = 5a).

Aquifer Details	
Region	Northeast
Water District	Peace River
Aquifer Area	519.7 km^2
No. Wells Correlated to Aquifer	92
Vulnerability to Contamination	Low
Productivity	Moderate
Aquifer Classification	IIIC
Hydraulic Connectivity[1]	Not Likely
Aquifer Stress Index	Method not applicable - confined aquifer
No. Water Licences Issued to Wells	1
Observation Wells (**Active**, Inactive)	112, **416**, **417**, 421

[1] Based on broad regional assessment



Detailed methods for all figures are described in the companion document (Aquifer Factsheet - Companion Document.pdf).

Factsheet generated: 2019-03-06. Available from: https://s3.ca-central-1.amazonaws.com/aquifer-docs/00000/00591_Aquifer_Factsheet.pdf.

Monthly Groundwater Level[1] with Precipitation from Climate Normals[2]

Graph not available
(no precipitation data)

Groundwater Levels and Long-term Trend

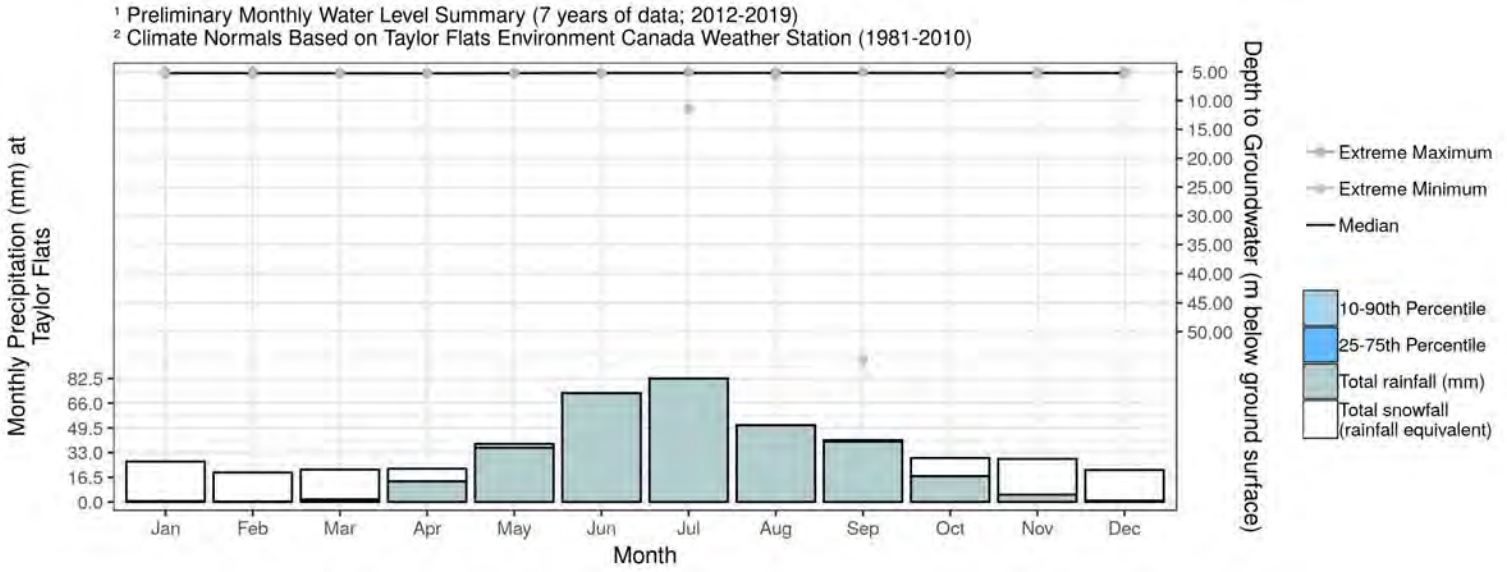
For more information regarding trends in groundwater levels see Environmental Reporting BC

Piper Plot

No summary at this point

Graph not available
(insufficient chemistry data)

Monthly Groundwater Level[1] with Precipitation from Climate Normals[2]



Groundwater Levels and Long-term Trend

For more information regarding trends in groundwater levels see Environmental Reporting BC

Piper Plot

No summary at this point

Graph not available
(insufficient chemistry data)

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0591

DESCRIPTIVE LOCATION: Groundbirch, Willow Valley, Sunset Prairie and Progress, BC.

NTS MAP SHEETS: 093P/10, 093P/11, 093P/14 and 093P/15

BCGS MAP SHEETS: 093P.075, 093P.076, 093P.077, 093P.085, 093P.086, 093P.087

CLASSIFICATION: III B **RANKING VALUE: 13**

Aquifer Size:

Area of aquifer is approximately 520 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development) and bedrock geology maps. The northern and western boundaries of the aquifer are based on a geological formation boundary. The southern boundary of the aquifer was inferred based on area of development. The eastern boundary is the Kiskatinaw River.

Geologic Formation (overlying):

Mixture of lacustrine, eolian, and morainal deposits. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin. Eolian deposits consist of sands and silts transported by wind action. Morainal deposits consist of a heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Shale with some sandstone formations of the Kaskapau Formation, Smoky Group, Upper Cretaceous Period of the Mesozoic Era.

Confined/Unconfined/Bedrock:

Bedrock

Vulnerability:

Moderate. The mean depth to static water level is 15.2 m (50 feet). The range of thickness of the confining layer in the well records ranges from 0 to 89.9 m (0 to 295 feet). The geometric mean thickness of the confining layer is 15.2 m (50 feet) and the median thickness of the confining layer is 18.3 m (60 feet). The porosity and permeability of the shale formation is likely low however water may move rapidly through the fracture system.

Productivity:

Moderate. The well yields reported in the well records range up to 3.15 L/s (50 USgpm). The geometric mean of reported well yields is 0.35 L/s (5.6 USgpm) and the median well yield is 0.41 L/s (6.5 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 15.2 m (50 feet). The median static water level is 22.6 m (74 feet) and the range of static water level is 0.6 to 45.7 m (2 to 150 feet).

Direction of Flow:

Has not been determined. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.19 wells/km^2.

Users/Level of Use:

Domestic Agricultural, and Industrial. Reported for domestic use, livestock purposes and a gas plant.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

Isolated cases of dry wells reported on water well records and low or declining production.

Quality Concerns (type, source, level of concern):

Isolated cases of poor water quality. Wells used for livestock but not drinking water. High iron, hard water.

Notes:

The geometric mean depth of water wells in this aquifer is 58.8 m (193 feet). The median depth of wells is 61 m (200 feet) and the range of well depths is from 8.2 to 182.9 m (27 to 600 feet).

The statistics quoted for this aquifer are based on a total of 99 water well records.

Screens are not used in wells completed into the bedrock aquifer.

There is a slight potential that a high capacity well could be developed in this aquifer. One high capacity well was reported. However, no long term pumping tests have been conducted on this high capacity well to confirm the initial production estimates.

One well in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

Four wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

McMechan, M.E., 1994. *Geology and structure cross section, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1858A, scale 1:250,000. Ottawa, ON.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Groundbirch Bedrock

AQUIFER REFERENCE NUMBER: 0591

AQUIFER TYPE: Bedrock

CLASSIFICATION: III B **RANKING VALUE: 13**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Moderate*** level of vulnerability to surface contamination.

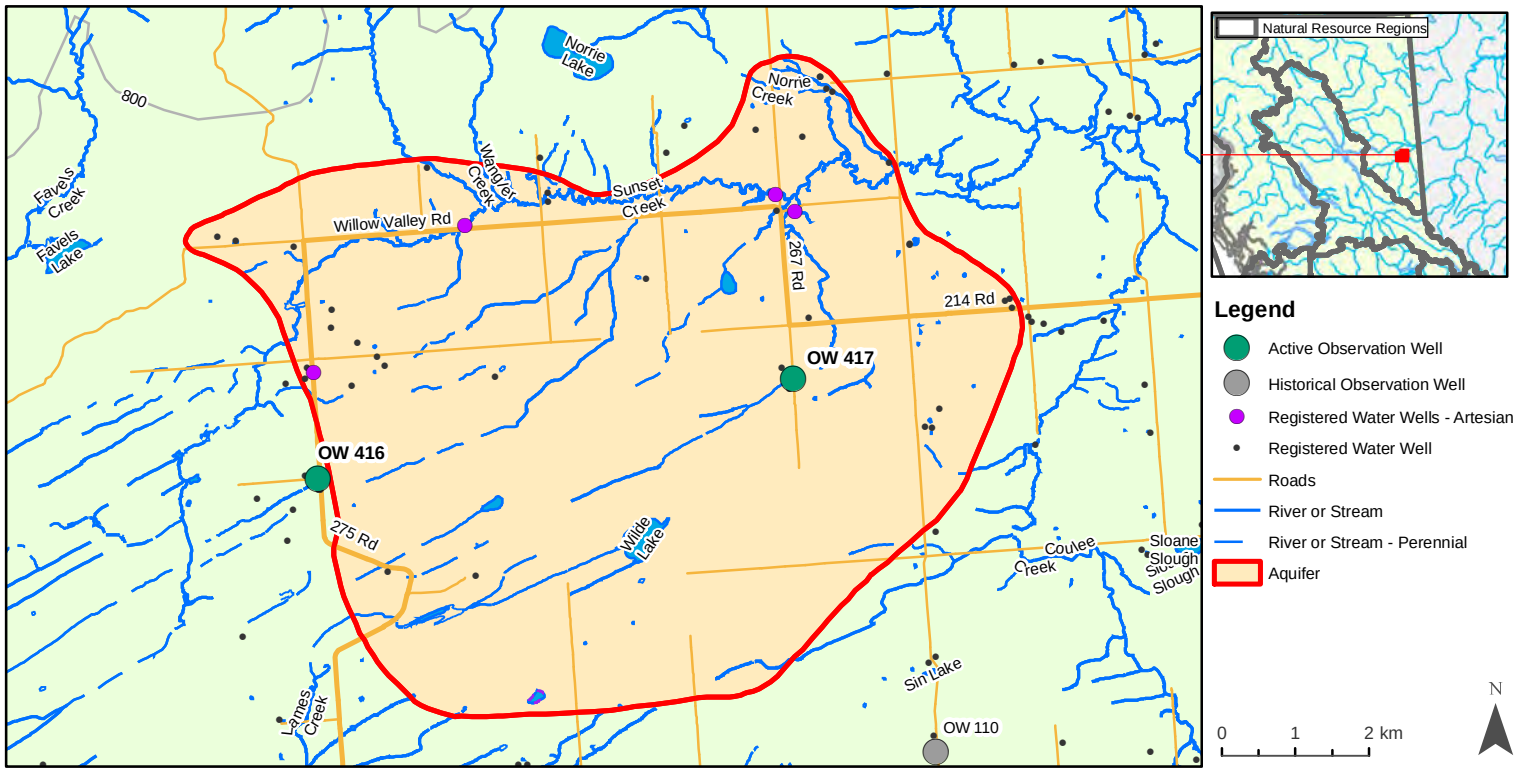
Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**1**
Quantity Concerns:	**1**
Total:	**13**

Statistical Analysis of Well Data for Aquifer 0591

Total number of wells available for statistical analysis: **99**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	99	54	85	76	86
Maximum	600	150	317	50	295
Minimum	27	2	**4**	0	0
Average	225	68	111	11	86
Median	200	74	100	7	60
Geometric Mean	193	50	74	6	50

Aquifer #592

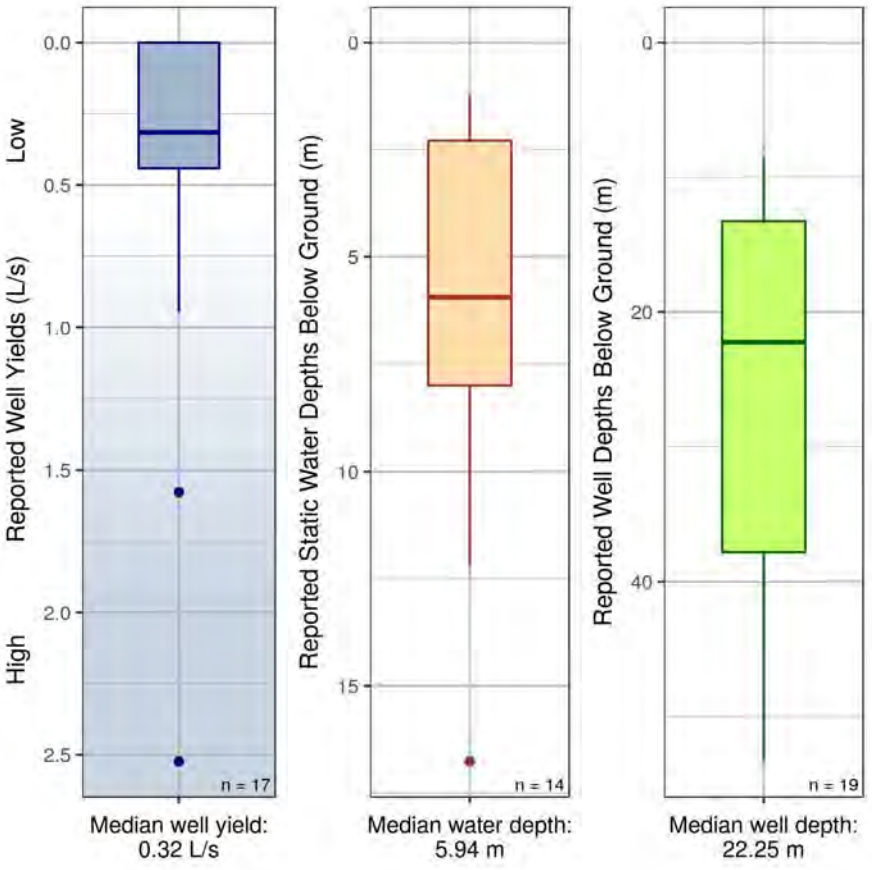


Aquifer Description (Mapping Report): Confined Glacio-fluvial sand and gravel aquifers underneath till, in between till layers, or underlying glacio-lacustrine deposits (subtype = 4b).

Aquifer Details

Region	Northeast
Water District	Peace River
Aquifer Area	63.9 km^2
No. Wells Correlated to Aquifer	20
Vulnerability to Contamination	Low
Productivity	Moderate
Aquifer Classification	IIIC
Hydraulic Connectivity[1]	Not Likely
Aquifer Stress Index	Method not applicable - confined aquifer
No. Water Licences Issued to Wells	0
Observation Wells (**Active**, Inactive)	None

[1] Based on broad regional assessment



Detailed methods for all figures are described in the companion document (Aquifer Factsheet - Companion Document.pdf).

Factsheet generated: 2019-03-06. Available from: https://s3.ca-central-1.amazonaws.com/aquifer-docs/00000/00592_Aquifer_Factsheet.pdf.

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

AQUIFER REFERENCE NUMBER: 0592

DESCRIPTIVE LOCATION: Groundbirch and Willow Valley, BC.

NTS MAP SHEETS: 093P/15

BCGS MAP SHEETS: 093P.076, 093P.085, 093P.086

CLASSIFICATION: III C **RANKING VALUE: 11**

Aquifer Size:

Area of aquifer is approximately 63.86 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development) and surficial geology maps. The eastern and southern boundaries of the aquifer are based on a change of geological formation. The surficial sediments are thin to the east and south of the aquifer and this is verified by information on bedrock wells in the vicinity. Therefore the aquifer boundary was defined as the boundary change between the ridged morainal deposits and the lacustrine veneer. The western boundary of the aquifer was inferred based on area of development. The northern boundary is Sunset Creek.

Geologic Formation (overlying):

Morainal deposits of the Cordilleran 'Classical' Wisconsin glacial deposits. A heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Glacio-fluvial deposits of poorly sorted sand, gravel and silt.

Confined/Unconfined/Bedrock:

Confined

Vulnerability:

Low. The geometric mean depth to static water level is 5.2 m (17 feet). The range of thickness of the confining layer in the well records ranges from 0 to 38.1 m (0 to 125 feet). The geometric mean thickness of the confining layer is 4.0 m (13 feet) and the median thickness of the confining layer is 13.4 m (44 feet). The porosity of the overlaying clay formation is low and was identified in all water well records.

Productivity:

Moderate. The well yields reported in the well records range up to 2.52 L/s (40 USgpm). The geometric mean of reported well yields is 0.63 L/s (10 USgpm) and the median well yield is 0.57 L/s (9 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 5.2 m (17 feet). The median static water level is 6.1 m (20 feet) and the range of static water level is 1.2 to 16.8m (4 to 55 feet).

Direction of Flow:

Has not been determined but may flow north towards the Sunset Creek. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.34 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

Isolated cases of poor water quality. Wells used for livestock but not drinking water. High iron, hard water.

Notes:

The geometric mean depth of water wells in this aquifer is 22.6 m (74 feet). The median depth of wells is 22.9 m (75 feet) and the range of well depths is from 8.5 to 53.3m (28 to 175 feet).

The statistics quoted for this aquifer are based on a total of 22 water well records.

Screens are not reported in several wells and some wells indicate siltation resulting in the wells being hydraulically inefficient.

There is a slight possibility that a high capacity well could be developed in this aquifer. There are currently no reported high capacity wells in this aquifer.

No wells in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

Two wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Willow Valley

AQUIFER REFERENCE NUMBER: 0592

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 11**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

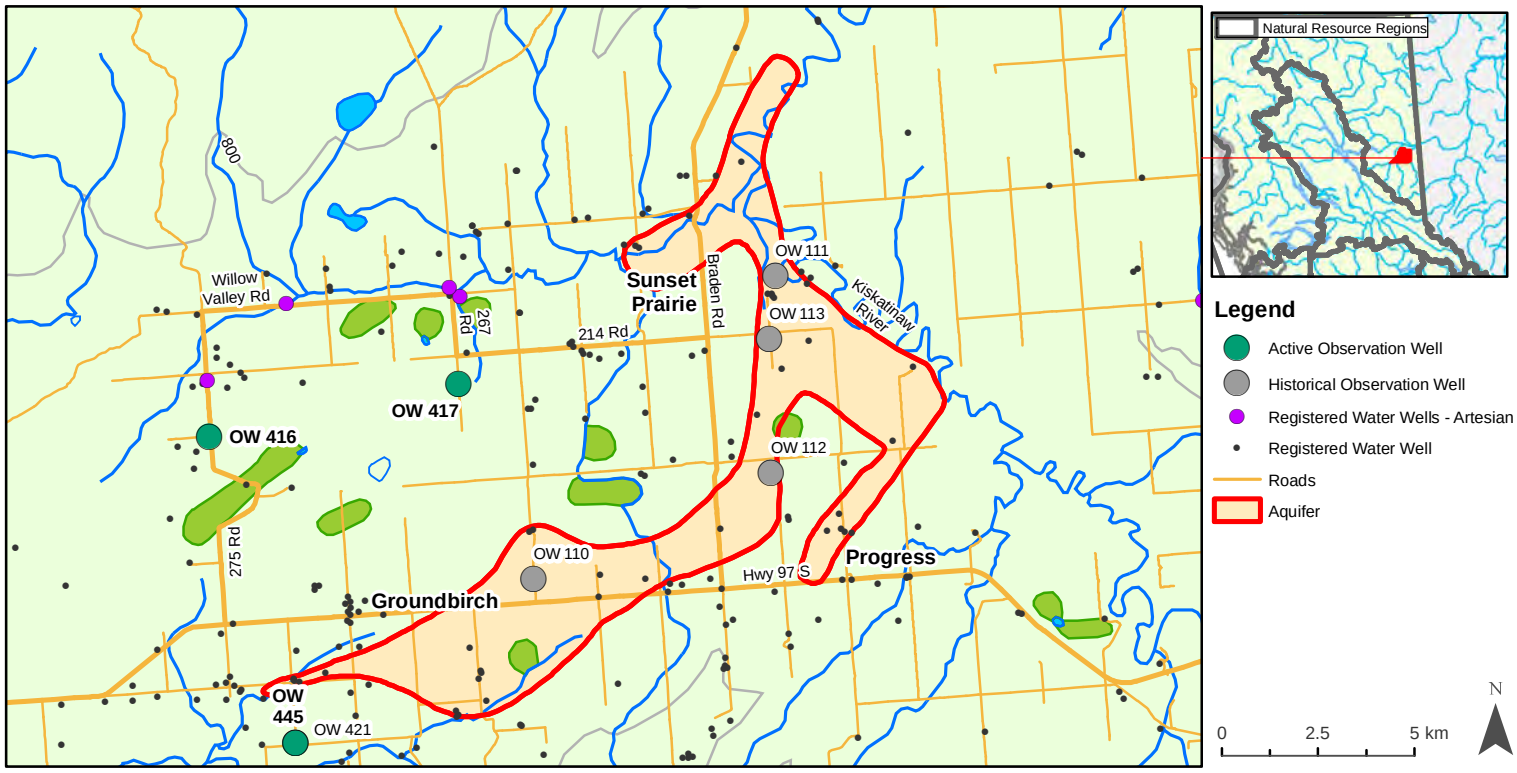
Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**1**
Total:	**11**

Statistical Analysis of Well Data to Aquifer 0592

Total number of wells for statistical analysis: 22

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	21	17	2	12	18
Maximum	175	55	120	40	125
Minimum	28	4	**65**	5	0
Average	87	22	93	13	48
Median	75	20	93	9	44
Geometric Mean	74	17	88	10	13

Aquifer #594

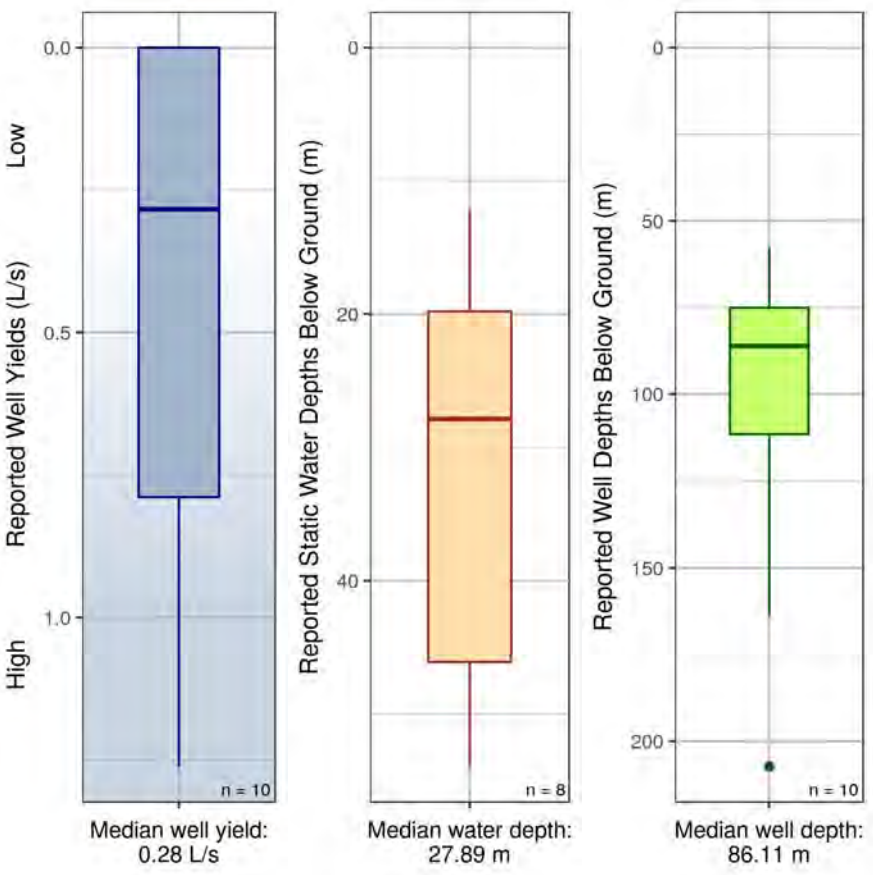


Aquifer Description (Mapping Report): Confined Glacio-fluvial sand and gravel aquifers underneath till, in between till layers, or underlying glacio-lacustrine deposits (subtype = 4b).

Aquifer Details

Region	Northeast
Water District	Peace River
Aquifer Area	53.8 km^2
No. Wells Correlated to Aquifer	10
Vulnerability to Contamination	Low
Productivity	Moderate
Aquifer Classification	IIIC
Hydraulic Connectivity[1]	Not Likely
Aquifer Stress Index	Method not applicable - confined aquifer
No. Water Licences Issued to Wells	0
Observation Wells (**Active**, Inactive)	110, 111

[1] Based on broad regional assessment



Detailed methods for all figures are described in the companion document (Aquifer Factsheet - Companion Document.pdf).

Factsheet generated: 2019-03-06. Available from: https://s3.ca-central-1.amazonaws.com/aquifer-docs/00000/00594_Aquifer_Factsheet.pdf.

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0594

DESCRIPTIVE LOCATION: Groundbirch, Sunset Prairie, Progress, BC.

NTS MAP SHEETS: 093P/15

BCGS MAP SHEETS: 093P.076, 093P.077, 093P.087

CLASSIFICATION: III C **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 53.77 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development), seismic and test drilling reports and geological reports on buried, pre-glacial, outwash channels. The inferred limits of the buried channels were determined from the availability of water well information. The geologic reports indicate that the buried channels may extend beyond these inferred boundaries.

Geologic Formation (overlying):

Mixture of lacustrine, alluvial, and morainal deposits. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin. Alluvial deposits consist of silt, sand and gravel and include sediments laid down in riverbeds and flood plains. Morainal deposits consist of a heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Pre-Laurentide Glacial Period buried channel. Pre-late Wisconsinan sediments consisting of coarse sands and cobbly sands, with lesser amounts of pebble and cobble gravels. Alternating sand and gravel units. Sandy units comprise approximately two thirds of the strata. Silt is present in small quantities. This aquifer may not be encountered throughout the buried channels.

Confined/Unconfined/Bedrock:

Confined

Vulnerability:

Low. The geometric mean depth to static water level is 27.7 m (91 feet). The range of thickness of the confining layer in the well records ranges from 0 to 83.2 m (0 to 273 feet). The geometric mean thickness of the confining layer is 18.6 m (61 feet) and the median thickness of the confining layer is 34.7 m (114 feet). Low permeable overlying clay was identified in all water well records.

Productivity:

Moderate. The well yields reported in the well records range up to 1.26 L/s (20 USgpm). The geometric mean of reported well yields is 0.57 L/s (9 USgpm) and the median well yield is 0.63 L/s (10 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 27.7 m (91 feet). The median static water level is 28 m (92 feet) and the range of static water level is 12.2 to 54 m (40 to 177 feet).

Direction of Flow:

The aquifer sediments were deposited in a buried channel flowing generally towards the northeast. Groundwater flow may follow this original drainage pattern, however further studies are required to verify the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.24 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in this aquifer is 93.9 m (308 feet). The median depth of wells is 80.8 m (265 feet) and the range of well depths is from 57.6 m to 207.3 m (189 to 680 feet).

The statistics quoted for this aquifer are based on a maximum of 13 water well records.

Screens are not reported in several wells and some wells indicate siltation resulting in the wells being hydraulically inefficient.

There is the possibility that a few high capacity wells could be developed in this aquifer. There are currently no reported high capacity wells in this aquifer.

No wells in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Callan, D.M., 1969. *Notes On A Subsurface Investigation of Four Townships in the Groundbirch Area of Northeastern British Columbia.* Groundwater Division. BC Ministry of Water, Land and Air Protection NTS File No. 38000-40/093P/15-03. Victoria, BC.

Callan, D.M., 1970. *An Investigation of Buried Channel Deposits in the Groundbirch Area of Northeastern British Columbia.* Report No. 3 of 1969 Peace River Rotary Drilling Programme. Groundwater Division. BC Ministry of Water, Land and Air Protection NTS File No. 38000-40/093P/15-04. Victoria, BC.

Catto, N.R. *Quaternary Geology and Landforms of the Peace River Region, Northeastern British Columbia: Implications for Water Supply.* Department of Geography Memorial University of Newfoundland, St. John's NF. 50 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Groundbirch Sunset Prairie Buried Channel

AQUIFER REFERENCE NUMBER: 0594

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 10**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	***Ranking Value***
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0594

Total number of wells available for statistical analysis: **13**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	13	8	2	6	12
Maximum	680	177	660	20	273
Minimum	189	40	**526**	4	0
Average	333	103	593	12	120
Median	265	92	593	10	114
Geometric Mean	308	91	589	9	61

Appendix F-3: Well Records

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 19067
Well Identification Plate Number:
Owner Name: NORTH GROUNDBIRCH SC
Intended Water Use: Private Domestic

Well Status: New
Well Class: Unknown
Well Subclass:
Aquifer Number: 594

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed
Licence Number:

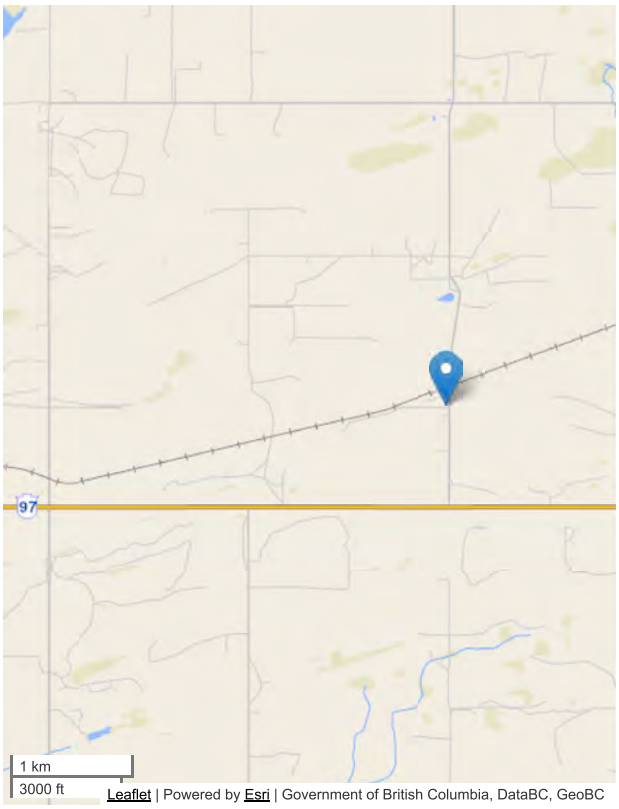
Location Information

Street Address:
Town/City: GROUNDBIRCH

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	27
Township	78
Range	19
Land District	44
Property Identification Description (PID)	

Description of Well Location: AT MCLEOD SCHOOL, GROUNDBIRCH



Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 55.788616
Longitude: -120.84619
UTM Easting: 635049
UTM Northing: 6184653
Zone: 10
Coordinate Acquisition Code: (200 m accuracy) Digitized from 1:50,000 maps

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
There has been no activity related to this well.				

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1965-01-01	1965-01-01				

Well Completion Data

Total Depth Drilled:
Finished Well Depth: 300.00 feet
Final Casing Stick Up:
Depth to Bedrock:
Ground elevation:

Static Water Level (BTOC): 155.00 feet
Estimated Well Yield: 4.000 USGPM
Artesian Flow:
Artesian Pressure:
Method of determining elevation: Unknown

Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Other
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0.00	120.00	clayey sand						
120.00	260.00	fine sand w/b						
260.00	280.00	fine sand						
280.00	300.00	coarse gravel						

Casing Details

From (ft)	To (ft)	Casing Type	Casing Material	Diameter	Wall Thickness	Drive Shoe
There are no records to show						

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:

Liner Thickness:
Liner to:

Liner perforations

From	To
There are no records to show	

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From	To	Diameter	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:

Development Total Duration:

Well Yield

No well yield data available.

Well Decommission Information

Reason for Decommission:
Sealant Material:
Decommission Details:

Method of Decommission:
Backfill Material:

Comments

PRODUCES AT LEAST 4GPM METHOD OF DRILLING = DRILLED

Alternative Specs Submitted: No

Documents

- WTN 19067_Well Record.pdf

Disclaimer

McLeod School

OSHKOSH FILTER & SOFTENER CO., CANADA LTD.
P.O. Box 699
BRANDON — MANITOBA — CANADA

LABORATORY REPORT
ANALYSIS NUMBER 122
DATE Nov. 1/65

Diamond Water Treating Equipment

SAMPLE IDENTIFICATION School Dist. #59 SEC 27/TP 78 Rg 19
93P/15 c W 93P.076.4

DEALER:

JOBBER: Western Supplies Limited
Dawson, Creek, B.C.

No. of Bathrooms 1 No. of Toilets 6
Total number of persons 80
Weekly requirements per person
Total number of gallons required per week

Water supply, city or private
Capacity of Present pump
Size of pressure tank

Turbidity
Color Odor
Sediment
Taste pH 6.8

Mineral Analysis In Parts Per Million

Positive Radicals		Negative Radicals	
Total Hardness (ca & Mg)	400	Alkalinity P (Phenolphthalein)	
Calcium (Ca)		Alkalinity M (Methyl Orange)	400
Magnesium (Mg)		Sulphates (SO_4)	
Sodium (Na)		Nitrates (NO_3)	
Iron (Fe)	0.6	Chlorides (Cl)	50
Manganese (Mn)		Free Carbon Dioxide (CO_2)	

Total Hardness 28 Grains per Imperial Gallon
Compensated Hardness Grains per Imperial Gallon

RECOMMENDATIONS:

FEEDERS	FILTERS	SOFTENERS	IMP. GALS. SOFT WATER	DAYS BETWEEN REGENERATION	MINIMUM PUMP
	AMG-16	SMC-45	1607		600 G.P.H.
					G.P.H.
	1607				G.P.H.

NOTE:
Chlorides over 350 P.P.M. may impart salty taste to softened water.
Alkalinity over 600 P.P.M. may show deposit after boiling, and impart slight taste to beverages.
Iron over 1 to 2 P.P.M. may foul mineral bed with loss of softening capacity.

REMARKS: Water is hard, however, main objection will be the iron content, which will cause bad rust stains if not removed. The above automatic iron filter will be required in order to handle the required flow rate. If softeneing is desired for the bathroom only, we suggest the above softener. Please note minimum pump capacity.

opt AMG 16
480 00

BY

Mcleod School

93P·076·4·4·3 WTN. 19067 #2

TENS	UNITS	MERIDIAN	TENS	UNITS	TENS	UNITS	QUARTER	TENS	UNITS
TOWNSHIP - 78			RANGE - 19		SECTION - 27		SE 1/4	LAND DISTRICT	

GROUND — WATER DIVISION, WATER INVESTIGATIONS BRANCH, DEPT. OF LANDS, FORESTS, and WATER RESOURCES, VICTORIA, B.C.

LOCATION (COMPLETE LEGAL DESCRIPTION) Sec 27 TP 78 R 19 W6M PEACE RIVER

OWNER'S NAME NORTH GROUNDBIRCH SCHOOL OR McLEOD SCHOOL ADDRESS GROUNDBIRCH

DRILLER'S NAME CLIFF BAKER ADDRESS PEACE COUPE DATE OF COMPLETION 1965

DEPTH 300' ELEVATION OF COLLAR 2406 (068) CASING DIAM. 6" LENGTH ____ TYPE ____

METHOD OF DIGGING DRILLED SCREEN ☑ SIZE #7 SLOT LENGTH 10' TYPE ____

LOCATION OF SCREEN 282' – 292' DEVELOPED ☐ DESCRIBE ____

PERFORATED CASING ☐ LENGTH ____ LOCATION OF PERFORATIONS ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

PUMP ☐ TYPE ____ POWER ____

CAPACITY ____ OTHER DATA ____

COSTS WELL ____ PUMP ____ PUMP HOUSE, ETC. ____

MAINTENANCE ____

DISTANCE TO WATER FROM TOP OF CASING 155' ☐ ESTIMATED ☐ MEASURED ELEVATION ____ FLUCTUATION ____

HIGH WATER ____ MONTH ____ LOW WATER ____ MONTH ____ OBSERVATION DATA ☐ FILE No. ____

WATER USE DOMESTIC, FOR SCHOOL (SCHOOLBOARD SAYS THIS IS A VERY GOOD SUPPLY)

MAX. RATE WITHDRAWAL ☐ ESTIMATED ☐ MEASURED ____

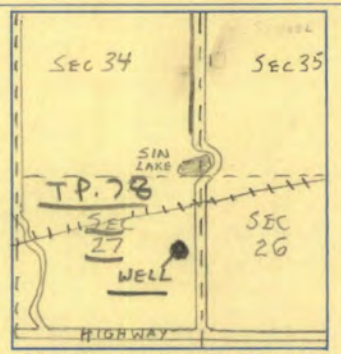
TEMPERATURE ____ PUMPS SAND ☐ ____

CLOGS SCREEN ☐ TYPE DEPOSIT ____ AQUIFER DATA SAND

LICENSE No. ____ DATE LICENSE ____ AMOUNT ____

DATE APPLICATION ____ USE ____

SEE TEMPORARY MAP 35



LOCATION SKETCH—INDICATE NORTH

ANALYSIS (BACK) (F)
- SOFT
- HARD
- HIGH IRON
- HIGH SULPHUR
- SALTY
- ALKALINE
- SALINE
- POLLUTED
- INADEQUATE QUALITY

WATER QUALITY

- DRY HOLE
- INADEQUATE QUANTITY
- PUMPING TEST

CAPACITY GPD.
- 0 – 10^3
- 10^3 – 10^4
- 10^4 – 10^5
- 10^5 – 10^6
- 10^6

METHOD: DUG, DRIVEN, DRILLED —, JETTED, BORED

DEPTH: 0 — 25, 25 — 50, 50 — 100, 100 — 200, 200 — 400 —, >400

OBSERVATION, ABANDONED, DEVELOPED —, SCREEN, PERF. CASING, GRAVEL ENV., PUMP

TYPE WELL: FLOWING —, NON-FLOW ARTESIAN, WATER TABLE, PART CONFINED

SUPPLY AQUIFER TENS	SUPPLY AQUIFER UNITS	OTHER AQUIFER PRESENT TENS	OTHER AQUIFER PRESENT UNITS	OTHER AQUIFER PRESENT TENS	OTHER AQUIFER PRESENT UNITS
1 2 4 7	1 2 4 7	1 2 4 7	1 2 4 7	1 2 4 7	1 2 4 7

CHARACTER OF SUPPLY AQUIFER: SAND 1, GRAVEL, TILL

WATER USE: SCHOOL 11, DOMESTIC, GARDEN, STOCK, COOLING, IRRIGATION, INDUSTRIAL, WATERWORKS

RELIABILITY OF DATA: GOOD 1, FAIR, POOR

ROCK, SPRING

SYSTEMS EQUIPMENT LIMITED, VICTORIA—CANADA O 2231-65 SYSTEMSORT

LOG

FROM	TO	DESCRIPTION	NAME
0	170	SILT	
170	300	SAND (INCREASING TO COARSE)	
		IN MAY 69 MR BAKER	
		RECALLED FROM MEMORY INFORMATION	
		ON THIS WELL:	
		DEATH 300' STATIC ABOUT 90'	
0	120	CLAYEY SAND	
120	260	FINE SAND (W.B)	
		SAND WOULD BLOW UP	
		CASING 50' AND CASING	
		COULDN'T BE DRIVEN ANY	
		FURTHER SO MOVED	
		ROTARY OVER HOLE.	
260	280	FINE SAND	
280	300	COARSE GRAVEL	
		10' OF #10 on #7 SLOT	
		JOHNSON SCREEN WAS SET	
		AT 290'-300'	
		PRODUCES AT LEAST 8-10 G.P.M.	
		WELL IS EQUIPPED WITH SUBMERSIBLE PUMP.	

SAMPLE No. 122 DATE Nov 1/65

LAB. OSHKOSH FILTER & SOFTENER CO., CANADA LTD

COLIFORM ORGANISMS

TOTAL BACTERIA

COLOUR ODOUR

TASTE

PUMPING TEST SUMMARY

TEST BY

DATE FILE No.

SPECIFIC CAPACITY PERMIABILITY

STORAGE COEFF TRANSMISSIBILITY

REMARKS PRODUCE AT LEAST 4 GPM

OTHER DATA

SIZE ANALYSIS. ETC.

CARD BY D. J. DATE Oct. 65

SOURCES INFORMATION JOHANSENS FIELD SURVEY

ANALYSIS (F)

ON MAP	PPM
Total Hardness	400
Carbonate Hard	
Magnesium Hard	
Fe	.6
SO_2	
Ca	
Mg	
Na	
K	
HCO_3	
CO_3	
Cl	50
SO_4	
NO_3	
B	
E	
Total Dis-solids	
Total Alkalinity	400
Suspended Solids	
Ph	6.7

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 22824
Well Identification Plate Number:
Owner Name: F N RONDEAU
Intended Water Use: Unknown Well Use

Well Status: New
Well Class: Unknown
Well Subclass:
Aquifer Number: 594

Observation Well Number: 110
Observation Well Status: Inactive
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

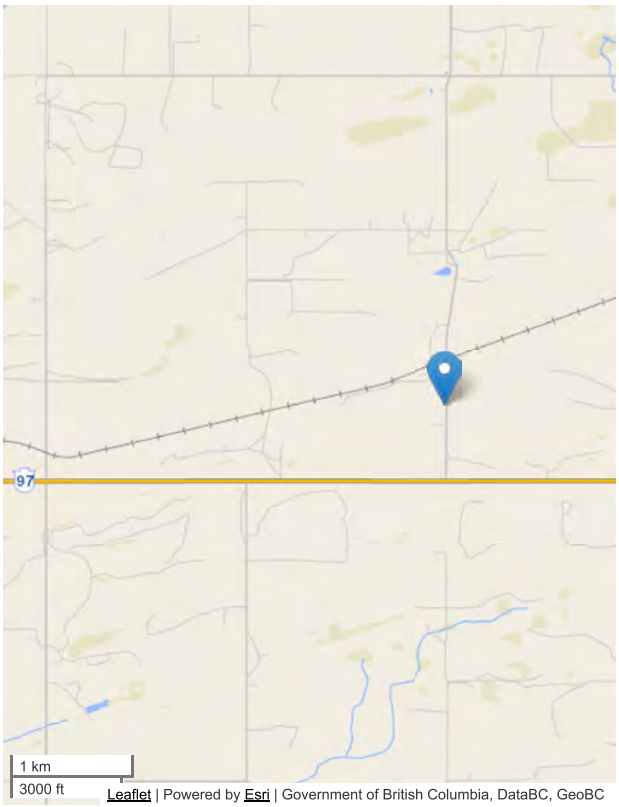
Location Information

Street Address:
Town/City:

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	
Township	
Range	
Land District	44
Property Identification Description (PID)	

Description of Well Location:



Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 55.786733
Longitude: -120.845959
UTM Easting: 635070
UTM Northing: 6184444
Zone: 10
Coordinate Acquisition Code: (50 m accuracy) Digitized from 1:20,000 mapping

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
There has been no activity related to this well.				

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1969-09-20	1969-09-20				

Well Completion Data

Total Depth Drilled:
Finished Well Depth: 537.00 feet
Final Casing Stick Up:
Depth to Bedrock:
Ground elevation:

Static Water Level (BTOC): 177.00 feet
Estimated Well Yield: 0.000 USGPM
Artesian Flow:
Artesian Pressure:
Method of determining elevation: Unknown

Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Other
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0.00	110.00	sand, very fine to fine grained						
110.00	120.00	sand coarse with pebbles						
120.00	265.00	clay light -med grey, stoney						
265.00	303.00	clay and coarse sand, lenses of clean						
0.00	0.00	clay stones.						
303.00	340.00	same						
340.00	395.00	compact sand and gravel, dirty, mainly						
0.00	0.00	limestone fragments						
395.00	420.00	till, grey						
420.00	434.00	compact sand and gravel, dirty						
434.00	445.00	clay, silty sand, light brown sand is						
0.00	0.00	sub to well rounded quartz & mafics						
445.00	462.00	clay, light brown silty sand						

Casing Details

From (ft)	To (ft)	Casing Type	Casing Material	Diameter	Wall Thickness	Drive Shoe
There are no records to show						

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:

Liner Thickness:
Liner to:

Liner perforations

From	To
There are no records to show	

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From	To	Diameter	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:

Development Total Duration:

Well Yield

No well yield data available.

Well Decommission Information

Reason for Decommission:
Sealant Material:
Decommission Details:

Method of Decommission:
Backfill Material:

Comments

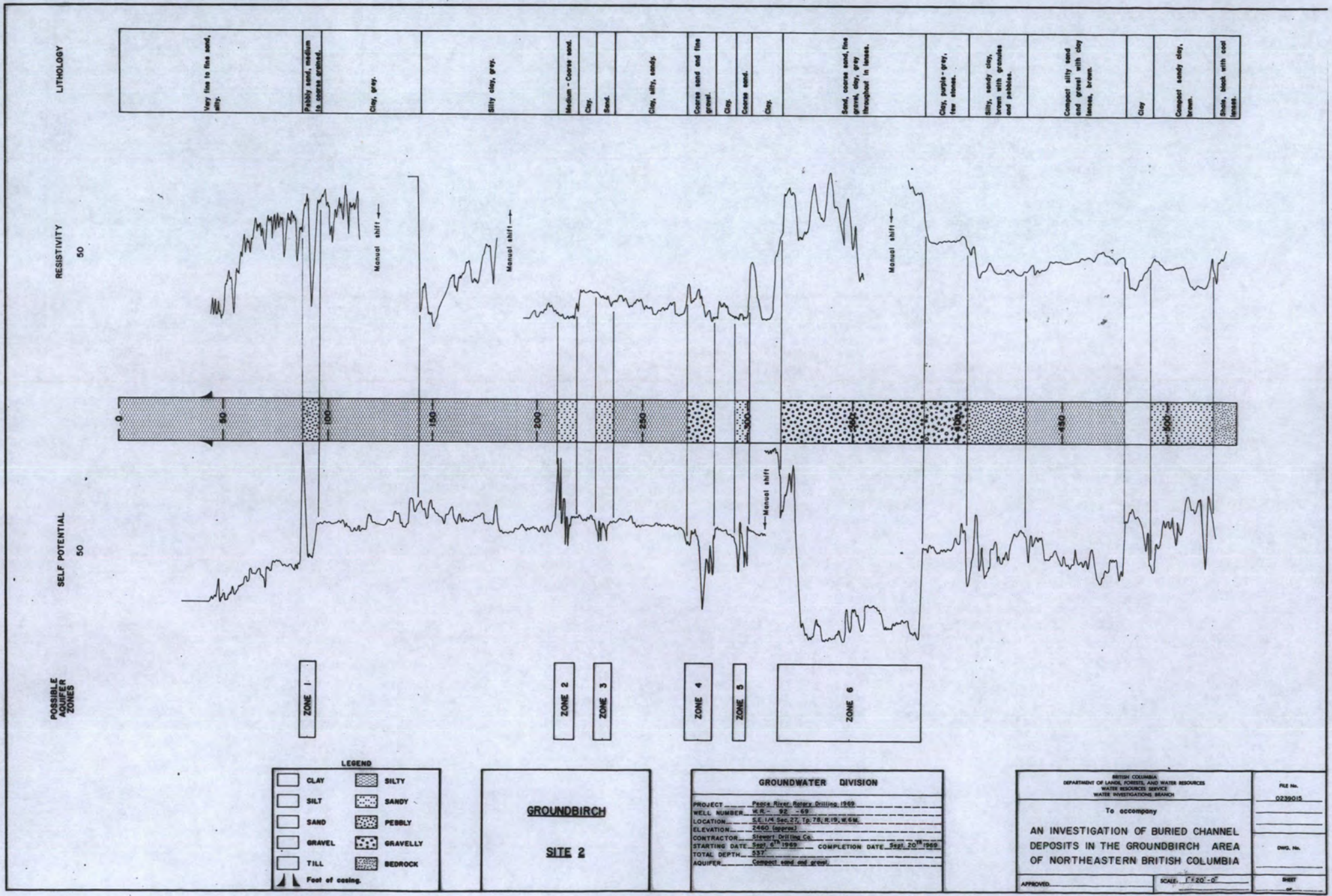
OLD OBS WELL # WR-92-69 AB.73 METHOD OF DRILLING = DRILLED

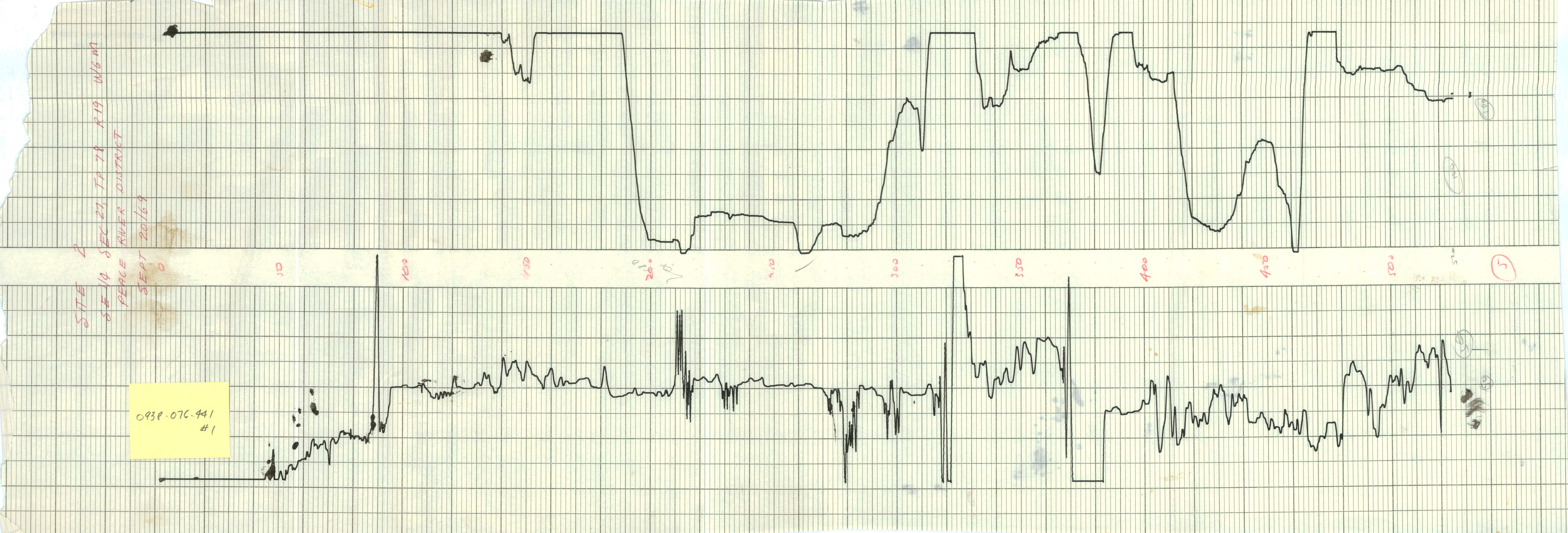
Alternative Specs Submitted: No

Documents

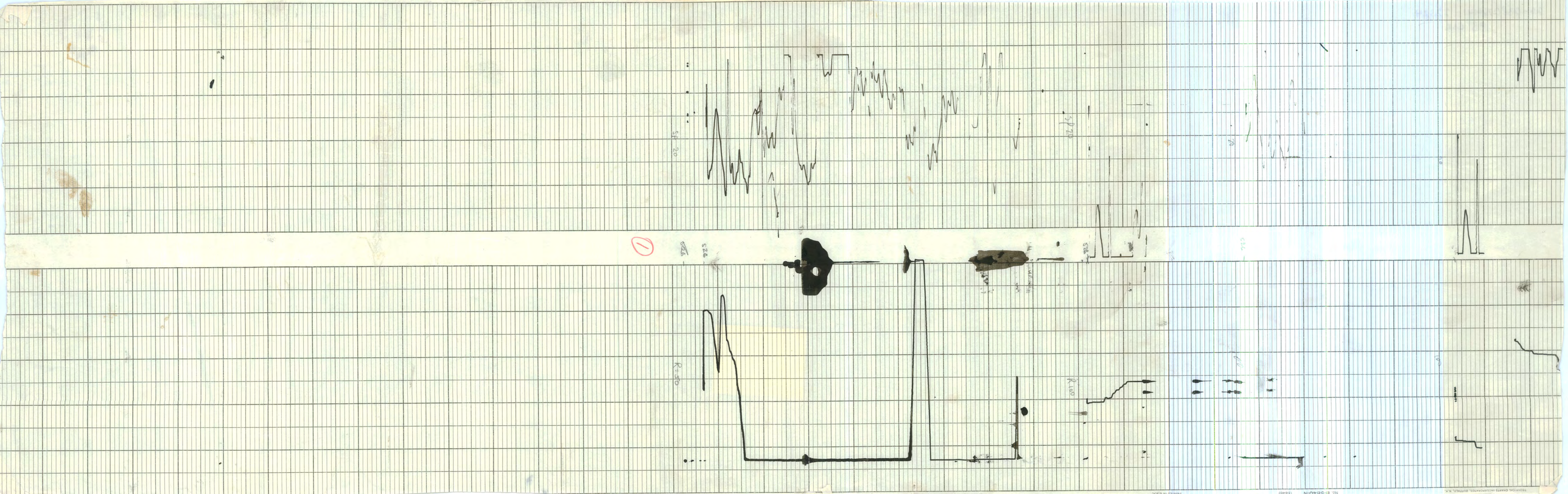
- WTN 22824_Well Record.pdf

Disclaimer


LITHOLOGY
Very fine to fine sand, silty.
Pebbly sand, medium to coarse grained.
Clay, grey.
Silty clay, grey.
Medium - Coarse sand.
Clay.
Sand.
Clay, silty, sandy.
Coarse sand and fine gravel.
Clay.
Coarse sand.
Clay.
Sand, coarse sand, fine gravel, clay, grey throughout in lenses.
Clay, purple - grey, few stones.
Silty, sandy clay, brown with granules and pebbles.
Compact silty sand and gravel with clay lenses, brown.
Clay
Compact sandy clay, brown.
Shale, black with coal lenses.
RESISTIVITY
50
Manual shift
SELF POTENTIAL
50
Manual shift
0
50
100
150
200
250
300
400
450
500
550
POSSIBLE AQUIFER ZONES
ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
ZONE 6
LEGEND
CLAY
SILT
SAND
GRAVEL
TILL
Foot of casing.
SILTY
SANDY
PEBBLY
GRAVELLY
BEDROCK
GROUNDBIRCH
SITE 2
GROUNDWATER DIVISION
PROJECT Peace River Rotary Drilling 1969
WELL NUMBER W.R. - 92 - 69
LOCATION S.E. 1/4 Sec. 27, Tp. 78, R. 19, W. 6 M.
ELEVATION 2460 (approx.)
CONTRACTOR Stewart Drilling Co.
STARTING DATE Sept. 6th 1969 COMPLETION DATE Sept. 20th 1969
TOTAL DEPTH 537'
AQUIFER Compact sand and gravel
BRITISH COLUMBIA
DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE
WATER INVESTIGATIONS BRANCH
To accompany
AN INVESTIGATION OF BURIED CHANNEL DEPOSITS IN THE GROUNDBIRCH AREA OF NORTHEASTERN BRITISH COLUMBIA
APPROVED
SCALE: 1" = 20' - 0"
FILE No. 0239015
DWG. No.
SHEET
OF
D


SITE 2
SE 1/4 SEC 21, T2S R19 W6M
FENCE RIVER DISTRICT
SEPT 2016
0938-076-441
#1


6
093P.076.441/#1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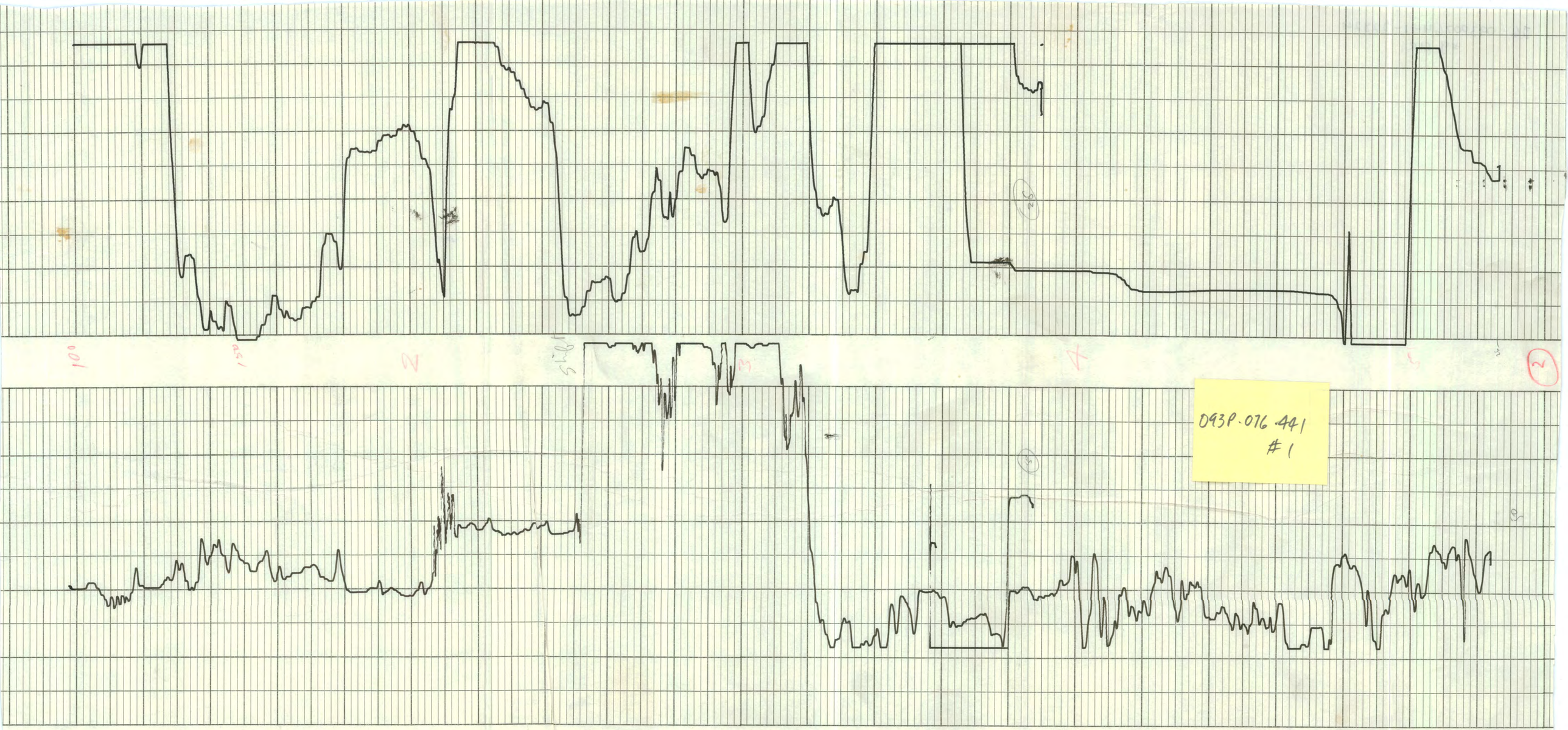
Sp 20
S20
R=50
R100



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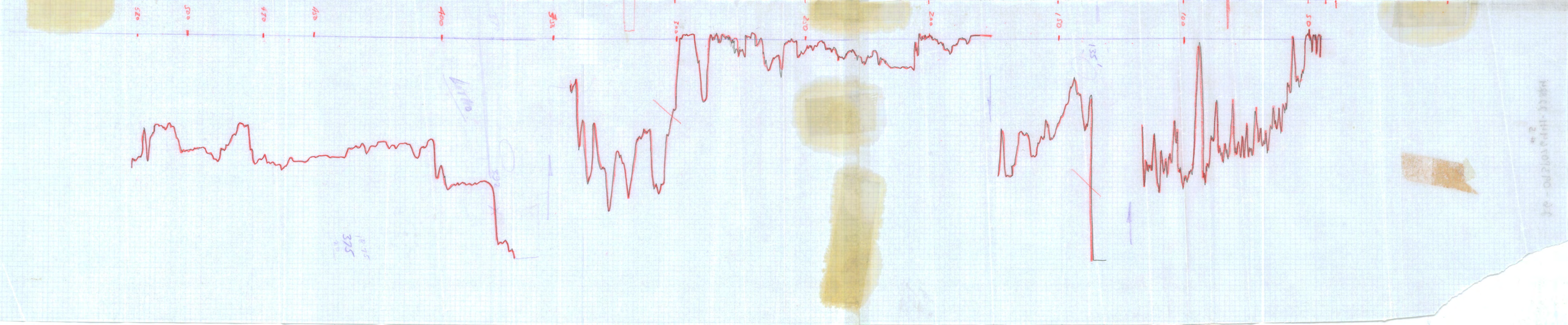

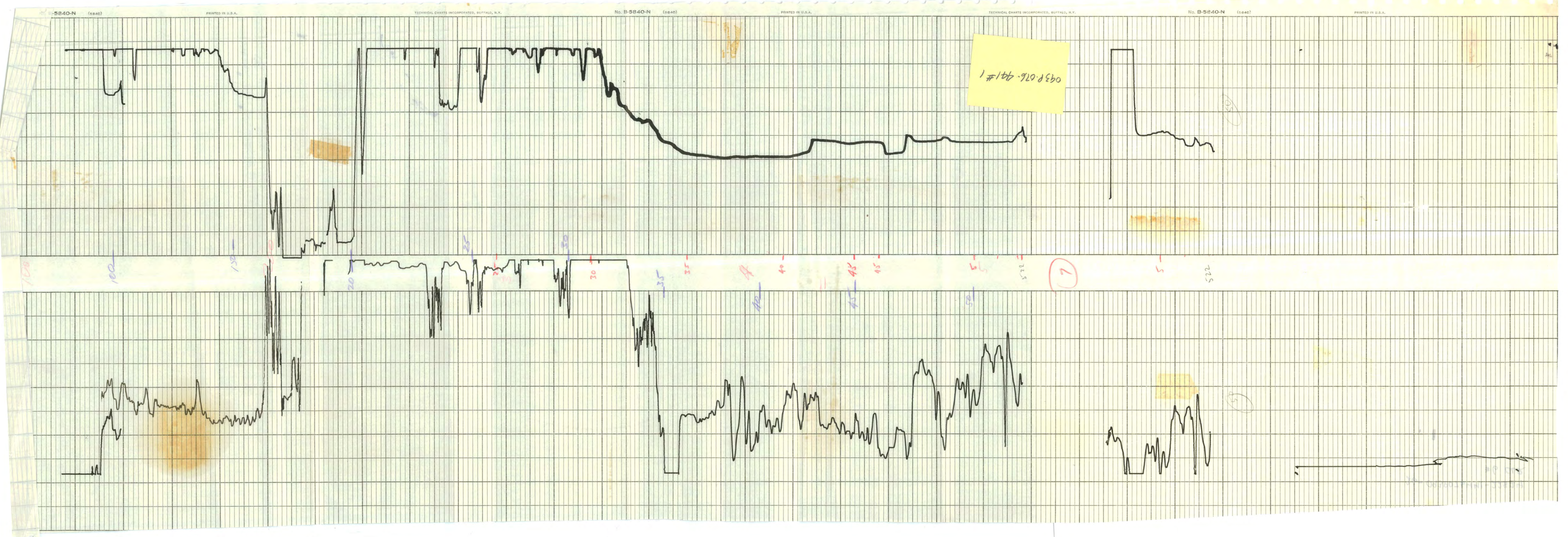
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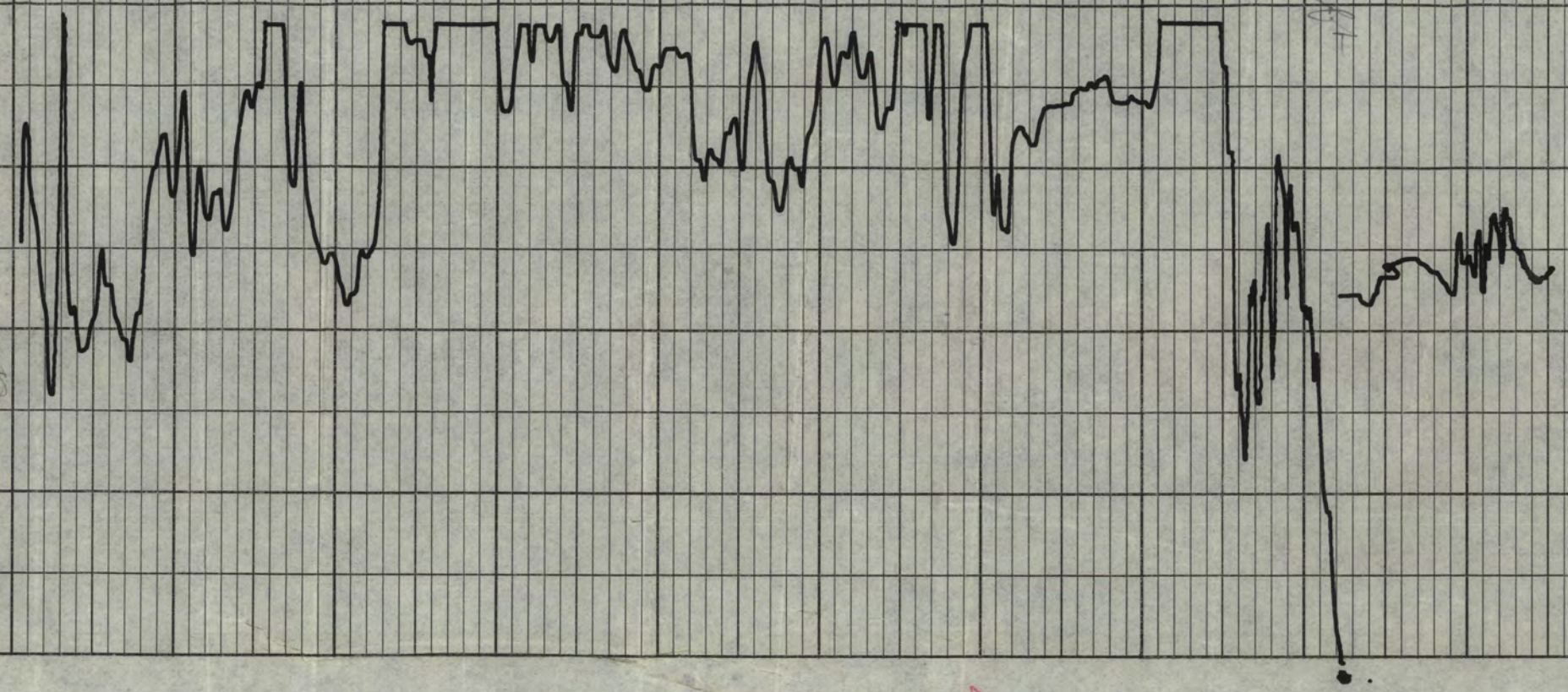
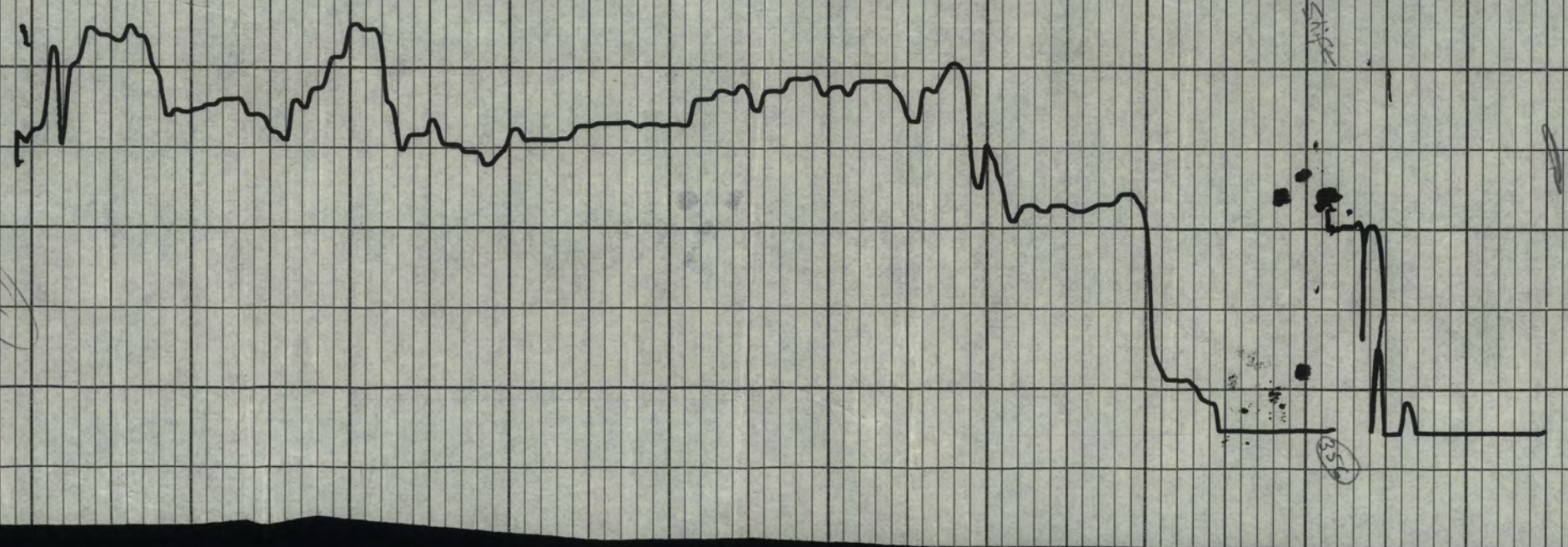
0437-076-441#1





93P.076.4.4.1 WTN 22824 #1

WATER INVESTIGATIONS BRANCH, DEPT. OF LANDS, FORESTS, AND WATER RESOURCES, VICTORIA, B.C.

LEGAL LOCATION SITE "A" SEC 27 TWP 78 R 19 W6 | WELL LOCATION MAP COORDINATES 78 19 27

LAND DISTRICT PEACE RIVER DISTRICT

LICENCE NO. | DATE LICENCE | AMOUNT | N.T.S. GRID SHEET 93P/15 E W

OWNER'S NAME F. N. RONDEAU ADDRESS GROUND BIRCH BC.

DRILLER'S NAME STEWART (130) ADDRESS INVERMERE DATE OF COMPLETION Sept 20/69

DEPTH 537' ELEVATION OF COLLAR 2460 ☐ ESTIMATED ☐ SURVEYED CASING DIAM. 5" LENGTH 44' TYPE STL.

METHOD OF CONSTRUCTION ROTARY SCREEN ☒ SIZE # 20 LENGTH 2' TYPE J. S. S.

LOCATION OF SCREEN 368' - 370' DEVELOPED ☒ DESCRIBE AIR LIFTED

PERFORATED CASING ☐ LENGTH | LOCATION OF PERFORATIONS

GRAVEL PACK ☐ LENGTH | DIAM. | SIZE GRAVEL, ETC.

DISTANCE TO WATER FROM 177' ☐ ESTIMATED ☒ MEASURED WATER LEVEL ELEVATION | ARTESIAN PRESSURE | P.S.I. DATE

WATER USE

PRODUCTION TEST SUMMARY

DATE
TEST BY
BAIL TEST ☐ DURATION OF TEST
PUMP TEST ☐ RATE G.P.M.
WATER LEVEL AT COMPLETION OF TEST
DRAWDOWN AVAILABLE DRAWDOWN
SPECIFIC CAPACITY gpm/ft. dd
PERMEABILITY USgpd/ft² STORAGE COEFF.
TRANSMISSIVITY DRAWDOWN USgpd/ft. RECOVERY USgpd/ft.
REMARKS

CHEMISTRY

TEST BY | DATE

TOTAL DISSOLVED SOLIDS mg/l TEMPERATURE °C pH CONDUCTANCE μmhos/cm AT 25°C

IRON (Fe) mg/l SILICA (SiO_2) mg/l TOTAL HARDNESS ($CaCO_3$) mg/l

TOTAL ALKALINITY ($CaCO_3$) mg/l PHEN. ALKALINITY ($CaCO_3$) mg/l MANGANESE (Mn) mg/l

ANIONS	mg/l	epm	% epm	CATIONS	mg/l	epm	% epm
CARBONATE (CO_3)				CALCIUM (Ca)			
BICARBONATE (AS CO_3)				MAGNESIUM (Mg)			
SULPHATE (SO_4)				SODIUM (Na)			
CHLORIDE (Cl)				POTASSIUM (K)			
NITRATE ($NO_2 + NO_3$)							
* TKN (NO_3)							
PHOSPHORUS (P)							
TOTAL				TOTAL			

* TKN : TOTAL KJELDAHL NITROGEN

CHEMISTRY FIELD TESTS

TEST BY | DATE | EQUIPMENT USED

CONTENTS OF FOLDER

☒ DRILL LOG ☐ SIEVE ANALYSIS ☐ PUMP TEST DATA ☒ GEOPHYSICAL LOGS ☐ CHEMICAL ANALYSIS ☐ REPORT

OTHER WR - 92 - 69

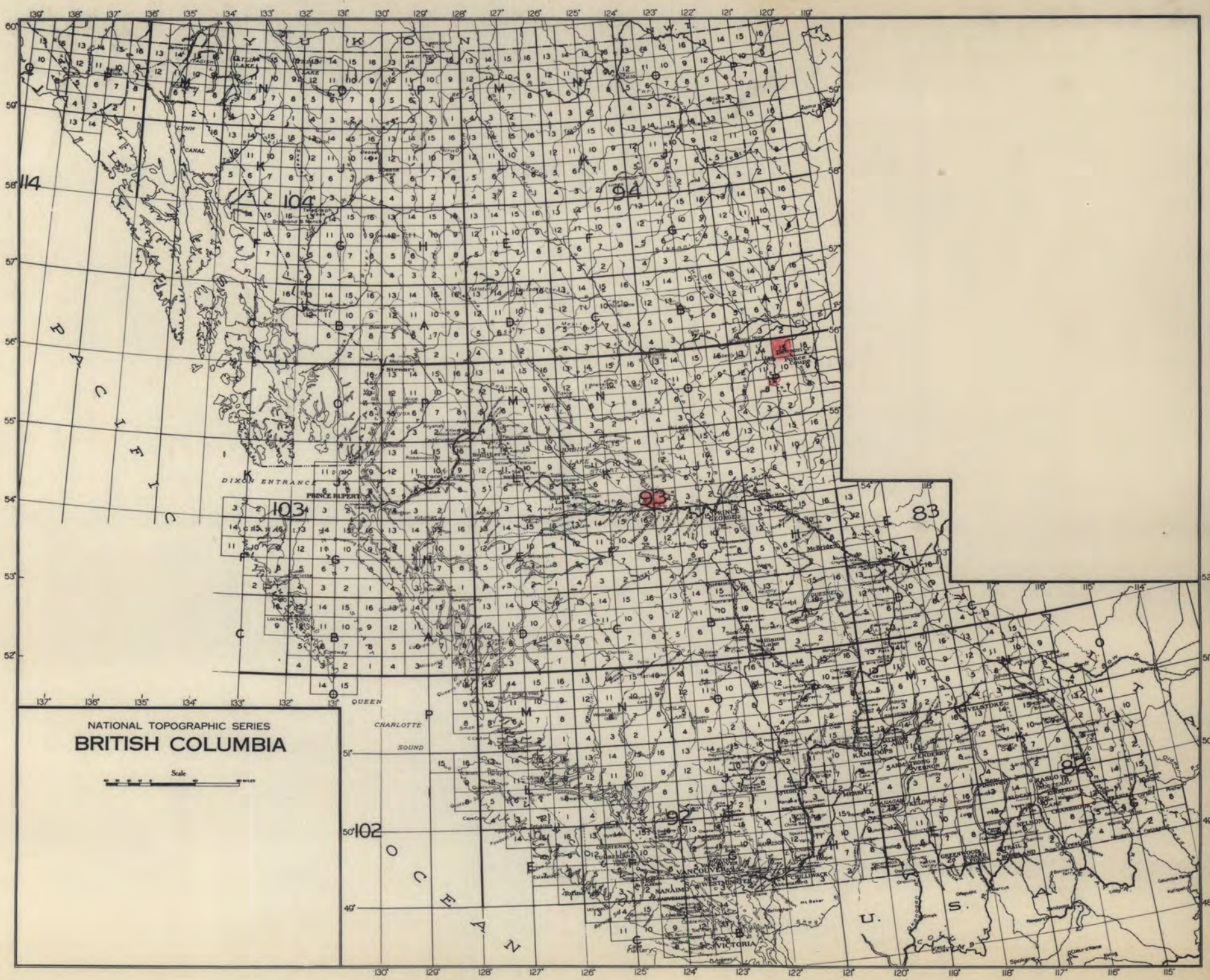
SOURCES OF INFORMATION OBS DISCONTINUED APR. 73 POOR HYDROGRAPH
FURTHER INFORMATION REFER TO PROJECT FOLIO
GROUND BIRCH 93 P/15

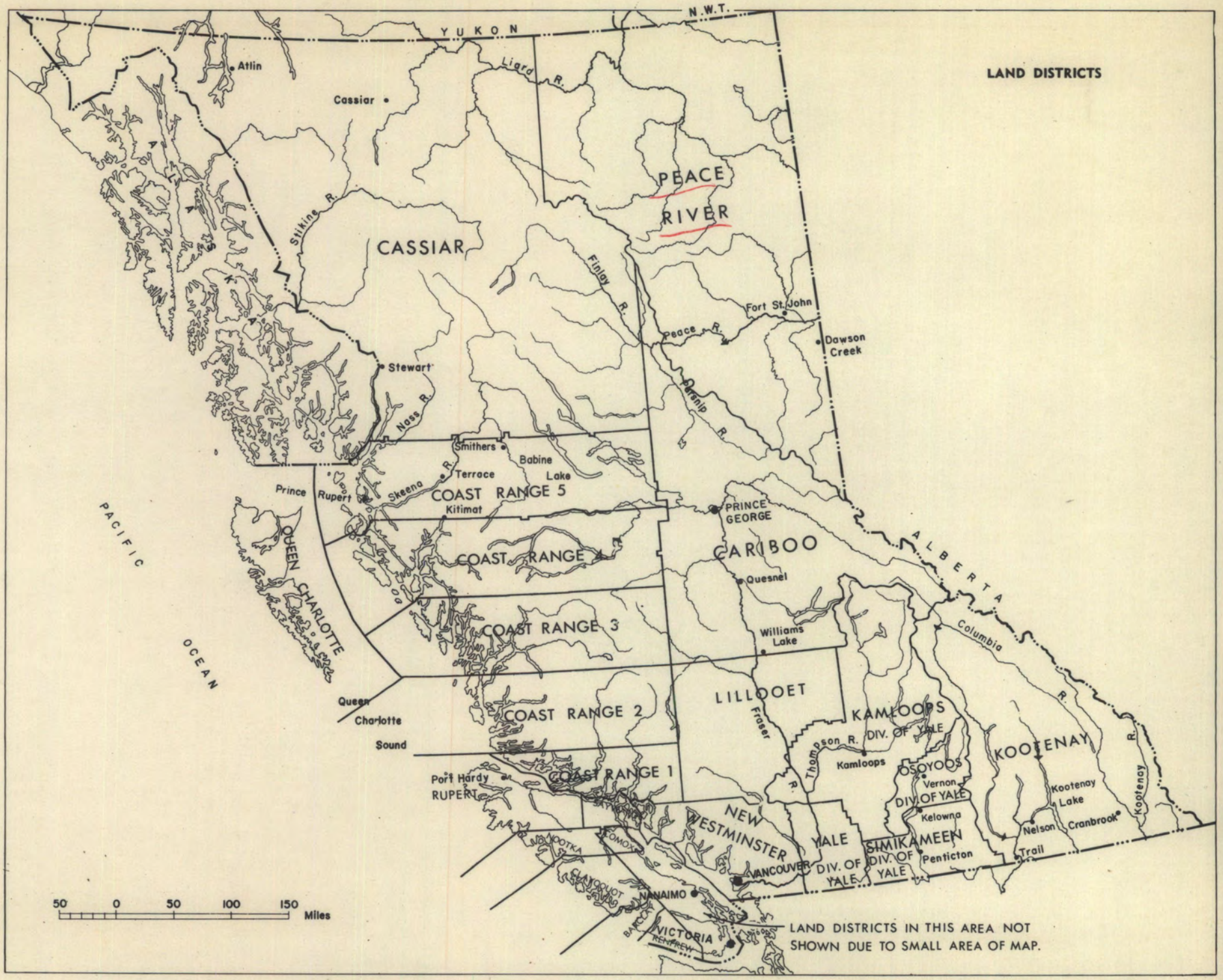
LITHOLOGY

FROM	TO	DESCRIPTION
0	110	SAND, VERY FINE TO FINE GRAINED
110	120	SAND COARSE WITH PEBBLES
120	265	CLAY LIGHT - MEDIUM GREY, STONEY
265	303	CLAY & COARSE SAND LENSES OF CLEAN CLAY STONES
303	340	SAME
340	395	COMPACT SAND & GRAVEL DIRTY MAINLY LIMESTONE FRAGMENTS
395	420	TILL, GREY
420	434	COMPACT SAND & GRAVEL DIRTY
434	445	CLAY SILTY SAND LIGHT BROWN SAND IS SUB TO WELL ROUNDED QUARTZ & MAFICS (50-50)
445	462	CLAY LIGHT BROWN SILTY SAND

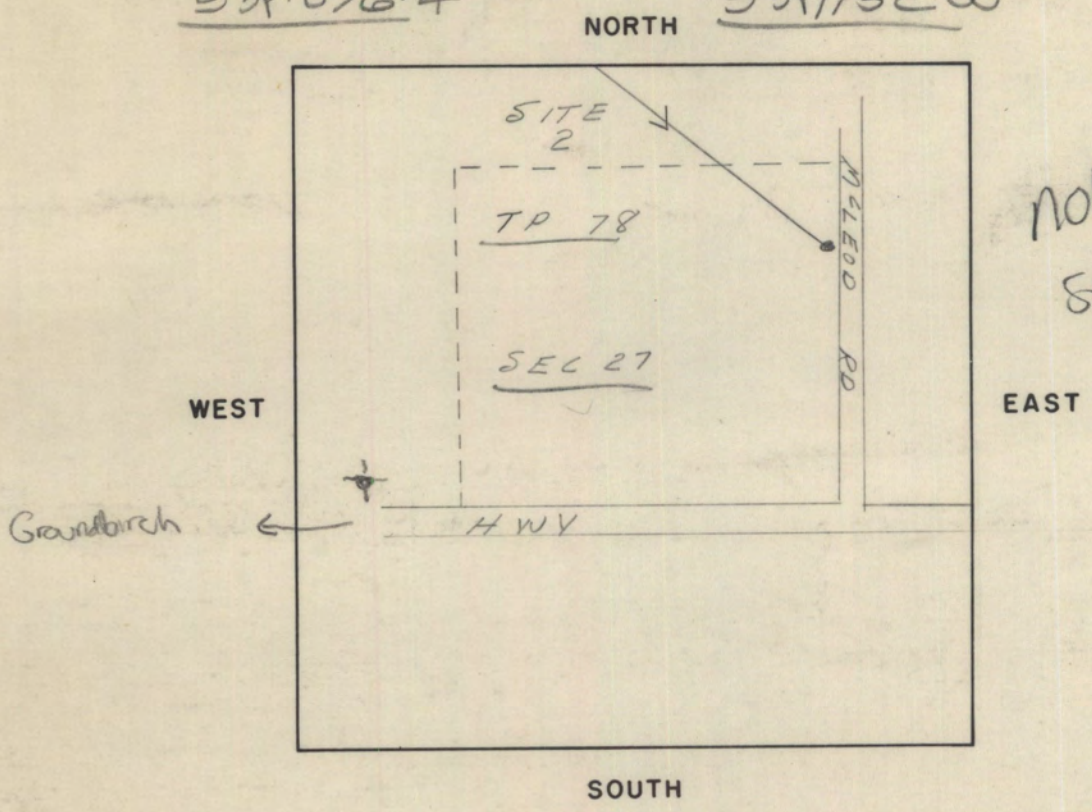
REMARKS

462	472	GRAVELLY CLAY
472	499	TILL PURPLISH GREY
499	526	SAND COMPACT & CLAY
526	537	SHALE, COAL


NATIONAL TOPOGRAPHIC SERIES
BRITISH COLUMBIA
Scale
YUKON
PACIFIC
OCEAN
DIXON ENTRANCE
QUEEN CHARLOTTE SOUND
PRINCE RUPERT
VANCOUVER
VICTORIA
U. S.
114
104
94
103
93
83
102
92
82


LAND DISTRICTS
N.W.T.
YUKON
ALASKA
PACIFIC OCEAN
Atlin
Cassiar
Liard R.
Stikine R.
CASSIAR
PEACE RIVER
Finlay R.
Fort St. John
Peace R.
Dawson Creek
Stewart
Nass R.
Parsnip R.
Smithers
Babine Lake
Terrace
Skeena R.
Prince Rupert
COAST RANGE 5
Kitimat
PRINCE GEORGE
CARIBOO
COAST RANGE 4
Quesnel
QUEEN CHARLOTTE ISLANDS
COAST RANGE 3
Williams Lake
ALBERTA
Columbia R.
Queen Charlotte Sound
COAST RANGE 2
LILLOOET
Fraser R.
KAMLOOPS
DIV. OF YALE
Thompson R.
Kamloops
KOOTENAY
Kootenay R.
Kootenay Lake
Port Hardy
RUPERT
COAST RANGE 1
OSOYOOS
Vernon
DIV. OF YALE
Kelowna
Nelson
Cranbrook
NEW WESTMINSTER
YALE
SIMILKAMEEN
DIV. OF YALE
DIV. OF YALE
Penticton
Trail
VANCOUVER
NANAIMO
VICTORIA
50 0 50 100 150 Miles
LAND DISTRICTS IN THIS AREA NOT SHOWN DUE TO SMALL AREA OF MAP.

93P·076·4 93P/15cW



not correct
see map inside

CARD BY G J H DATE Jan 30/75

ADDITIONAL DATA ADDED BY

REMARKS

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 52925
Well Identification Plate Number: 35907
Owner Name: MCLEOD RECREATION & SOCIAL SERVICES SOCIETY
Intended Water Use: Water Supply System

Well Status: New
Well Class: Water Supply
Well Subclass:

Aquifer Number: 594

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID: E292827
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

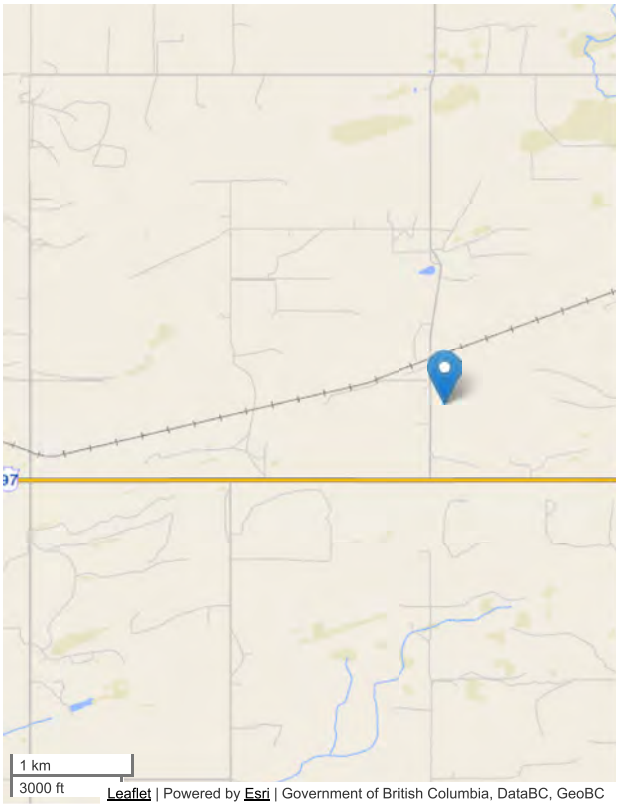
Location Information

Street Address: 8032 ROAD 265
Town/City: GROUNDBIRCH

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	26
Township	78
Range	19
Land District	44
Property Identification Description (PID)	

Description of Well Location: PARCEL A



Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 55.786715
Longitude: -120.843902
UTM Easting: 635199
UTM Northing: 6184446
Zone: 10
Coordinate Acquisition Code: (10 m accuracy) Handheld GPS with accuracy of +/- 10 metres

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
There has been no activity related to this well.				

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1983-10-21	1983-10-21				

Well Completion Data

Total Depth Drilled: 301.00 feet
Finished Well Depth: 300.00 feet
Final Casing Stick Up: 24.000 inches
Depth to Bedrock:
Ground elevation: 2516.00

Static Water Level (BTOC): 150.00 feet
Estimated Well Yield: 5.000 USGPM
Artesian Flow:
Artesian Pressure:
Method of determining elevation: Unknown

Well Cap: CAPPED
Well Disinfected Status: Not Disinfected
Drilling Method: Air Rotary
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0.00	120.00	sand brown						
120.00	150.00	silty sand						
150.00	205.00	silt						
205.00	245.00	silty sand						
245.00	290.00	sand black						
290.00	295.00	sand and gravel						
295.00	300.00	gravel						
300.00	301.00	sand						

Casing Details

From (ft)	To (ft)	Casing Type	Casing Material	Diameter	Wall Thickness	Drive Shoe
-2.00	300.00		Steel	6.000	0.188	Installed

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:

Liner Thickness:
Liner to:

Liner perforations

From	To
There are no records to show	

Screen Details

Intake Method: Screen
Type: Telescope
Material: Stainless Steel
Opening: Continuous Slot
Bottom: Bail

Installed Screens

From	To	Diameter	Assembly Type	Slot Size
295.00 ft	299.00 ft	5.50	SCREEN	20.00

Well Development

Developed by:

Development Total Duration:

Well Yield

No well yield data available.

Well Decommission Information

Reason for Decommission:
Method of Decommission:
Sealant Material:
Backfill Material:
Decommission Details:

Comments

2012-ID PLATE 35907 SENT TO OWNER. UPDATED COORDINATES PROVIDED BY CONTRACTOR WORKING IN NE.

Alternative Specs Submitted: No

Documents

- WTN 52925_Well Record.pdf

Disclaimer

WTN 52925 (13)

Province of British Columbia Ministry of Environment Water Management Branch

WATER WELL RECORD

Date 83 / 10 / 21 (YR / MO / DY)

NTS MAP ____ WELL No. ____ ELEV ____ Location Accuracy ____

UTM Z ____ E ____ N ____ UTM Date 19__ Well Type ____

Owners Name & Address McLEOD RECREATION & S.S.S. Co. of G. DANIELS Social Services Society BOX 672 DAWSON CR.

Legal Description & Address ____

Descriptive Location WILLOW VALLEY RD. GROUND BIRCH

1. TYPE OF WORK 1 ☑ New Well 2 ☐ Reconditioned 3 ☐ Deepened 4 ☐ Abandoned

2. WORK METHOD 1 ☐ Cable tool 2 ☐ Bored 3 ☐ Jetted 4 ☑ Rotary a ☐ mud b ☑ air c ☐ reverse ☐ Other ____

3. WATER WELL USE 1 ☑ Domestic 2 ☐ Municipal 3 ☐ Irrigation 4 ☐ Comm. & Ind. ☐ Other ____

4. DRILLING ADDITIVES NONE

5. MEASUREMENTS from 1 ☐ ground level 2 ☑ top of casing

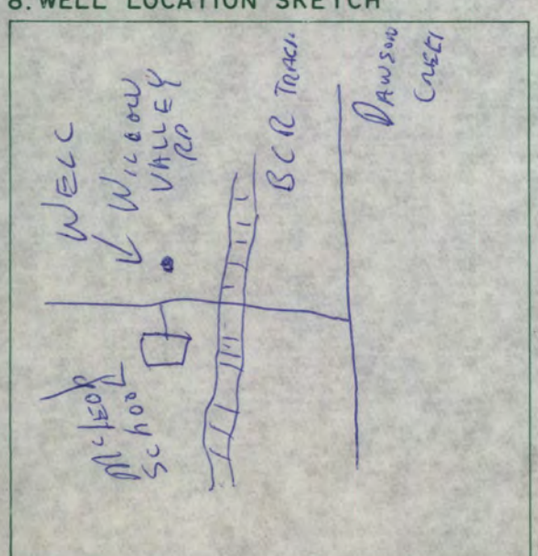
casing height above ground level 2 ft.

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	120	SAND BROWN	
120	150	SILTY SAND	
150	205	SILT	
205	245	SILTY SAND	
245	290	SAND BLACK	
290	295	SAND & GRAVEL	
295	300	GRAVEL	
300	301	SAND	
		759.	
		NW¼ Sec 19 Tp 79 Rg 18 07668. nn	
		NW¼ Sec 30 Tp 79 Rg 18 07711. nn	
		SW¼ Sec 30 Tp 79 Rg 18 07713. nn	

7. CONSULTANT ____

Address ____

8. WELL LOCATION SKETCH



9. CASING: Materials 1 ☑ Steel 2 ☐ Galvanized 3 ☐ Wood 4 ☐ Plastic 5 ☐ Concrete ☐ Other ____

							units
Hole Diameter	6"						ins
Diameter	6"						ins
from	+2						ft
to	300						ft
Thickness	.188						ins
Weight	12.60						lb/ft

Pitless unit ____ ft 1 ☐ above 2 ☐ below ground level

1 ☐ Welded 2 ☐ Cemented 3 ☐ Threaded | 1 ☐ New 2 ☐ Used

Perforations: ____

Shoe(s): ____

Open hole, from ____ to ____ ft Diameter ____ ins

Grout: ____

10. SCREEN: 1 ☑ Nominal (Telescope) 2 ☐ Pipe Size

Type 1 ☑ Continuous Slot 2 ☐ Perforated 3 ☐ Louvre ☐ Other ____

Material 1 ☑ Stainless Steel 2 ☐ Plastic ☐ Other ____

Set from 295 to 299 ft below ground level

RISER, SCREEN & BLANKS							units
Length	4'						ft
Diam. ID	5½						ins
Slot Size	.020						ins
from	295						ft
to	299						ft

Fittings, top K PACKER bottom BAIL

Gravel Pack ____

11. DEVELOPED BY: 1 ☑ Surging 2 ☐ Jetting 3 ☑ Air 4 ☐ Bailing 5 ☐ Pumping ☐ Other ____

12. TEST 1 ☐ Pump 2 ☐ Bail 3 ☑ Air Date ____ (YR / MO / DY)

Rate ____ USgpm Temp ____ °C SWL before test 150 ft

Water Level ____ ft after test of ____ hrs

☐ DRAWDOWN in ft				☐ RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13.

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
SUBMERSIBLE	240-260 ft	5 to 25 USgpm

14. WATER TYPE: 1 ☑ fresh 2 ☐ salty 3 ☑ clear 4 ☐ cloudy

colour ____ smell ____ ; gas 1 ☐ yes 2 ☐ no

15. WATER ANALYSIS: 1 Hardness ____ mg/L 2 Iron ____ mg/L 3 Chloride ____ mg/L 4 pH ____ Field Date ____ Lab Date ____ (YR / MO / DY)

SITE I D No ____

16. FINAL WELL COMPLETION DATA

Well Depth 300 ft Well Yield 50 US gpm

Static Water Level 150 ft Artesian Flow ____ US gpm Pressure Head ____ ft

Back filled ____

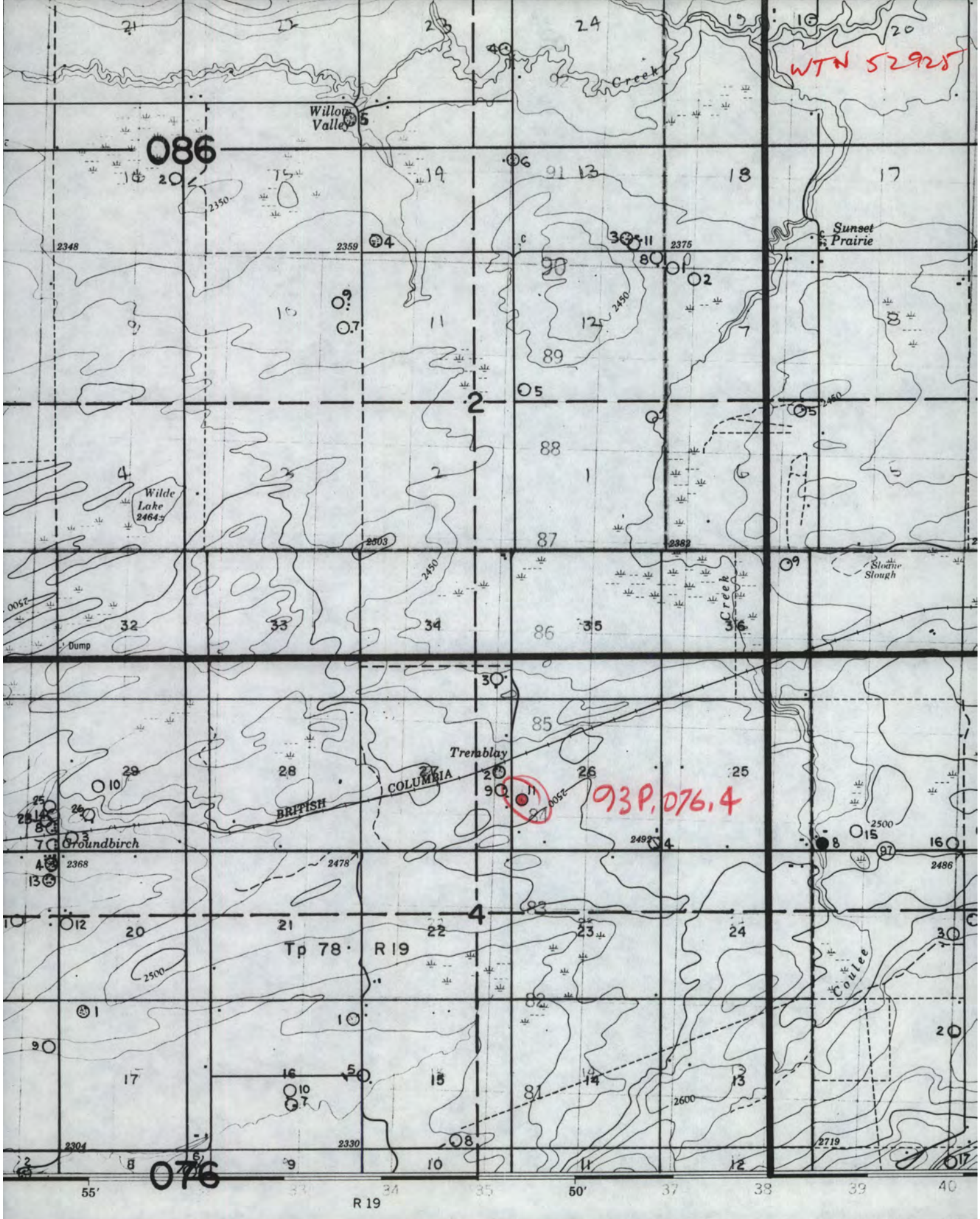
Well Head Completion CAPPED

17. DRILLER PLEASE PRINT SURNAME VLCHAEK FIRST NAME JOHN

Signature J Vlchaek

18. CONTRACTOR, Address Cariboo Water Wells Ltd Box 2265 Prince George

Member, BCWWDA ☑ yes ☐ no ; ____



Roads:
hard surface, all weather ..... pavée, toute saison ..... dual highway 2 chaussées séparées more than 2 lanes plus de 2 voies

SUN
PE
R

93P.076.4.4.1

PID: 016-360-419

13

WTN 52925

#2

WATER WELL RECORD

MINISTRY OF ENVIRONMENT, WATER MANAGEMENT BRANCH — VICTORIA, BRITISH COLUMBIA

Z ___ ___ WELL NO. ___ 1 1

___ E

___ N

Z X Y NO.

NAT. TOPO. SHEET NO. 93P/4

LEGAL DESCRIPTION: LOT ~~PARK~~ 1 SEC. 26 TP. 78 R. 19 W6 D.L. ___ LAND DISTRICT PEACE RIVER PLAN ___

DESCRIPTIVE LOCATION GROUNDBIRCH Parcel A LICENCE NO. ___ DATE ___

OWNER'S NAME G. DANIELS (McLOOD RECREATION SOCIETY) ADDRESS BOX 672 DAWSON CREEK

DRILLER'S NAME CARIBOO WATER WELLS ADDRESS BOX 2265 PRINCE GEORGE DATE COMPLETED OCT 21/83

DEPTH 301 ELEVATION OF 1024 ☐ ESTIMATED ☐ SURVEYED CASING DIAM. 6" LENGTH +2'-300'

METHOD OF CONSTRUCTION AIR ROTARY CASING DIAM ___ LENGTH ___

SCREEN LOCATION 295-299' SCREEN ☑ SIZE #20 LENGTH 4' TYPE STAINLESS

SANITARY SEAL YES ☐ NO ☐ SCREEN ☐ SIZE ___ LENGTH ___ TYPE ___

PERFORATED CASING ☐ LENGTH ___ PERFORATIONS FROM ___ TO ___

GRAVEL PACK ☐ LENGTH ___ DIAM. ___ SIZE GRAVEL, ETC. ___

DISTANCE TO WATER 150' ☐ ESTIMATED WATER LEVEL

FROM ___ ☐ MEASURED ELEVATION ___ ARTESIAN PRESSURE ___

DATE OF WATER LEVEL MEASUREMENT ___ WATER USE DOMESTIC

PRODUCTION TEST SUMMARY

DATE ___

TEST BY DRILLER

BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST ___

RATE ___ DRAWDOWN ___

WATER LEVEL AT COMPLETION OF TEST ___

AVAILABLE DRAWDOWN ___ SPECIFIC CAPACITY ___

PERMEABILITY ___ STORAGE COEFF. ___

TRANSMISSIVITY ___

RECOMMENDED PUMPING RATE 5-25 USGPM

RECOMMENDED PUMP SETTING 240-260'

CHEMISTRY

TEST BY ___ DATE ___

TOTAL DISSOLVED SOLIDS ___ mg/l TEMPERATURE ___ °C pH ___ SILICA (SiO_2) ___ mg/l

CONDUCTANCE ___ μmhos/cm AT 25°C TOTAL IRON (Fe) ___ mg/l TOTAL HARDNESS ($CaCO_3$) ___ mg/l

TOTAL ALKALINITY ($CaCO_3$) ___ mg/l PHEN. ALKALINITY ($Ca\ CO_3$) ___ mg/l MANGANESE (Mn) ___ mg/l

COLOUR ___ ODOUR ___ TURBIDITY ___

ANIONS	mg/l	epm	CATIONS	mg/l	epm
CARBONATE (CO_3)			CALCIUM (Ca)		
BICARBONATE (HCO_3)			MAGNESIUM (Mg)		
SULPHATE (SO_4)			SODIUM (Na)		
CHLORIDE (Cl)			POTASSIUM (K)		
$NO_2 + NO_3$ (NITROGEN)			IRON (DISSOLVED)		
• TKN. (NITROGEN)					
PHOSPHORUS (P)					

• TKN = TOTAL KJELDAHL NITROGEN CHEMISTRY SITE NO. ___

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY FIELD TESTS

TEST BY ___ DATE ___ EQUIPMENT USED ___

LITHOLOGY

FROM	TO	DESCRIPTION
0	120	SAND BROWN
120	150	SILTY SAND
150	205	SILT
205	245	SILTY SAND
245	290	SAND BLACK
290	295	SAND & GRAVEL
295	300	GRAVEL
300	301	SAND

According to ARC Map Rd 365 Road =

CONTENTS OF FOLDER

☑ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS

☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

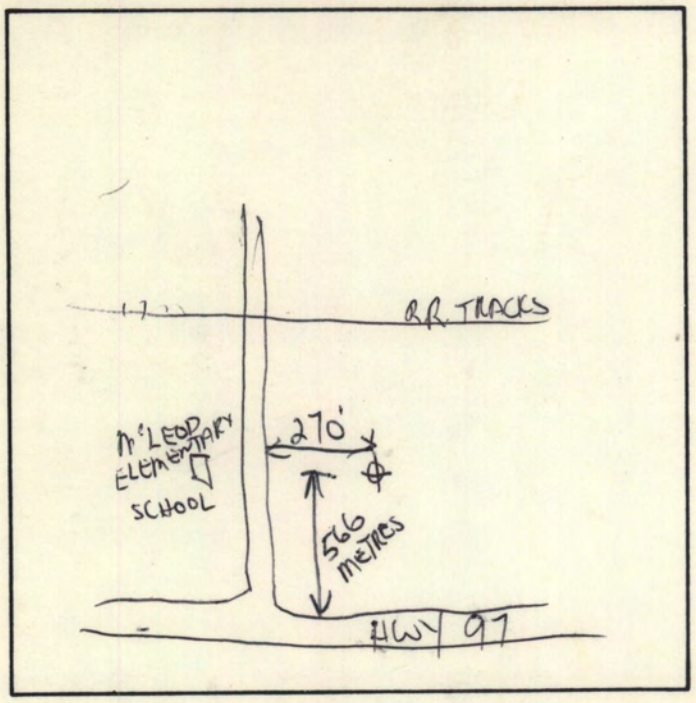
OTHER ___

SOURCES OF INFORMATION DRILLER.

NORTH

WEST

EAST



SOUTH

CARD BY B Jamieson DATE July 24/96

ADDITIONAL DATA ADDED BY

REMARKS

ID 6351198 6184478 H
Coordinates from Health Space database.

Wrong commust (2012)
Well coords more:

635173 E
6184430 N

ENV 1995

M28-1179

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 102568
Well Identification Plate Number: 12251
Owner Name: DAVE THOLA
Intended Water Use: Private Domestic

Well Status: New
Well Class: Water Supply
Well Subclass:
Aquifer Number: 594

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

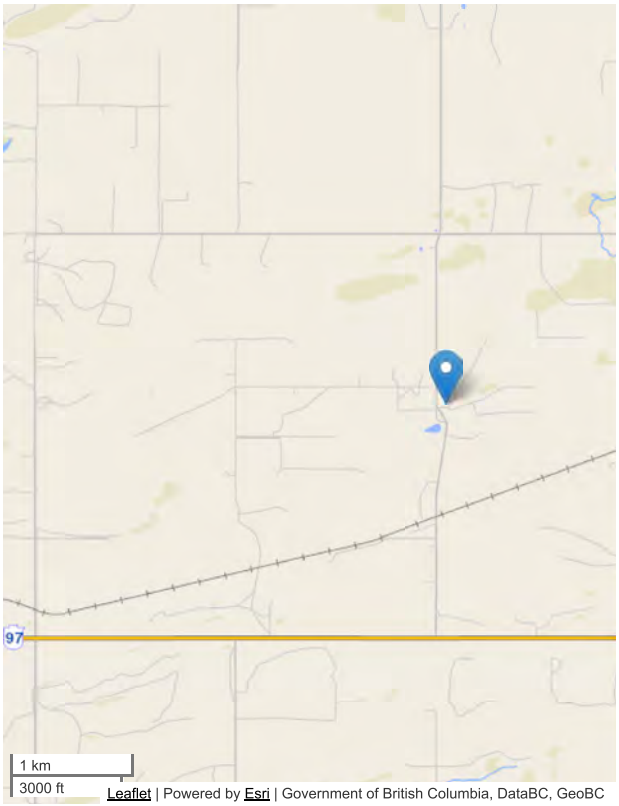
Location Information

Street Address: 265 ROAD
Town/City:

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	35
Township	78
Range	19
Land District	
Property Identification Description (PID)	014772230

Description of Well Location: SEE SKETCH FOR DETAILS. SEC 33 SE, 34 SE SW, 35 NW SW.



Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 55.798158
Longitude: -120.844514
UTM Easting: 635121
UTM Northing: 6185718
Zone: 10
Coordinate Acquisition Code: unknown, accuracy based on parcel size) ICF cadastre, poor or no location sketch, arbitrarily located in center of parcel

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
There has been no activity related to this well.				

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
2007-01-23	2007-01-23				

Well Completion Data

Total Depth Drilled: 388.00 feet
Finished Well Depth: 388.00 feet
Final Casing Stick Up: 24.000 inches
Depth to Bedrock:
Ground elevation:
Static Water Level (BTOC): 73.00 feet
Estimated Well Yield: 20.000 USGPM
Artesian Flow:
Artesian Pressure:
Method of determining elevation: Unknown
Well Cap: CAPED
Well Disinfected Status: Not Disinfected
Drilling Method: Air Rotary
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0.00	10.00							
10.00	200.00						WET	
200.00	240.00							
240.00	270.00	SAND SILTY WITH WATER						
270.00	330.00		hard				WET	
330.00	370.00	MUDDY WITH WATER GRAVEL						
370.00	388.00	BOULDER GRAVEL						

Casing Details

From (ft)	To (ft)	Casing Type	Casing Material	Diameter	Wall Thickness	Drive Shoe
-2.00	388.00		Steel	6.000	0.209	Installed

Surface Seal and Backfill Details

Surface Seal Material: Bentonite clay
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:
Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:
Liner Thickness:
Liner to:

Liner perforations

From	To
There are no records to show	

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From	To	Diameter	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:
Development Total Duration:

Well Yield

No well yield data available.

Well Decommission Information

Reason for Decommission:
Method of Decommission:
Sealant Material:
Backfill Material:
Decommission Details:

Comments

PERFORATIONS: OPEN BOTTOM. SHOE: WELDED. WELL HEAD COMPLETION: COPED.

Alternative Specs Submitted: No

Documents

- WTN 102568_Well Construction.pdf

Disclaimer

CARBON MOUNTAIN DRILLING Water Well Record. Date 2007 23 Jan

Box 6383, Fort St. John, BC V1J 4H8

093P076443
WTN: 102568

Owners Name & Address: 265Rd Dave Toews Thola

Legal Description & Address:

Tel/Fax No: SW 1/4

SEC 35 TP 78 R19
PID 014 772 230
10,635121,
6185718 "J"

Descriptive Location:

K TP S
19 78 33 SE
34 SE
SW
35 NW
SW

Type Of Work. (X)1. | New Well 2. | Reconditioned. 3. | Deepened. 4. | Abandoned.

Work Method. 1. | Cable Tool 2. | Bored. 3. | Jetted. (X)4. | Rotary. a. | mud b. | air. c. | reverse. | Other.

Water Well Use (X)1. | Domestic 2. | Municipal 3. | Irrigation 4. | Rotary. | Other.

Drilling Additives:

Measurements from X1. | ground level 2. | top of casing

casing height above ground level _____ ft.

Casing & Liner Material (X)1. | Steel 2. | Galvanized 3. | Wood. x4. |Plastic 5.|Concrete 6. | Other

Type							
Diameter	6"	6"					
From	42						
To	388						
Thickness	209						
Weight							

Pitless unit_____ ft.

X1. | Above 2. | below ground level

X1. | Welded 2. | Cemented 3. | Threaded

X1. | New 2. | Used

Perforations open bottom

Shoe(s): (welded)

Open hole, from_____ ro_____ ft. Dia._____ ins.

Grout: Bentonite

Screen: 1. | Nominal (Telescope) (X)2. | PipeSize

Type 1. | Continuous Slot x 2. | Perforated 3. | Louvre

Material 1. | Stainless Steel x 2. | Plastic. 3. | Other_____

Set from_____ to_____ ft below ground level

Riser, Screen & Blanks

Length							
Diam. ID							
Slot Size							
From							
to							

Fittings, top _____ bottom _____

Gravel Pack _____

Riser Pipe _____ ft. Tail Pipe _____ ft.

Developed by: 1 □ Surging 2 □ Jetting 3 □ Air. 4 □ Bailing 5 □ Pumping 6 □ Other _____

Test: 1 □ Pump 2 □ Bail 3 □ Air Date |__|__|__|

Rate 30 Usgpm Temp_____ °C SWL before Test_____ ft. Water level_____ ft. after test of _____ hrs.

# Drawdown in ft.		# Recovery in ft.	
Mins WL	Mins WL	Mins. WL	Mins WL

From ft.	To ft.	Well Log Description	SWL ft.
0	10	over burden	
10	200	Sand wit	
200	240	Clay	
240	270	Sand silty with water	
270	330	Clay hard wit	
330	370	Mudy With water Gravel	
370	388	Solder Gravel	

Recommended Pump Type	Recommended Pump Setting.	Recommended Pumping Rate

Consultant:

Address:

Well Location Sketch:

Water Type: 1 □ Fresh 2 □ Salty 3 □ Clear 4 □ Cloudy

Colour_____ smell_____ : gas 1 □ yes 2 □ no

Water Analysis: 1. Hardness |__|__|30| mg/L

2. Iron |__|13/8| mg/L 3. Chloride |__|__|__|__|__|

4. pH 7.5T Field Date |__.__|__.__|__.__|

Site ID NO_____ Lab Date |__.__|__.__|__.__|

Final Well Completion Data

Well Depth |__|518|8| ft. Well Yield |__|__|20gl

Static Water Level |__|__|73| ft. Artesian flow |__|__|__| Pre

Pressure Head_____ ft. Back Filled_____

Well Head Completion Capped

Driller_____

Signature_____

Unit # 503

Work Order # 6055 Invoice # 6917

Contractor: CARBONMAUNTAIN

BC # 12251

gps: 10635015E
6185668N

***** Must be completed in full*****

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 17930
Well Identification Plate Number:
Owner Name: PETE REMPEL
Intended Water Use: Private Domestic

Well Status: New
Well Class: Unknown
Well Subclass:
Aquifer Number:

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

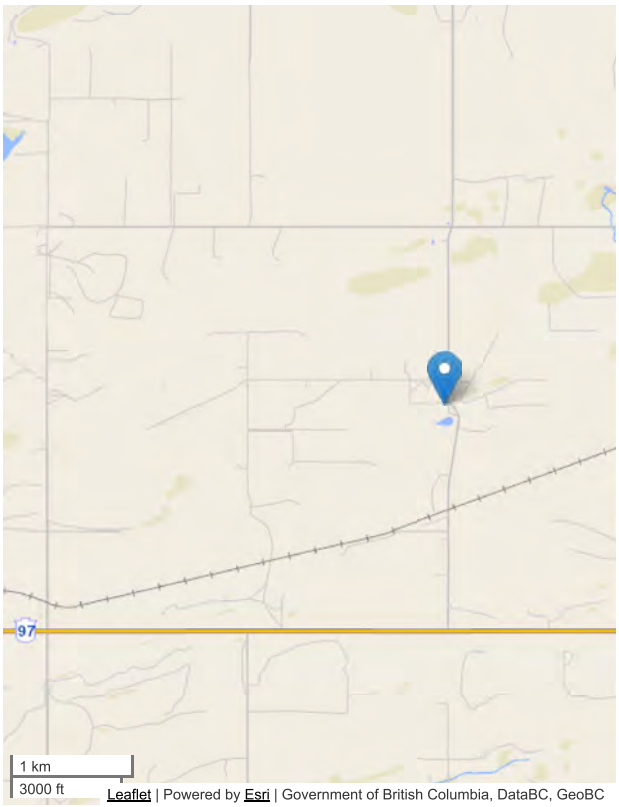
Location Information

Street Address:
Town/City:

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	34
Township	78
Range	19
Land District	44
Property Identification Description (PID)	

Description of Well Location:



Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 55.797656
Longitude: -120.846154
UTM Easting: 635020
UTM Northing: 6185659
Zone: 10
Coordinate Acquisition Code: (200 m accuracy) Digitized from 1:50,000 maps

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
There has been no activity related to this well.				

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1963-01-01	1963-01-01				

Well Completion Data

Total Depth Drilled:
Finished Well Depth: 45.00 feet
Final Casing Stick Up:
Depth to Bedrock:
Ground elevation:
Static Water Level (BTOC): 44.00 feet
Estimated Well Yield:
Artesian Flow:
Artesian Pressure:
Method of determining elevation: Unknown
Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Excavating
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0.00	45.00	silt with fine sand						

Casing Details

From (ft)	To (ft)	Casing Type	Casing Material	Diameter	Wall Thickness	Drive Shoe
There are no records to show						

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:
Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:
Liner Thickness:
Liner to:

Liner perforations

From	To
There are no records to show	

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From	To	Diameter	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:
Development Total Duration:

Well Yield

No well yield data available.

Well Decommission Information

Reason for Decommission:
Sealant Material:
Decommission Details:
Method of Decommission:
Backfill Material:

Comments

No comments submitted

Alternative Specs Submitted: No

Documents

- WTN 17930_Well Record.pdf

Disclaimer

93P·076·4·4·3 WTN 17930 #1

TOWNSHIP (TENS / UNITS)	MERIDIAN	RANGE (TENS / UNITS)	SECTION (TENS / UNITS)	QUARTER	LAND DISTRICT (TENS / UNITS)
7 8		1 9	3 4	S.E. 1/4	

GROUND — WATER DIVISION, WATER INVESTIGATIONS BRANCH, DEPT. OF LANDS, FORESTS, and WATER RESOURCES, VICTORIA, B.C.

LOCATION ~~S~~ 5 1/2 SEC 34 TP 78 R19 W6M PEACE RIVER
(COMPLETE LEGAL DESCRIPTION)

OWNER'S NAME PETE REMPEL ADDRESS GROUNDBIRCH

DRILLER'S NAME ADDRESS DATE OF COMPLETION 1963

DEPTH 45' ELEVATION OF COLLAR 2400' CASING DIAM. LENGTH TYPE

METHOD OF DIGGING DUG SCREEN ☐ SIZE LENGTH TYPE

LOCATION OF SCREEN DEVELOPED ☐ DESCRIBE

PERFORATED CASING ☐ LENGTH LOCATION OF PERFORATIONS

GRAVEL PACK ☐ LENGTH DIAM. SIZE GRAVEL, ETC.

PUMP ☐ TYPE POWER

CAPACITY OTHER DATA

COSTS WELL PUMP PUMP HOUSE, ETC.

MAINTENANCE

DISTANCE TO WATER FROM TOP OF CASING 43' 6" ☐ ESTIMATED ☐ MEASURED ELEVATION FLUCTUATION

HIGH WATER MONTH LOW WATER MONTH OBSERVATION DATA ☐ FILE No.

WATER USE DOMESTIC

MAX. RATE WITHDRAWAL ☐ ESTIMATED ☐ MEASURED

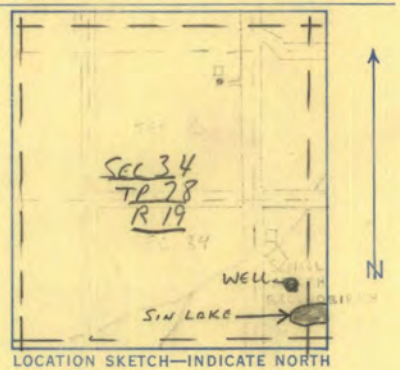
TEMPERATURE PUMPS SAND ☐

CLOGS SCREEN ☐ TYPE DEPOSIT AQUIFER DATA SAND

LICENSE No. DATE LICENSE AMOUNT

DATE APPLICATION USE

SEE TEMPORARY MAP 3E



LOCATION SKETCH—INDICATE NORTH

UNITS. TENS MUNICIPALITY

WATER QUALITY: ANALYSIS; SOFT; HARD ✓; HIGH IRON; HIGH SULPHUR; SALTY; ALKALINE; SALINE; POLLUTED; INADEQUATE QUALITY

CAPACITY GPD.: DRY HOLE; INADEQUATE QUANTITY ✓; PUMPING TEST; $0 - 10^3$; $10^3 - 10^4$; $10^4 - 10^5$; $10^5 - 10^6$; 10^6

METHOD: DUG —; DRIVEN; DRILLED; JETTED; BORED

DEPTH: 0 — 25; 25 — 50 —; 50 — 100; 100 — 200; 200 — 400; >400

OBSERVATION; ABANDONED; DEVELOPED —; SCREEN; PERF. CASING; GRAVEL ENV.; PUMP

TYPE WELL: FLOWING —; NON-FLOW ARTESIAN; WATER TABLE; PART CONFINED

ROCK; SPRING

SUPPLY AQUIFER		OTHER AQUIFER PRESENT		OTHER AQUIFER PRESENT		CHARACTER OF SUPPLY AQUIFER	WATER USE							RELIABILITY OF DATA		
TENS	UNITS	TENS	UNITS	TENS	UNITS	SAND	DOMESTIC	GARDEN	STOCK	COOLING	IRRIGATION	INDUSTRIAL	WATERWORKS	GOOD	FAIR	POOR
1 2 4 7	1 2 4 7	1 2 4 7	1 2 4 7	1 2 4 7	1 2 4 7	GRAVEL										
						TILL										

SYSTEMS EQUIPMENT LIMITED. VICTORIA—CANADA O 2231-65 SYSTEMSORT

LOG

FROM	TO	DESCRIPTION	NAME
0	45	SILT WITH FINE SAND	

SAMPLE No. _____ DATE _____

LAB. _____

COLIFORM ORGANISMS _____

TOTAL BACTERIA _____

COLOUR _____ ODOUR _____

TASTE _____

PUMPING TEST SUMMARY

TEST BY _____

DATE _____ FILE No. _____

SPECIFIC CAPACITY _____ PERMIABILITY _____

STORAGE COEFF _____ TRANSMISSIBILITY _____

REMARKS _____

ANALYSIS

	PPM
Total Hardness	
Carbonate Hard	
Magnesium Hard	
Fe	
SO_2	
Ca	
Mg	
Na	
K	
HCO_3	
CO_3	
Cl	
SO_4	
NO_3	
B	
E	
Total Dis-solids	
Total Alkalinity	
Suspended Solids	
Ph	

OTHER DATA

SIZE ANALYSIS. ETC. _____

CARD BY W. J. DATE Oct. 65

SOURCES INFORMATION JOHANSENS FIELD SURVEY

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 102595
Well Identification Plate Number: 12120
Owner Name: AL WETHERILL
Intended Water Use: Water Supply System

Well Status: New
Well Class: Water Supply
Well Subclass:
Aquifer Number:

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

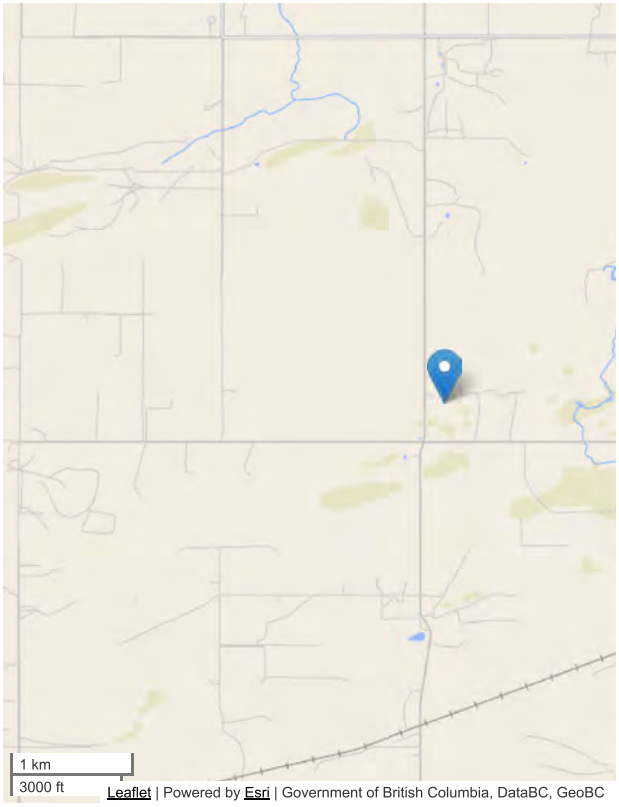
Location Information

Street Address:
Town/City:

Legal Description:

Lot	
Plan	
District Lot	
Block	
Section	
Township	
Range	
Land District	44
Property Identification Description (PID)	

Description of Well Location: MCLEOD RD 3 MILE WEST. SEE SKETCH FOR DETAILS.



Geographic Coordinates - North American Datum of 1983 (NAD 83)

Latitude: 55.813367
Longitude: -120.842556
UTM Easting: 635191
UTM Northing: 6187414
Zone: 10
Coordinate Acquisition Code: (unknown, accuracy based on parcel size) No ICF cadastre, poor or no location sketch; site located in center of primary parcel

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
There has been no activity related to this well.				

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
2009-01-21	2009-01-21				

Well Completion Data

Total Depth Drilled: 220.00 feet
Finished Well Depth: 220.00 feet
Final Casing Stick Up: 24.000 inches
Depth to Bedrock: 180.00 feet
Ground elevation:
Static Water Level (BTOC): 166.00 feet
Estimated Well Yield: 15.000 USGPM
Artesian Flow:
Artesian Pressure:
Method of determining elevation: Unknown
Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Air Rotary
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0.00	20.00							
20.00	40.00							
40.00	60.00							
60.00	80.00							
80.00	100.00	SILT CLAY						
100.00	120.00	CLAY SHALES						
120.00	140.00	CLAY SHALES						
140.00	160.00	CLAY SHALES						
160.00	180.00	CLAY SHALES						
180.00	200.00	CLAY SHALE - BEDROCK						
200.00	220.00	BEDROCK					WATER	

Casing Details

From (ft)	To (ft)	Casing Type	Casing Material	Diameter	Wall Thickness	Drive Shoe
0.00	18.00		Open hole	7.800		Not Installed
0.00	140.00		Steel	6.630	0.250	Installed

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:
Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material: PVC
Liner Diameter:
Liner from:
Liner Thickness:
Liner to:

Liner perforations

From	To
There are no records to show	

Screen Details

Intake Method:
Type:
Material: Plastic
Opening:
Bottom:

Installed Screens

From	To	Diameter	Assembly Type	Slot Size
180.00 ft	200.00 ft	5.00	SCREEN	
200.00 ft	220.00 ft	5.00	SCREEN	

Well Development

Developed by:

Development Total Duration:

Well Yield

No well yield data available.

Well Decommission Information

Reason for Decommission:
Sealant Material:
Decommission Details:

Method of Decommission:
Backfill Material:

Comments

DRILLING ADDITIVES: BENTONITE. MEASUREMENTS FROM TOP OF CASING. SHOE: WELDED. GROUT: 2 BAGS.

Alternative Specs Submitted: No

Documents

- WTN 102595_Well Construction.pdf

Disclaimer

INV#1951 WTN: 102595
WO#6394
093P085223

CARBON MOUNTAIN DRILLING Water Well Record Date Jan 12 09
Box 6383, Fort St. John, BC V1J 4H8

Owners Name & Address: AL Watterill
Legal Description & 911: W1/4 - 79 - 19 - W6
Tel/Fax No: 250-780-2018 Box 189 - Ground Birch BC - V0G-1T0

Descriptive Location: Meload RD 3 mile west

Type Of Work. 1. | New Well 2. | Reconditioned. 3. | Deepened. 4. | Abandoned.

Work Method. 1. | Cable Tool 2. | Bored. 3. | Jetted. 4. | Rotary. a. | mud b. | air c. | reverse. | Other.

Water Well Use 1. | Domestic 2. | Municipal 3. | Irrigation 4. | Rotary. | Other.

Drilling Additives: Bentenite

Measurements from 1. | ground level 2. | top of casing
casing height above ground level 2 ft.

From ft.	To ft.	Well Log Description	SWL ft.
0	20	Sand	
20	40	Silt	
40	60	Silt	
60	80	Silt	
80	100	Silt clay	
100	120	Clay shales	
120	140	Clay shales	
140	160	Clay shales	
160	180	clay shales	
180	200	Clayshale - Bed Rock	
200	220	Bed Rock - Water	
		Tag # 12120	
		Depth: 220	
		Static: 166' of water	
		Rate: 15 GPM	
		GPS 55° 48' 48 N	
		120° 50' 33 W	

Casing & Liner Material 1. Steel 2. | Galvanized 3. | Wood. 4. | Plastic 5. | Concrete 6. | Other

Type							
Diameter	6 5/8	6 1/4					
From	0	30					
To	140	220					
Thickness	250	.250					
Weight							

Pitless unit _____ ft.
X1. | Above 2. | below ground level
X1. | Welded 2. | Cemented 3. | Threaded
X1. | New 2. | Used
Perforations _____

Shoe(s): 1 welded Yes
Open hole, from 0 to 18 ft. Dia. 7 7/8 ins.
Grout: 2 Bags
Screen: 1. | Nominal (Telescope)x 2. | PipeSize
Type 1. | Continuous Slot x 2. | Perforated 3 | Louvre
Material 1. | Stainless Steel x 2. | Plastic 3. | Other _____
Set from 180 to 220 ft below ground level

Riser, Screen & Blanks							
Length	20'	2'					
Diam. ID	5"	5"					
Slot Size							
From	200	180					
to	220	200					

Fittings, top _____ bottom _____
Gravel Pack _____
Riser Pipe _____ ft. Tail Pipe _____ ft.
Developed by: 1 Surging 2 Jetting 3 Air 4 Bailing 5 Pumping 6 Other _____

Test: 1 Pump 2 Bail 3 Air Date |__|__|__|
Rate 15 Usgpm Temp _____ °C SWL before Test _____ ft. Water level _____ ft. after test of _____ hrs.

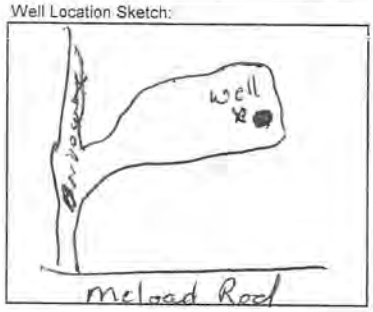
# Drawdown in ft.				# Recovery in ft.			
Mins	WL	Mins	WL	Mins.	WL	Mins	WL

Recommended Pump Type	Recommended Pump Setting.	Recommended Pumping Rate

Water Type: 1 Fresh 2 Salty 3 Clear 4 Cloudy
Colour _____ smell _____ gas 1 yes 2 no
Water Analysis: 1. Hardness |__|__|3|7|__| mg/L
2. Iron |__|__|5|.0| mg/L 3. Chloride |__|__|__|__|__|
4. pH |6|.|2| Field Date |__|__|__|__|__|__|
Site ID NO 12120 Lab Date |__|__|__|__|__|__|

Final Well Completion Data
Well Depth |__|2|2|0| ft. Well Yield |__|__|1|5|__|
Static Water Level |__|1|6|6| ft. Artesian flow |__|__|__| Pre
Pressure Head _____ ft. Back Filled _____
Well Head Completion Yes
Driller Richard Parker
Signature Richard Parker
Unit # 503-505-542
Work Order # 6394
Contractor: CARBON MOUNTAIN
BC #
gps:

Consultant: _____
Address: _____
Well Location Sketch:



*** Must be completed in full***

10 63 19 W
E

located per lat long given - cannot confirm owner/sketch/road

Appendix G
Groundbirch Connector
Vegetation Technical Data Report

Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3) Appendix G Groundbirch Connector Vegetation Technical Data Report

CGL80373-STC-ENV-RP-004

October 13, 2020

Revision 1

Issued for Use

Stantec

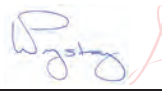
Authorization Page

Stantec Consulting Ltd.

Prepared by: Dmitry Petelin Digitally signed by Dmitry Petelin Date: 2020.10.08 21:31:38 +03'00' Date: _____

Name: Dmitry Petelin

Title: Author, Senior Vegetation Biologist

Endorsed by:  Digitally signed by Ward Prystay, R.P.Bio. Date: 2020.10.09 12:53:42 -07'00' Date: _____

Name: Ward Prystay

Title: Independent Review, Vice President Environmental Services

Approved by: Catherine Meyer Digitally signed by Catherine Meyer Date: 2020.10.12 13:52:36 -06'00' Date: _____

Name: Catherine Meyer

Title: Technical Project Manager, Environmental Services

Authorization Page

Coastal GasLink Pipeline Project

Endorsed by: _____ Date: _____

Name: Jeff Quennelle

Title: Environmental Advisor, Coastal GasLink

Endorsed by: _____ Date: _____

Name: Adair Rigney

Title: Environmental Team Lead, Coastal GasLink

Accepted by: _____ Date: _____

Name: Craig Losos

Title: Manager, Environmental Planning and Permitting, Coastal GasLink

Revision Log

Rev	Section	Revision Description
0	All	Issued for Use
1	All	Issued for Use

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1.0 INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at: https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Vegetation Technical Data Report includes relevant baseline information for the proposed Groundbirch Connector.

Traditional Land and Resource Use (TLRU) is presented in Section 15.0 of the Amendment Application. The Groundbirch Connector crosses exclusively private land, so no Traditional Ecological Knowledge was collected during field programs.

Abbreviations and acronyms used in this report are described in Appendix G-1.

1.1 OBJECTIVES

This Vegetation TDR considers the direction of the EAC Application Information Requirements issued by the EAO (BC EAO 2013), the Section 25 required assessment matters under the revitalized BC *Environmental Assessment Act* (refer to Section 1.2 of the Amendment Application) and references the guidance contained in the following documents:

- EAO User Guide (BC EAO 2020a)
- Guide to Indigenous Knowledge in Environmental Assessments (BC EAO 2020b)

The objectives of this TDR are to document the baseline condition of vegetation in the proposed Groundbirch Connector study areas using methods that are consistent with the 2013 approved Application Information Requirements for the Project and provide the data needed to facilitate the assessment of potential environmental effects and potential cumulative effects. These objectives were achieved through a combination of terrestrial ecosystem mapping and field surveys.

Mitigation for Vegetation can be found in Section 8.5 of the EAC Application (Coastal GasLink 2014a). No additional mitigation is required for the proposed Groundbirch Connector for potential effects on vegetation.

1.2 STUDY AREA BOUNDARIES

The vegetation study area boundaries consist of the Groundbirch Connector Footprint, the local study area (LSA), and the regional study area (RSA). These study boundaries are described below and presented in Figure 1-1.

1.2.1 Groundbirch Connector Footprint

The Groundbirch Connector Footprint is the area potentially affected by physical works and activities, such as clearing, construction and cleanup. The Groundbirch Connector Footprint is delineated by a 50-m wide buffer on each side of the pipeline centerline, and encompasses the construction ROW, the permanent ROW, an access road, temporary workspace, and tie-in locations.

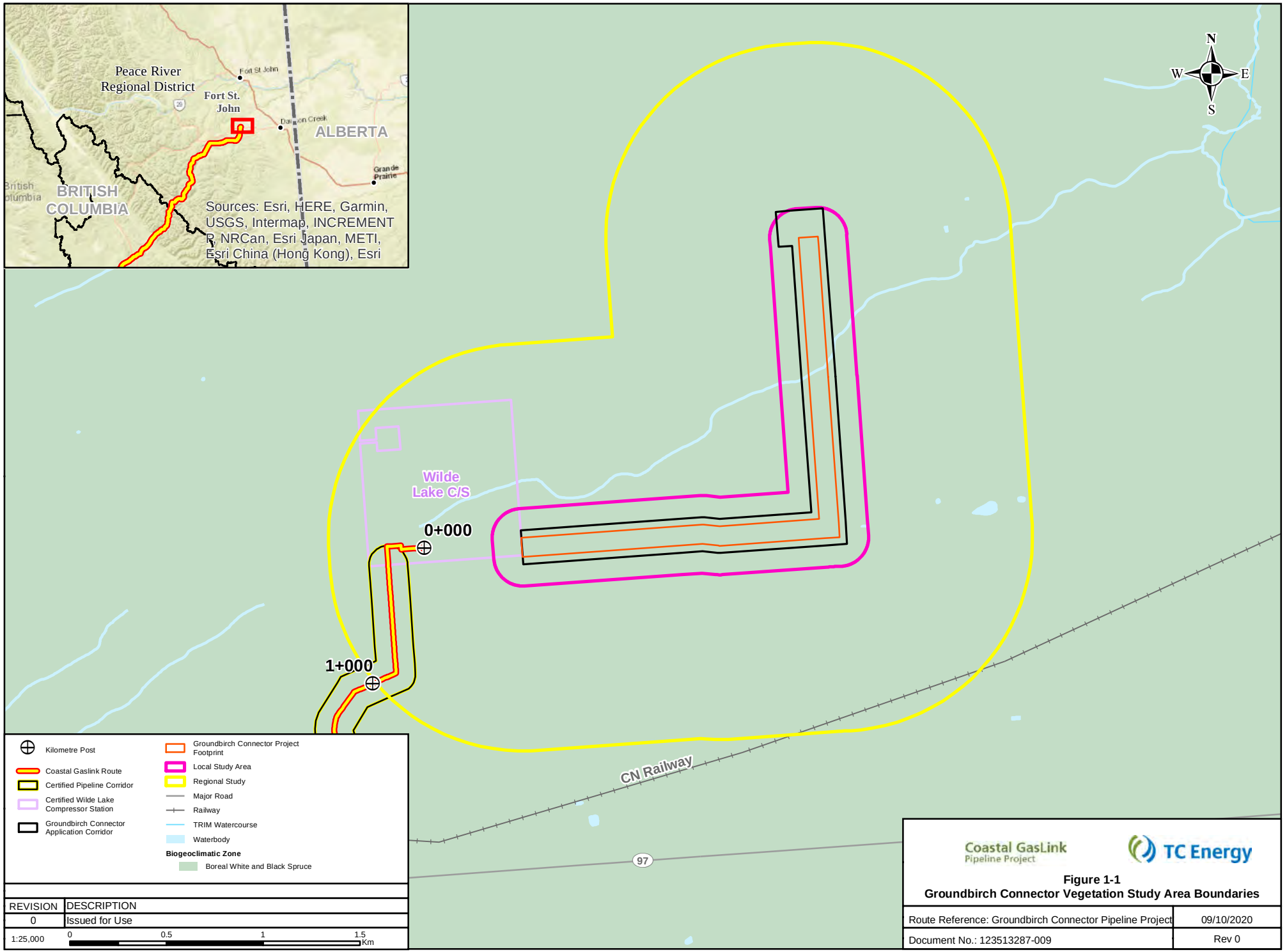
The Groundbirch Connector Application Corridor varies in width from approximately 175 m to 245 m to account for temporary workspace, but is not used in assessment analysis within this report.

1.2.2 Local Study Area

The vegetation LSA (Figure 1-1) is based on the area in which Groundbirch Connector activities and facilities could potentially affect vegetation resources. The vegetation LSA includes the proposed Groundbirch Connector Footprint plus a 150 m buffer on each side of the proposed pipeline centreline. The total area of the Groundbirch Connector LSA is 133.7 hectares.

1.2.3 Regional Study Area

The vegetation RSA was defined to evaluate potential effects of the proposed Groundbirch Connector on vegetation at a regional scale (Figure 1-1). The vegetation RSA encompasses the proposed Groundbirch Connector Footprint and vegetation LSA and includes a broader surrounding area where there is the potential for interaction of the proposed Groundbirch Connector with past, present and reasonably foreseeable future activities that might result in cumulative adverse effects on vegetation. The vegetation RSA is based on a 1 km-wide buffer on each side of the Groundbirch Connector pipeline centreline. The total area of the Groundbirch Connector RSA is 963.5 hectares.



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2.0 GROUNDBIRCH CONNECTOR PROJECT SETTING

The Groundbirch Connector is located in the Boreal Plains Ecoprovince of BC. Ecoprovinces are part of the BC Ecoregion Classification System, developed to provide a systematic view of small-scale ecological relationships throughout the province based on climate and physiography (Demarchi 2011). The Boreal Plains are characterized by flat or undulating terrain with thick Cretaceous shale bedrock with overlaying soil deposits. The Boreal Plains have extensive trembling aspen (*Populus tremuloides*), black spruce (*Picea mariana*), and white spruce (*Picea glauca*) stands with minimal elevation change across the landscape. Extensive natural disturbance is common in the form of fire and insect outbreaks (Demarchi 2011).

The Groundbirch Connector is also located within the moist warm Boreal White and Black Spruce subzone (BWBSmw) of the provincial Biogeoclimatic Ecosystem Classification (BEC) system. The BEC system brings together information related to climate, soils, and vegetation to determine the mature vegetation community for a site. The BWBSmw subzone is characterized by short, continental growing seasons and modest precipitation of 424 to 749 mm annually, almost half of which comes as snow. Forest stands within the BWBSmw feature white and black spruce, and trembling aspen, as well as lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), tamarack (*Larix laricina*), balsam poplar (*Populus balsamifera*), and paper birch (*Betula papyrifera*) as the dominant canopy species (BC MOFR 2011).

3.0 METHODS

The methods used to gather baseline information to support the assessment of potential effects of the proposed Groundbirch Connector are the same as those used in the Coastal GasLink Vegetation Technical Data Report (Appendix 2J of the EAC Application) (Coastal GasLink 2014b). The process of selecting key indicators, conducting data and literature reviews, and identifying mitigation is unchanged.

3.1 DESKTOP ASSESSMENT

A review of existing information was completed for the Amendment Application using the same methods as in the Coastal GasLink Vegetation Technical Data Report (Section 4.1 of Appendix 2J of the EAC Application). Existing data were compiled from published literature and government and non-governmental databases. This desktop review was used to assist in characterizing baseline vegetation conditions for the Groundbirch Connector.

3.1.1 Definitions

The vegetation resources described in this report address:

- ecological communities of concern
- plant species of concern

Ecological communities of concern include the full range of ecosystems identified through the Terrestrial Ecosystem Mapping (TEM) and by the existing Dawson Creek Land and Resource Management Plan (LRMP) (Province of British Columbia, 1999). These include ecological communities at risk, communities identified as conservation priorities within the LRMP, old forest, and Old Growth Management Areas (OGMAs), deciduous-dominated forests, grasslands, wetlands, and floodplain ecosystems.

Ecological communities at risk are defined as plant communities that are included on the provincial red or blue lists maintained by the BC Conservation Data Centre (BC CDC). For the purpose of this TDR, riparian areas are mapped and described as floodplain ecosystems and will be discussed in this report. Where wetland ecosystems are red- or blue-listed, they are included within this report; however, their potential to provide habitat for at-risk communities is discussed in more detail in the wetlands TDR (see Appendix H Proposed Groundbirch Connector Wetlands Technical Data Report). The *Species at Risk Act* (SARA) does not track ecological communities at risk and is not applicable on provincial lands in BC.

Old forest is determined according to the natural disturbance type of each given BEC zone in accordance with the Field Manual for Describing Terrestrial Ecosystems (BC MOFR and MOE 2015). Old Growth Management Areas (OGMAs), a component of old forest, are areas that either contain, or are expected to attain, old-growth attributes in the near future. There are two types of OGMAs: legal and non-legal. Legal OGMAs must be incorporated into the forest stewardship plan by forest licensees. Non-legal OGMAs have not been included in an old-growth order. Forest licensees are not required to incorporate non-legal OGMAs in a forest stewardship plan if they can achieve targets in other ways (Forest Practices Board 2012).

Deciduous-dominated forests were determined using the presence of any deciduous tree in the climax canopy composition. These species included balsam poplar, black cottonwood, and trembling aspen.

Plant species of concern include species at risk and non-native invasive species. Plant species at risk include vascular and non-vascular species (bryophytes and lichens) that are included on the provincial red or blue lists developed and maintained by the BC CDC or on Schedule 1 of SARA (BC CDC 2020; Government of Canada 2019, respectively).

Non-native invasive plant species are those defined by the BC *Weed Control Act* and Regulation and the Invasive Plant Committee of the Peace River Regional District (Peace River Regional District 2019). Invasive plant species can negatively affect the integrity of natural plant communities once established.

Vegetation resources described above are depicted in a series of maps provided in Appendix G-2.

3.1.2 Review of Existing Data Sources and Literature

A desktop review of existing data sources and literature pertaining to vegetation resources in the RSA included:

- provincially available datasets, such as the Broad Ecosystem Inventory (BEI), the BC CDC, and the Vegetation Resource Inventory (VRI);
- published literature, including scientific papers, reference books, reports, information letters, fact sheets, guides, as well as aerial photographs and provincial and federal government maps, registries, and interactive websites; and
- results of engagement with Indigenous communities, local communities and land users, landowners, local and regional governments, federal and provincial government agencies, and the general public.

Research material was obtained by searching libraries and the Internet, as well as from documents received directly from government agencies. References used in the preparation of the baseline information are among the references listed in Section 6.0.

Ecological communities at risk with the potential to occur in the study areas were identified using the BC CDC's Ecosystems Explorer tool (BC CDC 2020). Potential ecological communities (red- or blue-listed) were identified by searching according to BEC zone and forest districts that intersect the vegetation RSA.

Old forests were initially identified in the vegetation RSA (prior to fieldwork and mapping) using the most recent government VRI data (BC MFLNRO 2019). The VRI provides average stand age for the leading and secondary canopy species. Based on this age value for each polygon, a query was performed to identify stands that were potentially old forest, using the appropriate criteria. For example, in the BWBS, old forest is defined as coniferous stands older than 140 years of age, and deciduous stands older than 100 years of age based on Natural Disturbance Type 3, as defined by the provincial Old Growth Order (Province of British Columbia 2004).

Plant species at risk that could occur in the study areas were identified using the BC CDC Ecosystems Explorer tool (BC CDC 2020), as well as the list of SARA-designated plants.

Prior to fieldwork, non-native invasive plant species with the potential to occur in the RSA were identified based on the BC *Weed Control Act*, the associated Regulation, and regional invasive plant councils (Peace River Regional District 2019) and the BC Invasive Plant Program Database (Province of British Columbia 2020). The Invasive Plant Committee of the Peace River Regional District oversees the weed management within the areas of the Groundbirch Connector and their listings identify regionally specific weeds. In some instances, the invasive species overlap with the provincial list, but all species will need to be managed accordingly if found along the ROW.

Background information on the native vegetation communities in the RSA was compiled prior to field work to aid in sample design and compile a field atlas. Provincial publicly available data sources were used to provide initial vegetation information, ecoprovince, BEC zone boundaries, as well as digital spatial data layers of various important features, such as anthropogenic, planimetric, and hydrological data (Province of BC 2018).

3.1.3 Terrestrial Ecosystem Mapping

TEM was completed for the portions of the Groundbirch Connector study areas that were not mapped for the 2014 EAC Application. The vegetation RSA delineates the

TEM extent for this assessment. TEM consists of a hierarchical coding of polygons based on topography, slope position, parent material, soils, and vegetation. Prior to the initiation of fieldwork, the vegetation RSA was mapped at a scale of 1:20,000 using digital orthophotography in a 3D environment. The TEM was subsequently verified through ground-truthing.

All TEM work was carried out in accordance with the *Standard for Terrestrial Ecosystem Mapping* (RISC 1998), with the aid of various Land Management Handbooks (LMH) produced by the BC MOF to guide in the classification of ecosystems, and plant guides to assist in the identification of all plant taxa.

In addition, wetlands and red- and blue-listed ecological communities were mapped to support EAC Condition 6, EAC Condition 17, and OGC permitting requirements.

3.2 FIELD SURVEYS

During the TEM and rare plant field programs (from August 1 to August 3, 2019, and from June 27 to June 29, 2020), 41 field plots were established within the RSA. Of these 41 sites, 12 were located in wetlands, 5 at ponds, 12 on cultivated fields, and 12 in upland ecosystems. The objectives of sampling were to:

- ground-truth TEM mapping;
- inform mapping edits;
- characterize the existing vegetation in the vegetation Groundbirch Connector LSA and RSA;
- identify ecological communities at risk;
- identify old forests;
- identify plant species of concern (early and late season rare plant surveys); and
- identify non-native invasive plant species.

The TEM field work achieved Survey Intensity Level 4 (for 1:20,000 scale mapping), with an average of approximately 45 ha per ground inspection. Refer to the Standards for Terrestrial Ecosystem Mapping in British Columbia (RISC 1998) for additional information.

Methods used for vegetation surveys to ground-truth TEM followed the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (BC MOE 2015). Early and late-season rare plant surveys completed on from August 1 to 3, 2019, and from June 27 to June 29, 2020followed Protocols for Rare Vascular Plant Surveys (Penny and Klinkenberg 2013).

Old forest was determined by structural stage in forested ecosystems assigned in the TEM and validated during field surveys completed in 2019 and 2020.

A non-native invasive plant species survey of the LSA was conducted between August 21 and August 23, 2019 in conjunction with the soils field program.

The 2020 field survey was completed between June 27 and June 29, 2020. The 2020 field survey focused on early summer rare plant and invasive plants located on or near the Groundbirch Connector Footprint.

3.3 LIMITATIONS OF STUDY

The only limitations for the vegetation studies include the practicality of sampling every mapped polygon and the potential possibility of concluding the absence of a species of concern based on a lack of observation.

4.0 RESULTS

The following sections provide a summary of both desktop and field assessments.

4.1 RESULTS OF DESKTOP ASSESSMENT AND FIELD SURVEYS

4.1.1 Native Vegetation Communities

A total of 156 plant species and 17 ecological communities were identified within the Groundbirch Connector study areas during the field surveys. A full species list can be found in Appendix G-4. Of the 17 communities identified, 13 consist of native vegetation, one is anthropogenic vegetated, and three are non-vegetated. Cultivated fields (mapped as an anthropogenic feature) occupy the largest area within the study areas: 27.3 ha, 87.9% within the Groundbirch Connector Footprint, 97.0 ha, 72.5% within the LSA, and 524.3 ha, 54.4% within the RSA (Table 4-1). All of the cultivated fields identified are pastures, cereal crops, and hayfields.

Within the LSA, native upland communities (all of which are forested), occupy 31.5 ha (23.5% of the LSA) and native wetlands occupy 4.6 ha (3.5% of the LSA). The forested communities within the LSA are located along the southern portion of the route whereas wetlands occur mainly in the northern portion, and cover only 4.6 ha (3.5%), of the LSA. (Appendix G-2). No native grasslands were identified within the LSA.

Within the Groundbirch Connector Footprint, anthropogenic vegetated communities make up approximately 27.3 ha (87.9% of the Groundbirch Connector Footprint). Native upland communities (all of which are forested), occupy 2.7 ha (8.6% of the Groundbirch Connector Footprint) and native wetlands occupy 1.0 ha (3.2% of the Groundbirch Connector Footprint; Appendix G-2). No native grasslands were identified within the Groundbirch Connector Footprint. Table 4-1 provides a summary of mapped vegetation community types within the Groundbirch Connector study areas.

Table 4-1: Mapped Vegetation Communities within the Groundbirch Connector Study Areas

Site Series	Map Code	Ecosystem Name	Groundbirch Connector Footprint		Local Study Area (LSA)		Regional Study Area (RSA)	
			ha	%	ha	%	ha	%
Native Vegetation Communities								
Upland Forests								
111	SH	White spruce – Red swamp currant – Horsetails	<0.1	0.2	<0.1	<0.1	2.1	0.2

Table 4-1: Mapped Vegetation Communities within the Groundbirch Connector Study Areas

Site Series	Map Code	Ecosystem Name	Groundbirch Connector Footprint		Local Study Area (LSA)		Regional Study Area (RSA)	
			ha	%	ha	%	ha	%
101$	AR	Trembling aspen – Rose – Creamy peavine	1.6	5.2	24.5	18.3	338.7	35.2
111$6.1	DH	Balsam poplar – Dogwood – Highbush-cranberry	0.9	2.8	5.2	3.9	16.7	1.8
111$6.2	AC	Trembling aspen – Cow-parsnip – Meadowrue	<0.1	0.3	1.8	1.3	8.5	0.9
Total Upland Forest			**2.7**	**8.6**	**31.5**	**23.5**	**366.0**	**38.0**
Floodplain								
-	FL	Floodplain	<0.1	0.3	0.6	0.5	12.0	1.2
Subtotal Floodplain			**<0.1**	**0.3**	**0.6**	**0.5**	**12.0**	**1.2**
Wetlands								
Bogs								
Wb03	BT	Black spruce – Lingonberry – Peat-moss	0.0	0.0	0.0	0.0	18.6	1.9
Wb05	SS	Black spruce – Water sedge – Peat-moss	0.0	0.0	0.0	0.0	0.5	<0.1
Wb09	BH	Black spruce – Common horsetail – Peat-moss	0.0	0.0	0.0	0.0	1.4	0.1
Subtotal Bog			**0.0**	**0.0**	**0.0**	**0.0**	**20.5**	**2.1**
Marshes								
Wm01	MA	Beaked sedge – Water sedge	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Swamps								
Ws03	BJ	Bebb's willow – Bluejoint	0.8	2.6	4.1	3.1	7.3	0.8
Ws07	SL	White spruce – Common horsetail – Leafy moss	0.0	0.0	0.0	0.0	4.2	0.4
Ws14	AB	Mountain alder – Bebb's willow – Bluejoint	0.0	0.0	0.0	0.0	1.0	0.1
Subtotal Swamp			**0.8**	**2.6**	**4.1**	**3.1**	**12.6**	**1.3**
Shallow Open Water								
Ww00	OW	Shallow open water	0.2	0.5	0.4	0.3	0.6	<0.1
Total Wetlands			**1.0**	**3.2**	**4.6**	**3.5**	**33.7**	**3.5**
Total Native Veg Communities			**3.7**	**12.1**	**36.7**	**27.5**	**411.8**	**42.7**
Anthropogenic Vegetated Communities								
00	CF	Cultivated Field	27.3	87.9	97.0	72.5	524.3	54.4

Table 4-1: Mapped Vegetation Communities within the Groundbirch Connector Study Areas

Site Series	Map Code	Ecosystem Name	Groundbirch Connector Footprint		Local Study Area (LSA)		Regional Study Area (RSA)	
			ha	%	ha	%	ha	%
Total Anthropogenic Vegetated Communities			**27.3**	**87.9**	**97.0**	**72.5**	**524.3**	**54.4**
Non-Vegetated Communities								
00	IN	Industrial	0.0	0.0	0.0	0.0	8.2	0.9
00	PD	Pond	<0.1	<0.1	<0.1	<0.1	1.2	0.1
00	RR	Rural Area	0.0	0.0	0.0	0.0	17.9	1.8
Total Non-Vegetated			**<0.1**	**<0.1**	**<0.1**	**<0.1**	**27.4**	**2.8**
TOTAL			**31.0**	**100.0**	**133.7**	**100.0**	**963.5**	**100.0**

NOTE:
The totals presented in the table may not add up fully, due to rounding

4.1.2 Ecological Communities at Risk

Two blue-listed ecological communities (BC CDC 2020) were identified during field surveys within the RSA (Table 4-2), one of them, namely Bebb's willow – Bluejoint swamp, was recorded within the Groundbirch Connector Footprint and LSA. A mapbook showing the locations of blue-listed ecological communities can be found in Appendix G-2. No red-listed communities were identified within the Groundbirch Connector Footprint, LSA, or RSA (BC CDC 2020).

Table 4-2: Ecological Communities at Risk within the Groundbirch Connector Study Areas

Site Series	Map Code	Ecosystem Name	Groundbirch Connector Footprint		Local Study Area (LSA)		Regional Study Area (RSA)	
			ha	%	ha	%	ha	%
Wb03	BT	Black spruce – Lingonberry – Peat-moss	0.0	0.0	0.0	0.0	18.6	1.9
Ws03	BJ	Bebb's willow – Bluejoint	0.8	2.6	4.1	3.1	7.3	0.8
Total			**0.8**	**2.6**	**4.1**	**3.1**	**25.9**	**2.7**

NOTE:
The totals presented in the table may not add up fully, due to rounding

4.1.3 Old Forest

No old forest exists within the LSA or RSA as confirmed through desktop assessment and field surveys. Existing forest within the LSA and RSA is classified as structural stage 6 (mature forest) or lower.

4.1.4 Old Growth Management Areas

Based on desktop assessment and field verification, there are no legal or non-legal OGMAs within the LSA or RSA.

4.1.5 Plant Species at Risk

No blue or red-listed plants species were documented within the LSA or RSA (BC CDC 2020).

No red or blue listed plant species were observed during 2019 field surveys of the LSA and RSA. Further, no rare plant species were observed in 2020 during the early-summer rare plant survey within the Groundbirch Connector Footprint or within the LSA. The identification of the 2020 bryophyte and sedge collections in laboratory did not reveal any listed species either. Though *Salix petiolaris* was identified through desktop assessment relatively close to the study areas, it was not observed during 2019 and/or 2020 field surveys.

4.1.6 Non-Native Invasive Plant Species

Non-native invasive plant species potentially occurring within the Peace River Regional District were compiled from lists published via the Invasive Plant Committee Peace Regional District, BC *Weed Control Act* and Regulation, and BC Invasive Alien Plant Program (IAPP) and are summarized in Appendix G-3 (Peace River Regional District 2019, Province of British Columbia 2020). A total of 118 species were identified overall, 50 of which, are designated as noxious weeds according to the BC *Weed Control Act* and Regulation. Under the Act and its regulation, duties can be imposed on all land occupiers to control plants designated as noxious weeds.

The 2019 field survey identified one non-native invasive species within the Groundbirch Connector LSA, annual saw-thistle (*Sonchus oleraceus*) which is designated noxious under the BC *Weed Control Act* (Table 4-3). However, the 2020 field survey for invasive plants conducted within the Groundbirch Connector Footprint and LSA (including the location where annual saw-thistle had been recorded a year before) did not document any noxious weeds.

Table 4-3: Non-Native Invasive Species Occurring in the Local Study Area of the Groundbirch Connector

Species Scientific Name	Species Common Name	Listed by Invasive Plant Committee Peace River Regional District[1]	BC Weed Control Act Status[2]
Sonchus oleraceus	annual sow-thistle	Noxious	Provincially Noxious

SOURCES:
[1] Peace River Regional District 2019
[2] BC *Weed Control Act* (2011)

5.0 KEY FINDINGS AND CONCLUSIONS

Baseline data on vegetation resources were collected to characterize the vegetation along the proposed Groundbirch Connector in support of the assessment of potential effects on vegetation resources.

Key results and findings pertaining to vegetation resources are presented for each of the spatial boundaries of the proposed Groundbirch Connector; however, the Groundbirch Connector Footprint and vegetation LSA represent the areas where direct and indirect effects on vegetation resources are most likely to occur.

The key findings are as follows:

- Native Upland forest represents 2.7 ha (8.6% of the Groundbirch Connector Footprint) and 31.5 ha (23.5% of the LSA).
- Wetlands are represented by three bogs, one marsh, three swamps and one shallow open water site within the LSA. There are 1.0 ha of wetland communities (3.2%), including marshes, Swamps, and shallow open water within the Groundbirch Connector Footprint.
- Two blue-listed ecological communities were documented within the RSA, with one occurring in the LSA and Groundbirch Connector Footprint where it covers 3.1% and 2.6% respectively.
- No red-listed ecological communities at risk were observed.
- No legal or non-legal OGMAs were identified within the LSA or RSA. Existing forest is classified as structural stage 6 (mature forest) or lower.
- No blue or red-listed species were documented within the LSA or RSA.
- Annual saw-thistle (*Sonchus oleraceus*) was observed within the LSA during field surveys in 2019. This species is designated as noxious under the BC *Weed Control Act* (2011); however, this species was not observed during field surveys in 2020.
- No other invasive species and/or noxious weeds were encountered within the LSA in 2019 or within the Groundbirch Connector Footprint and 150 m buffer in 2020.

There are no material differences between baseline information reported in the EAC Application and baseline information reported in this TDR.

6.0 REFERENCES

BC CDC (British Columbia Conservation Data Centre). 2014. Occurrence Report Summary, Shape ID: 14718, meadow willow. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc. Accessed: July 2020.

BC CDC. 2020. BC Species and Ecosystems Explorer. B.C. Ministry of Environment. Victoria, B.C. Available at: http://a100.gov.bc.ca/pub/eswp/. Accessed: July 2020.

BC EAO (British Columbia Environmental Assessment Office). 2013a. Coastal GasLink Pipeline Project Application Information Requirements (AIR) for an Environmental Assessment Certificate.

BC EAO. 2013b. Guide to Involving Proponents when Consulting First Nations in the Environmental Assessment Process.

BC EAO (British Columbia Environmental Assessment Office). 2014. Coastal GasLink Pipeline Project Environmental Assessment Certificate # E14-03. Available at: http://a100.gov.bc.ca/appsdata/epic/documents/p392/1414168837008_ZXZPJK QpsCJ7p994vTQyyJhsM8TBWSnzlv34wMyC67yCBwdyhKHr!-351597226!1414168702186.pdf.

BC EAO. 2020a. *EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018)*. Version 1.01. March 2020. p. 53.

BC EAO. 2020b. *Guide to Indigenous Knowledge in Environmental Assessments*. Version 1.0. April 2020. p. 20.

BC MOE (British Columbia Ministry of the Environment). 2015. Field Manual for Describing Terrestrial Ecosystems. 2nd Edition (reprint with updates 2015). Land Management Handbook No. 25.

BC MOFR (British Columbia Ministry of Forests and Range). 2011. A Field Guide to Ecosystem Identification for the Boreal White and Black Spruce Zone of British Columbia. Land Management Handbook Number 65. Victoria, BC.

BC MFLNRO (British Columbia Ministry of Forests, Lands and Natural Resource Operations). 2019. Vegetation Resources Inventory (VRI).

BC MOFR and MOE (British Columbia Ministry of Forests and Range and Ministry of Environment). 2015. Field Manual for Describing Terrestrial Ecosystems. 2nd Edition (reprint with updates 2015). Land Management Handbook No. 25.

Coastal GasLink. 2014a. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate. Available at: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_392_37367.html. Accessed August 2020.

Coastal GasLink. 2014b. Vegetation Technical Data Report, Revision 1. 125 pp + appendices.

Demarchi, Dennis A. 2011. An Introduction to the Ecoregions of British Columbia, Third Edition. Ecosystem Information Section, Ministry of Environment. Victoria, British Columbia. Available at: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/ecosystems/broad-ecosystem/an_introduction_to_the_ecoregions_of_british_columbia.pdf?bcgovtm=CSMLS. Accessed August 2020.

Forest Practices Board. 2012. Conserving Old Growth Forests in BC: Implementation of old-growth retention objectives under FRPA. Special Investigation. Available at: www.fpb.gov.bc.ca/SIR36_Conserving_old_Growth_Forests_in_BC.pdf. Accessed August 2020.

Government of Canada. 2019. Species at Risk Public Registry. Schedule 1. Available at: https://laws.justice.gc.ca/eng/acts/S-15.3/page-17.html#h-435647. Accessed August 2020.

Peace River Regional District. 2019. Invasive Plant Program. Strategic Plan and Profile. Available at: https://prrd.bc.ca/wp-content/uploads/page/plans-reports-invasive-plants/2019-Strategic-Plan-and-Profile.pdf. Accessed: July 2020.

Penny, J.L. and R. Klinkenberg 2013. Protocols for Rare Vascular Plant Surveys. In: B. Klinkenberg (ed.), 2018. E-Flora BC: Electronic Atlas of the Flora of British Columbia [eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver, BC. Available at: http://www.geog.ubc.ca/biodiversity/eflora/ProtocolsforRarePlantSurveys.html. Accessed August 2020.

Province of British Columbia. 1999. Dawson Creek Land and Resource Management Plan. Pp. 248. Available at: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/northeast-region/dawsoncreek-lrmp/dawson_creek_lrmp_plan_4mar1999.pdf. Accessed August 2020.

Province of British Columbia. 2004. Order Establishing Provincial Non-Spatial Old Growth Objectives. Available at: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/policies-guides/old_growth_order_may18th_final.pdf. Accessed August 2020.

Province of British Columbia. 2018. Data Catalogue. Published by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development - Forest Analysis and Inventory Licensed under Open Government Licence - British Columbia. Available at: https://catalogue.data.gov.bc.ca/dataset. Accessed August 2020.

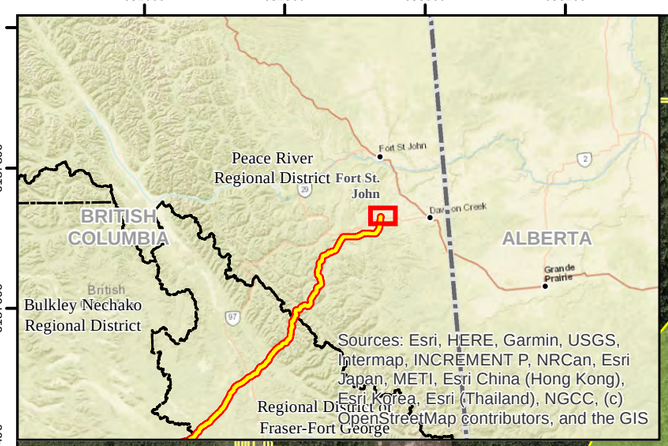
Province of British Columbia. 2020. Invasive Alien Plant Program Application (IAPP). B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development Available at: https://catalogue.data.gov.bc.ca/dataset/invasive-alien-plant-program-application-iapp. Accessed: July 2020.

RISC (Resource Inventory Standards Committee). 1998. Standard for Terrestrial Ecosystem Mapping in British Columbia. Prepared by Ecosystems Working Group, Terrestrial Ecosystems Task Force, Resources Inventory Committee. Available at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/tem_man.pdf. Accessed August 2020.

Appendix G-1: Abbreviations and Acronyms

Acronym	Definition
Units of Measurement	
%	percent
ha	hectare
km	kilometre = 1,000 metres
m	metre
mm	millimetre
Other Terms	
BC	British Columbia
BC CDC	BC Conservation Data Centre
BC MFLNRO	BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
BC MOF	BC Ministry of Forests
BC MOFR	BC Ministry of Forests and Range
BC MOE	BC Ministry of Environment
BC OGC	BC Oil and Gas Commission
BEC	Biogeoclimatic Ecosystem Classification
BEI	Broad Ecosystem Inventory
BWBS	Boreal White and Black Spruce Zone
Coastal GasLink	Coastal GasLink Pipeline Limited
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
IAPP	Invasive Alien Plant Program
LMH	Land Management Handbook
LRMP	Land and Resource Management Plan
LSA	local study area
NPS	Nominal Pipe Size
OGMA	Old Growth Management Area
Project	Coastal GasLink Pipeline Project
RISC	Resources Information Standards Committee
ROW	right-of-way
RSA	regional study area
SARA	*Species at Risk Act*
TEM	Terrestrial Ecosystem Mapping
TDR	Technical Data Report
VRI	Vegetation Resources Inventory

Appendix G-2: Vegetation Mapbook



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N W E S

Rd 212

Rd 265

WL-30011 WL-30001

DP19153 DP19185 DP19176 WL-30002 DP19177

DP19184

DP19155 WL-30014 DP20058 DP19156 DP20059 DP19183

DP19182 WL-30016 DP20057 DP19157 DP19158

DP20056 WL-30015 DP20055 DP19159 DP19162 DP20054 DP19160 DP19181 DP19161 DP20053

DP19180

DP19172

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airb

2020 Survey Plot
2019 Survey Plot
Coastal Gaslink Route
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Groundbirch Connector OGC Footprint Corridor
Local Study Area
Regional Study Area
Blue Listed Community

Dominant Broad Ecosystem Category

Anthropogenic
Coniferous Forest
Deciduous Forest
Open Water (Anthropogenic)
Wetland
Access Road
Road

REVISION	DESCRIPTION
0	Issued

1:8,500 0 75 150 300 450 600 Meters

Coastal GasLink Pipeline Project

TC Energy

Figure G-2
Vegetation Mapbook

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513287-0010	Page 1 of 3

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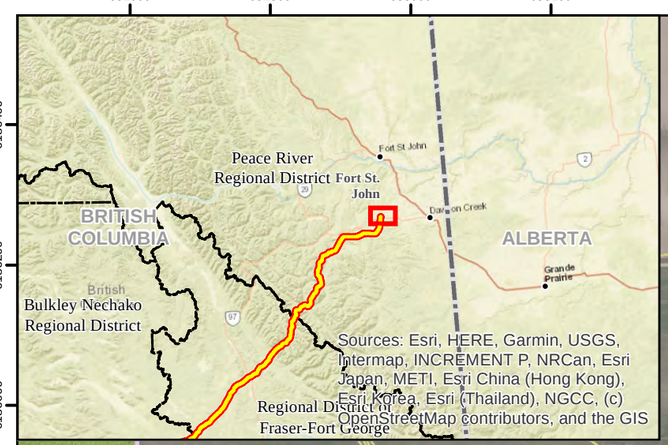

2020 Survey Plot
2019 Survey Plot
Coastal Gaslink Route
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Groundbirch Connector OGC Footprint Corridor
Local Study Area
Regional Study Area
Blue Listed Community

Dominant Broad Ecosystem Category

Anthropogenic
Deciduous Forest
Floodplain
Open Water
Open Water (Anthropogenic)
Wetland
Access Road

Railway
Road
Existing Pipeline
TRIM Watercourse

REVISION	DESCRIPTION
0	Issued

1:8,500

0 75 150 300 450 600 Meters

Coastal GasLink Pipeline Project

TC Energy

Figure G-2
Vegetation Mapbook

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513287-0010	Page 2 of 3

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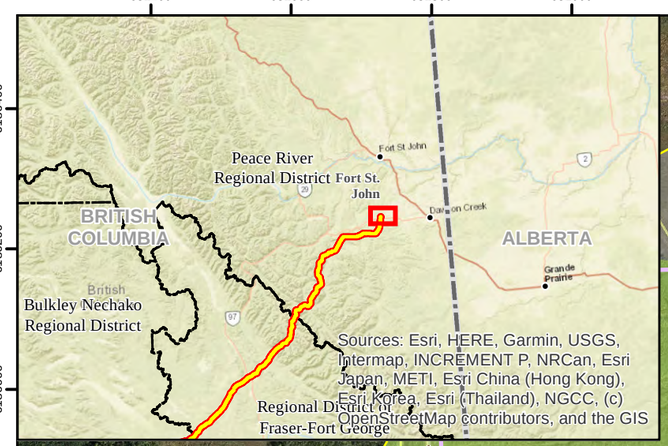

Approved Wilde Lake C/S

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RE-6200 Rd 269

WL-30000

WL-0073

WL-11766

WL-11765

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WL-30008

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DP19183

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DP19179

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DP20052

DP20050

DP20051

DP19169

DP19164

DP19165

DP19163

DP19170

DP19171

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2020 Survey Plot
2019 Survey Plot
Kilometre Post
Coastal Gaslink Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station

Groundbirch Connector Application Corridor
Groundbirch Connector OGC Footprint Corridor
Local Study Area
Regional Study Area
Blue Listed Community

Dominant Broad Ecosystem Category
Anthropogenic
Coniferous Forest
Deciduous Forest
Floodplain
Open Water
Open Water (Anthropogenic)
Wetland

Railway
Road
Existing Pipeline
TRIM Watercourse

REVISION	DESCRIPTION
0	Issued

1:8,500

0 75 150 300 450 600 Meters

Coastal GasLink Pipeline Project

TC Energy

Figure G-2
Vegetation Mapbook

Route Reference: Groundbirch Connector Pipeline Project | 10/9/2020

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Appendix G-3: Non-native Invasive Plant Species Potentially Occurring Within the Peace River Regional District

Table G-3.1 Non-native Invasive Plant Species Potentially Occurring Within the Peace River Regional District

Scientific Name	Common Name	BC Weed Control Act[1]	Peace River Regional District[2]	BC IAPP[3]
Abutilon theophrasti	velvetleaf	Noxious	-	
Aegilops cylindrica	jointed goatgrass	Noxious	-	
Agropyron repens	quackgrass	Noxious – Peace River	E	
Alliaria petiolata	garlic mustard	Noxious	-	
Anthemis cotula	stinking mayweed	-	E	
Anthriscus caucalis	bur chervil	Noxious	-	
Anthriscus sylvestris	wild chervil	Noxious – Peace River	REDRR	
Arctium spp.	burdock	-	A	
Artemisia absinthium	wormwood or absinthium	-	REDRR	
Avena fatua	wild oats	Noxious	E	
Berteroa incana	hoary alyssum	-	REDRR	
Bromus tectorum	cheat qrass	-	REDRR	
Butomus umbellatus	flowering rush	Noxious	E	
Campunula rapunculiodes	creeping bell flower	-	REDRR	
Cardaria draba	hoary cress	-	REDRR	
Carduus nutans	nodding thistle	-	REDRR	
Carduus acanthoides	plumeless thistle	-	REDRR	
Carum carvi	wild caraway	-	A	Potential
Centaurea biebersteinii	spotted knapweed	-	A	
Centaurea diffusa	diffuse knapweed	Noxious	REDRR	
Centaurea jacea	brown knapweed	-	REDRR	
Centaurea macrocephala	big headed knapweed	-	REDRR	
Centaurea maculosa	spotted knapweed	Noxious	-	
Centaurea montana	mountain bluet	-	REDRR	

Table G-3.1 Non-native Invasive Plant Species Potentially Occurring Within the Peace River Regional District

Scientific Name	Common Name	BC Weed Control Act[1]	Peace River Regional District[2]	BC IAPP[3]
Centaurea solstitialis	yellow starthistle	Noxious	-	
Cerastium spp.	chickweed	-	E	
Chenopodium album	lamb's quartes	-	E	
Chondrilla juncea	rush skeletonweed	Noxious	REDRR	
Chrysanthemum leucanthemum	oxeye daisy	Noxious – Peace River	B	
Cichorium intybus	chicory	-	REDRR	
Cicuta douglasii	western water hemlock	-	E	
Cirsium arvense	Canada thistle	Noxious	B	Potential
Cirsium palustre	marsh thistle	-	REDRR	
Cirsium vulgare	bull thistle	-	E	
Clematis tangutica	yellow clematis	-	E	
Crepis tectorum	hawksbeard, narrowleaf	-	E	
Crupina vulgaris	common crupina	Noxious	-	
Cuscuta spp.	dodder	Noxious	-	
Cynoglossum officinale	hound's-tongue	Noxious	REDRR	
Cyperus esculentus	yellow nutsedge	Noxious	-	
Cyperus rotundus	purple nutsedge	Noxious	-	
Daucus carota	Queen Anne's lace	-	REDRR	
Descurainia sophia	flixweed	-	E	
Dracocephalum parviflorum	American dragonhead	-	E	
Echium vulgare	blueweed	-	REDRR	
Erodium spp.	stork's bill	-	E	
Erucastrum gallicum	mustard, dog	-	E	
Euphorbia cyparissias	cypress spurge	-	REDRR	
Euphorbia esula	leafy spurge	Noxious	REDRR	
Fagopyrum tataricum	tartary buckwheat	Noxious – Peace River	REDRR	
Fallopia japonica	Japanese knotweed	Noxious	REDRR	

Table G-3.1 Non-native Invasive Plant Species Potentially Occurring Within the Peace River Regional District

Scientific Name	Common Name	BC Weed Control Act[1]	Peace River Regional District[2]	BC IAPP[3]
Fallopia sachalinensis	giant knotweed	Noxious	REDRR	
Fallopia x bohemica	bohemian knotweed	Noxious	REDRR	
Galeopsis tetrahit	hemp nettle		E	
Galium aparine	cleavers	Noxious – Peace River	E	
Glyceria maxima	giant mannagrass/reed sweetgrass	Noxious	-	
Gypsophila paniculata	baby's breath	-	REDRR	
Hieracium aurantiacum	orange hawkweed	-	A	Potential
Hieracium pratense	yellow hawkweed	-	A	Potential
Heracleum mantegazzianum	giant hogweed	Noxious	-	
Hesperis matronalis	dame's rocket	-	E	
Hippophae rhamnoides	sea buckthorn	-	E	
Hordeum jubatum	foxtail barley	-	E	
Hvpericum perforatum	St. john's wort	-	REDRR	
Hyoscyamus niger	black henbane	-	REDRR	
Impatiens glandulifera	Himalayan balsam	-	REDRR	
Iris pseudacorus	yellow flag iris	Noxious	-	
Knautia arvensis	field scabious/blue button	-	REDRR	
Kochia scoparia	kochia	Noxious – Peace River	B	
Lactuca serriola	prickly lettuce		E	
Lamiastrum galeobdolon	yellow archangel	-	REDRR	
Lappula spp.	bluebur western	-	E	
Leucanthenum x superbum	Shasta daisy	-	E	
Linaria dalmatica	dalmatian toadflax	Noxious	A	
Linaria vulgaris	common toadflax	Noxious	B	

Table G-3.1 Non-native Invasive Plant Species Potentially Occurring Within the Peace River Regional District

Scientific Name	Common Name	BC Weed Control Act[1]	Peace River Regional District[2]	BC IAPP[3]
Lychnis alba	white cockle	Noxious – Peace River	E	
Lythrum salicaria	purple loosestrife	Noxious	REDRR	
Madia glomerata	tarweed	-	E	
Malva neglecta	mallow	-	E	
Matricaria maritima	scentless chamomile	Noxious	-	Potential
Matricaria matricariodes	pineapple weed	-	E	
Matricaria perforata	scentless chamomile	-	B	
Nymphoides peltata	yellow floating heart	-	E	
Pastinaca sativa	wild parsnip	-	REDRR	
Phragmites australis subsp. australis	common reed	Noxious	-	
Poa annua	annual bluegrass	-	B	
Polygonum convolvulus	buckwheat, wild	-	E	
Polygonum polystachyum	Himalayan knotweed	Noxious	REDRR	
Polygonum spp.	smartweed	-	E	
Potentilla recta	sulphur cinquefoil	-	REDRR	
Ranunculus acris	tall buttercup	-	B	
Rumex acetosella	sheep sorrel	-	E	
Rumex crispus	curled dock	-	E	
Salsola kali	Russian thistle	Noxious – Peace River	A	
Senecio jacobaea	tansy ragwort	Noxious	REDRR	
Senecio vulgaris	groundsel, common	-	E	
Setaria viridis	green foxtail	Noxious – Peace River	A	
Silene cucbalus	bladder campion	-	E	
Silene noctiflora	night-flowering catchfly	Noxious – Peace River	B	
Silybum marianum	milk thistle	Noxious	-	
Sinapis arvensis	wild mustard	Noxious – Peace River	E	

Table G-3.1 Non-native Invasive Plant Species Potentially Occurring Within the Peace River Regional District

Scientific Name	Common Name	BC Weed Control Act[1]	Peace River Regional District[2]	BC IAPP[3]
Sisymbrium spp.	mustards	-	E	
Sonchus arvensis	perennial sow thistle	Noxious	-	Potential
Sonchus oleraceus	annual sow thistle	Noxious	-	
Sonchus spp.	sow thistles	-	E	
Spartina alterniflora	smooth cordgrass	Noxious	-	
Spartina anglica	common cordgrass	Noxious	-	
Spartina densiflora	dense-flowered cordgrass	Noxious	-	
Spartina patens	saltmeadow cordgrass	Noxious	-	
Spergula arvensis	corn spurry	-	E	
Symphytum spp.	comfrey	-	A	
Tanacetum vulgare	common tansy	-	A	
Thlaspi arvense	stinkweed or pennycress	-	E	
Tragopogon pratensis	goat's-beard or salsify	-	A	
Triglochin maritima	arrow grass	-	E	
Ulex europaeus	gorse	Noxious	-	
Ventenata dubia	north africa grass	Noxious	-	
Verbascum thapsus	mullein	-	E	

SOURCES:

[1] BC *Weed Control Act* (2011)

[2] Peace River Regional District 2019

- REDRR – Regional Early Detection Rapid Response
- A – Category A: High Priority for Eradication and Containment
- B – Category B: Medium Priority for Eradication and Containment
- E – Education and Awareness

[3] BC Invasive Alien Plant Program 2019

Appendix G-4: Plant Species Observed During Vegetation Surveys

Table G-4.1 Plant Species Observed during Vegetation Surveys on the Groundbirch Connector

Scientific Name	Common Name	Provincial Status
Broad-leaved Trees		
Alnus incana	mountain alder	S5
Betula papyrifera	paper birch	S5
Populus balsamifera	balsam poplar	S5
Populus tremuloides	trembling aspen	S5
Salix bebbiana	Bebb's willow	S5
Salix scouleriana	Scouler's willow	S5
Coniferous Trees		
Picea glauca	white spruce	S5
Picea mariana	black spruce	S5
Deciduous Shrubs		
Amelanchier alnifolia	saskatoon	S4S5
Betula nana	scrub birch	S5
Cornus stolonifera	red-osier dogwood	S5
Lonicera dioica	glaucous honeysuckle	S5
Lonicera involucrata	black twinberry	S5
Ribes hudsonianum	northern blackcurrant	S5
Ribes lacustre	black gooseberry	S5
Ribes triste	red swamp currant	S5
Rosa acicularis	prickly rose	S5
Rubus idaeus	red raspberry	S5
Salix barclayi	Barclay's willow	S5
Shepherdia canadensis	soopolallie	S5
Spiraea betulifolia	birch-leaved spirea	S5
Symphoricarpos albus	common snowberry	S5
Vaccinium myrtilloides	velvet-leaved blueberry	S5
Viburnum edule	highbush cranberry	S5
Evergreen Shrubs		
Rhododendron groenlandicum	Labrador tea	S5
Dwarf Woody Plants		
Linnaea borealis	twinflower	S3S4
Oxycoccus oxycoccos	bog cranberry	S5

Table G-4.1 Plant Species Observed during Vegetation Surveys on the Groundbirch Connector

Scientific Name	Common Name	Provincial Status
Rubus chamaemorus	cloudberry	S5
Vaccinium vitis-idaea	lingonberry	S5
Ferns or Fern-ally		
Athyrium filix-femina	lady fern	S5
Equisetum arvense	common horsetail	S5
Equisetum fluviatile	swamp horsetail	S5
Equisetum sylvaticum	wood horsetail	S5
Forbs		
Achillea millefolium	yarrow	SNA
Actaea rubra	baneberry	S5
Aconitum delphinifolium	mountain monkshood	S5
Aralia nudicaulis	wild sarsaparilla	S5
Arnica cordifolia	heart-leaved arnica	S5
Astragalus americanus	American milk-vetch	S5
Bidens cernua	nodding beggarticks	S5
Castilleja miniata	scarlet paintbrush	S5
Cerastium sp.	chickweed	#N/A
Chenopodium album	lamb's-quarters	SNA
Circaea alpina	enchanter’s-nightshade	S5
Coeloglossum viride	long-bracted frog orchid	S5
Comarum palustre	marsh cinquefoil	S5
Cornus canadensis	bunchberry	S5
Delphinium glaucum	tall larkspur	S5
Epilobium angustifolium	fireweed	S5
Epilobium ciliatum	purple-leaved willowherb	S5
Erysimum cheiranthoides	wormseed mustard	SNA
Eurybia conspicua	showy aster	S5
Fallopia convolvulus	black bindweed	SNA
Fragaria virginiana	wild strawberry	S5
Galeopsis tetrahit	hemp-nettle	SNA
Galium boreale	northern bedstraw	S5
Galium trifidum	small bedstraw	S5
Galium triflorum	sweet-scented bedstraw	S5
Geum macrophyllum	large-leaved avens	S5

Table G-4.1 Plant Species Observed during Vegetation Surveys on the Groundbirch Connector

Scientific Name	Common Name	Provincial Status
Geum rivale	water avens	S4?
Gnaphalium uliginosum	marsh cudweed	SNA
Heracleum maximum	cow-parsnip	S5
Hieracium umbellatum	narrow-leaved hawkweed	S5
Hippuris vulgaris	common mare's-tail	S5
Impatiens capensis	spotted touch-me-not	SNA
Lathyrus ochroleucus	creamy peavine	S5
Lemna minor	common duckweed	S5
Lemna trisulca	ivy-leaved duckweed	S5
Maianthemum canadense	wild lily-of-the-valley	S5
Maianthemum trifolium	three-leaved false Solomon's-seal	S5
Medicago sativa	alfalfa	SNA
Mentha arvensis	field mint	S5
Mertensia paniculata	tall bluebells	S4
Mitella nuda	common mitrewort	S5
Moehringia lateriflora	blunt-leaved sandwort	S5
Osmorhiza depauperata	blunt-fruited sweet-cicely	S5
Persicaria amphibia var. emersa	swamp smartweed	S5
Petasites frigidus var. frigidus	sweet coltsfoot	S4
Petasites frigidus var. palmatus	palmate coltsfoot	S5
Prosartes trachycarpa	rough-fruited fairybells	S5
Pyrola asarifolia	pink wintergreen	S5
Pyrola minor	lesser wintergreen	S5
Ranunculus cymbalaria	shore buttercup	S5
Ranunculus gmelinii	small yellow water-buttercup	S5
Ranunculus uncinatus	little buttercup	S5
Rhinanthus minor	yellow rattle	S5
Rubus arcticus	dwarf nagoonberry	S5
Rubus pubescens	dwarf red raspberry	S5
Rumex occidentalis	western dock	S5
Scutellaria galericulata	marsh skullcap	S5
Senecio eremophilus	dryland ragwort	S4
Sium suave	hemlock water-parsnip	S5
Solidago canadensis	Canada goldenrod	SNA

Table G-4.1 Plant Species Observed during Vegetation Surveys on the Groundbirch Connector

Scientific Name	Common Name	Provincial Status
Sonchus oleraceus	common sow-thistle	SNA
Sparganium angustifolium	narrow-leaved bur-reed	S5
Spergula arvensis	corn spurry	SNA
Stellaria longifolia	long-leaved starwort	S5
Symphyotrichum ciliolatum	Lindley's aster	S5
Symphyotrichum foliaceum	leafy aster	S4S5
Taraxacum officinale	common dandelion	SNA
Thalictrum occidentale	western meadowrue	S5
Thlaspi arvense	field pennycress	SNA
Trifolium hybridum	alsike clover	SNA
Urtica dioica	stinging nettle	SNA
Valeriana dioica	marsh valerian	S5
Vicia americana	American vetch	S5
Viola canadensis	Canada violet	S5
Viola palustris	marsh violet	S5
Viola sp.	violet	#N/A
Graminoids		
Alopecurus aequalis	little meadow-foxtail	S5
Avena sativa	common oat	SNA
Beckmannia syzigachne	American sloughgrass	S5
Bromus inermis	smooth brome	SNA
Bromus vulgaris	Columbia brome	S5
Calamagrostis canadensis	bluejoint reedgrass	S5
Carex capillaris	hairlike sedge	S5
Carex deweyana	Dewey’s sedge	S5
Carex disperma	soft-leaved sedge	S5
Carex lasiocarpa	slender sedge	S5
Carex pellita	wooly sedge	S5
Carex sp.	sedge	#N/A
Carex utriculata	beaked sedge	S5
Dactylis glomerata	orchard-grass	SNA
Eleocharis palustris	common spike-rush	S5
Elymus glaucus	blue wildrye	S5
Elymus lanceolatus	thickspike wildrye	S5

Table G-4.1 Plant Species Observed during Vegetation Surveys on the Groundbirch Connector

Scientific Name	Common Name	Provincial Status
Elymus sp.	wildrye	#N/A
Glyceria borealis	northern mannagrass	S5
Glyceria sp.	mannagrass	#N/A
Phalaris arundinacea	reed canarygrass	SNA
Phleum pratense	common timothy	SNA
Poa palustris	fowl bluegrass	S5
Poa pratensis	Kentucky bluegrass	SNA
Triticum sp.	wheat	SNA
Lichens		
Cladonia sp.	clad lichens	#N/A
Mosses		
Aulacomnium palustre	glow moss	S5
Brachythecium asperrimum		S5?
Brachthecium frigidum		S5?
Chiloscyphus pallescens		S5
Dicranum sp.	heron's-bill moss	#N/A
Hylocomium splendens	step moss	S5
Jamesoniella autumnalis		S5?
Mnium sp.	leafy moss	#N/A
Oncophorus wahlenbergii	mountain curved-back moss	S4S5
Plagiomnium medium		S4S5
Pleurozium schreberi	red-stemmed feathermoss	S5
Polytrichum juniperinum	juniper haircap moss	S5
Polytrichum sp.	haircap moss	#N/A
Ptilium crista-castrensis	knight's plume	S5
Pylaisiella polyantha		S4S5
Sanionia uncinata		S5
Sciuro-hypnum latifolium		S3S4
Sphagnum sp.	peat-moss	#N/A
Parasitic/Saprophytes		
Corallorhiza maculata	spotted coralroot	S5

Appendix H
Groundbirch Connector
Wetlands Technical Data Report

Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3) Appendix H Groundbirch Connector Wetlands Technical Data Report

CGL80373-STC-ENV-RP-005

October 13, 2020

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Authorization Page

Stantec Consulting Ltd.

Prepared by: Dmitry Petelin Digitally signed by Dmitry Petelin Date: 2020.10.08 21:32:45 +03'00' Date: _____

Name: Dmitry Petelin

Title: Author, Senior Vegetation Biologist

Endorsed by:  Digitally signed by Ward Prystay, R.P.Bio. Date: 2020.10.09 12:54:16 -07'00' Date: _____

Name: Ward Prystay

Title: Independent Review, Vice President Environmental Services

Approved by: Catherine Meyer Digitally signed by Catherine Meyer Date: 2020.10.10 11:46:07 -06'00' Date: _____

Name: Catherine Meyer

Title: Project Manager, Environmental Services

Authorization Page

Coastal GasLink Pipeline Project

Endorsed by: _____ Date: _____

Name: Jeff Quennelle

Title: Environmental Advisor, Coastal GasLink

Endorsed by: _____ Date: _____

Name: Adair Rigney

Title: Environmental Team Lead, Coastal GasLink

Accepted by: _____ Date: _____

Name: Craig Losos

Title: Manager Environmental Planning and Permitting, Coastal GasLink

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1.0 INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at: https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Wetlands Technical Data Report includes relevant baseline information for the proposed Groundbirch Connector. Traditional Land and Resource Use (TLRU) is presented in Section 15.0 of the Amendment Application. The Groundbirch

Connector crosses exclusively private land, so no Traditional Ecological Knowledge was collected during field programs.

Abbreviations and acronyms used in this report are described in Appendix H-1.

1.1 OBJECTIVES

This Wetland TDR considers the direction of the EAC Application Information Requirements issued by the EAO (BC EAO 2013), the Section 25 required assessment matters under the revitalized BC *Environmental Assessment Act* (refer to Section 1.2 of the Amendment Application) and references the guidance contained in the following documents:

- EAO User Guide (BC EAO 2020a); and
- Guide to Indigenous Knowledge in Environmental Assessments (BC EAO 2020b).

The objectives of this TDR are to document the baseline condition of wetlands in the proposed Groundbirch Connector study areas using methods that are consistent with the 2013 approved Application Information Requirements for the Project and provide the data needed to facilitate the assessment of potential effects and potential cumulative effects. These objectives were achieved for wetlands by data and literature reviews, ecosystem mapping and wetland field surveys in the local study area (LSA).

Mitigation for Wetlands can be found in Section 9.5 of the EAC Application (Coastal GasLink 2014a). No additional mitigation is required for the proposed Groundbirch Connector for potential effects on wetlands

1.2 STUDY AREA BOUNDARIES

The wetland study area boundaries consist of the Groundbirch Connector Footprint, the LSA, and the regional study area (RSA). These study boundaries are described below and presented in Figure 1-1.

1.2.1 Groundbirch Connector Footprint

The Groundbirch Connector Footprint is the area potentially affected by physical works and activities, such as clearing, construction and cleanup. The Groundbirch Connector Footprint is delineated by a 50-m wide buffer on each side of the pipeline centreline, and encompasses the construction ROW, the permanent ROW, an access road, temporary workspace, and tie-in locations.

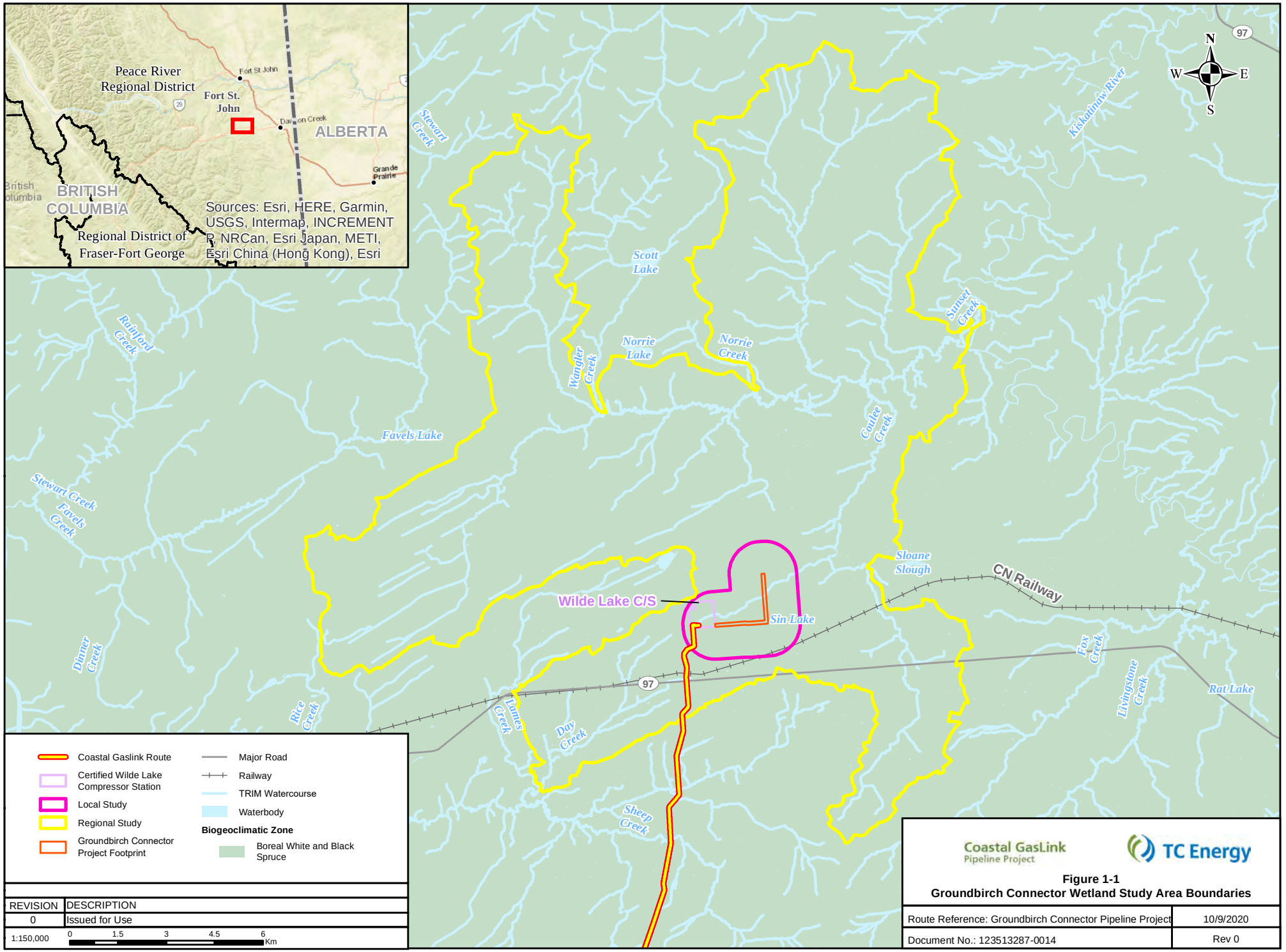
The Groundbirch Connector Application Corridor varies in width from approximately 175 m to 245 m to account for temporary workspace, but is not used in assessment analysis within this report.

1.2.2 Local Study Area

The wetlands LSA (see Figure 1-1) is defined by a 1 km buffer on each side of the Groundbirch Connector pipeline centreline (i.e., a 2 km wide band). The wetlands LSA encompasses the zone of influence in which wetlands could potentially be affected by Groundbirch Connector activities and facilities directly through removal of vegetation, or indirectly through changes in hydrology, as well as local surface water and its connectivity (e.g., inflow and outflow).

1.2.3 Regional Study Area

The wetland RSA encompasses the Groundbirch Connector Footprint and the LSA (Figure 1-1). It is spatially defined by the watershed boundaries of the major drainages crossed by the Groundbirch Connector. The wetlands RSA is defined to evaluate effects of the Groundbirch Connector on wetlands at a regional scale and the potential interaction of the Groundbirch Connector with past, present and future activities that might result in cumulative adverse effects on wetlands.



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2.0 GROUNDBIRCH CONNECTOR PROJECT SETTING

This section provides a general overview of the biophysical environment traversed by the Groundbirch Connector, with respect to wetlands.

2.1 PHYSICAL SETTING

The wetlands RSA is located in the Boreal Plains Ecoprovince of BC. Ecoprovinces are part of the BC Ecoregion Classification System which was developed to provide a systematic view of small-scale ecological relationships throughout the province based on climate and physiography (Demarchi 2011). The Boreal Plains are characterized by flat or undulating terrain with thick Cretaceous shale bedrock with overlaying soil deposits. Extensive natural disturbance is common in the form of fire and insect outbreaks (Demarchi 2011).

It also is located within the moist warm Boreal White and Black Spruce subzone (BWBSmw) of the provincial Biogeoclimatic Ecosystem Classification (BEC) system. The BEC system brings together information related to climate, soils, and vegetation to determine the mature vegetation community for a site. The BWBSmw subzone is characterized by short, continental growing seasons and modest precipitation of 424 to 749 mm annually, almost half of which comes as snow. Forest stands within the BWBS feature white and black spruce and trembling aspen, as well as lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), tamarack (*Larix laricina*), balsam poplar (*Populus balsamifera*), and paper birch (*Betula papyrifera*) as the dominant canopy species (BC MOFR 2011).

Using the classification system of MacKenzie and Moran (2004), major wetland classes within the study area include bogs, swamps, marshes and shallow open water.

2.2 ANTHROPOGENIC DISTURBANCES

Anthropogenic disturbances exist throughout the wetlands LSA. Typical disturbances that affect the condition of wetlands include changes in hydrology (through drainage or dyking), filling, vegetation removal, and the presence of non-native invasive species. The most common land use within the Groundbirch Connector study areas is agricultural and much of the land within the Groundbirch Connector study areas is cultivated fields.

3.0 METHODS

The methods used to gather baseline information to support the assessment of potential effects of the proposed Groundbirch Connector are the same as those used in the Coastal GasLink Wetland Technical Data Report (Appendix 2K of the EAC Application; Coastal GasLink 2014b). The process of selecting key indicators, conducting data and literature reviews, and identifying mitigation is unchanged.

3.1 DESKTOP ASSESSMENT

A review of existing information was completed for the Amendment Application using the same methods as in the Coastal GasLink Wetlands Technical Data Report (Section 4.1 of Appendix 2K of the EAC Application). Existing data were compiled from published literature and government and non-governmental databases. This desktop review was used to assist in characterizing baseline wetland conditions for the Groundbirch Connector.

3.1.1 Definitions

Wetlands are defined as “land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment” (National Wetlands Working Group 1988). Floodplain ecosystems technically differ from this definition and are included in the Vegetation TDR (Appendix G Groundbirch Connector Vegetation TDR).

Wetland ecosystems and their attendant functions described in this report are:

- wetland classes and site associations;
- hydrological functions;
- biogeochemical functions; and
- habitat functions.

3.1.2 Wetland Classes and Site Associations

Wetland classes are defined by both the *Canadian Wetland Classification System* (National Wetlands Working Group 1997) and *Wetlands of British Columbia: A Guide to Identification* (MacKenzie and Moran 2004). The *Canadian Wetland Classification System* recognizes five wetland classes:

1. Bogs are organic wetlands formed of *Sphagnum* peat. They generally receive water from precipitation and are virtually unaffected by runoff waters or groundwater.

2. Fens are organic wetlands formed of decomposed sedge or brown moss peat. Fens are characterized by a fluctuating water table due to their connection with groundwater and surface water movement.

3. Swamps are treed or tall shrubby wetlands that generally occur on mineral soils. They can contain an accumulation of well decomposed wood-rich peat and are influenced by groundwater.

4. Marshes are wetlands dominated by graminoid vegetation, including rushes, reeds, grasses, and sedges. Marshes occur on mineral soils and have shallow surface water that fluctuates dramatically.

5. Shallow open water wetlands are transitions between the other four wetland classes and permanent, deep water bodies (i.e. lakes), characterized by standing or flowing water less than 2 m deep in mid-summer.

Site associations are classified following *Wetlands of British Columbia: A Guide to Identification* (MacKenzie and Moran 2004), a system that classifies the common wetland ecosystems of BC based on wetland class and plant species assemblages (or vegetation communities). The wetland site associations align with the provincial conservation tracking lists managed by the BC Conservation Data Centre (BC CDC; red- or blue-listed ecological communities).

3.1.3 Wetland Functions

Wetland functions are natural processes that are independent of the benefits that humans may garner from them (Hanson et al. 2008). Three main wetland functions are hydrologic, biogeochemical, and habitat.

Hydrologic functions include:

- water flow moderation (i.e., peak flow attenuation and reduction of surface water velocity, thereby reducing erosive force);
- groundwater recharge and baseflow augmentation; and
- erosion protection.

Biogeochemical functions include:

- water quality improvement;
- nutrient and organic export; and
- carbon sequestration and storage (which in turn contribute to maintenance of global carbon balance and climate).

Habitat functions include:

- provision of life-history requisites (e.g., for, nesting, denning, rearing) for various wetland-dependent faunal groups (mammals, birds, herptiles, and fish), particularly migratory birds, species at risk, and fisheries; and
- suitable soils and hydrology to support wetland-associated vegetation resources such as ecological communities at risk (BC red- and blue-listed ecological communities) and plant species at risk.

3.1.4 Review of Existing Data Sources and Literature

A desktop review of existing data sources and literature to compile baseline information included:

- provincially available datasets such as the Broad Ecosystem Inventory (BEI), the BC Conservation Data Centre (BC CDC), and the Terrain Resource Information Management Program Freshwater Atlas (Province of British Columbia 2019); and
- published literature, including scientific papers, reference books, reports, information letters, fact sheets, and guides, as well as aerial photographs, and provincial and federal government maps, registries, and interactive web sites.

3.1.5 Wetland Mapping

Terrestrial Ecosystem Mapping (TEM) was conducted following provincial standards (RISC 1998). Bioterrain mapping was first conducted at 1:20,000 scale within the wetlands LSA and the ecosystem mapping was subsequently conducted within this linework.

Non-wetland ecosystems were delineated at a scale of 1:20,000 per the baseline methods in the EAC Application (see Coastal GasLink EAC Application Wetland Technical Data Report (Appendix 2K); Coastal GasLink 2014b) and wetland ecosystems were delineated at a scale of 1:5,000 within the study boundaries to provide more precise locations and area extent of wetlands. Field surveys were conducted to verify the ecosystem mapping and collect information on vegetation, wetlands, wildlife, and aquatic resources.

Information about wetlands in the RSA was obtained from the publicly available datasets, including the Freshwater Atlas and BEI. Given that the BEI did not delineate any wetlands within the RSA, only the Freshwater Atlas dataset was chosen to delineate wetlands in the RSA. This contains information about streams, lakes, and wetlands. The Freshwater Atlas delineates only two classes of wetlands: marshes and swamps.

3.2 FIELD SURVEYS

During the TEM and rare plant field programs (completed from August 1 to August 3, 2019, and from June 27 to June 29, 2020), 41 field plots were established within the wetlands LSA. Of these 41 sites, 12 were located in wetlands, 5 were at ponds, 12 were located in upland ecosystems, and 12 were located on the cultivated fields. The 2019 and 2020 TEM field programs followed guidelines in the *Field Manual for Describing Terrestrial Ecosystem*s (BC MOFR and BC MOE 2015).

The objectives of ground inspections of wetlands during the 2019 and 2020 TEM field program were to:

- record detailed vegetation and hydrology data within wetland ecological communities; and
- ground-truth wetland mapping.

The following data were collected at each ground inspection location:

- site descriptors such as aspect, coordinates, elevation, and slope position;
- plant species list and percent cover;
- soil moisture and nutrient regime; and
- wetland ecosystem classification and confirmation.

Data on wetland-associated wildlife habitat were collected by wildlife biologists during the field program from June 25 to June 26, 2019, and August 1 to August 3, 2019. Wildlife biologists completed surveys to determine whether breeding birds or pond-dwelling amphibians were present. Wildlife habitat assessments were also completed in representative habitat types (see Appendix I Groundbirch Connector Wildlife TDR).

Wildlife biologists followed provincial Resource Inventory Standards Committee (RISC) standards for breeding bird and ground-based pond-dwelling amphibian surveys. Complete methods for amphibian, breeding bird and habitat assessment surveys can be found in Section 3.2 of Appendix I Groundbirch Connector Wildlife and Wildlife Habitat TDR.

4.0 RESULTS

4.1 WETLANDS IN THE REGIONAL STUDY AREA

According to Freshwater Atlas (FWA) mapping, there are 577.9 hectares of wetlands in the Groundbirch Connector RSA (see Table 4-1 and Appendix H-2).

The FWA includes approximately 17.5 ha of wetlands within the LSA. Terrestrial Ecosystem Mapping available for the Groundbirch Connector provides more precise estimates of wetland area and type within the LSA than the publicly available FWA data source (see Section 4.2).

Table 4-1: Wetland Area in the Groundbirch Connector Local and Regional Study Areas Based on Freshwater Atlas Mapping[a]

Freshwater Atlas Unit	Description	Wetland Area in Local Study Area (ha)	Wetland Area in Regional Study Area (ha)
Marsh	marsh	3.0	74.2
Swamp	swamp	14.5	500.4
Shallow Open Water [b]	-	0.0	3.2
TOTAL (Freshwater Atlas Wetland Area)		**17.5**	**577.9**

NOTES:
[a] No wetland areas identified by Broad Ecosystem Inventory (BEI) mapping in RSA.
[b] Shallow open water is equivalent to 'Flooded Land', and inundated category within the Freshwater Atlas dataset.
[c] The totals presented may not add up fully, due to rounding

4.2 WETLANDS IN THE LOCAL STUDY AREA

According to the TEM, the LSA includes 33.7 ha of wetlands consisting of eight site associations referring to four wetland classes: bogs, marshes, swamps and shallow open water. The Groundbirch Connector Footprint contains 1.0 ha of wetlands consisting of three wetland classes (e.g., marshes, swamps, and shallow open water). Bogs occupy the largest wetland area within the LSA, consisting of 20.5 ha, followed by swamps which consist of 12.6 ha total. Swamps are the most abundant wetland class in the Groundbirch Connector Footprint (0.8 ha); they are represented there by one site association (Ws03) (see Table 4-2 and Appendix H-2).

Table 4-2: Wetland Area in the Groundbirch Connector Footprint and Local Study Area Based on Terrestrial Ecosystem Mapping

Site Series	Map Code	Ecosystem Name	Area in Groundbirch Connector Footprint (ha)	Area in Local Study Area (ha)
Bog				
Wb03	BT	Black spruce – lingonberry – peat moss	0.0	18.6
Wb05	SS	Black spruce – water sedge – peat moss	0.0	0.5
Wb09	BH	Black spruce – common horsetail – peat moss	0.0	1.4
Subtotal Bog			*0.0*	*20.5*
Marsh				
Wm01	MA	Beaked sedge – water sedge	<0.1	<0.1
Swamp				
Ws03	BJ	Bebb's willow – bluejoint	0.8	7.3
Ws07	SL	Spruce – common horsetail – leafy moss	0.0	4.2
Ws14	AB	Mountain alder – Bebb's willow – bluejoint	0.0	1.0
Subtotal Swamp			*0.8*	*12.6*
Shallow Open Water				
Ww00	OW	Shallow open water	0.2	0.2
TOTAL			**1.0**	**33.3**
NOTE: The totals presented may not add up fully, due to rounding				

4.3 WETLAND FUNCTIONS

Wetland functions are generally characterized according to each wetland class, except where certain wetland associations include particular attributes (e.g., unique vegetation or hydrologic regime) that affect the potential of a wetland to provide select functions. The area of each wetland class provides a relative sense of the abundance of wetlands and their associated functions. The four classes of wetlands present in the LSA vary in their potential to provide various hydrological, biogeochemical, and habitat functions. See Section 3.3 of the 2014 EAC Application Wetlands TDR (Appendix 2K; Coastal GasLink 2014c) for a complete discussion of the potential for each wetland class to provide particular ecological functions.

4.3.1 Hydrological Functions

Hydrological function is the capacity of a wetland to store, moderate, and release water in a watershed (i.e., peak flow attenuation, downstream erosion reduction, groundwater recharge and baseflow provision). Wetlands within the Groundbirch Connector Footprint provide peak flow attenuation by storing precipitation and surface flows from the contributing watershed during major storm events and releasing this stored water gradually. A wetland's potential to perform this function depends on its size, the amount of water it can hold, the size and elevation of its outlet channel(s) relative to its basin, and its position in the watershed (Hruby et al. 1999; Kusler 2011; Null et al. 2000). When wetlands are situated in a floodplain and contain dense woody vegetation, they can also dissipate the energy of flood events and reduce the erosive force of peak flows. Groundwater recharge can feed deep aquifers or supplement baseflows of streams depending on the groundwater elevations, soil texture and infiltration rate.

4.3.2 Biogeochemical Functions

Biogeochemical function refers to the biological, geological, and chemical processes and reactions that govern the composition of the natural environment as it relates to the chemistry cycles between plants, animals and the earth's sediments and atmosphere. Wetland functions within the Groundbirch Connector Footprint are associated with biogeochemical cycling typically related to the maintenance or improvement of water quality and regulation of global climate through carbon capture and sequestration. Wetlands within the Groundbirch Connector Footprint can improve water quality by removing sediment, nutrients, heavy metals, and organic contaminants. Their potential to improve water quality in these ways depends on their geomorphic setting (i.e., basin shape, size, inlet/outlet and location in the landscape), vegetation structure, soils, and hydroperiod (i.e., depth and duration of inundation) (Hruby et al. 1999; Null et al. 2000). Their potential to sequester carbon depends on rates of primary productivity, export of organic carbon downstream, and rates of decomposition of organic carbon. Indicators of biogeochemical function include vegetation type, degree of surface flow through the wetland, and accumulation of peat.

4.3.3 Habitat Functions

Habitat function refers to the manner in which a wetland contributes to biological productivity and diversity of wetland-associated faunal and floral groups, such as invertebrates, amphibians, birds, mammals, and at-risk plant species or communities. The potential for a wetland to provide food, shelter, breeding conditions and staging areas depends on the surface water hydrology, structural attributes of the vegetation, and landscape ecology (Hruby et al. 1999; Null et al. 2000). For example, the

hydroperiod and depth of water are important factors affecting the potential of wetlands to provide amphibian breeding habitat. Also, the degree of tree canopy closure and ratio of open water to vegetation cover are important factors affecting the potential of wetlands to provide bird nesting and foraging habitat. Furthermore, the connection to adjacent uplands is an important factor affecting the potential of wetlands to provide foraging or denning sites for certain mammals.

Pond-dwelling Amphibians

Of the wetlands in the LSA surveyed for amphibians, four had observations of amphibians. Wood frog (*Lithobates sylvaticus*) was the only species of amphibian detected. All four sites had one juvenile each, though one site also contained an adult. Wood frog is not listed under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the *Species at Risk Act* (SARA).

Migratory Birds

Of the 17 breeding bird point count surveys completed within the Wetlands LSA, only one was located near a wetland. At this survey point, nine species of bird were recorded. White-throated sparrow (*Zonotrichia albicollis*), yellow warbler (*Setophaga petechia*), American robin (*Turdus migratorius*) and clay-coloured sparrow (*Spizella pallida*) were the most common species detected. No species listed under COSEWIC or SARA were detected in wetlands.

Waterfowl

No waterfowl surveys were completed for the Groundbirch Connector study areas. The wetlands and waterbodies within the wildlife and wildlife habitat LSA have limited value for waterfowl but, in any given year, small numbers (e.g., one pair per water feature) of waterbirds (ducks, geese, and sandpipers) may use these habitats for breeding or during migration. Three waterbird species (mallard, green-winged teal, and lesser yellowlegs) were observed incidentally at wetlands surveyed for amphibians within the wildlife and wildlife habitat LSA (see Section 4.2.4), and older data indicate that two other species (bufflehead and Canada goose) may also be present at times within this area.

Wetland-associated Plant Species and Communities at Risk

Through desktop assessment, one blue-listed wetland associated plant species, meadow willow (*Salix petiolaris*), was historically documented to exist near the LSA, in the RSA (BC CDC 2014). This previous occurrence was documented in 1967 in an area of swamp forest, and last observed in 1969.

Two blue-listed wetland ecosystems occur in the LSA, the black spruce – lingonberry – peat moss bog (Wb03) and Bebb's willow – bluejoint swamp (Ws03), that cover 18.6 ha and 7.3 ha in the LSA respectively; the latter overlaps with the Groundbirch Connector Footprint where it occupies 0.8 ha. In total, blue-listed wetlands account for 2.7% of the LSA and 2.6% of the Groundbirch Connector Footprint.

No red-listed ecosystems were observed within the Groundbirch Connector Footprint or LSA.

5.0 KEY FINDINGS AND CONCLUSIONS

Key findings within the Groundbirch Connector LSA are as follows:

- Field work and TEM show that there are 33.3 ha of wetlands in the Groundbirch Connector wetlands LSA, with 1.0 ha in the Groundbirch Connector Footprint. Three classes of wetlands occur within the Groundbirch Connector LSA (e.g., swamps, marsh, and shallow open water).
- Two blue-listed wetland site associations occur within the Groundbirch Connector LSA, with total area 25.9 ha (2.7%), and include bog Wb03 and swamp Ws03. The Ws03 wetland site association overlaps with the Groundbirch Connector Footprint where it covers 0.8 ha (2.6%).
- Wetlands in the Groundbirch Connector Footprint and LSA have the potential to provide the following hydrological and biogeochemical functions:
  - peak flow attenuation
  - groundwater recharge
  - carbon sequestration through peat accumulation
  - water quality improvement
- No protected wetland-associated wildlife species were observed during the 2019 surveys though the potential exists for western toad and other wetland-associated migratory birds to exist in the identified wetlands. See Appendix I Groundbirch Connector Wildlife TDR for full discussion.

6.0 REFERENCES

BC CDC (British Columbia Conservation Data Centre). 2014. Occurrence Report Summary, Shape ID: 14718, meadow willow. B.C. Ministry of Environment. Available: http://maps.gov.bc.ca/ess/hm/cdc. Accessed: July 2020.

BC CDC. 2020. BC Species and Ecosystems Explorer. B.C. Ministry of Environment. Victoria, B.C. Available at: http://a100.gov.bc.ca/pub/eswp/. Accessed: July 2020.

BC EAO (British Columbia Environmental Assessment Office). 2013. Coastal GasLink Pipeline Project Application Information Requirements (AIR) for an Environmental Assessment Certificate.

BC EAO. 2014. Coastal GasLink Pipeline Project Environmental Assessment Certificate # E14-03. Website: http://a100.gov.bc.ca/appsdata/epic/documents/p392/1414168837008_ZXZPJK QpsCJ7p994vTQyyJhsM8TBWSnzlv34wMyC67yCBwdyhKHr!-351597226!1414168702186.pdf.

BC EAO. 2020a. *EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018)*. Version 1.01. March 2020. p. 53.

BC EAO. 2020b. *Guide to Indigenous Knowledge in Environmental Assessments*. Version 1.0. April 2020. p. 20.

BC MOFR (British Columbia Ministry of Forests and Range). 2011. A Field Guide to Ecosystem Identification for the Boreal White and Black Spruce Zone of British Columbia. Land Management Handbook Number 65. Victoria, BC.

BC MOFR and MOE (British Columbia Ministry of Forests and Range and Ministry of Environment). 2015. Field Manual for Describing Terrestrial Ecosystems. 2nd Edition (reprint with updates 2015). Land Management Handbook No. 25.

Coastal GasLink. 2014a. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate. Available at: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_392_37367.html.

Coastal GasLink. 2014b. Wetland Technical Data Report, Revision 1. 125 pp + appendices.

Coastal GasLink. 2014c. Coastal GasLink Pipeline Project - Wetlands Technical Data Report.

Demarchi, Dennis A. 2011. An Introduction to the Ecoregions of British Columbia, Third Edition. Ecosystem Information Section, Ministry of Environment. Victoria, British Columbia. Available at: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/ecosystems/broad-ecosystem/an_introduction_to_the_ecoregions_of_british_columbia.pdf?bcgovtm=CSMLS

Hanson, A., L. Swanson, D. Ewing, G. Grabas, S. Meyer, L. Ross, M. Watmough and J. Kirkby. 2008. Wetland Ecological Functions Assessment: An Overview of Approaches. Canadian Wildlife Service Technical Report Series No. 497. Atlantic Region. 59 pp.

Hruby, T, T. Granger, K. Brunner, S. Cooke, K. Dublanica, R. Gersib, L. Reinelt, K. Richter, D. Sheldon, E. Teachout, A. Wald and F. Weinmann. July 1999. Methods for Assessing Wetland Functions Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington. WA State Department Ecology Publication #99-115.

Kusler, J.A. 2011. Assessing the Natural and Beneficial Functions of Floodplains: Issues and Approaches; Future Directions. Association of State Wetland Managers.

MacKenzie, W.H. and J.R. Shaw. 2000. In L.M. Darling (ed.). Proceedings of a Conference on the Biology and Management of Species and Habitats at Risk. Volume Two. Kamloops, BC, February 15–19, 1999. BC Ministry of Environment, Lands and Parks, Victoria, BC and the University College of the Cariboo, Kamloops, BC. 520 pp.

MacKenzie, W.H. and J.R. Moran. 2004. Wetlands of British Columbia: A Guide to Identification. Handbook. No. 52. Resource Branch, British Columbia Ministry of Forests, Victoria, BC.

National Wetlands Working Group. 1988. Wetlands of Canada. Ecological Land Classification Series, No. 24. Environment Canada and Polyscience Publications Inc. Ottawa, ON. 452 pp.

National Wetlands Working Group. 1997. The Canadian Wetland Classification System. Second Edition. Wetlands Research Centre, University of Ecological Land Classification Series, No. 24. Environment Canada and Polyscience Publications Inc. Ottawa, ON. 452 pp.

Null, W.S., G. Skinner and W. Leonard. 2000. Wetland Functions Characterization Tool for Linear Projects. Washington State Department of Transportation, Environmental Affairs Office. Olympia WA. Available: http://www.wsdot.wa.gov/NR/rdonlyres/B92BE0D4-9078-4EFC-99DA-3C0EA4805E2F/0/Wet_BPJtool.pdf.

Province of British Columbia. 2019. Data Catalogue. Published by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development - Forest Analysis and Inventory Licensed under Open Government Licence - British Columbia. Available at: https://catalogue.data.gov.bc.ca/dataset.

Resources Inventory Standards Committee (RISC) 1998. Standards for Terrestrial Ecosystem Mapping in British Columbia. Standards for Components of British Columbia's Biodiversity British Columbia Ministry of Environment, Lands and Parks, Victoria, BC. 225 pp.

Appendix H-1: Abbreviations and Acronyms

Acronym	Definition
Units of Measurement	
%	percent
ha	hectare
km	kilometre = 1,000 metres
m	metre
mm	millimetre
Other Terms	
BC	British Columbia
BC CDC	BC Conservation Data Centre
BC MOFR	BC Ministry of Forests and Range
BC MOE	BC Ministry of Environment
BEC	Biogeoclimatic Ecosystem Classification
BEI	Broad Ecosystem Inventory
BWBS	Boreal White and Black Spruce Zone
Coastal GasLink	Coastal GasLink Pipeline Limited
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
FWA	Freshwater Atlas
LSA	local study area
NPS	Nominal Pipe Size
Project	Coastal GasLink Pipeline Project
RIC	Resources Information Committee
RISC	Resource Inventory Standards Committee
ROW	right-of-way
RSA	regional study area
SARA	*Species at Risk Act*
TEM	Terrestrial Ecosystem Mapping
TDR	Technical Data Report

Appendix H-2: Wetlands Mapbook

N
W
E
S

Sunrise Valley

Sunset Prairie

Willow Valley

CN Railway

Coastal Gaslink Route
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Groundbirch Connector Project Footprint
Local Study Area
Regional Study Area
Freshwater Atlas Wetland
TEM Wetland
Road
Existing Pipeline

REVISION	DESCRIPTION
0	Issued

1:75,000 0 750 1,500 3,000 4,500 Meters

Coastal GasLink Pipeline Project

TC Energy

Figure H-2
Wetlands Mapbook

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
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Kilometre Post
Coastal Gaslink Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Groundbirch Connector Project Footprint
Local Study Area
Regional Study Area
Freshwater Atlas Wetland
Open Water
TEM Open Water (Anthropogenic)
TEM Wetland
Blue Listed Community
Railway
Road
Existing Pipeline

REVISION	DESCRIPTION
0	Issued

1:75,000 0 750 1,500 3,000 4,500 Meters

Coastal GasLink Pipeline Project

TC Energy

Figure H-2
Wetlands Mapbook

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
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WL-30001
WL-30011
WL-30012
WL-30002
WL-30014
WL-30016
WL-30015
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WL-30013
WL-0073
WL-11765
WL-11763
WL-30008
WL-30018
WL-11764
CN Railway

- Kilometre Post
- Coastal Gaslink Route
- Certified Pipeline Corridor
- Certified Wilde Lake Compressor Station
- Groundbirch Connector Application Corridor
- Groundbirch Connector Project Footprint
- Local Study Area
- Regional Study Area
- Freshwater Atlas Wetland
- Open Water
- TEM Open Water (Anthropogenic)
- TEM Wetland
- Blue Listed Community
- Railway
- Road
- Existing Pipeline

REVISION	DESCRIPTION
0	Issued

1:20,000 0 205 410 820 1,230 Meters

Coastal GasLink Pipeline Project

TC Energy

Figure H-2
Wetlands Mapbook

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
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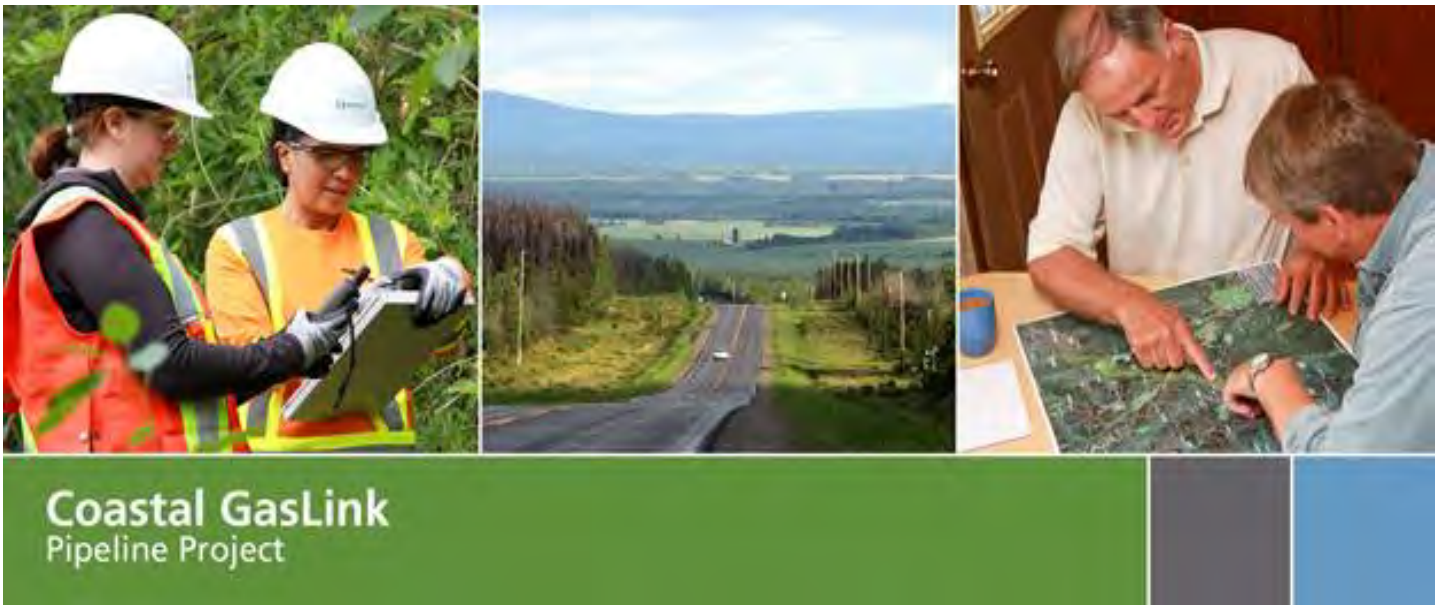
Appendix I
Groundbirch Connector
Wildlife and Wildlife Habitat
Technical Data Report



Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment 3) Appendix I Groundbirch Connector Wildlife and Wildlife Habitat Technical Data Report

CGL80373-STC-ENV-RP-006

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Authorization Page

Stantec Consulting Ltd.

Prepared by: Rebecca Wilson Digitally signed by Rebecca Wilson Date: 2020.10.08 11:38:38 -06'00' Date: _____

Name: Rebecca Wilson

Title: Author

Prepared by:  Date: 2020.10.08 10:33:14 -07'00' Date: _____

Name: Colleen Bryden

Title: Author

Endorsed by: Michael Preston Digitally signed by Michael Preston Date: 2020.10.08 10:36:45 -07'00' Date: _____

Name: Michael Preston

Title: Technical Quality Review

Endorsed by:  Digitally signed by Ward Prystay, R.P.Bio. Date: 2020.10.09 12:55:27 -07'00' Date: _____

Name: Ward Prystay

Title: Independent Senior Review

Approved by: Catherine Meyer Digitally signed by Catherine Meyer Date: 2020.10.10 11:45:11 -06'00' Date: _____

Name: Catherine Meyer

Title: Project Manager,
Environmental Services

Authorization Page

Coastal GasLink Pipeline Project

Endorsed by: _____ Date: _____

Name: Jeff Quennelle

Title: Environmental Advisor, Coastal GasLink

Endorsed by: _____ Date: _____

Name: Adair Rigney

Title: Environmental Planning and Permitting Team Lead, Coastal GasLink

Accepted by: _____ Date: _____

Name: Craig Losos

Title: Manager, Environmental Planning and Permitting, Coastal GasLink

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1.0 INTRODUCTION

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at: https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route (SHAR)) amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Wildlife and Wildlife Habitat Technical Data Report includes relevant baseline information for the proposed Groundbirch Connector.

Traditional Land and Resource Use (TLRU) is presented in Section 15.0 of the Amendment Application. The Groundbirch Connector crosses exclusively private land, so no Traditional Ecological Knowledge was collected during field programs.

Abbreviations and acronyms used in this TDR are provided in Appendix I-1.

1.1 OBJECTIVES

This Wildlife and Wildlife Habitat TDR considers the directives presented in the EAC Application Information Requirements issued by the EAO (BC EAO 2013), the Section 25 required assessment matters under the revitalized BC *Environmental Assessment Act* (refer to Section 1.2 of the Amendment Application) and references the guidance contained in the following documents:

- EAO User Guide (BC EAO 2020a)
- Guide to Indigenous Knowledge in Environmental Assessments (BC EAO 2020b)

The objectives of this TDR are to describe baseline conditions for wildlife and wildlife habitat within the proposed Groundbirch Connector study areas using methods that are consistent with the 2013 approved Application Information Requirements for the Project and provide the data needed to facilitate the assessment of potential effects and potential cumulative effects. These objectives were achieved for wildlife and wildlife habitat by completing wildlife field surveys within the local study area (LSA).

Mitigation for the Wildlife and Wildlife Habitat topic can be found in Section 10.6 of the EAC Application (Coastal GasLink 2014a). No additional mitigation is required for the proposed Groundbirch Connector for potential effects on wildlife and wildlife habitat.

1.2 STUDY AREA BOUNDARIES

Wildlife and wildlife habitat study area boundaries are described below and presented in Figure 1-1.

1.2.1 Groundbirch Connector Footprint

The Groundbirch Connector Footprint is the area potentially affected by physical works and activities, such as clearing, construction and cleanup. The Groundbirch Connector Footprint is delineated by a 50-m wide buffer on each side of the proposed pipeline centreline, and encompasses the construction ROW, the permanent ROW, an access road, temporary workspace, and tie-in locations.

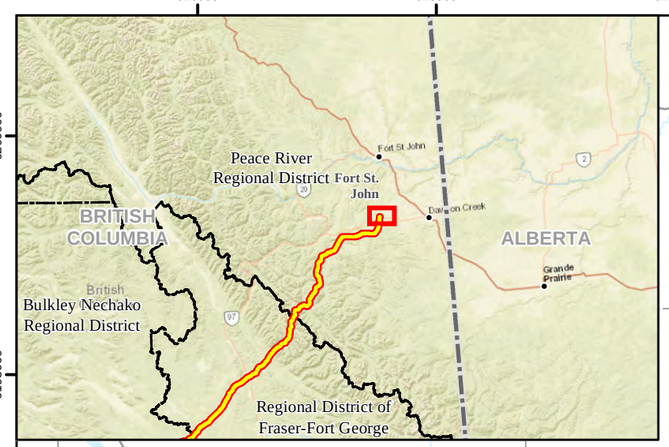
The Groundbirch Connector Application Corridor varies in width from approximately 175 m to 245 m to account for temporary workspace, but is not used in assessment analysis within this report.

1.2.2 Local Study Area

The wildlife and wildlife habitat LSA is defined as the area in which activities associated with the Groundbirch Connector could affect wildlife and wildlife habitat. The wildlife and wildlife habitat LSA includes the Groundbirch Connector Footprint and a 1 km buffer on each side of the proposed pipeline centerline. The total area of the wildlife and wildlife habitat LSA is 963.5 hectares.

1.2.3 Regional Study Area

The wildlife and wildlife habitat regional study area (RSA) is established to evaluate effects of the Groundbirch Connector on wildlife and wildlife habitat on a regional scale. The wildlife and wildlife habitat RSA includes the Groundbirch Connector Footprint, the wildlife and wildlife habitat LSA, and a broader surrounding area where there is potential for interaction of the proposed Groundbirch Connector with past, present, and future activities that might result in cumulative environmental effects on wildlife. The wildlife and wildlife habitat RSA is delineated by a 15 km buffer on each side of the proposed pipeline Groundbirch Connector pipeline centerline.



610000 615000 620000 625000 630000 635000 640000 645000 650000 655000

6200000 6195000 6190000 6185000 6180000 6175000

N W E S

Alaska Hwy
Rd 220
T80R16W6
Sweetwat
T80R17W6
Rd 245
Parkland
Parkland Rd
Rd 218
T80R19W6
T80R18W6
T80R20W6
Stewart Lake Rd
Scott Lake
Norrie Lake
Road 275 Rd
Rd 267
Rd 253
Rd 243
Rd 241
T79R16W6
Rd 216
Sunrise Valley
T79R18W6
Rd 247
Rd 249
Braden Rd
T79R20W6
Favels Lake
Willow Valley Rd
Foresman Rd
Willow Valley
Sunset Prairie
T79R21W6
T79R19W6
Wanglar Rd
Rd 214
Wrangler Rd
Rd 212 A
Approved Wilde Lake C/S
Rd 265
Rd 212
Willowbrook
Bessborough
Sloane Slough
Rd 245A
Pine River
Rice Rd
Rd 275
Wetherill Rd
Rd 271
0+000
Sin Lake
T78R17W6
Rd 210
Groundbirch
Scott Rd
Keller Rd
Rd 239
Rat Lake
T78R22W6
T78R21W6
Hwy 97
Rd 277
Stuckey Rd
Rd 269
Rd 263
Rd 257
Rd 208
Schmidt Rd
T78R20W6
Rd 273
5+000
Harris Rd
T78R19W6
Rd 259
Cooper Rd
Rd 261
Rd 255
Arras Rd
Parr Rd
Deveraux Rd
T78R18W6
Chetwynd Pulpmill Rd
97
Watkins Rd
Rd 206
Bedell Rd
Woodrow Rd
52
EAST PINE PARK
Fabrick Rd
Hwy 97 S
East Pine
10+000
Roys Rd
T77R18W6
Rd 204
Rd 251
T77R19W6
T77R20W6
15+000
20+000
25+000
Rd 202

Kilometre Post
CGL Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station
Groundbirch Connector Project Footprint Local Study Area
Regional Study Area
Populated Places
Railway
Road
Transmission Line
Watercourse
Provincial Park
Township Grid
Waterbody

Note:

REVISION	DESCRIPTION
0	Issued

1:125,000 0 1 2 4 6 Kilometres

Coastal GasLink Pipeline Project

TC Energy

Figure 1-1 Wildlife and Wildlife Habitat Study Area Boundaries

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513105-0006	REV 0

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2.0 GROUNDBIRCH CONNECTOR PROJECT SETTING

The Groundbirch Connector is in the Peace Region of northeastern BC, in the Boreal Plains Ecoprovince and the Dawson Creek Land and Resource Management Plan area. The region is characterized by rolling foothills, river valleys, floodplains, wetlands, and a mix of deciduous and coniferous forest. The Groundbirch Connector is within the moist warm subzone of the Boreal White and Black Spruce biogeoclimatic zone, which ranges in elevation from 750 m to 1,050 m and is characterized by white spruce (*Picea glauca*), black spruce (*Picea mariana*), balsam poplar (*Populus balsamifera*), and trembling aspen (*Populus tremuloides*) forests (DeLong *et al.* 2011). Much of the region is used for cattle grazing, crop production, and forestry; several private acreages overlap with the Groundbirch Connector Footprint.

3.0 METHODS

The methods used to gather baseline information to support the assessment of potential effects of the Groundbirch Connector are consistent with those used in the 2014 Coastal GasLink EAC Application (Coastal GasLink 2014).

3.1 DESKTOP ASSESSMENT

A review of existing information was completed for this TDR using the same methods as in the EAC Application (Section 3.0 of Appendix 2L of the 2014 EAC Application). Existing data were compiled from published literature and government and non-governmental databases on species of conservation concern (i.e., provincially red- or blue-listed, federally designated as Endangered, Threatened, or Special Concern by the *Species at Risk Act* [SARA] or the Committee on the Status of Endangered Wildlife in Canada). Where available, data gathered within the wildlife and wildlife habitat RSA for other environmental assessments were also considered. This desktop assessment was used to assist in characterizing baseline conditions for the Groundbirch Connector.

3.2 FIELD SURVEYS

3.2.1 Breeding Bird Surveys

The purpose of the breeding bird surveys was to determine baseline estimates of species richness and diversity of migratory songbirds within the wildlife and wildlife habitat LSA. Species richness is a fundamental measurement of community and regional diversity and often underlies conservation strategies (Gotelli and Colwell 2001).

Survey sites were located along roads and in agricultural fields and were selected in the field by the lead biologist. Sites were chosen based on broad habitat type (e.g., forest type and age, wetland type, grassland and shrubland), and landowner access constraints. Emphasis was placed on areas likely to support songbird species of conservation concern or songbird key indicators. Surveys in forested habitats were focused on older stands, although surveys in younger stands also occurred.

Songbird point-count surveys followed provincial standards for relative abundance (RISC 1999a) using a 100 m fixed radius count area and were at least 250 m apart to reduce potential for double counting birds. All surveys were completed by a single surveyor working as part of a team of two. Songbird surveys began at sunrise and lasted for up to five hours thereafter (e.g., if sunrise is at 0400 h, surveys end at 0900 h). Surveys ceased, or did not occur at all, under one of the following weather

conditions: wind speeds greater than or equal to Beaufort 3 (12 to 19 km/h); precipitation; or temperatures below 3°C.

Sites were accessed by vehicle and foot, and the survey team waited one minute after they arrived at each site to allow birds potentially affected by the observer's arrival to return to normal activity. Surveys were undertaken at 16 sites on June 25 and 26, 2019. Survey duration of each point count station was ten minutes. At each survey site the survey team recorded the date, time, location (Universal Transverse Mercator [UTM] coordinates), and weather (wind speed, precipitation, and temperature).

Bird detections were recorded digitally on a global positioning system (GPS)-enabled iPad using a proprietary software application, onLOOKer. The location of each bird detection was plotted on a digital onLOOKer map, and data attributes such as weather, species, detection time, distance to bird, abundance of birds, and behaviour were documented following standards described in RISC (1999a). Birds detected further than 100 m away were recorded as incidentals.

3.2.2 Pond-dwelling Amphibian Surveys

Surveys for pond-dwelling amphibians used systematic searches for amphibian presence using provincial protocols from the *Inventory Methods for Pond-breeding Amphibians and Painted Turtle, Version 2.0* (RISC 1998). Systematic searches were completed at 12 sites within the wildlife and wildlife habitat LSA that had potential to provide adequate habitat for breeding pond-dwelling amphibians.

Searches were undertaken by a biologist walking the shores or the shallow water zones along the perimeter of dugout and wetland areas, and visually scanning for adults, tadpoles, larvae, or egg masses. For each systematic search, the data attributes that were documented included time, survey effort, location (UTM coordinates), weather conditions (temperature, wind speed and direction, cloud cover, and precipitation), and habitat type and dimensions. If an amphibian detection occurred, the species, life stage, and number of individuals was documented. Surveys were completed from August 1 to 3, 2019, between the hours of 0700 and 1730.

In accordance with provincial protocols, all searches were completed during the amphibian breeding season and were stopped during heavy precipitation or if wind speeds exceeded 20 km/hour (RISC 1998).

3.2.3 Wildlife Habitat Ratings

Wildlife habitat assessments were completed within the wildlife and wildlife habitat LSA from August 1 to 3, 2019, following methods outlined in *Field Manual for Describing Terrestrial Ecosystems* (BC MOFR and BC MOE 2010) and the *Wildlife Habitat Rating Standards* (RISC 1999b). Twenty wildlife habitat assessment plots were completed in representative habitat types within the wildlife and wildlife habitat LSA. At each plot, wildlife habitat suitability ratings were assigned based on the potential for the habitat to support the selected life requisites for the bird and mammal key indicator species.

3.2.4 Incidental Observations

Incidental observations of wildlife, wildlife sign, and wildlife habitat features (e.g., dens, nests, potential bat hibernation sites) were collected outside of formal survey periods and during travel between survey sites. Data were comprised of both aural and visual detections and included wildlife habitat features such as nests and dens. During breeding bird point counts, birds detected outside of the 100 m survey radius were classified as incidental observations. For each detection, the location was recorded using a GPS unit, as well as relevant notes and photos, where possible.

Incidental observations can be used to supplement data collected during formal surveys and inform the selection of mitigation measures.

3.3 WILDLIFE HABITAT SUITABILITY MODELS

Wildlife habitat suitability models were developed for the Groundbirch Connector and the results were used to inform the assessment of potential project effects and cumulative effects. The methods used to model habitat suitability in this Amendment Application are the same as those described in Section 3.6 of Appendix 2L of the EAC Application. The modelling assumptions and rules defined for each species in the 2014 EAC Application (Sections 3.6.6 through 3.6.8 in Appendix 2L of the EAC Application) were followed.

Wildlife habitat suitability models were developed for the same key indicators as identified in the 2014 EAC Application, but only for those species or species groups whose ranges overlap with the wildlife and wildlife habitat RSA of the Groundbirch Connector (Table 3-1). Habitat suitability models were not completed for key indicator species that are not expected to overlap with the wildlife and wildlife habitat RSA (i.e., marbled murrelet[1], band-tailed pigeon, the coastal subspecies of western screech-owl, the coastal subspecies of northern goshawk, and coastal tailed frog).

[1] Common names and scientific names of the wildlife species mentioned in this technical data report are provided in Appendix B.

Table 3-1: Key Indicators Selected for Habitat Suitability Modeling

Key Indicator	Season	Life Requisite
Northern goshawk, *atricapillus*	Growing	Breeding
Common nighthawk	Growing	Breeding
Canada warbler	Growing	Breeding
Rusty blackbird	Growing	Breeding
Old Seral Forest Bird Community	Growing	Breeding
Early Seral Forest Bird Community	Growing	Breeding
Grassland and Shrubland Bird Community	Growing	Breeding
Wetland Bird Community	Growing	Breeding
Moose	Winter	Feeding
	Winter	Shelter
Marten	Year-round	Living
Fisher	Spring	Natal Denning
Grizzly bear	Spring	Feeding
	Fall	Feeding
Western toad	Growing	Breeding
	Overwintering	Hibernation
Pond-dwelling amphibians	Growing	Breeding

4.0 RESULTS

4.1 DESKTOP ASSESSMENT

Provincial government data sources (i.e., BC Conservation Data Centre, HabitatWizard) were queried for historical occurrences of species of conservation concern and for locations of management areas for wildlife (e.g., critical habitat for federally-listed species, wildlife habitat areas, ungulate winter ranges) within the Groundbirch Connector Footprint, and the wildlife and wildlife habitat LSA and RSA (Figure 4-1). Data from annual bird surveys and citizen science programs, such as the BC Breeding Bird Atlas, the North American Breeding Bird Survey, the Christmas Bird Count, and eBird, were also queried for occurrences of bird species of conservation concern. Recent changes to conservation listings of species of conservation concern with potential to occur within the study area boundaries were reviewed using the Species at Risk Public Registry (SRPR 2020) and the BC Species and Ecosystems Explorer (BC CDC 2020).

The southern portion of the RSA, south of Highway 97, is within the Hart Grizzly Bear Population Unit; the Groundbirch Connector Footprint and the wildlife and wildlife habitat LSA are in an area where grizzly bear is extirpated (Environmental Reporting BC 2012). The Groundbirch Connector Footprint and wildlife and wildlife habitat LSA and RSA do not intersect with important bird areas, ungulate winter ranges, or wildlife habitat areas.

The northern extent of the wildlife and wildlife habitat RSA intersects with 1,952 ha (0.8%) of a polygon that has potential to contain critical habitat for northern myotis (ECCC 2018) (Figure 4-1). Critical habitat for northern myotis is defined as sites that contain biophysical attributes that could support winter hibernation, such as caves, abandoned mines, hollow tree roots, rock crevices, cellars, tunnels, and hand-excavated wells that provide stable temperatures, high humidity, and low light and noise levels (ECCC 2018). No biophysical attributes of critical habitat for northern myotis were observed within the Groundbirch Connector Footprint or wildlife and wildlife habitat LSA during the 2019 field surveys (see Section 4.2).

There are historical occurrences (1976 to 2020 [Province of British Columbia 2020; eBird 2020]) of sixteen bird species of conservation concern within the wildlife and wildlife habitat RSA (Figure 4-1, Table 4-1). There are no historical occurrence records for bird species of conservation concern within the Groundbirch Connector Footprint or wildlife and wildlife habitat LSA (Province of British Columbia 2020; eBird 2020).

Table 4-1: Bird Species of Conservation Concern Recorded within the Wildlife and Wildlife Habitat RSA

Species[1]	Conservation Status	
	BC List	**SARA Schedule 1**
Horned grebe	Yellow	Special Concern
Common nighthawk	Yellow	Threatened
Northern goshawk, *atricapillus* subspecies	Blue	-
Broad-winged hawk	Blue	-
Rough-legged hawk	Blue	Not at Risk
Upland sandpiper	Red	-
Peregrine falcon, *anatum* subspecies	Red	Special Concern
Olive-sided flycatcher	Blue	Special Concern
Bank swallow	Yellow	Threatened
Barn swallow	Blue	Threatened
Evening grosbeak	Yellow	Special Concern
Baltimore oriole	Blue	-
Rusty blackbird	Blue	Special Concern
Connecticut warbler	Blue	-
Cape May warbler	Blue	-
Black-throated green warbler	Blue	-

NOTE
[1] Scientific names of these bird species are provided in Appendix I-2.

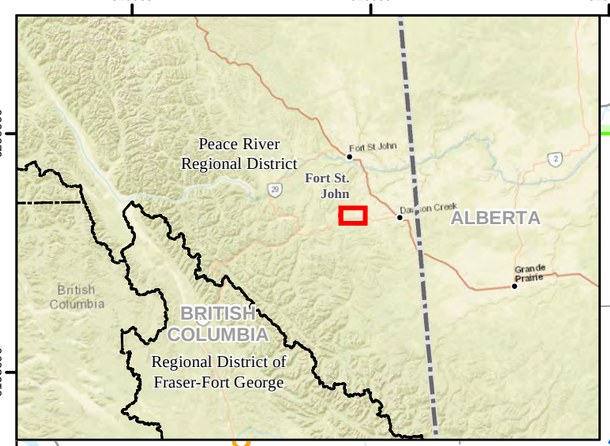
The changes in conservation status for wildlife since the EAC was issued for the Project (BC CDC 2020; SRPR 2020) are:

- Western population of grizzly bear was listed as Special Concern on Schedule 1 of SARA in 2018;
- Wolverine, *luscus* subspecies, was listed as Special Concern on Schedule 1 of SARA in 2018;
- Boreal population of fisher recognized as a distinct population in 2020, provincial status is Blue (as it was before the population split);
- Little brown myotis and northern myotis were listed as Endangered on Schedule 1 of SARA in 2014;
- Horned grebe was listed as Special Concern on Schedule 1 of SARA in 2017;
- Northern goshawk, *atricapillus* subspecies, was up-listed provincially from Yellow to Blue in 2017;
- Bank swallow was listed as Threatened on Schedule 1 of SARA in 2017;

- Barn swallow was listed as Threatened on Schedule 1 of SARA in 2017;
- Evening grosbeak was listed as Special Concern on Schedule 1 of SARA in 2019;
- Connecticut warbler was down-listed provincially from Red to Blue in 2015;
- Cape May warbler was down-listed provincially from Red to Blue in 2018; and
- Western toad was down-listed provincially from Blue to Yellow in 2016.

Five species (i.e., wolverine, little brown myotis, northern myotis, horned grebe, and bank swallow) that were not key indicators for the Project's EAC Application were up-listed since the EAC was issued. These species were not selected as new key indicator species for the Groundbirch Connector because they have overlapping habitat requirements with several existing key indicator species and communities. Wolverine, little brown myotis, and northern myotis have similar habitat requirements as moose, marten, fisher, and the mature old seral forest bird community, for which habitat suitability models have been developed. Potential effects on horned grebe are assessed by using the findings for the wetland bird community and the pond-dwelling amphibian key indicators as surrogates. Bank swallow colonies have potential to occur along riverbanks, lakes, and wetlands and if detected, would be documented as part of project-specific field surveys.

Figure 4-1 shows spatial data from provincial government agencies and locations of records of bird species of conservation concern from annual bird counts and citizen science databases.



Area of Grizzly Bear Extirpation

Hart Grizzly Bear Population Unit

Northern Myotis

Wilde Lake C/S

0+000 5+000 10+000 15+000 20+000

Groundbirch

Willow Valley

Sunset Prairie

Sunrise Valley

Parkland

Willowbrook

Bessborough

Arras Rd

East Pine

EAST PINE PARK

Fabrick Rd

Stuckey Rd

Wetherill Rd

Harris Rd

Parr Rd

Cooper Rd

Woodrow Rd

Roys Rd

Keller Rd

Parkland Rd

Sweetwater Rd

Willow Valley Rd

Foresman Rd

Wanglar Rd

Wrangler Rd

Rd 212 A

Rd 214

Rd 216

Rd 218

Rd 210

Rd 212

Rd 213

Rd 206

Rd 208

Rd 202

Rd 204

Rd 220

Scott Lake

Norrie Lake

Favels Lake

Sloane Slough

Sin Lake

Rat Lake

Pine River

Alaska Hwy

Stewart Lake Rd

Road 275 Rd

Rice Rd

Schmidt Rd

Watkins Rd

Chetwynd Pulpmill Rd

Hwy 97

Hwy 97 S

Braden Rd

Scott Rd

Bedell Rd

Deveraux Rd

Kenzie Subdiv

T80R20W6 T80R19W6 T80R18W6 T80R17W6 T80R16W6

T79R20W6 T79R21W6 T79R19W6 T79R18W6 T79R16W6

T78R21W6 T78R20W6 T78R19W6 T78R18W6 T78R17W6

T77R20W6 T77R19W6 T77R18W6

Rough-legged 2018
Upland Sandpiper 2016
Upland Sandpiper 2013
Bank Swallow 2010
Upland Sandpiper 2017
Broad-winged Hawk 2018
Upland Sandpiper 2018 x 4
Barn Swallow 2017
Connecticut Warbler
Upland Sandpiper 2016
Rough-legged Hawk 2018
Upland Sandpiper 2017
Baltimore Oriole 2017
Baltimore Oriole 2011
Rusty Blackbird 2013
Barn Swallow 2013
Common Nighthawk 1988
Peregrine Falcon 2015
Barn Swallow 2017
Upland Sandpiper 2017
Bank Swallow 2017
Barn Swallow 2016
Barn Swallow 1980, 2014
Horned Grebe 1980
Baltimore Oriole 1980
Evening Grosbeak 1980
Bank Swallow 2014
Rough-legged Hawk 2013
Evening Grosbeak 2013
Connecticut Warbler 2017
Rough-legged 2014
Upland Sandpiper 1976
Northern Goshawk 2016
Rough-legged Hawk 2016
Barn Swallow 2015
Cape May Warbler 2015
Upland Sandpiper 2007
Cape May Warbler 2012
Cape May Warbler 2012
Upland Sandpiper 1983
Baltimore Oriole 2016
Barn Swallow 2016
Baltimore Oriole 2009
Barn Swallow 1983
Baltimore Oriole 1997
Barn Swallow 1997
Evening Grosbeak 2015
Evening Grosbeak 2017
Connecticut Warbler 2008
Barn Swallow 1980
Horned Grebe 1980
Baltimore Oriole 1980
Evening Grosbeak 1980
Bank Swallow 2014
Barn Swallow 2014
Olive-sided Flycatcher 2017 x 4
Olive-sided Flycatcher 2016
Black-throated Green Warbler 2016
Barn Swallow 2001
Connecticut Warbler 2015
Connecticut Warbler 2015
Connecticut Warbler 2012
Connecticut Warbler 2011
Connecticut Warbler 2012

Legend
Kilometre Post
Coastal Gaslink Route
Certified Wilde Lake Compressor Station
Local Study Area
Regional Study Area
BBA Location
Ebird Location
Critical Habitat for federally-listed species at risk (posted)
Endangered Species and Ecosystems - Non-Confidential Occurrences
Grizzly Bear Population Unit
Populated Places
Railway
Road
Transmission Line
Watercourse
Provincial Park
Township Grid
Waterbody

Note:

REVISION	DESCRIPTION
0	Issued

1:125,000 0 1 2 4 6 Kilometres

Coastal GasLink Pipeline Project

TC Energy

Figure 4-1 Wildlife and Wildlife Habitat Study Area and Desktop Assessment Results

Route Reference: Groundbirch Connector Pipeline Project | 10/9/2020

Document No.: 123513105-0006 | REV 0

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4.2 FIELD SURVEYS

4.2.1 Breeding Bird Surveys

Breeding bird surveys were completed at 16 sites within the wildlife and wildlife habitat LSA from June 25 to 26, 2019 (Figure 4-2). Sites were located on (seven sites) and off (nine sites) of roads. Sites were in agricultural fields (seven sites), at the edge of agricultural fields and forest (four sites), in forest patches (four sites), and at the edge of agricultural fields and a wetland (one site; Table 4-2). Forested and forest edge sites included deciduous (five sites), mixedwood (two sites), or coniferous (one site) patches.

During the 2019 breeding bird surveys, 216 individual birds representing 27 species were detected (Appendix I-3). The most frequently detected species were white-throated sparrow (36 birds), savannah sparrow (31 birds), clay-colored sparrow (29 birds), yellow warbler (25 birds), American robin (17 birds), and red-eyed vireo (15 birds). No species of conservation concern were detected during breeding bird surveys.

Species richness (i.e., total number of species) was highest at the agricultural-only point count stations (18 species). Species richness was lowest at the agricultural field and wetland station (nine species); species richness at this site is not comparable with other habitat types because only one site of this habitat type was available for surveying. The number of individual birds was highest at forest stations (15.8 birds per station on average), followed by the agricultural field and wetland station (13.0 birds [single station]). Please refer to Table 4-2 for summary of survey findings.

Table 4-2: Average Number of Breeding Bird Individuals and Number of Species Detected by Habitat Type within the Groundbirch Connector Wildlife and Wildlife Habitat LSA

Habitat Type	Number of Point Count Stations	Commonly Detected Species[1]	Average Number of Individuals per Station	Number of Species
Agricultural field	7	Savannah sparrow (27%) White-throated sparrow (12%) Yellow warbler (12%)	11.9	18
Agricultural field and forest	4	White-throated sparrow (20%) Savannah sparrow (12%) Clay-colored sparrow (10%) Red-eyed vireo (10%) Yellow warbler (10%)	12.5	16

Table 4-2: Average Number of Breeding Bird Individuals and Number of Species Detected by Habitat Type within the Groundbirch Connector Wildlife and Wildlife Habitat LSA

Habitat Type	Number of Point Count Stations	Commonly Detected Species[1]	Average Number of Individuals per Station	Number of Species
Forest	4	Clay-colored sparrow (22%) White-throated sparrow (21%) American robin (17%)	15.8	15
Agricultural field and wetland	1	White-throated sparrow (15%) Yellow warbler (15%) American robin (15%) Clay-colored sparrow (15%)	13.0	9

NOTES:
[1] Top three most commonly detected species, including ties.

Breeding bird survey locations are shown in Figure 4-2.

The wetlands and waterbodies within the wildlife and wildlife habitat LSA have limited value for waterfowl but, in any given year, small numbers (e.g., one pair per water feature) of waterbirds (ducks, geese, and sandpipers) may use these habitats for breeding or during migration. Three waterbird species (mallard, green-winged teal, and lesser yellowlegs) were observed incidentally at wetlands surveyed for amphibians within the wildlife and wildlife habitat LSA (see Section 4.2.4), and older data indicate that two other species (bufflehead and Canada goose) may also be present at times within this area.

- Breeding Bird Survey Location
- Kilometre Post
- CGL Route
- Certified Pipeline Corridor
- Certified Wilde Lake Compressor Station
- Groundbirch Connector Application Corridor
- Local Study Area
- Project Footprint
- Existing Pipeline
- Railway
- Road
- TRIM Watercourse
- Section Grid
- Water Body

Note:

REVISION	DESCRIPTION
0	Issued

1:15,000 0 125 250 500 750 1,000 Metres

Coastal GasLink Pipeline Project

TC Energy

Figure 4-2 Breeding Bird Survey Locations

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513105-0007	REV 0

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4.2.2 Pond-dwelling Amphibian Surveys

Wood frog was the only amphibian detected during the systematic searches completed within the Groundbirch Connector wildlife and wildlife habitat LSA. Wood frog was detected at 4 of 12 sites surveyed; all four sites had one juvenile each, and PDA-08 also had one adult (Table 4-3).

Table 4-3: Detections of Wood Frog Recorded during Systematic Searches for Groundbirch Connector

Survey Site	Wetland type	Wood Frog Detected	
		Number	Stage
PDA-10	Marsh	1	Juvenile
PDA-09	Dugout	1	Juvenile
PDA-11	Dugout	1	Juvenile
PDA-08	Dugout	1	Adult
PDA-08	Dugout	1	Juvenile

Pond-dwelling amphibian survey sites are shown in Figure 4-3.

S3 T79 R19 M6

S2 T79 R19 M6

S1 T79 R19 M6

Rd 271

Rd 212

Rd 263

PDA-13

PDA-12

PDA-11

PDA-10

PDA-09

PDA-08

PDA-07

PDA-04

PDA-03

PDA-02

PDA-01

PDA-17

S32 T78 R19 M6

S33 T78 R19 M6

S34 T78 R19 M6

S35 T78 R19 M6

S28 T78 R19 M6

S27 T78 R19 M6

S26 T78 R19 M6

Wilde Lake C/S

Day Creek

Sin Lake

Cache Creek

0+000

0+500

1+000

1+500

Kilometre Post
Pond-dwelling Amphibian Survey Location
Coastal Gaslink Route
Certified Pipeline Corridor
Certified Wilde Lake Compressor Station
Groundbirch Connector Application Corridor
Groundbirch Connector Project Footprint
Local Study Area
Existing Pipeline
Railway
Road
TRIM Watercourse
Section Grid
Water Body

Note:	
REVISION	DESCRIPTION
0	Issued

1:15,000 0 125 250 500 750 1,000 Metres

Coastal GasLink Pipeline Project

TC Energy

Figure 4-3 Pond-dwelling Amphibian Survey Locations

Route Reference: Groundbirch Connector Pipeline Project	10/9/2020
Document No.: 123513105-0008	REV 0

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4.2.3 Wildlife Habitat Ratings

A wildlife biologist completed field-based wildlife habitat assessments at 20 plots within the wildlife and wildlife habitat LSA (Figure 4-4). These assessments were completed with a vegetation ecologist and soil specialist as part of the Terrestrial Ecosystem Mapping (TEM) field program (see Appendix G Groundbirch Connector Vegetation TDR). For each TEM survey plot visited in the wildlife and wildlife habitat LSA, a habitat suitability rating was assigned for each bird and mammal key indicator species identified in Section 3.3 (Table 3-1). Ratings from these plots were used to support the wildlife habitat suitability models (Section 4.3).

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4.2.4 Incidental Observations

There were 81 detections of 34 wildlife species observed incidentally during wildlife field surveys (Table 4-4). Five of these species were mammals, 29 were birds, and 1 was an amphibian. Birds were the most detected taxonomic group and white-throated sparrow was the most frequently detected bird species. Among the 34 species of wildlife detected, barn swallow (*Hirundo rustica*), which is on the BC Blue List and is Threatened on Schedule 1 of SARA, was the only species of conservation concern.

Table 4-4: Incidental Detections of Wildlife and Wildlife Signs within the Wildlife and Wildlife Habitat LSA

Species	Conservation Status	Detection Type				
		Aural	Visual & Aural	Visual	Sign	Total
Mammals						
Deer sp.	-				1	1
Moose	-				5	5
Mule deer	-			1		1
Red squirrel	-			1		1
Rocky Mountain elk	-				6	6
Mammal Totals				***2***	***12***	***14***
Birds						
Alder flycatcher	-	1				1
American robin	-	2		1		3
Barn swallow	SARA Schedule 1 - Threatened BC Blue List			1		1
Black-billed magpie	-	1				1
Black-capped chickadee	-	5		1		6
Brown-headed cowbird	-	2				2
Canada jay	-			1		1
Clay-colored sparrow	-	3				3
Green-winged teal	-			3		3
Hermit thrush	-	1				1
Least flycatcher	-	1				1
Lesser yellowlegs	-			1		1
Lincoln's sparrow	-	2				2
Mallard	-			1		1
Northern flicker	-	1				1
Northern harrier	-			1		1
Red-eyed vireo	-	1				1

Table 4-4: Incidental Detections of Wildlife and Wildlife Signs within the Wildlife and Wildlife Habitat LSA

Species	Conservation Status	Detection Type				
		Aural	Visual & Aural	Visual	Sign	Total
Red-tailed hawk	-	1	2	1		4
Red-winged blackbird	-	1				1
Ruby-crowned kinglet	-	3				3
Savannah sparrow	-	4				4
Song sparrow	-			2		2
Tennessee warbler	-			1		1
Western wood-pewee	-	1				1
White-throated sparrow	-	12				12
Wilson's warbler	-	1				1
Yellow-bellied sapsucker	-			1		1
Yellow warbler	-	4		1		5
Bird Totals		***47***	***2***	***16***		***65***
Amphibians						
Wood frog	-			2		2
Amphibian Totals				***2***		***2***

4.3 WILDLIFE HABITAT SUITABILITY MODELS

The following sections present baseline habitat suitability results for each key indicator species and life requisite combination (Section 3.3). Species were modeled using either a 4- or 6-class model depending on the available knowledge of the habitat requirements of the species-life requisite (Section 3.6.4 in Appendix 2L of the EAC Application). Effective habitat for 4-class models is the sum of those areas classed as moderate and high. Effective habitat for 6-class models is the sum of those areas classed as moderate, moderate-high, and high. Nil and low rating represent habitats with limited or no characteristics required to support the species-life requisite. The wildlife habitat suitability models were applied to the TEM prepared for the wildlife and wildlife habitat LSA for this Amendment Application (see Appendix G Groundbirch Connector Vegetation TDR).

Model reliability was assessed using the methods described in Section 3.6.1 in Appendix 2L of the EAC Application. All habitat suitability models were assigned a reliability qualifier (i.e., low-moderate, moderate or moderate-high) based on the availability and quality of information used to develop the models.

4.3.1 Northern Goshawk

At baseline, there are 47 ha of effective breeding habitat for the interior subspecies of northern goshawk within the wildlife and wildlife habitat LSA (Table 4-5). This represents 5.2% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-5: Baseline Breeding Habitat for Northern Goshawk, Interior Subspecies, within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
0	47	94	770	47

4.3.2 Common Nighthawk

At baseline, there are 454 ha of effective breeding habitat for common nighthawk within the wildlife and wildlife habitat LSA (Table 4-6). This represents 49.9% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-6: Baseline Breeding Habitat for Common Nighthawk within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
0	454	130	326	454

4.3.3 Canada Warbler

At baseline, there are 35 ha of effective breeding habitat for Canada warbler within the wildlife and wildlife habitat LSA (Table 4-7). This represents 3.6% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-7: Baseline Breeding Habitat for Canada Warbler within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
27	35	211	637	35

4.3.4 Rusty Blackbird

At baseline, there are 38 ha of effective breeding habitat for rusty blackbird within the wildlife and wildlife habitat LSA (Table 4-8). This represents 4.2% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-8: Baseline Breeding Habitat for Rusty Blackbird within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
8	30	19	854	38

4.3.5 Old Seral Forest Bird Community

At baseline, there are 62 ha of effective breeding habitat for the old seral forest bird community within the wildlife and wildlife habitat LSA (Table 4-9). This represents 6.8% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-9: Baseline Breeding Habitat for the Old Seral Forest Bird Community within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
27	35	212	636	62

4.3.6 Early Seral Forest Bird Community

At baseline, there are 65 ha of effective breeding habitat for the early seral forest bird community within the wildlife and wildlife habitat LSA (Table 4-10). This represents 7.1% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-10: Baseline Breeding Habitat for the Early Seral Forest Bird Community within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
8	57	187	659	65

4.3.7 Grassland and Shrubland Bird Community

At baseline, there are 507 ha of effective breeding habitat for the grassland and shrubland bird community within the wildlife and wildlife habitat LSA (Table 4-11). This represents 55.7% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-11: Baseline Breeding Habitat for the Grassland and Shrubland Bird Community within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
20	487	28	375	507

4.3.8 Wetland Bird Community

At baseline, there are 17 ha of effective breeding habitat for the wetland bird community within the wildlife and wildlife habitat LSA (Table 4-12). This represents 1.9% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-12: Baseline Breeding Habitat for the Wetland Bird Community within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
0	17	33	860	17

4.3.9 Moose

At baseline, there are 149 ha of effective moose winter feeding habitat within the wildlife and wildlife habitat LSA (Table 4-13). This represents 16.4% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-13: Baseline Winter Feeding Habitat for Moose within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)						Effective Habitat (ha)
High	Mod-High	Moderate	Low	Very Low	Nil	
24	55	70	120	105	536	149

At baseline there are 39 ha of effective moose winter shelter habitat within the wildlife and wildlife habitat LSA (Table 4-14). This represents 4.3% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-14: Baseline Winter Shelter Habitat for Moose within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)						Effective Habitat (ha)
High	Mod-High	Moderate	Low	Very Low	Nil	
0	0	39	71	238	562	39

4.3.10 Fisher

At baseline, there are 28 ha of effective natal denning habitat for fisher within the wildlife and wildlife habitat LSA (Table 4-15). This represents 3.1% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-15: Baseline Natal Denning Habitat for Fisher within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
0	28	236	647	28

4.3.11 Marten

At baseline, there is no effective year-round living habitat for marten within the wildlife and wildlife habitat LSA (Table 4-16). Model reliability is considered moderate.

Table 4-16: Baseline Year-round Living Habitat for Marten within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
0	0	298	613	0

4.3.12 Grizzly Bear

At baseline, there are 7 ha of effective grizzly bear spring feeding habitat within the wildlife and wildlife habitat LSA (Table 4-17). This represents 0.8% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-17: Baseline Spring Feeding Habitat for Grizzly Bear within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)						Effective Habitat (ha)
High	Mod-High	Moderate	Low	Very Low	Nil	
0	1	6	318	52	534	7

At baseline, there are 234 ha of effective grizzly bear fall feeding habitat within the wildlife and wildlife habitat LSA (Table 4-18). This represents 25.7% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-18: Baseline Fall Feeding Habitat for Grizzly Bear within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)						Effective Habitat (ha)
High	Mod-High	Moderate	Low	Very Low	Nil	
1	71	162	38	103	535	234

4.3.13 Pond-dwelling Amphibians

At baseline, there are 38 ha of effective breeding habitat for pond-dwelling amphibians within the wildlife and wildlife habitat LSA (Table 4-19). This represents 4.2% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-19: Baseline Breeding Habitat for Pond-dwelling Amphibians within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
1	37	13	860	38

4.3.14 Western Toad

At baseline, there are 19 ha of effective breeding habitat for western toad within the wildlife and wildlife habitat LSA (Table 4-20). This represents 2.1% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-20: Baseline Breeding Habitat for Western Toad within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
1	18	36	857	19

At baseline, there are 3 ha of effective overwintering habitat for western toad within the wildlife and wildlife habitat LSA (Table 4-21). This represents 0.3% of the wildlife and wildlife habitat LSA (963.5 ha). Model reliability is considered moderate.

Table 4-21: Baseline Overwintering Habitat for Western Toad within the Wildlife and Wildlife Habitat LSA for Groundbirch Connector

Habitat Suitability Class (ha)				Effective Habitat (ha)
High	Moderate	Low	Nil	
2	1	224	683	3

5.0 KEY FINDINGS AND CONCLUSIONS

During the Groundbirch Connector wildlife surveys, barn swallow was the only species of conservation concern that was detected (blue-listed in BC and Threatened on Schedule 1 of SARA). Sixteen bird species of conservation concern have been previously recorded within the wildlife and wildlife Habitat RSA for Groundbirch Connector during annual bird and citizen science surveys.

The northern edge of the wildlife and wildlife habitat RSA overlaps with a polygon that has potential to contain critical habitat for northern myotis; no biophysical attributes of critical habitat for northern myotis were observed during field surveys within the wildlife and wildlife habitat LSA.

Wildlife habitat features, such as confirmed breeding locations for species of conservation concern (e.g., western toad) are included in ongoing design and construction planning for the Groundbirch Connector. Although western toad was not detected during baseline wildlife surveys for the Groundbirch Connector, it is known to occur in the Peace Region and to breed in shallow wetlands, including anthropogenic water features (BC CDC 2020). Mitigation for wildlife habitat features and species such as northern myotis, barn swallow, and western toad are included in the Environmental Management Plan (Coastal GasLink 2018) and will be applicable to the Groundbirch Connector.

There are no material differences between baseline information reported in the EAC Application and baseline information reported in this TDR. The bird and amphibian species detected during breeding bird and pond-dwelling amphibian surveys for the Groundbirch Connector and in the areas surveyed for the EAC Application adjacent to the Groundbirch Connector are similar, as was expected based on similarities in habitat. Habitat suitability models developed for the 2014 EAC Application partially overlap the area that was modelled for the Groundbirch Connector.

6.0 REFERENCES

BC EAO. 2013a. Coastal GasLink Pipeline Project Application Information Requirements (AIR) For an Environmental Assessment Certificate.

BC EAO. 2014. Coastal GasLink Pipeline Project Environmental Assessment Certificate # E14-03. Website. Available at: https://projects.eao.gov.bc.ca/. Accessed: September 2019.

BC EAO. 2020a. EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018). Version 1.01. March 2020. p. 53.

(BC EAO). 2020b. Guide to Indigenous Knowledge in Environmental Assessments. Version 1.0. April 2020. p. 20.

BC CDC (British Columbia Conservation Data Centre). 2020. BC Species and Ecosystems Explorer. B.C. Ministry of Environment. Victoria, B.C. http://a100.gov.bc.ca/pub/eswp/. Accessed: July 2020.

BC MOFR and BC MOE (British Columbia Ministry of Forests and Range and British Columbia Ministry of Environment). 2010. Field Manual for Describing Terrestrial Ecosystems 2nd Edition: Land Management Handbook Number 25. Victoria, BC.

Coastal GasLink (Coastal GasLink Pipeline Limited). 2014. Coastal GasLink Pipeline Project: Application for an Environmental Assessment Certificate. Available at: https://projects.eao.gov.bc.ca/. Accessed: September 2019.

Coastal GasLink Pipeline Project. 2018. Environmental Management Plan. TransCanada.

DeLong, C., A. Banner, W. H. MacKenzie, B. J. Rogers, and B. Kaytor. 2011. A field guide to ecosystem identification for the Boreal White and Black Spruce Zone of British Columbia. Land Management Handbook. No. 65. British Columbia Ministry of Forests and Range, Forest Science Program, Victoria, BC.

eBird. 2020. An Online Database of Bird Distribution and Abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available at: http://www.ebird.org. Accessed: July 2020.

ECCC (Environment and Climate Change Canada). 2018. Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*) and the Tri-coloured Bat (*Perimyotis subflavus*) in Canada.

Environmental Reporting BC. 2012. Grizzly Bear Population Status in B.C. State of Environment Reporting, Ministry of Environment, Victoria, BC.

Gotelli, N.J., and R.K. Colwell. 2001. Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. Ecology Letters 4: 379–391.

Province of British Columbia. 2020. HabitatWizard. Available at: https://maps.gov.bc.ca/ess/hm/habwiz/. Accessed: July 2020.

RISC (Resource Inventory Standards Committee). 1998. Inventory methods for pond-breeding amphibians and painted turtle. Standards for Components of British Columbia's Biodiversity No. 37. British Columbia Ministry of Environment, Lands and Parks, Victoria, BC. 94 pp.

RISC. 1999a. Inventory methods for forest and grassland songbirds. Standards for Components of British Columbia's Biodiversity No. 15. British Columbia Ministry of Environment, Lands and Parks, Victoria, BC. 37 pp.

RISC. 1999b. British Columbia wildlife habitat rating standards. British Columbia Ministry of Environment, Lands and Parks, Victoria, BC. 97 pp.

SRPR (Species at Risk Public Registry). 2020. Species at risk public registry A to Z species index. Available at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html. Accessed: July 2020.

Appendix I-1: Abbreviations and Acronyms

Acronym	Definition
Units of Measurement	
°C	degree Celsius
%	percent
h	hour
ha	hectare
km	kilometre = 1000 metres
km/h	kilometre per hour
m	metre
Other Terms	
BC	British Columbia
BC CDC	BC Conservation Data Centre
BC MOE	BC Ministry of Environment
BC MOFR	BC Ministry of Forests and Range
Coastal GasLink	Coastal GasLink Pipeline Limited
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
ECCC	Environment and Climate Change Canada
GPS	global positioning system
LSA	local study area
NPS	Normal Pipe Size
PDA	Pond-dwelling amphibian
Project	Coastal GasLink Pipeline Project
ROW	right-of-way
RSA	regional study area
RISC	Resource Inventory Standards Committee
SARA	*Species at Risk Act*
SRPR	Species at Risk Public Registry
TEM	Terrestrial Ecosystem Mapping
TDR	Technical Data Report
UTM	Universal Transverse Mercator

Appendix I-2: List of Species

Table I-2.1: List of Species Referred to in the Technical Data Report

Taxonomic Group	Species Name	Scientific Name
Mammal	Rocky Mountain elk	*Cervus elaphus*
Mammal	Fisher	*Martes pennanti*
Mammal	Grizzly bear	*Ursus arctos*
Mammal	Little brown myotis	*Myotis lucifugus*
Mammal	Marten	*Martes americana*
Mammal	Moose	*Alces alces*
Mammal	Mule deer	*Odocoileus hemionus*
Mammal	Northern myotis	*Myotis septentrionalis*
Mammal	Red squirrel	*Sciurus vulgaris*
Mammal	White-tailed deer	*Odocoileus virginianus*
Mammal	Wolverine, *luscus* subspecies	*Gulo gulo luscus*
Bird	Canada goose	*Branta canadensis*
Bird	Mallard	*Anas platyrhynchos*
Bird	Green-winged teal	*Anas carolinensis*
Bird	Bufflehead	*Bucephala albeola*
Bird	Horned grebe	*Podiceps auritus*
Bird	Band-tailed pigeon	*Patagioenas fasciata*
Bird	Common nighthawk	*Chordeiles minor*
Bird	Upland sandpiper	*Bartramia longicauda*
Bird	Red-necked phalarope	*Phalaropus lobatus*
Bird	Lesser yellowlegs	*Tringa flavipes*
Bird	Marbled murrelet	*Brachyramphus marmoratus*
Bird	Northern harrier	*Circus cyaneus*
Bird	Northern goshawk, *atricapillus* subspecies	*Accipiter gentilis atricapillus*
Bird	Broad-winged hawk	*Buteo platypterus*
Bird	Red-tailed hawk	*Buteo jamaicensis*
Bird	Rough-legged hawk	*Buteo lagopus*
Bird	Western screech-owl, *kennicottii* subspecies	*Megascops kennicottii kennicottii*
Bird	Yellow-bellied sapsucker	*Sphyrapicus varius*
Bird	Northern flicker	*Colaptes auratus*
Bird	Peregrine falcon, *anatum* subspecies	*Falco peregrinus anatum*
Bird	Olive-sided flycatcher	*Contopus cooperi*
Bird	Western wood-pewee	*Contopus sordidulus*
Bird	Alder flycatcher	*Empidonax alnorum*

Table I-2.1: List of Species Referred to in the Technical Data Report

Taxonomic Group	Species Name	Scientific Name
Bird	Least flycatcher	*Empidonax minimus*
Bird	Red-eyed vireo	*Vireo olivaceus*
Bird	Canada jay	*Perisoreus canadensis*
Bird	Black-billed magpie	*Pica hudsonia*
Bird	Black-capped chickadee	*Poecile atricapillus*
Bird	Bank swallow	*Riparia riparia*
Bird	Barn swallow	*Hirundo rustica*
Bird	Ruby-crowned kinglet	*Regulus calendula*
Bird	Hermit thrush	*Catharus guttatus*
Bird	American robin	*Turdus migratorius*
Bird	Evening grosbeak	*Coccothraustes vespertinus*
Bird	Clay-colored sparrow	*Spizella pallida*
Bird	White-throated sparrow	*Zonotrichia albicollis*
Bird	Savannah sparrow	*Passerculus sandwichensis*
Bird	Song sparrow	*Melospiza melodia*
Bird	Lincoln's sparrow	*Melospiza lincolnii*
Bird	Baltimore oriole	*Icterus galbula*
Bird	Red-winged blackbird	*Agelaius phoeniceus*
Bird	Rusty blackbird	*Euphagus carolinus*
Bird	Brown-headed cowbird	*Molothrus ater*
Bird	Tennessee warbler	*Leiothlypis peregrina*
Bird	Connecticut warbler	*Oporornis agilis*
Bird	Cape May warbler	*Setophaga tigrina*
Bird	Yellow warbler	*Setophaga petechia*
Bird	Black-throated green warbler	*Setophaga virens*
Bird	Canada warbler	*Cardellina canadensis*
Bird	Wilson's Warbler	*Cardellina pusilla*
Amphibian	Coastal tailed frog	*Ascaphus truei*
Amphibian	Western toad	*Anaxyrus boreas*
Amphibian	Wood frog	*Lithobates sylvaticus*

Appendix I-3: Bird Species Detected During Breeding Bird Surveys

Table I-3.1: Bird Species Detected During Breeding Bird Surveys

Species Name	Scientific Name	Number of Individuals
Killdeer	*Charadrius vociferus*	1
Red-tailed hawk	*Buteo jamaicensis*	1
Western wood-pewee	*Contopus sordidulus*	3
Least flycatcher	*Empidonax minimus*	7
Hammond's flycatcher	*Empidonax hammondii*	3
Red-eyed vireo	*Vireo olivaceus*	15
American crow	*Corvus brachyrhynchos*	1
Golden-crowned kinglet	*Regulus satrapa*	1
Ruby-crowned kinglet	*Regulus calendula*	4
Red-breasted nuthatch	*Sitta canadensis*	2
Hermit thrush	*Catharus guttatus*	2
American robin	*Turdus migratorius*	17
Rose-breasted grosbeak	*Pheucticus ludovicianus*	1
Chipping sparrow	*Spizella passerina*	2
Clay-colored sparrow	*Spizella pallida*	29
White-crowned sparrow	*Zonotrichia leucophrys*	1
Golden-crowned sparrow	*Zonotrichia atricapilla*	1
White-throated sparrow	*Zonotrichia albicollis*	36
Vesper sparrow	*Pooecetes gramineus*	8
Le Conte's sparrow	*Ammodramus leconteii*	5
Savannah sparrow	*Passerculus sandwichensis*	31
Song sparrow	*Melospiza melodia*	3
Lincoln's sparrow	*Melospiza lincolnii*	4
Red-winged blackbird	*Agelaius phoeniceus*	3
Brown-headed cowbird	*Molothrus ater*	9
MacGillivray's Warbler	*Geothlypis tolmiei*	1
Yellow warbler	*Setophaga petechia*	25
Grand Total		**216**

Appendix J
Groundbirch Connector Social and Economic Technical Data Report

Proposed Coastal GasLink Pipeline Ltd. Groundbirch Connector Application to Amend Environmental Assessment Certificate #E14-03 (Amendment #3) Social and Economic Technical Data Report

CGL80373-JEG-ENV-RPT-0001

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Acronyms and Abbreviations

AIR	application information requirements
ALC	Agricultural Land Commission
ALCA	*Agricultural Land Commission* Act
ALR	Agricultural Land Reserve
Amendment Application	Environmental Assessment Certificate Amendment Application
BC	British Columbia
Coastal GasLink	Coastal GasLink Pipeline Ltd.
EA	Environmental Assessment
EAA	*Environmental Assessment Act*
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
GMZ	Game Management Zone
GB KP	Groundbirch Kilometre Post
ha	hectare(s)
km	kilometre(s)
LEH	Limited Entry Hunt
LRMP	Land and Resource Management Plan
LSA	Local Study Area
OCP	Official Community Plan
OGMA	Old-Growth Management Area
PRRD	Peace River Regional District
RSA	Regional Study Area
the Project	Coastal GasLink Pipeline Project
this report	Social and Economic Technical Report for the Amendment Application
TLRU	Traditional Land and Resource Use
VC	Valued Component
WMU	Wildlife Management Unit

1. Introduction

On March 11, 2014, Coastal GasLink Pipeline Ltd. (Coastal GasLink) submitted an Application for an Environmental Assessment Certificate (EAC) to the British Columbia (BC) Environmental Assessment Office (EAO) for the Coastal GasLink Pipeline Project (the Project). On October 23, 2014, Coastal GasLink received an EAC (EAC #E14-03) for the Project. On November 8, 2017, Coastal GasLink submitted an Amendment Application to the EAC (#E14-03) to the BC EAO. On May 15, 2018, the BC EAO concluded that the changes to the amendment were unlikely to modify the conclusions related to impacts to Indigenous interests identified in the BC EAO's assessment of Coastal GasLink (Amendment #1 to the Certificate #E14-03). Additionally, on April 1, 2020, Coastal GasLink submitted a second amendment (Amendment #2) to the EAC (#E14-03) to the BC EAO. On May 14, 2020, the BC EAO concluded that the changes would not have the potential to adversely impact Indigenous interests beyond the conclusions of the EAC (#E14-03).

The EAC for the Project is located on the BC EAO website at: https://projects.eao.gov.bc.ca/p/588511c4aaecd9001b825604/application;currentPage=1;pageSize=10;sortBy=+sortOrder,-datePosted,+displayName;ms=1592421681709

The South of Houston Alternate Route amendment (Amendment #1) is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5a04c0ad66e3e4001955853b/download/CGL4703-CGP-ENV-RP-021%20EAC%20SHAR%20Amendment2_Rev%200.pdf

Amendment #2 is located on the BC EAO website at:

https://www.projects.eao.gov.bc.ca/api/public/document/5ebead83e551e4002197c296/download/CGL%20Amendment2%20-%20Assessment%20Report.pdf

As a result of Coastal GasLink's continued refinement of its design specifications, as well as further understanding of control points and tie-in locations, Coastal GasLink is requesting an amendment to its EAC in accordance with Section 32 of the BC *Environmental Assessment Act* (EAA). This Amendment Application (the Amendment Application) is for the proposed Groundbirch Connector Pipeline Project (the proposed Groundbirch Connector). The requested amendment would add the proposed Groundbirch Connector to the existing Certified Pipeline Corridor. This Amendment Application outlines the rationale for the proposed Groundbirch Connector and provides a summary of relevant baseline information and an assessment of potential effects associated with the proposed Groundbirch Connector, where appropriate.

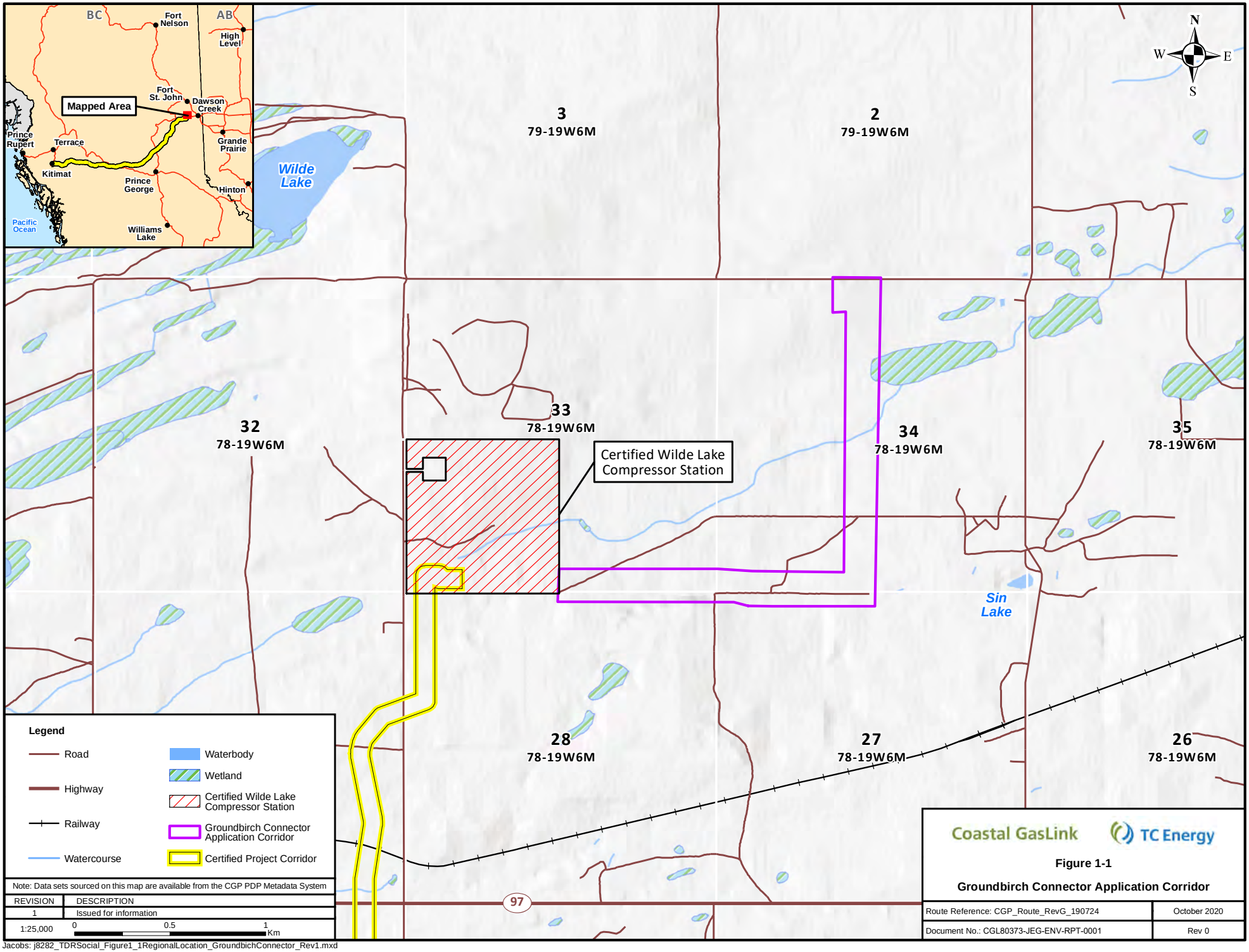
The Social and Economic Technical Report for the Amendment Application (this report) describes the setting along the proposed Groundbirch Connector where it differs from the existing Certified Pipeline Corridor. Baseline information for the social and economy pillars was provided in Appendices 2M and 2N of the EAC Application. This report identifies new setting information that was not identified on the existing Certified Pipeline Corridor.

1.1 Amendment Description

The Project involves the construction and operation of an approximately 670-km 48-inch (nominal pipe size 48) (1,219-millimetre)-diameter natural gas transmission pipeline from an area near the community of Groundbirch (approximately 40 km west of the City of Dawson Creek, BC) to the certified LNG Canada export facility in the District of Kitimat, BC.

The proposed Groundbirch Connector is located in the PRRD, approximately 400 metres east of the existing Certified Pipeline Corridor, on flat cultivated freehold lands. Reference points along the existing Certified Pipeline Corridor are referred to as EA Kilometre Posts. Kilometre Posts along the proposed Groundbirch Connector are referred to as Groundbirch KPs (GB KPs). The proposed Groundbirch Connector consists of approximately 3 km of connecting pipeline that begins at a NOVA Gas Transmission Ltd. meter station located at NW 34-78-19 W6M and ends at the certified Wilde Lake Compressor Station, located at SW 33-78-19 W6M. The proposed Groundbirch Connector also includes the installation of associated above-ground facilities, including pigging stations that would be located within the designated pipeline right-of-way and cathodic protection measures to protect the pipeline.

An overview map of the proposed Groundbirch Connector is provided on Figure 1-1.



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1.2 Social and Economic Information

Table 1-1 summarizes the Social Valued Components (VCs) assessed in the EAC Application, as required in the application information requirements (AIR), and includes references to technical reports and sections of the Amendment Application or the EAC Application for detailed baseline information relevant to the proposed Groundbirch Connector.

Table 1-1. Proposed Groundbirch Connector – Table of Concordance for Detailed Baseline Information Related Social Valued Components

Valued Component	Technical Report, Section of Amendment Application, or Section of EAC Application
Economy	Appendix 2N of the EAC Application
Employment and Labour Force	Appendix 2N of the EAC Application
Current Use of Land and Resources	Social and Economic Technical Report (this report)
Domestic Water Supply	Social and Economic Technical Report (this report)
Community Utilities and Services	Appendix 2M of the EAC Application
Transportation Infrastructure and Services	Appendix 2M of the EAC Application
Community Quality of Life	Appendix 2M of the EAC Application
Current Use of Land and Resources for Traditional Purposes	Section 15 of the Amendment Application for the proposed Groundbirch Connector
Cultural Sites	Section 15 of the Amendment Application for the proposed Groundbirch Connector

This report provides information about current conditions to support the assessment of the VCs under the Land and Resource Use topic, which are defined in Section 6.0 of the AIR for the Project (issued May 23, 2013, by the BC EAO). The VCs under the Land and Resource Use topic include the following:

- Current Use of Land and Resources
- Domestic Water Supply

Recommended mitigation is not included in this report. Mitigation for the Land and Resource Use topic can be found in Section 14.5 of the EAC Application.

Baseline conditions for the Economy and Employment and Labour Force VCs under the economy pillar for the proposed Groundbirch Connector are comparable to those presented in Appendix 2N of the EAC Application.

The local and regional labour force activity, educational attainment, as well as income and earnings for the regional districts, municipalities, and Indigenous communities considered in the economic local study area (LSA) and regional study area (RSA) in the EAC Application outline the local and regional economic context and do not materially change for the proposed Groundbirch Connector. For instance, major sources of government revenue and labour force activity for communities and the District in the Economic RSA have not materially changed from those described in the EAC Application, although revenues change annually. Educational attainment in the PRRD has increased slightly from counts of 13,520 in 2012 to 15,065 in 2016 for high school diplomas or equivalent and from counts of 8,105 in 2012 to 8,415 in 2016 for college or other non-university certificates or diplomas (Statistics Canada 2017).

Baseline conditions for the Community Utilities and Services and Community Quality of Life VCs under the Community and Regional Infrastructure and Services topic for the proposed Groundbirch Connector are comparable to those presented in Appendix 2M of the EAC Application and are therefore not discussed further in this report. For instance, emergency services, health care, social support services, waste management, recreational facilities and services, educational services, government services and accommodation are comparable to what was originally assessed in the EAC Application. Community quality of life is reflected in areas such as traffic, air quality, surface and groundwater quality, overall sound levels, employment and training opportunities, accidents and malfunctions, housing and commercial accommodation, traditional land and resource use and human health. Upon review, it is understood that these areas for community quality of life are comparable to what was originally assessed in the EAC application.

Baseline conditions for the Transportation Infrastructure and Services VC under the Community and Regional Infrastructure and Services topic for the proposed Groundbirch Connector are comparable to those presented in Appendix 2M of the EAC Application. Since the EAC Application, the *Navigable Waters Protection Act* has been replaced by the *Navigation Protection Act* (2014). However, this does not change the baseline information in the EAC Application, which identified that some of the watercourses crossed by the existing Certified Pipeline Corridor may be used as travel routes for vessels, including motorboats, rafts, canoes, and kayaks. The proposed Groundbirch Connector is located entirely on private land and does not cross any watercourses (Appendix D -Groundbirch Connector Fish Habitat Assessment Technical Memorandum, of the Amendment Application).

Information to support other related social VCs, including current use of land and resources for traditional purposes, cultural sites, archaeological sites, historical sites, palaeontological sites, architectural sites, and human and ecological health, is provided in separate technical reports and relevant sections of the Amendment Application.

As described in Section 1.2 of the Amendment Application, assessment matters required under Section 25 of the revitalized BC EAA (2018) are considered in the Amendment Application. This Social and Economic Technical Report for the proposed Groundbirch Connector includes consideration for relevant information to support the Section 25 assessment matter related to distinct human populations, including populations identified by gender. Information to support other Section 25 required assessment matters related to biophysical factors, which include effects on biophysical factors that support ecosystem function and effects on current and future generations, is provided in various sections of the Amendment Application.

1.3 Objectives

This report considers the direction of the AIR issued by the BC EAO (BC EAO 2013) and the Section 25 required assessment matters under the revitalized BC EAA (refer to Section 1.2 of the Amendment Application). This report also refers to the guidance contained in the BC *EAO User Guide* (BC EAO 2020a) and *Guide to Indigenous Knowledge in Environmental Assessments* (BC EAO 2020b).

The objectives of the Groundbirch Connector Social and Economic Technical Report are to document the baseline conditions of the Land and Resource Use VCs within the proposed Groundbirch Connector study areas and to report these data using methods that facilitate the assessment of potential effects and potential cumulative effects. This objective was achieved for the Land and Resource Use VCs by completing desktop reviews and spatial analysis of land uses in the LSA and RSA.

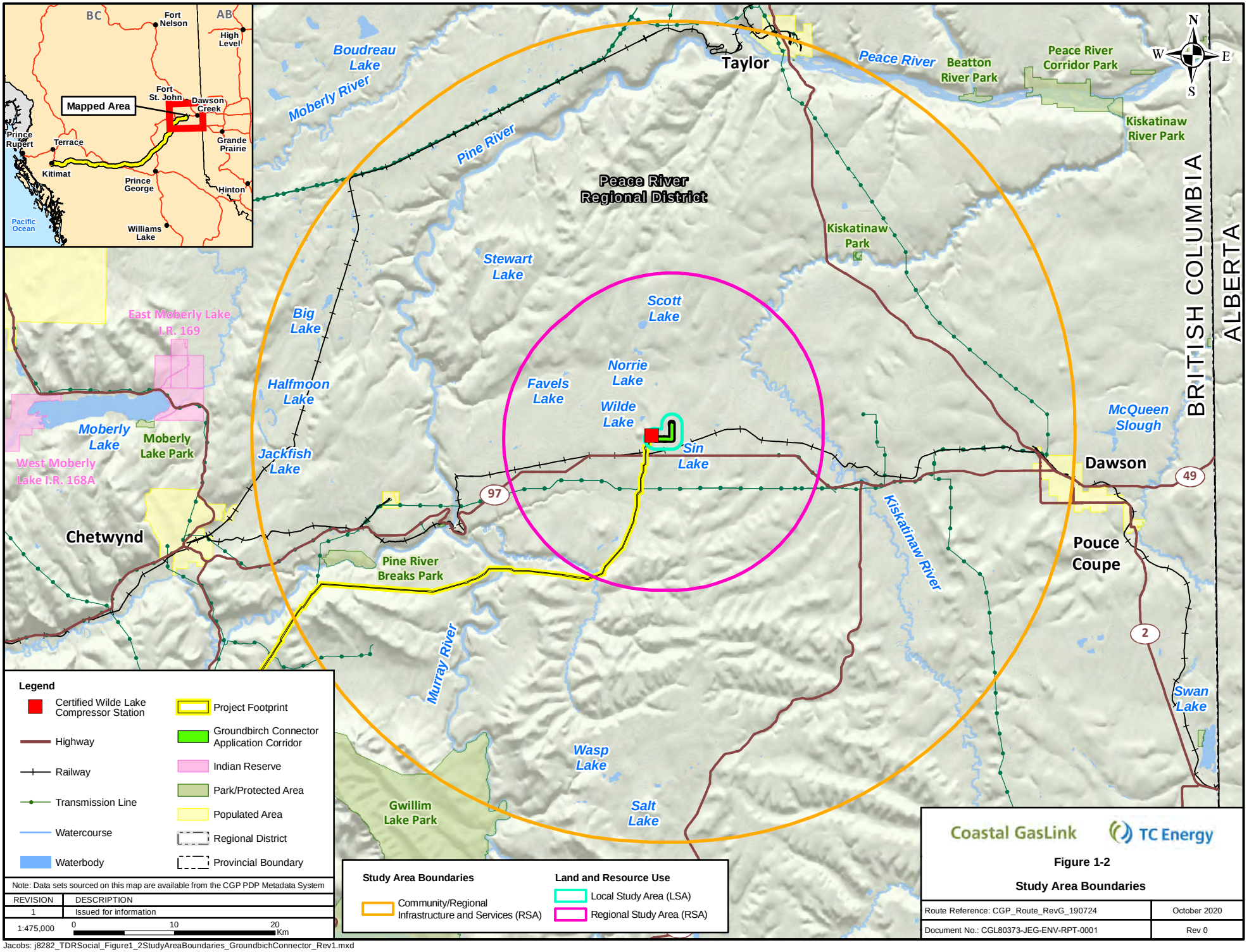
1.4 Study Area Boundaries

The Groundbirch Connector footprint is the 100-m-wide corridor centred on the proposed Groundbirch Connector centreline. The Groundbirch Connector footprint is the area within the proposed Groundbirch Connector that has the potential to be affected by physical works and activities, such as clearing, construction and clean-up.

This report applies the same Land and Resource Use LSA and RSA described in Section 3.0 of the EAC Application for the Project (Volume 1). The Land and Resource Use LSA is a 2-km band centred on the proposed Groundbirch Connector route (that is, extending 1 km on both sides of the proposed route). The Land and Resource Use RSA is a 30-km band centred on the proposed Groundbirch Connector route (that is, extending 15 km on both sides of the proposed route). The Land and Resource Use LSA and RSA for the proposed Groundbirch Connector is shown on Figure 1-2.

1.5 Construction Schedule

The number of construction spreads and the size and composition of the construction workforce are not expected to materially change with the addition of the proposed Groundbirch Connector. Table 1-3 in the EAC Application Social Technical Report (Appendix 2M) provides detailed information on construction sections, duration, and main work camps.



Jacobs: j8282_TDRSocial_Figure1_2StudyAreaBoundaries_GroundbichConnector_Rev1.mxd

2. Methods

This report provides information to support the assessment of potential social effects of the proposed Groundbirch Connector. Desktop information gathering and spatial analysis of land uses were used to describe the setting along the proposed Groundbirch Connector where it differs from the existing Certified Pipeline Corridor. Baseline information for the social and economy pillars was provided in Appendices 2M and 2N, respectively, of the EAC Application. This report identifies new setting information that was not identified on the existing Certified Pipeline Corridor. Setting information that is unchanged from Appendices 2M and 2N of the EAC Application for the Project is not provided in this report.

In the EAC Application, several Treaty 8 First Nations provided third-party socioeconomic baseline data that were considered. For setting information to support the assessment of disproportionate effects on distinct human populations as required under Section 25 of the 2018 BC EAA, the Social Technical Report and the Economic Technical Report of the EAC Application provided various background and demographic information that contributes to understanding distinct human populations that may be affected by the Project, including Indigenous women and children. The information included in the Social Technical Report and the Economic Technical Report of the EAC Application included gender (that is, male/female), Indigenous populations, age group, income, labour force participation, and educational attainment.

3. Current Land and Resource Use

This section of the report describes human occupancy and resource use in the footprint and Land and Resource Use LSA and RSA for the proposed Groundbirch Connector, including privately owned and Crown land, development and land use plans, provincial land use designations, natural resource use, recreation, parks, and visual attributes. Construction and operation of the proposed Groundbirch Connector may affect existing land and resource use.

Traditional Land and Resource Use (TLRU) is presented in Section 15.0 of the Amendment Application.

3.1 Community Background and Demographics

The proposed Groundbirch Connector is located in Electoral Area E of the PRRD and in the traditional territories or areas of interests of Blueberry First Nations, Doig River First Nation, Halfway River First Nation, Horse Lake First Nation, McLeod Lake Indian Band, Saulteau First Nations, and West Moberly First Nations.

Baseline conditions for the communities and demographics along the proposed Groundbirch Connector are comparable to those presented in Appendix 2M of the EAC Application. The proposed Groundbirch Connector does not cross any settlements or communities, including Indigenous communities, where it can reasonably be expected that direct potential adverse effects from the Project will occur.

3.2 Land Use

The entire length of the proposed Groundbirch Connector crosses private land that mainly supports agricultural land use. The Land and Resource Use LSA and RSA cross Crown lands that support a variety of activities, including forestry, mineral exploration and development, oil and gas activities, range use, trapping, hunting and guide outfitting, fishing, and outdoor recreational use (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2020).

The proposed Groundbirch Connector crosses private land, including 27.3 hectares (ha) of cultivated fields that are mostly pasture and hay fields. No Crown lands or federally owned or administered lands are crossed by the proposed Groundbirch Connector (BC Ministry of Citizens Services 2020).

3.2.1 Land Use Plans

The proposed Groundbirch Connector crosses private land in areas where land use is guided by the Dawson Creek Land and Resource Management Plan (LRMP) and one Official Community Plan (OCP). There are no First Nation land use plans identified as being crossed by the proposed Groundbirch Connector. The proposed Groundbirch Connector does not cross boundaries of any sustainable resource management plans.

3.2.1.1 Land and Resource Management Plans

The entire length of the proposed Groundbirch Connector crosses the Dawson Creek LRMP which is also crossed by the existing Certified Pipeline Corridor. There have been no updates to the Dawson Creek LRMP since referenced in the EAC Application. The proposed Groundbirch Connector crosses the progress zone designated as Settlement type in the Dawson Creek LRMP. Agriculture and settlement predominate within this LRMP zone, with most land being privately owned and not subject to the guidance in the LRMP. More information on the intent of the Dawson Creek LRMP is provided in Appendix 2M of the EAC Application.

3.2.1.2 Regional District Plans and Bylaws

The proposed Groundbirch Connector crosses the rural OCP (Bylaw No. 1940 2011) of the PRRD. The proposed Groundbirch Connector crosses one land use designation—agriculture rural use—which is also crossed by the existing Certified Pipeline Corridor at a different location within the OCP boundary. The objectives of the OCP and the management intent of the agricultural land use designation are provided in Appendix 2M of the EAC Application.

3.2.2 Provincial Land Use Designations

The proposed Groundbirch Connector does not cross a legal or nonlegal old-growth management area (OGMA). No ungulate winter range or wildlife habitat areas are crossed by the proposed Groundbirch Connector, and none occur in the Land and Resource Use LSA or RSA.

3.2.2.1 Old-Growth Management Areas

The proposed Groundbirch Connector does not cross a legal OGMA or nonlegal OGMA, and none occur in the Land and Resource Use LSA. Eight legal OGMAs and no nonlegal OGMAs were identified in the Land and Resource Use RSA for the proposed Groundbirch Connector. Legal OGMAs have been designated under ministerial order and generally require forest licensees to replace areas designated to protect old-growth forest for an area equivalent to the area that was removed by harvesting or road construction. Nonlegal OGMAs are spatially defined areas of old-growth forest that have not yet been legally established. Further information on OGMAs is provided in the EAC Application in Section 10.0, Wildlife and Wildlife Habitat, and Appendix 2J (Vegetation Technical Data Report).

3.3 Resource Use

Resource-based activities in the Land and Resource Use RSA for the proposed Groundbirch Connector include oil and gas exploration/development, range use, hunting, fishing, trapping, forestry, and recreation. Current uses of the land for the proposed Groundbirch Connector that differ from the EAC Application are described in the following subsections. Detailed information regarding TLRU is presented in Section 16.0 of the Amendment Application.

The proposed Groundbirch Connector does not cross any of the following: transmission lines, contaminated sites, wind farms or investigative permits, or parks or protected areas.

3.3.1 Mineral and Subsurface Resources

No mineral tenures are crossed by the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA. Seven mineral tenures were identified in the Land and Resource Use RSA. No operating mines are crossed by the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA or RSA.

No aggregate tenures are crossed by the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA. There are four aggregate tenures (sand and gravel quarries) in the Land and Resource Use RSA.

The entire length of the proposed Groundbirch Connector is located in one oil and gas tenure (tenure type: gas; tenure holder: Groundbirch). Construction of the proposed route may affect the ability of oil and gas disposition holders to conduct exploration or development activities in their tenured areas. During the operations phase, oil and gas development could be restricted in proximity to the operating pipeline and facilities. Crossing active pipelines will require crossing agreements and communication with the pipeline operators. The proposed Groundbirch Connector crosses active oil and gas pipelines seven times (Table 3-1).

Table 3-1. Existing Pipelines Crossed by the Proposed Groundbirch Connector

GB KP Intersection(s)	Operator	Type
GB KP 1.091	Shell Canada Ltd.	Sour natural gas
GB KP 2.209	Shell Canada Ltd.	Sour natural gas
GB KP 2.224	Shell Canada Ltd.	Sweet natural gas
GB KP 2.465	Shell Canada Ltd.	Sweet natural gas
GB KP 2.465	Shell Canada Ltd.	Sour natural gas
GB KP 2.471	Shell Canada Ltd.	Produced water
GB KP 2.471	Shell Canada Ltd.	Sweet natural gas

Source:
Midwest Surveys 2020

3.3.2 Agriculture

The proposed Groundbirch Connector crosses land designated as Agricultural Land Reserve (ALR) for its entire length. The existing Certified Pipeline Corridor crosses approximately 40 km of ALR land across the entire Project route, and the proposed Groundbirch Connector would add an additional 3 km to the total amount of ALR land crossed by the Project. Land designated as ALR is public or private land where agriculture is the priority land use (Agricultural Land Commission [ALC] 2014). Agricultural lands are designated as an ALR under the *Agricultural Land Commission Act* (ALCA). Under Section 26 of the *ALCA*, the ALC can enter into an agreement to allow certain governments or authorities to exercise the ALC's power to decide applications for nonfarm use. Such agreements may also exempt a nonfarm use in a specified area from the requirement of an application for permission for nonfarm use on certain conditions. The ALC has exercised power to enter into an agreement with the BC Oil and Gas Commission (OGC) relating to certain oil and gas nonfarm uses within the ALR in the Peace River Region (BC OGC 2017), which means the OGC acts as the ALC and makes decisions guided by the *ALCA* and regulations.

3.3.3 Range Lands

No Crown range tenures are crossed by the proposed Groundbirch Connector (Province of BC 2020a). There are 24 active Crown range tenures in the Land and Resource Use RSA.

There are nine grazing leases in the Land and Resource Use RSA for the proposed Groundbirch Connector. Range lands support agricultural activity through livestock grazing (Agriculture and Agri-Food Canada 2014). In BC, permission to use public lands for grazing activities is administered through a system of tenures and leases by the Province of BC. More information on range lands is provided in Appendix 2M of the EAC Application.

3.3.4 Hunting

Specific hunting information as a subsistence activity for TLRU purposes is provided in Section 16.0 of the Amendment Application.

The proposed Groundbirch Connector crosses the Omineca/Peace Region in the Peace Natural Resource District for its entire length. It crosses Wildlife Management Unit 7-32 (WMU 7-32), which is also crossed by the existing Certified Pipeline Corridor. Species commonly hunted in WMU 7-32 include mule deer, white-tailed deer, moose, elk, black bear, wolf, cougar, coyote, wolverine, lynx, snowshoe hare, grouse, raven, coots, duck and geese (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2020). A detailed list of hunting seasons for WMU 7-32 is provided in Appendix 2M of the EAC Application. Further information on wildlife and wildlife habitat is provided in Appendix I (Groundbirch Connector Wildlife and Wildlife Habitat TDR) of the Amendment Application.

A limited entry hunt (LEH) allocates a defined number of hunting authorizations to BC resident hunters through a lottery system. The LEH system was introduced as a way to maintain hunting opportunities by limiting the number of hunters or limiting the number, class, or sex of animals hunted. The proposed Groundbirch Connector crosses three LEH areas: two in WMU 7-32 and one in Peace River Zone A (Table 3-2), which is also crossed by the existing Certified Pipeline Corridor.

Table 3-2. Limited Entry Hunt Zone Crossed by the Proposed Groundbirch Connector

GB KP Intersection(s)	LEH Area	Species	Season
GB KP 0.0 to 3.0 (entire length)	Peace River Zone A of 7-20	Elk	September to October
	7-32	Elk	September to October
	7-32	Mule Deer	September to November

Sources:

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2020

Province of BC 2020b

Game management zones (GMZs) are management units grouped together based on geographical, ecological, and access criteria (BC Ministry of Water, Land and Air Protection 2003). Although GMZs encompass larger areas than the Land and Resource Use LSA and RSA boundaries, they provide an indication of hunting activity in the proposed Groundbirch Connector footprint and Land and Resource Use LSA and RSA. The proposed Groundbirch Connector is located in the North Peace GMZ. As measured by the number of days BC residents spent hunting in 2011, most hunters in this GMZ hunted elk, followed by moose and white-tailed deer (see the EAC Application Social Technical Report in Appendix 2M).

3.3.5 Fishing

Specific fishing information as a subsistence activity for TLRU purposes is discussed in Section 16.0 of the Amendment Application.

The proposed Groundbirch Connector crosses the Omineca/Peace Region, which is also crossed by the existing Certified Pipeline Corridor. Game fish commonly found in the region include trout, Arctic grayling, burbot, kokanee, whitefish and white sturgeon, northern pike, inconnu, goldeye, walleye and yellow perch (Appendix 2M of the EAC Application).

The proposed Groundbirch Connector is located entirely on private land and does not cross any watercourses (Appendix D - Groundbirch Connector Fish Habitat Assessment Technical Memorandum). No additional popular fishing lakes or rivers were identified as being crossed by the Land and Resource Use LSA for the proposed Groundbirch Connector. Kiskatinaw River is located (approximately 14 km east from the proposed Groundbirch Connector Project Footprint) within the Land and Resource Use RSA and is a popular fishing river in the region.

3.3.6 Trapping

Specific trapping information as a subsistence activity for TLRU purposes is found in Section 16.0 of the Amendment Application.

There are two trapper cabins located in the Land and Resource Use RSA. The entire length of the proposed Groundbirch Connector is located in one trapline territory (Trapline Licence TR0732T010) (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2020).

3.3.7 Guide Outfitting

The proposed Groundbirch Connector is located entirely in one guide outfitting territory (Table 3-3).

Table 3-3. Guide Outfitting Territories Crossed by the Proposed Groundbirch Connector

GB KP Intersection(s)	Certificate Holder	Guide Outfitter	Certificate No.	Target Species	Other Services
GB KP 0.0 to 3.0 (entire length)	Dean Keitsch	Lael Brewster	701271	Unknown	Information not available

Source:

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2020

3.3.8 Forestry

Forestry associated with TLRU (for example, culturally modified trees) is discussed in Section 16.0 of the Amendment Application. The proposed Groundbirch Connector is located in the Dawson Creek Timber Supply Area in the Peace Forest District, which is also crossed by the existing Certified Pipeline Corridor.

The proposed Groundbirch Connector does not cross any active forest tenure cutblocks. There are no active or pending woodlot licences in the Land and Resource Use LSA; however, there are four active woodlot licences in the Land and Resource Use RSA. No community forests or tree farm licences are crossed by the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA; however, there is one tree farm licence in the Land and Resource Use RSA (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development 2020).

3.3.9 Outdoor Recreational Uses

The proposed Groundbirch Connector does not cross any trails or recreation sites, and none occur in the Land and Resource Use LSA and RSA (Province of BC 2020a).

3.4 Visual Quality and Aesthetics

The proposed Groundbirch Connector crosses an unclassified area in visual quality objective polygon No. 2249 in the Dawson Creek LRMP area (BC Ministry of Forests, Lands and Natural Resource Operations 2020).

4. Domestic Water Supply

This section describes domestic water supply quantity and quality in the proposed Groundbirch Connector footprint and Land and Resource Use LSA and RSA. Domestic water in the Land and Resource Use LSA and RSA is available from groundwater or surface water sources.

The proposed Groundbirch Connector does not cross any community watersheds, and no community watersheds were identified in the Land and Resource Use LSA and RSA. The proposed Groundbirch Connector does not encroach upon any registered water wells. There are 97 registered water wells identified in the Land and Resource Use RSA (BC Ministry of Environment - Water Protection and Sustainability 2020). Of these wells, 57 are private domestic wells, 2 are commercial and industrial wells, 8 are water supply system wells, and 30 are unknown use. No points of diversion overlap with the proposed Groundbirch Connector, and none are located in the Land and Resource Use LSA. There are 24 points of diversion identified in the Land and Resource Use RSA for the proposed Groundbirch Connector (BC Ministry of Forests, Lands and Natural Resource Operations - Water Management 2020).

5. Conclusions

The setting identified in the EAC Application Social Technical Report (Appendix 2M) has not materially changed as a result of the proposed Groundbirch Connector. No new land use types were identified related to the proposed Groundbirch Connector that had not previously been considered in the EAC Application. No additional mitigation, beyond mitigation measures described in the EAC Application for potential effects on land and resource use as well as the management plans that have been prepared to meet the conditions of the EAC, is required for the proposed Groundbirch Connector.

6. References

6.1 Literature Cited

Agricultural Land Commission. 2014. *ALR and Maps*. Accessed July 2020. http://www.alc.gov.bc.ca/alc/content/alr-maps.

Agriculture and Agri-Food Canada. 2014. *Land management through grazing*. Accessed July 2020. https://www.agr.gc.ca/eng/agriculture-and-climate/agricultural-practices/soil-and-land/land-management-through-grazing/?id=1242752035499.

British Columbia Oil and Gas Commission. 2017. *Agreement between the Provincial Agricultural Land Commission and the Oil and Gas Commissions*. Accessed July 2020. https://www.bcogc.ca/files/application-manuals/Oil-and-Gas-Activity-Application-Manual/Supporting-Documents/alcogcdelegationagreement2017update.pdf.

British Columbia Oil and Gas Commission. 2019. Oil and Gas Activity Application Manual. Version 1.33: December 2019. Accessed July 2020. https://www.bcogc.ca/files/application-manuals/Oil-and-Gas-Activity-Application-Manual/Oil-and-Gas-Activity-Application-Manual.pdf.

British Columbia Environmental Assessment Office. 2013. *Coastal GasLink Pipeline Project: Application Information Requirements for an Environmental Assessment Certificate*. Accessed June 2020. https://projects.eao.gov.bc.ca/api/public/document/5e41882e74d1830021b67709/download/CGL%20-%20Application%20Information%20Requirements%20-%2020130523.pdf.

British Columbia Environmental Assessment Office. 2020a. *EAO User Guide: An Introduction to Environmental Assessment under the Provincial Environmental Assessment Act (2018)*. Version 1.01. March 2020. p. 53.

British Columbia Environmental Assessment Office. 2020b. *Guide to Indigenous Knowledge in Environmental Assessments*. Version 1.0. April 2020. p. 20.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Hunting & Trapping Regulations Synopsis 2020–2022*. pp. 97.

Province of British Columbia. 2020a. *iMapBC:* Range Tenures. Accessed July 2020. https://maps.gov.bc.ca/ess/hm/imap4m/.

Province of British Columbia. 2020b. *LEH Zone Maps for Region 7: Omineca/Peace*. Accessed July 2020. https://www2.gov.bc.ca/gov/content/sports-culture/recreation/fishing-hunting/hunting/limited-entry-hunting/leh-zone-maps/region-7-omineca-peace.

Statistics Canada. 2017. *Peace River, RD [Census division], British Columbia and British Columbia [Province]* (table). *Census Profile*. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released November 29, 2017. Accessed July 2020. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E.

6.2 GIS Data and Mapping References

British Columbia Ministry of Citizens Services. 2020. *BC Parcel Fabric* (digital file). Accessed June 15, 2020. https://catalogue.data.gov.bc.ca/dataset/parcelmap-bc-parcel-fabric.

British Columbia Ministry of Energy, Mines and Petroleum Resources, Mineral Titles. 2020. *MTA - Mineral, Placer and Coal Tenure Spatial View* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/mta-mineral-placer-and-coal-tenure-spatial-view.

British Columbia Ministry of Energy, Mines and Petroleum Resources. 2020. *Oil and Gas Tenure Areas* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/oil-and-gas-tenure-areas.

British Columbia Ministry of Environment - Water Protection and Sustainability. 2020. *Ground Water Wells* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/e4731a85-ffca-4112-8caf-cb0a96905778.

British Columbia Ministry of Environment - Water Protection and Sustainability. 2020. *Ground Water Well Capture Zones* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/ground-water-well-capture-zones.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2020. *Recreation Polygons* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/263338a7-93ee-49c1-83e8-13f0bde70833.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2020. *Recreation Line* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/7fcb21f7-e51c-4342-a5e1-445a6c42128e.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2019. *Recreational Features Inventory* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/4cadfc5b-a19b-4d49-8a20-48747c28209c.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2019. *Section 58 Recreation Orders - Polygons* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/77ca3d95-a3b4-4069-9599-3959b9481c33.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Recreation Sites and Trails BC. 2020. *Section 58 Recreation Orders - Lines* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/b05ae99e-b4ce-49c5-8d09-fc59c84e7bf9.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Resource Practices. 2020. *Visual Landscape Inventory* (digital file). Accessed March 10, 2020. https://catalogue.data.gov.bc.ca/dataset/4e941067-20ec-4b5d-bca3-8831c9b2e4db.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020. *Water Rights Licences* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/5549cae0-c2b1-4b96-9777-529d9720803c.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020. *Water Rights Applications* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/f3a53d7f-da09-4726-ac83-f0032e4bd490.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020. *Water Licence Works - Lines* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/water-licensed-works-lines.

British Columbia Ministry of Forests, Lands and Natural Resource Operations - Water Management. 2020. *Water Licensed Works - Points* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/water-licensed-works-points#edc-pow.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2020. Tantalis Crown Tenures (digital file). Accessed February 2020. https://catalogue.data.gov.bc.ca/dataset/3544ad91-0cf2-4926-a08a-bfe42d9a031d. Record Last Modified: January 10, 2020.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Indian Reserves and Band Names - Administrative Boundaries* (digital file). Accessed May 25, 2020. https://catalogue.data.gov.bc.ca/dataset/c2ce81af-78c1-467c-b47e-c392cd0a771f.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *TANTALIS - Crown Tenures* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/tantalis-crown-tenures.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Transmission Lines* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/bc-transmission-lines.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Wildlife Management Units* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/wildlife-management-units.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Traplines of British Columbia* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/traplines-of-british-columbia.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Guide Outfitter Areas* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/guide-outfitter-areas.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Tree Farm License Agreement Boundary (TFL)* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/fadm-tree-farm-license-agreement-boundary-tfl-.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *FADM - Tree Farm License (TFL) Addition* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/fadm-tree-farm-license-tfl-addition.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *FADM - Tree Farm License (TFL) Deletion* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/fadm-tree-farm-license-tfl-deletion.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. *Forest Tenure Managed Licence* (digital file). Accessed July 9, 2020. https://catalogue.data.gov.bc.ca/dataset/forest-tenure-managed-licence.

Coastal GasLink Pipeline Ltd. 2020. *First Nation Traditional Territory* (digital file). Calgary, AB. Accessed June 17, 2020.

Midwest Surveys Land Surveying Ltd. 2020. *Coastal GasLink Project – Groundbirch Connector Construction Plan. Revision 0*. Document No. CGE4703-MSI-G-MP-1531. May 15.

Ministry of Community, Sport and Cultural Development. 2020. *Municipalities - Legally Defined Administrative Areas of BC* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/e3c3c580-996a-4668-8bc5-6aa7c7dc4932.

Ministry of Forests, Lands and Natural Resource Operations - Resource Management Objectives. 2020. *Strategic Land and Resource Plans - Current* (digital file). Accessed February 24, 2020. https://catalogue.data.gov.bc.ca/dataset/4b142d4c-83d6-4ecc-b66c-66601ae65992.