ASKI RECLAMATION LP

PNG LEGACY SITE GROUNDBIRCH-BRASSEY RESTORATION PROGRAM

SUMMARY REPORT

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SUBMITTED BY

ASKI RECLAMATION LP & SILVERBERRY PRO

PNG Legacy Site Groundbirch-Brassey Restoration Program

Prepared for:
BC Oil & Gas Research and Innovation Society
And Petroleum and Natural Gas
PO Box 9331 Stn. Prov Govt
Victoria, BC V8W 9N3

Prepared by:
Silverberry Pro
1303 112 St. #127
Fort St. John, BC V1J 0N6

February 7, 2022

Daniel Monaco, B.Sc, BIT
Intermediate Ecologist, Report Writing
Silverberry Pro

Date

February 7, 2022

Nanette Richards, B.Sc., RPBio.
Senior Vegetation Ecologist, Report Review
Silverberry Pro

Date

SUMMARY

Aski Reclamation LP (Aski) and Silverberry Pro (Silverberry) worked together on the PNG Legacy Site Groundbirch-Brassey Restoration Program to achieve legacy seismic line revegetation through live stake and eco-cultural seedling installation.

The project area was selected due to its traditional cultural importance for Saulteau First Nations and Aski, as well as having ecological conditions ideal for restoration activities. Targeted spatial analysis and extensive reconnaissance within the project area were used to select legacy seismic lines most suitable for restoration.

An integrated team of Aski and Silverberry staff combined their expertise in the field of native plant restoration to deliver effective legacy seismic line treatments. Working closely together with the spirit of training and mentorship, Silverberry also aimed to pass on their technical knowledge to build capacity within Aski's team.

In total, 37 legacy seismic lines received treatment, totaling 30.1 km, with the installation of 30,000 live stakes and 50,000 eco-cultural seedlings. Using an adaptive management approach, the legacy seismic line treatments were tailored to the site conditions of each individual legacy seismic line to maximize the chances of success on the project.

The program allowed for major learnings and was a great opportunity for the Aski and Silverberry staff to extend their knowledge, while delivering quality restoration and removing linear disturbances from the landscape.

TABLE OF CONTENTS

SUMMARY 2
PROGRAM GOALS AND ACCOMPLISHMENTS 6
1 INTRODUCTION 6
1.1 Background Information 6
1.2 Employment Summary 7
1.3 Location and Access 8
1.4 Environmental Setting 8
2 ACQUIRING PERMITS 10
2.1 Permit Requirements 10
2.2 Special Use Permit 10
2.3 Section 52 Permit 10
3 STAKEHOLDER ENGAGEMENT 11
4 7SITE SELECTION METHODS 13
4.1 Site Selection Goals 13
4.2 Review of Existing Information – Spatial Datasets 13
4.2 Field Reconnaissance Surveys 15
4.2.1 Air Reconnaissance Survey 15
4.2.2 Ground Reconnaissance Survey 15
4.2.3 Final Legacy Seismic Line Selection 16
5 RESTORATION METHODS 18
5.1 Plant Prescriptions for Restoration 18
5.1.1 Planting Density 18
5.1.2 Planting Distribution 19
5.1.3 Planting Design 20
5.2 Live Stake Collection Methods 20
5.2.1 Live Stake Collection 20
5.2.2 Live Stake Scouting 20
5.2.3 Live Stake Harvesting 21
5.2.4 Live Stake Processing 22
5.2.5 Live Stake Transportation and Storage 22
5.3 Live Stake Installation Methods 22
5.3.1 Live Stake Installation 22
5.4 Eco-cultural Seedling Installation Methods 23

5.5 Monitoring 24
5.5.1 Field Monitoring Methods 24
5.5.2 Photo Plot Locations 24
5.5.3 Photo Monitoring Data Collection 25
6 QUALITY CONTROL 26
7 RESTORATION AND MONITORING SUMMARY 27
7.1 Live Staking and Native Plant Installation and Monitoring Summary 27
7.1.1 Legacy Seismic Line Treatment Summary: A01 29
7.1.2 Legacy Seismic Line Treatment Summary: A02 30
7.1.3 Legacy Seismic Line Treatment Summary: A03 31
7.1.4 Legacy Seismic Line Treatment Summary: A04 32
7.1.5 Legacy Seismic Line Treatment Summary: A05 33
7.1.6 Legacy Seismic Line Treatment Summary: A06 34
7.1.7 Legacy Seismic Line Treatment Summary: A07 35
7.1.8 Legacy Seismic Line Treatment Summary: A08 36
7.1.9 Legacy Seismic Line Treatment Summary: A12 37
7.1.10 Legacy Seismic Line Treatment Summary: A13 38
7.1.11 Legacy Seismic Line Treatment Summary: A14 39
7.1.12 Legacy Seismic Line Treatment Summary: A15 40
7.1.13 Legacy Seismic Line Treatment Summary: A16 41
7.1.14 Legacy Seismic Line Treatment Summary: A17 42
7.1.15 Legacy Seismic Line Treatment Summary: A18 43
7.1.16 Legacy Seismic Line Treatment Summary: A19 44
7.1.17 Legacy Seismic Line Treatment Summary: A20 45
7.1.18 Legacy Seismic Line Treatment Summary: A21 46
7.1.19 Legacy Seismic Line Treatment Summary: A22 47
7.1.20 Legacy Seismic Line Treatment Summary: A25 48
7.1.21 Legacy Seismic Line Treatment Summary: A26 49
7.1.22 Legacy Seismic Line Treatment Summary: A27 50
7.1.23 Legacy Seismic Line Treatment Summary: A28 51
7.1.24 Legacy Seismic Line Treatment Summary: A29 52
7.1.25 Legacy Seismic Line Treatment Summary: A30 53
7.1.26 Legacy Seismic Line Treatment Summary: A31 54
7.1.27 Legacy Seismic Line Treatment Summary: A32 55
7.1.28 Legacy Seismic Line Treatment Summary: A33 56

7.1.29 Legacy Seismic Line Treatment Summary: A34 57
7.1.30 Legacy Seismic Line Treatment Summary: A35 58
7.1.31 Legacy Seismic Line Treatment Summary: A37 59
7.1.32 Legacy Seismic Line Treatment Summary: A38 60
7.1.33 Legacy Seismic Line Treatment Summary: A39 61
7.1.34 Legacy Seismic Line Treatment Summary: A40 62
7.1.35 Legacy Seismic Line Treatment Summary: A41 63
7.1.36 Legacy Seismic Line Treatment Summary: A42 64
7.1.37 Legacy Seismic Line Treatment Summary: A44 65
7.2 Creation of Shapefiles and Attribute Tables 66
8 CAPACITY BUILDING 66
9 RECOMMENDATIONS 72
9.1 Lessons Learned and Adaptive Management 72
9.2 Sites for Future Treatment 74
9.3 Capacity Building Recommendations 74
9.4 Monitoring 74
10 CLOSURE 75
11 REFERENCES 75
Appendix A: Stock Assessment Data Example 76
Appendix B: Photo Monitoring Program Data 79
Appendix C: Legacy Seismic Line Treatment Summary – Shapefile Attribute Table 80

PROGRAM GOALS AND ACCOMPLISHMENTS

The goals and accomplishments of the Legacy Site Groundbirch-Brassey Restoration Program are listed in Table 1.

Table 1. Program Accomplishments

Program Goal	Accomplishment
Revegetate 32 linear kilometers of legacy seismic line disturbance using eco-cultural restoration techniques.	Success: revegetated 31 km of legacy seismic lines.
Install 30,000 live stakes on legacy seismic lines.	Success: installed 30,000 live stakes of *Salix spp.* (willow), and *Populus balsamifera* (balsam poplar).
Install 50,000 seedlings, which are eco-culturally relevant species, on legacy seismic lines.	Success: installed 50,000 eco-cultural seedlings.
Increase biodiversity with culturally and ecologically suitable and commercially available species.	Success: installed five tree species and five shrub species sourced from local native plant nurseries.
	Success: utilized Aski's knowledge of traditional practices in the area to select culturally relevant plant species.
On the job training (capacity building) for Aski Employees from Silverberry's Vegetation Ecologist.	Success: Aski's employees received training and mentorship at all stages of the project: logistics planning and permit applications, execution of field work (live stake collection and installation, and eco-cultural seedling installation), and reporting and data management.

1 INTRODUCTION

1.1 Background Information

The British Columbia Oil and Gas Research and Innovation Society (BC OGRIS) provided funding to Aski and Silverberry, working together with Saulteau First Nations' Treaty Rights & Environmental Protection Branch (TREP), to restore legacy seismic lines within the Groundbirch and Brassey areas of the Peace Region, in BC. BC OGRIS provided funding for the Groundbirch-Brassey Program (the Project) under the Petroleum and Natural Gas Legacy Sites Restoration Program. The BC OGRIS is increasing their focus on oil and gas reclamation activity to retore the footprint left on the landscape. The Peace Region was selected for several reasons:

- Saulteau First Nations identified the Groundbirch and Brassey areas as culturally significant because this area is largely where the Saulteau First Nation practice their treaty rights, gather plants for sustenance and medicinal use, hold cultural ceremonies, and is part of a historical travel route for fur trade.
- Industrial impact on this region has had a high cumulative impact on many groups, including First Nations and recreational users.
- Numerous native plant species range distributions start or end within the region.
- High land-use value for wildlife species.

Aski, a wholly Saulteau First Nations owned company, and Silverberry have worked together since 2019 on several projects focusing on the planning and implementation of ecologically suitable species installation on reclaimed industrial sites, and vegetation monitoring programs. Aski's focuses on eco-cultural reclamation and restoration within Treaty 8 territory, which incorporates both Western and Traditional Ecological Knowledge values into end land use planning. Aski is involved in reclamation and native plant restoration with multiple natural resource sectors including oil and gas, mining, and forestry.

Silverberry specializes in both native plant revegetation in Northern British Columbia (BC) and developing and delivering collaborative technical revegetation programs with Indigenous organizations in the Peace Region. Silverberry has been advancing the science of native plant revegetation in the Groundbirch area since 2015 and has completed many successful restoration projects in the oil and gas, mining, hydro, and transportation sectors.

1.2 Employment Summary

Throughout the duration of the project, the Aski-Silverberry team employed pre-existing staff members and hired new staff members to execute various aspects of the project. This provided all staff with an opportunity to further their professional development and maintain employment tenure. Total number of staff employed, and total hours of work created as a result of the project are outlined in Table 2.

Table 2. Summary of the number of staff employed and hours worked throughout the project.

Category	Actuals
Number of Aski-Silverberry Staff Employed in Project Execution.	39
Number of Contractors Employed in Project Execution.	2
Total Hours of Work Created for All Staff.	7940

1.3 Location and Access

The Groundbirch and Brassey areas of the Peace Region, located between Chetwynd, Fort St John, and Dawson Creek, were the areas initially identified as the ideal target location for the project's restoration activities.

The Groundbirch area is located north of highway 97 and east of the Pine River (Figure 1). The Brassey area is located south of highway 97, along highway 52 south of Fellers Heights.

1.4 Environmental Setting

The Groundbirch and Brassey areas fall within the Moist, Warm Subzone of the Boreal White and Black Spruce Biogeoclimatic Zone (BWBSmw; DeLong et.al., 2011). The BWBSmw zone is extensive, covering almost 3 million hectares (ha) and ranges in elevation from 750 to 1050 metres (m). The BWBSmw zone ranges from the Alberta Plateau, extending from near where the Rocky Mountains transect the Alberta border, to near the northern extent of the Beatton River.

Trembling aspen (*Populus tremuloides*) dominates the landscape due to fire history and land clearing. Moist sites with less historical disturbances are dominated by white spruce (*Picea glauca*). Along watercourses and lower slope positions, balsam poplar (*Populus balsamifera*) is common. Lodgepole pine (*Pinus contorta*), a seral species, is present on drier and poorer sites. On organic soils, black spruce (*Picea mariana)* with a minor component of tamarack (*Larix laricina*) are common.

Fine-textured Luvisols dominate where morainal and (glacio) lacustrine parent materials occur, grading to Gleysols where drainage is impeded. Brunisols occur on coarse-textured glaciofluvial deposits, and Regosols dominate the river floodplains as well as the (often unstable) valley sides above floodplains. Limited areas of grassland Chernozems and saline soils (Solonetzic Order) occur along the Peace River near the Alberta border. Significant portions of the Peace River lowlands near larger centres, such as Fort St. John and Dawson Creek, have been converted to agricultural lands (DeLong et.al., 2011).

This BWBS zone is characterized by long, cold winters and short growing seasons. The mean annual temperature ranges from −2.4 to 3.6°C and annual precipitation ranges between 341 and 897 mm (DeLong et.al., 2011).

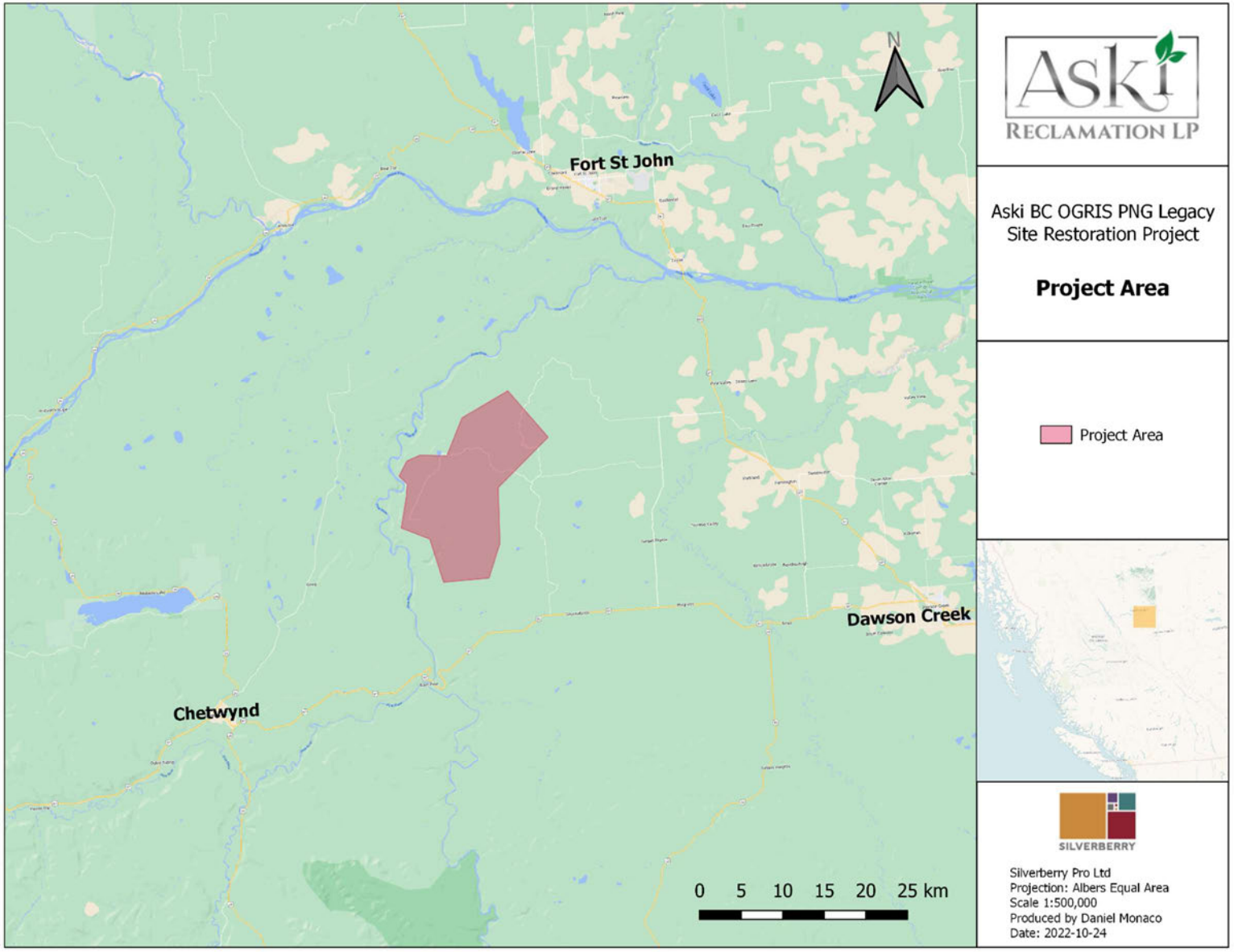

Figure 1. Project Location.

2 ACQUIRING PERMITS

2.1 Permit Requirements

A Special Use Permit (SUP) was required for installation of live stakes and eco-cultural seedlings. The permit was acquired through the Ministry of Forest, Lands, and Natural Resource Operations and Development (FLNROD). An SUP required a conflict report and significant consultation with adjacent land users and stakeholders, such as First Nation groups, trapline holders, and agricultural land lease tenure holders. Within the SUP details related to project location, planned activities, project objectives and technical approaches were outlined.

In addition to an SUP, a Section 52 authorization was required to conduct live stake collection.

2.2 Special Use Permit

The project location occurs within Crown land in Groundbirch, BC. As a result, an SUP administered by FLNROD was required to conduct proposed project activities including live stake installation, and eco-cultural seedling installation. The SUP granted the Aski-Silverberry team with authorization to conduct the restoration work and hold the permit for 5 years from the time of permit approval.

Stakeholder consultation and engagement is a significant requirement within the SUP approval process. To ensure adequate, comprehensive, and timely consultation, the Aski-Silverberry team used GIS analysis to identify relevant stakeholders in February 2022. In addition, FLNROD provided a conflict report in late March 2022 with a list of relevant stakeholders. The following documentation was submitted to FLNROD to obtain an SUP Permit:

- Restoration Activity Management Plan
- Special Use Permit Application Form
- Archaeological Impact Assessment Letter of Consent
- Project Maps
- Project Shapefiles
- Stakeholder Engagement Consultation Tracking Document

On June 24th, 2022 the Aski-Silverberry team was issued an approved SUP by the Ministry of Forests, Peace Natural Resource District.

2.3 Section 52 Permit

A Section 52 Permit was required for cutting and harvesting 30,000 live stakes from donor sites on Crown land located within the North and West regions of Dawson Creek with Pine River as the Eastern boundary. The live stakes were harvested from selected host shrubs including *Salix spp.* (willow species) and *Populus balsamifera* (balsam poplar), using minimally invasive methods to preserve the host shrub. The Section 52 Permit was issued by FLNROD on March 18th, 2022, and was valid from March 18th, 2022, to April 15th, 2022.

3 STAKEHOLDER ENGAGEMENT

To meet the requirements of the SUP and ensure comprehensive stakeholder consultation, the Aski-Silverberry team developed a stakeholder engagement plan focused on an information sharing approach.

The information sharing approach involved the development of a Stakeholder Information Package including details related to project objectives, project benefits, project timelines, project area map, and contact information for the Aski-Silverberry team to field any stakeholder questions or concerns. Stakeholder Information Packages were distributed via mail and email to all identified land tenure holders and land users including:

- Trappers and Trapper Associations
- Range Tenure Holders
- Road Tenures
- Industry Tenures
- Government Tenures
- Indigenous Communities

When possible, written confirmation of support and resolution for the project was requested. If stakeholders did not respond to contact attempts; it was assumed that the project was supported. The Aski-Silverberry team was dedicated to selecting an alternative project site or eliminating the area of concern for project activities, if a stakeholder had significant concerns or opposition to a selected project area.

To ensure comprehensive consultation, the following Indigenous communities were contacted: Blueberry River First Nations, Doig River First Nations, Halfway River First Nations, Horselake First Nations, McLeod Indian Band and West Moberly First Nations. Stakeholder Information Packages were mailed on March 16th, 2022 and May 2nd, 2022. Follow-up phone calls to each Indigenous community was conducted between May 5th, 2022, to May 6th, 2022 to provide an opportunity for review of the project scope and to discuss any questions or suggestions. Phone calls were also followed up with an email providing each Indigenous community with the contact information for the Aski team who was available to answer further questions, address concerns or document recommendations for the project. No major concerns or feedback were noted.

Additionally, on March 9th, 2022, a virtual meeting was conducted with Saulteau First Nations TREP Branch to review the project objectives and schedule, and receive feedback for reclamation objectives and goals. Saulteau First Nations TREP noted their support of the reclamation objectives and goals, particularly relating to revegetation through eco-cultural species. Ongoing communications between the Aski team and Saulteau First Nations provided opportunities for feedback, recommendations, and continued project progress updates. A final debrief meeting with the Saulteau First Nations TREP will be scheduled for November 2022 to review the project outcomes.

During the installation of live stakes and eco-cultural species, no contact attempts were made by adjacent stakeholders. In September 2022, the local trappers association concerned with the live stakes installed along some of the restored legacy seismic lines contacted the Aski-Silverberry team via a phone call. The restored legacy seismic lines of concern occurred within the trapline

travel routes. To maximize public safety and awareness, signage was installed at 18 out of 37 restored legacy seismic line entrance locations following treatment.

The goal of this program was to create meaningful restoration impacts for the ecosystem and associated land users. The Aski-Silverberry team took comprehensive steps to ensure adequate stakeholder consultation and engagement, providing the community with opportunities to ask questions, voice concerns and offer recommendations.

4 7SITE SELECTION METHODS

4.1 Site Selection Goals

Site selection was completed in multiple stages by incorporating information from various sources to identify the legacy seismic lines most suitable for restoration treatment, and to maximize success with the treatment activities. The goal of the selection process was to identify legacy seismic lines with an ecologically suitable environment for the installation of live stakes and eco-cultural species during restoration activities. In addition, site access was considered in selecting the legacy seismic lines. The following criteria was used for selecting legacy seismic line sites for restoration:

- Priority was given to areas with confirmed Traditional Land Use.
- On upland sites.
- Lacking natural revegetation – further plant installations will progress the sites along a trajectory towards a revegetated state.
- Less than 50% natural woody revegetation.
- Legacy seismic line width >2m.
- Project activities have a minimal impact on the environment.
- In areas of high-density legacy seismic lines.
- Within 500 m of road access.
- Logistically accessible with pick-up trucks and UTVs.
- Free of Stakeholder conflicts (i.e., trapline access).

4.2 Review of Existing Information – Spatial Datasets

The first step to identifying candidate sites (legacy seismic lines) for restoration was a desktop analysis of publicly available spatial data from the Government of BC's Data Catalogue. Prior to this analysis, the project area was submitted to Saulteau First Nations' TREP Branch to compare to their inhouse Land Use Data collected over years of Traditional Land Use Studies and community shared Traditional Ecological Knowledge. TREP's analysis identified the Groundbirch and Brassey areas as priorities for restoration due to their high concentration of Traditional Land Use. The following information was then reviewed:

- Biogeoclimatic Unit
- Conservation Data Centre (CDC) rare plants (Government of BC 2022a)
- Satellite Imagery (Bing Maps, 2022)
- Freshwater Atlas (Government of BC 2022b)
- Vegetation Resource Inventory (VRI) (Government of BC 2022b)
- Linear Disturbance Shapefile provided by BC Oil and Gas Commission (OGC)
- Tenure Data: forest tenures, grazing tenures, pipelines, power lines, roads (Government of BC 2022b)
- Ecological Data: wildlife habitat areas, ungulate winter ranges, conservation lands, sensitive fish habitat ranges, wetlands (Government of BC 2022b)

Spatial data analysis was conducted using data provided by the BC OGC, satellite imagery, and publicly available data from the BC Data Centre. The BC OGC provided a shapefile containing all legacy seismic line footprints in the area. Since the shapefile contained approximately 1,100 km of legacy seismic line, spatial filters using the datasets listed above were applied to narrow the selection to approximately 60 km. Table 3 lists the data filters applied to the shapefile.

Table 3. Spatial Data Filters Applied to Legacy Seismic Line Footprint for Site Selection

Data Source	Data Filter
DWB Consulting Services Ltd. (Reconnaissance data from Caribou habitat project)	Eliminated legacy seismic lines within caribou habitat range.
BC Crown Tenures, Leases, Permits, and Licenses	Selected legacy seismic lines with access points within 500 m of a resource road tenure or pipeline tenures.
	Eliminated legacy seismic lines within active mining tenures, and agricultural lands.
Vegetation Resource Inventory (VRI)	Selected legacy seismic lines within Boreal White and Black Spruce (BWBS) and Engelmann Spruce-Subalpine Fir (ESSF) Biogeoclimatic Zones.
	Selected legacy seismic lines with high soil nutrient regimes.
	Selected younger forest age class (Projected Age Class 1 to 3: up to 60 years old).
Freshwater Atlas	Eliminated legacy seismic lines with intersecting watercourses or that would require crossing a watercourse to access.
	Eliminated legacy seismic lines within wetlands.
Forestry Tenures	Eliminated legacy seismic lines within active Harvest Authorities.
Grazing Tenures	Eliminated legacy seismic lines within active Grazing Tenures.
Wildlife Habitat Areas	Eliminated legacy seismic lines within all known Wildlife Habitat Areas.
Ungulate Winter Ranges	Eliminated legacy seismic lines within all known Ungulate Winter Ranges.
Conservation Lands	Eliminated legacy seismic lines within all Conservation Lands.

The candidate site legacy seismic lines identified during the desktop spatial data analysis were used to develop a map to guide the air reconnaissance survey. During the first day of air reconnaissance, the legacy seismic lines identified through spatial analysis were not suitable for treatment, because numerous legacy seismic lines had revegetated naturally or may not have existed as the spatial data suggested. Therefore, a new selection of legacy seismic lines was produced using satellite imagery, which proved to be more accurate for existing disturbances.

Firstly, satellite imagery was used to identify linear disturbances likely to be legacy seismic lines within the Groundbirch area. The linear disturbances were compared to the BC legacy seismic line spatial data to confirm the disturbances were legacy seismic lines, and the remaining lines were eliminated. Finally, the legacy seismic lines spatial data was filtered using the same data sources and filters as listed in (Table 3). The new linear disturbances were used to create a map to guide the second round of air reconnaissance.

4.2 Field Reconnaissance Surveys

4.2.1 Air Reconnaissance Survey

An air reconnaissance survey was completed by helicopter on March 8th, 2022, and March 9th, 2022. The purpose of the air reconnaissance was to confirm the presence of the legacy seismic lines identified through the first spatial analysis. The following data was collected:

- Degree of natural revegetation.
- Tree species composition of the surrounding forest.
- Suitability for treatment.
- Access from the nearest road.
- A priority ranking from 1 to 4, based on the overall quality of the site for treatment was provided.

However, observations during air reconnaissance revealed the spatial data for the candidate legacy seismic line locations on the landscape were inaccurate. In both the Brassey and the Groundbirch areas, numerous legacy seismic lines in the spatial data were not visible on the landscape. Furthermore, the legacy seismic lines visible in the Brassey area had several land tenure conflicts and therefore, were not appropriate for restoration. As a result, the Brassey area was removed from the program.

Following, a second spatial review by satellite imagery, a second air reconnaissance survey was conducted on March 18, 2022. The data collected during the second air reconnaissance survey was reviewed and the 43 candidate legacy seismic lines with a priority rank of one (1) were selected as restoration candidates for the project.

4.2.2 Ground Reconnaissance Survey

Following the spatial analysis of the satellite imagery, a ground reconnaissance survey of the selected legacy seismic lines was planned. The timing of ground reconnaissance was originally planned to commence immediately following air reconnaissance surveys. Since the air reconnaissance surveys were completed in March 2022, the ground was frozen and covered in

snow, and the extent of natural revegetation was difficult to evaluate. Therefore, the ground reconnaissance was delayed until later in the season, immediately before live stake and eco-cultural seedling installation was to begin in June 2022.

A Vegetation Ecologist from the Silverberry team surveyed the legacy seismic lines on foot to evaluate the vegetation and condition of the line. This assessment aided the development of the treatment design. The Vegetation Ecologist also marked out the planting or staking locations on the legacy seismic line using flagging tape and points on Avenza maps for the Field Crews (Aski-Silverberry's Ecological Restoration Technicians and Field Leads) to guide their restoration activities.

4.2.3 Final Legacy Seismic Line Selection

Following the desktop spatial analysis and the air and ground reconnaissance, 37 legacy seismic lines in the Groundbirch area were selected for treatment. Figure 2 shows the final selection of the legacy seismic lines to be restored.

Figure 2. Final Selection of Legacy Seismic Lines Suitable for Restoration within the Groundbirch area and nearby Land Tenure Conflicts.

5 RESTORATION METHODS

Prescriptions for restoration efforts were based on a combination of available ecological data, Aski and Silverberry experience in the area, professional advice of both Biologists and Foresters familiar with the area, traditional knowledge, and restoration best practices and guidelines. Through use of these sources, it was determined live staking and planting eco-cultural seedlings were the techniques most ecologically appropriate, technically feasible, efficient, and likely to succeed within the project area.

5.1 Plant Prescriptions for Restoration

Revegetation treatments and species distribution assigned to each legacy seismic line were determined by a Vegetation Ecologist during ground reconnaissance site visits. The total quantity of live stakes to be installed and seedlings to be planted were determined during the project's proposal phase. Based on the legacy seismic line ecology and restoration logistics, the Vegetation Ecologist on site determined how to assign the plant species to each legacy seismic line.

Specifically, live staking was generally assigned to wider legacy seismic lines with less existing woody vegetation and canopy cover, with the intention of establishing tall woody debris quickly. For legacy seismic lines where a limited amount of woody vegetation had been established, eco-cultural seedling installation was prescribed for filling in the gaps between existing vegetation and increasing biodiversity. Plant species assigned to each legacy seismic line were selected based on soil moisture regime, soil nutrient regime, light availability, and slope aspect.

5.1.1 Planting Density

The average target planting density for the project was 2,500 stems/km. The planting density assumed an average legacy seismic line width of 10 m, to achieve planting densities of 1,500 stems/ha of trees and 1,000 steams/ha of shrubs. The target was used to determine the total target length of legacy seismic lines to be treated (32 km) and the total number of plants to be installed (80,000). While the average was intended to be 2,500 stems/km, the actual planting density for each legacy seismic line depended on the characteristics of each individual legacy seismic line: specifically, width of the line, degree of natural revegetation, and extent of canopy cover.

Planting density also varied along the length of each seismic line legacy seismic line, with higher density at the access points of the legacy seismic line and lower densities progressing towards the end of the line. The change in densities was to discourage line access and to promote revegetation in areas less likely to recover naturally. In Figure 3, the darker colors represent high density while lighter colors represent lower density.

Figure 3. Example of Plant Installation Density Along the Length of Legacy Seismic Lines.

5.1.2 Planting Distribution

Two different planting distributions were used during legacy seismic line plant installation: island and continuous (Figure 4). Island planting involved installing plants in clusters of a pre-determined size with regular size and spacing along the legacy seismic line. Continuous planting involved distributing plants with an even distribution and spacing along the legacy seismic line.

For legacy seismic lines where both live stake and eco-cultural seedling installation were prescribed, the two planting distributions were often used together. Combining the two planting distributions promotes canopy closure with islands of live stake species, while increasing biodiversity of the understory with planted seedlings.

Figure 4. Example of Island Planting Distribution.

5.1.3 Planting Design

The planting design refers to the plant species, density, and distribution assigned to each legacy seismic line or section of a legacy seismic line for restoration activities. The Vegetation Ecologist on site assigned the planting design for each legacy seismic line based on:

- Degree of natural revegetation and distribution of existing vegetation.
- Site conditions (slope, moisture and nutrient regime, shade, etc.).
- Natural vegetation of the surrounding forest.
- Access restrictions.
- Width of the legacy seismic line.

5.2 Live Stake Collection Methods

Prior to collecting live stakes, areas with the highest likelihood of locating high-quality live stakes were identified using spatial analysis of publicly available data. The goal of this analysis was to locate sites with young, healthy shrubs of the appropriate species in high densities to maximize harvesting efficiency. Access was also a major consideration in identifying sites, therefore, priority was assigned to roadside sites to facilitate efficient scouting and collection. This analysis was completed using the Government of BC's VRI data (Government of BC 2022b). Filters were applied as follows to identify appropriate sites:

- Sites containing VRI shrub data.
- BGC Zone: Boreal White and Black Spruce (BWBS).
- VRI dominant vegetation: St (Tall Shrub) and Sl (low shrubs).
- Vegetation height: 1.5-6m shrubs only.
- Crown closure: > 50%.

The results of the spatial analysis were used to target general areas during ground reconnaissance. In the VRI data, stands of appropriate shrubs were difficult to pinpoint at the desktop level, therefore the results were used as a guide to identify general vegetation communities where the desired shrub species were likely to be located during the scouting phase.

5.2.1 Live Stake Collection

Live stake collection was completed in four steps: scouting, harvesting, processing, and transportation and storage.

5.2.2 Live Stake Scouting

Scouting of the identified high-priority donor sites was completed immediately before collection to locate suitable individual stands for harvesting live stakes. Table 4 lists several factors considered in choosing suitable stands of appropriate species. A stand required at least 1,000 harvestable individual plants of one of the desired species to be considered suitable.

While red-osier dogwood (*Cornus sericea*) was originally part of the plan for live stake collection, it was later removed from the program. Upon further reconnaissance of the legacy seismic lines, it became apparent that live stakes of balsam poplar (*Populus tremuloides*) and willow species (*Salix spp.*) were better suited to the conditions of the selected seismic line sites than the red-osier dogwood species. Furthermore, since balsam poplar and willow species tend to grow taller, they were most likely to achieve the project goal of increasing canopy cover as opposed to red-osier dogwood. Consequently, live stakes of red-osier dogwood were neither collected nor installed.

In the Groundbirch area, scouting identified the [redacted].

Table 4. Live Stake Specifications.

Factors	Comments
Species	balsam poplar
	willow species
Age	Shrubs should be young (approximately 1-8 years old).
Size	Main stems of shrubs are 1 to 1.5 inches thick.
Growth Form	Shrubs should be growing straight (or have a straight portion of the stem long enough for harvesting).
	Shrubs should not have forks or crooks on the main stem.
	The minimum length for a live stake is 1 m.
Health	The shrub should be healthy (i.e., no signs of damage, pests, or disease on the bark).

5.2.3 Live Stake Harvesting

Once suitable stands were identified, the Field Crew (Ecological Restoration Technicians, Field Leads) with guidance from the Vegetation Ecologist, began harvesting by cutting appropriate shrubs using loppers or other cutting tools and transporting the live stakes to a central location for processing. Cuttings were taken from the main stem of the shrub (no side branches), which have a straight section, and were at least 1 m long. One Field Crew harvested the shrubs and laid the live stakes along the road, while a second Field Crew would collect, load, and transport the live stakes to a central processing location. Sustainable harvesting practices were followed; specifically, less than 30% of total shrub stems from each donor site were harvested.

Harvesting was completed while shrubs are dormant, either in the early spring before the shrubs thaw, or in the fall after the growing season has ended. Installation of live stakes should occur

shortly after harvesting as their viability decreases when stored for long periods of time. Harvesting for this project began in March 2022, with the intention of installation to follow immediately afterwards in April 2022 to May 2022.

5.2.4 Live Stake Processing

At the central processing location, Field Crews cut stakes from the harvested live stakes. Specifically, the side branches of shrubs were trimmed off the main stem as close to the main stem as possible. The main stems were cut to a specific length as directed by the Vegetation Ecologist on site each day (either 0.75, 1, or 1.25m). Cuts on both ends of the live stake were made at a 90-degree angle to avoid any sharp points. The live stakes were bundled into groups of 25, spray-painted in a colour indicating the species (blue for balsam poplar and white for willow species), and flagged. This colour-coding was to identify and distinguish the live stake species during later project phases.

5.2.5 Live Stake Transportation and Storage

At the end of every workday, bundles of live stakes were delivered to a refrigerated container for storage. Transportation and storage of the bundles was completed and overseen by the Aski Field Crew who were responsible for ensuring the container had sufficient fuel and was kept at an appropriate temperature (1-3°C).

5.3 Live Stake Installation Methods

Live stakes were installed between June 30th, 2022, and August 12th, 2022, by a Field Crew consisting of 6 to 10 Ecological Restoration Technicians, 2 Field Leads, and 1 Vegetation Ecologist. Installation was initially intended to begin immediately after collection in April or May but was postponed due to a delay in obtaining the required SUP.

5.3.1 Live Stake Installation

Prior to installation, live stakes were soaked in a nearby waterbody for at least 48 hours. The waterbodies were selected based on depth of the water, proximity to the installation sites, and ease of access. Live stake bundles were placed in the water with at least 30 cm of the bottom ends submerged. To prevent excessive drying of the upper ends, the bundles were kept in the shade when possible or covered in silvicool tarps.

Prior to installation, the Vegetation Ecologist would mark live stake bundle cache locations along the legacy seismic line using flagging tape, and instruct the Field Crew on the number of live stakes to be delivered to each cache location according to the planting design. Firstly, the bottom end of the live stake was cut off (about 1 to 2 inches removed) at a 45° angle, and inserted into a hole 30-50 cm in depth, which was dug perpendicular to the ground surface. The live stake was then secured in the ground by pounding the soil around the hole to fill gaps around the live stake. The top end of the live stake was cut at a 90° angle, leaving 50 cm of the live stake exposed above the ground surface. The exposed cut was painted with a 1:1 mixture of latex paint and water to seal it, preventing disease and desiccation.

5.4 Eco-cultural Seedling Installation Methods

The eco-cultural seedlings were stored in the same refrigerated container as the live stakes. Eco-cultural seedlings are more susceptible to damage when left in storage for prolonged periods of time. Therefore, the eco-cultural seedlings were installed immediately, and the live stake installation was resumed after all seedlings were installed. Upon receiving the seedlings from the nursery, prior to being placed into storage in the refrigerated container, a digital Stock Assessment data sheet (Appendix A) was completed for one box of each of the plant species received to ensure the quality of the seedlings.

Because the seedlings were received from PRT nursery, Industrial Forestry Service (IFS) nursery and Twin Sisters Native Plant Nursery at different times, the installation of the eco-cultural seedling occurred in two separate planting sessions. Conifer seedlings were received from PRT nursery and IFS nursery on June 30th, 2022 and July 4th, 2022 (Table 5) and the first seedling installation started on July 8th, 2022 and was completed as of August 23rd, 2022. Table 5 lists the species from IFS nursery and PRT nursery.

Table 5. Eco-Cultural Seedling Species from IFS and PRT Nursery

Nursery	Species Common Name	Species Scientific Name	Quantity
IFS Nursery	white spruce	*Picea glauca*	10,944
PRT Nursery	lodgepole pine	*Pinus contorta*	7,980

The seedlings from Twin Sisters Native Plant Nursery were received on August 14th, 2022. The species received during this phase were more diverse and included deciduous native plant species (Table 6). These plants were installed between August 16th, 2022 and August 23rd, 2022.

Table 6. Eco-Cultural Seedling Species from Twin Sisters Native Plant Nursery

Species Common Name	Species Scientific Name	Quantity
paper birch	*Betula papyrifera*	2,700
white spruce	*Picea glauca*	3,300
black spruce	*Picea mariana*	630
lodgepole pine	*Pinus contorta*	1,080
balsam poplar	*Populus balsamifera*	2,340
trembling aspen	*Populus tremuloides*	3,510
mountain alder	*Alnus incana ssp. Tenuifolia*	3,510
red-osier dogwood	*Cornus sericea*	4,950
Bebb's willow	*Salix bebbiana*	8,100
serviceberry willow	*Salix pseudomonticola*	540

Prior to installation, the Vegetation Ecologist would mark the eco-cultural seedling cache locations along the legacy seismic line using flagging tape. The Field Crew installed seedlings along the legacy seismic lines in accordance with the planting design developed by the Vegetation Ecologist. Using a planting shovel, the Field Crew planted the seedlings deep enough for the entire root plug to be covered with soil, and then secured the seedling.

5.5 Monitoring

The goal of the monitoring program was to provide a visual record of the treated legacy seismic lines to track changes in canopy cover, species richness, distribution, and the progression of revegetation following treatment. Permanent photo monitoring stations were installed on the legacy seismic lines that received live stakes or eco-cultural seedlings as treatments. Photo plots at monitoring stations were located strategically to obtain representative photos of the site. The monitoring plot locations are permanent, therefore in subsequent years, the treated legacy seismic lines can be revisited and the progress of revegetation can be compared over time.

5.5.1 Field Monitoring Methods

5.5.2 Photo Plot Locations

The location of the photo plot was marked with a metal stake and flagging tape. Additional flagging was placed in a nearby tree to help locate the metal stake for future monitoring visits. Legacy seismic lines typically had 3 photos recorded at two locations (Table 7). For some legacy seismic lines, additional photo monitoring plots may be necessary. For legacy seismic lines where there was no clear access point (e.g., when one legacy seismic line leads into another), Location 1 was omitted. All photos were taken at an angle parallel to the ground and the photo monitor held the camera 1.5 m off the ground.

Table 7. Monitoring Program Photos

Photo Number	Location	Direction of Photo
1	Legacy seismic line access point.	Taken 5 m back from the edge of the legacy seismic line (e.g., where a legacy seismic line is accessed from a road right-of-way, the plot will be located within the road right-of-way to obtain a view of the end of the legacy seismic line). The photo was taken towards the legacy seismic line to give a full view of the access point.
2	Strategically selected location representative of the legacy seismic line treatment, at least 100 m from the access point.	Taken from the center of the line with a line of sight parallel to the edge of the legacy seismic line, facing **away from** the access point.
3		Taken from the center of the line with a line of sight parallel to the edge of the legacy seismic line, facing **towards** the access point.

Figure 5. Monitoring Plot Locations Along a Legacy Seismic Line.

5.5.3 Photo Monitoring Data Collection

At each photo monitoring station, data was collected digitally using the Fulcrum mobile application. A digital data form was created in Fulcrum, and the mobile application allowed photos to be attached. The following information was recorded at each photo monitoring station:

- Date and time (recorded automatically in Fulcrum)
- Location (recorded automatically in Fulcrum)
- Site number (legacy seismic line number)
- Photo Plot Number
- Photos
- Optional: Additional remarks

An example of the photo data collected during photo monitoring for one legacy seismic line can be found in Appendix B.

6 QUALITY CONTROL

Quality control is a very important aspect of this program. The following quality control methods were employed throughout the entire program to ensure that the highest quality of work was completed (Table 8).

Table 8. Quality Control Methods and Details

Quality Control Method	Responsible Party	Method Details
Continual Guidance and Supervision	Vegetation Ecologist	Before collecting, installation, or planting, the Vegetation Ecologist would review protocol for conducting the work with the Ecological Restoration Technicians and Field Leads. While in the field, Ecological Restoration Technicians were under constant supervision by the on-site Vegetation Ecologist. The Vegetation Ecologist monitored collection, installation, and planting techniques and answered any questions the Ecological Restoration Technicians had.
Continual Guidance and Supervision	Field Lead	The Field Lead was responsible for making sure the Ecological Restoration Technicians were conducting the work at the highest quality while also being efficient. Under directions from the Vegetation Ecologist, the Field Lead provided the same continuous guidance and supervision to the Ecological Restoration Technicians during collection, installation, and planting. The Field Lead and Vegetation Ecologist had frequent discussions to offer consistent advice to the Ecological Restoration Technicians.
Periodic Audits	Vegetation Ecologist	At least once per day, the Vegetation Ecologist conducted an audit on the work being completed. For live stake collection, the Vegetation Ecologist inspected the processed live stakes and pulled out any unacceptable stakes to be re-cut or discarded. For live stake and eco-cultural seedling installation, the Vegetation Ecologist made sure the live stakes or seedlings were installed properly; any unacceptable stakes or seedlings would then be reinstalled.

7 RESTORATION AND MONITORING SUMMARY

7.1 Live Staking and Native Plant Installation and Monitoring Summary

Of the 43 candidate legacy seismic lines selected for the project during reconnaissance, 37 received treatment. Figure 6 shows the treatments delivered to each of the restored legacy seismic lines. Sections 7.1.1 to 7.1.37 contain summaries of the treatments for each legacy seismic line. A shapefile with data summarizing legacy seismic line treatments is also provided with this report. A table of the attributes associated with the shapefile is included in Appendix C.

Of the legacy seismic lines originally selected for the project, 6 did not receive any treatment for various reasons. Specifically, legacy seismic lines A23 and A24 had no live stakes or eco-cultural seedlings installed because, during ground reconnaissance in June 2022, the extent of the natural vegetation growth revealed further planting would not improve the overall biodiversity or assist with canopy closure. Furthermore, trying to access A23 and A24 legacy seismic lines would likely damage the existing vegetation. Legacy seismic lines A09, A10, A11, and A43 were not accessible at the time of plant installation because the right-of-way of an active pipeline construction project was blocking the access point for those sites. Alternative access was attempted for lines A11 and A43 from the east, but steep slopes and wetland areas prevented access. Finally, legacy seismic line A36 does not exist and was introduced to the list of sites due to a numbering error.

All plant species common and scientific names listed in the summaries below were retrieved from the Government of BC's *Conservation Data Centre's BC Species & Ecosystems Explorer* (2022a).

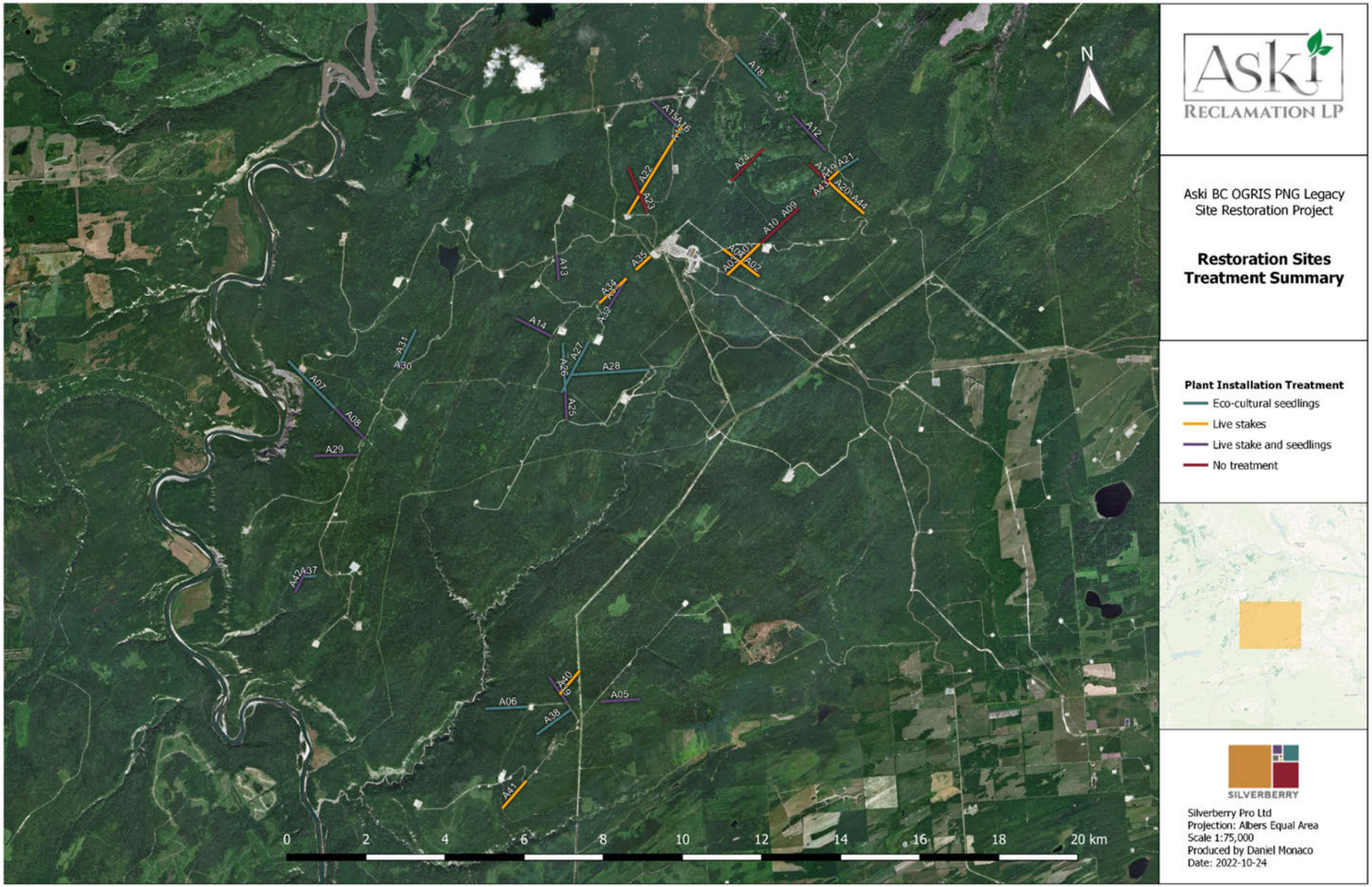

Figure 6. Restoration Site Treatment Summary.

7.1.1 Legacy Seismic Line Treatment Summary: A01

[redacted]	[redacted]
Length of Legacy Seismic Line	0.64 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	900

Figure 7. Legacy Seismic Line A01.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	900
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.2 Legacy Seismic Line Treatment Summary: A02

[redacted]	[redacted]
Length of Legacy Seismic Line	0.56 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	300

Figure 8. Legacy Seismic Line A02.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	300
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.3 Legacy Seismic Line Treatment Summary: A03

[redacted]	[redacted]
Length of Legacy Seismic Line	0.43 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	600

Figure 9. Legacy Seismic Line A03.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	600
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.4 Legacy Seismic Line Treatment Summary: A04

[redacted]	[redacted]
Length of Legacy Seismic Line	0.51 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	700

Figure 10. Legacy Seismic Line A04.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	700
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.5 Legacy Seismic Line Treatment Summary: A05

[redacted]	[redacted]
Length of Legacy Seismic Line	0.94 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	3590

Figure 11. Legacy Seismic Line A05.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with eco-cultural seedlings installed in a continuous distribution between. Live stakes installed in higher density at the end of the line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart; Seedling planting density: 0.83 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	1250
Planted Eco-Cultural Seedlings	mountain alder	*Alnus incana ssp. Tenufolia*	720
	paper birch	*Betula papyrifera*	630
	black spruce	*Picea mariana*	630
	serviceberry willow	*Salix pseudomonticola*	360

7.1.6 Legacy Seismic Line Treatment Summary: A06

[redacted]	[redacted]
Length of Legacy Seismic Line	1.01 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	1440

Figure 12. Legacy Seismic Line A06.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.47 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	mountain alder	*Alnus incana ssp. Tenufolia*	180
	balsam poplar	*Populus balsamifera*	810
	Bebb's Willow	*Salix bebbiana*	450

7.1.7 Legacy Seismic Line Treatment Summary: A07

Figure 13. Legacy Seismic Line A07.

[redacted]	[redacted]
Length of Legacy Seismic Line	1.67 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	2100

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.42 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	lodgepole pine	*Pinus contorta*	2100

7.1.8 Legacy Seismic Line Treatment Summary: A08

Figure 14. Legacy Seismic Line A08.

[redacted]	[redacted]
Length of Legacy Seismic Line	1.06 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	2754

Treatment Description:

Planting Installation Design	Eco-cultural seedlings planted with a continuous distribution; live stakes installed in high density at entrance to restrict access.
Installation Specifications	Seedling planting density: 0.72 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	450
Planted Eco-Cultural Seedlings	white spruce	*Pinus glauca*	2304

7.1.9 Legacy Seismic Line Treatment Summary: A12

[redacted]	[redacted]
Length of Legacy Seismic Line	1.16 km
Approx. Width	10 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	4330

Figure 15. Legacy Seismic Line A12.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with eco-cultural seedlings in a continuous distribution installed in between.
Installation Specifications	Islands: 50 live stakes per island, spaced 10 m apart; Seedling planting density: 0.21 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	1500
	willow species	*Salix spp.*	400
Planted Eco-Cultural Seedlings	white spruce	*Picea glauca*	900
	lodgepole pine	*Pinus contorta*	810
	balsam poplar	*Populus balsamifera*	540
	serviceberry willow	*Salix pseudomonticola*	180

7.1.10 Legacy Seismic Line Treatment Summary: A13

[redacted]	[redacted]
Length of Legacy Seismic Line	0.60 km
Approx. Width	5 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	1740

Figure 16. Legacy Seismic Line A13.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at end to restrict access.
Installation Specifications	Seedling planting density: 0.48 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	300
Planted Eco-Cultural Seedlings	white spruce	*Picea glauca*	1440

7.1.11 Legacy Seismic Line Treatment Summary: A14

[redacted]	[redacted]
Length of Legacy Seismic Line	0.99 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	1890

Figure 17. Legacy Seismic Line A14.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at end to restrict access.
Installation Specifications	Seedling planting density: 0.48 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	450
Planted Eco-Cultural Seedlings	white spruce	*Picea glauca*	1440

7.1.12 Legacy Seismic Line Treatment Summary: A15

Figure 18. Legacy Seismic Line A15.

[redacted]	[redacted]
Length of Legacy Seismic Line	0.75 km
Approx. Width	5 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	2570

Treatment Description:

Planting Installation Design	Live stakes installed in islands with eco-cultural seedlings installed in a continuous distribution in between.
Installation Specifications	Islands: 50 live stakes per island, spaced 10 m apart; Seedling planting density: 0.39 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	1100
Planted Eco-Cultural Seedlings	paper birch	*Betula papyrifera*	270
	white spruce	*Picea glauca*	1200

7.1.13 Legacy Seismic Line Treatment Summary: A16

[redacted]	[redacted]
Length of Legacy Seismic Line	0.28 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	1260

Figure 19. Legacy Seismic Line A16.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 1.49 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	trembling aspen	*Populus tremuloides*	1260

7.1.14 Legacy Seismic Line Treatment Summary: A17

[redacted]	[redacted]
Length of Legacy Seismic Line	0.44 km
Approx. Width	5 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	1750

Figure 20. Legacy Seismic Line A17.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 50 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	1750
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.15 Legacy Seismic Line Treatment Summary: A18

[redacted]	[redacted]
Length of Legacy Seismic Line	1.10 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	4860

Figure 21. Legacy Seismic Line A18.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 1.47 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	red-osier dogwood	*Cornus sericea*	4860

7.1.16 Legacy Seismic Line Treatment Summary: A19

[redacted]	[redacted]
Length of Legacy Seismic Line	0.39 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	600

Figure 22. Legacy Seismic Line A19.

Treatment Description:

Planting Installation Design	Live stakes installed in high density at ends to restrict access.
Installation Specifications	High density island at access points.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	600
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.17 Legacy Seismic Line Treatment Summary: A20

Figure 23. Legacy Seismic Line A20.

[redacted]	[redacted]
Length of Legacy Seismic Line	0.70 km
Approx. Width	10 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	4150

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 50 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	4150
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.18 Legacy Seismic Line Treatment Summary: A21

[redacted]	[redacted]
Length of Legacy Seismic Line	0.53 km
Approx. Width	5 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	1800

Figure 24. Legacy Seismic Line A21.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.68 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	mountain alder	*Alnus incana ssp. Tenufolia*	450
	paper birch	*Betula papyrifera*	900
	Bebb's willow	*Salix bebbiana*	450

7.1.19 Legacy Seismic Line Treatment Summary: A22

[redacted]	[redacted]
Length of Legacy Seismic Line	2.08 km
Approx. Width	5 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	1950

Figure 25. Legacy Seismic Line A22.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 50 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	Salix spp.	1950
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.20 Legacy Seismic Line Treatment Summary: A25

[redacted]	[redacted]
Length of Legacy Seismic Line	0.65 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	2940

Figure 26. Legacy Seismic Line A25.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with eco-cultural seedlings installed in between the live stakes in a continuous distribution. Live stakes installed in high density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart; Seedling planting density: 0.74 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	1500
Planted Eco-Cultural Seedlings	paper birch	*Betula papyrifera*	270
	white spruce	*Picea glauca*	900
	lodgepole pine	*Pinus contorta*	270

7.1.21 Legacy Seismic Line Treatment Summary: A26

[redacted]	[redacted]
Length of Legacy Seismic Line	1.17 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	No
Total Installed Stem Count	2016

Figure 27. Legacy Seismic Line A26.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.57 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	white spruce	*Picea glauca*	2016

7.1.22 Legacy Seismic Line Treatment Summary: A27

[redacted]	[redacted]
Length of Legacy Seismic Line	1.42 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	No
Total Installed Stem Count	2016

Figure 28. Legacy Seismic Line A27.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.47 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	white spruce	*Picea glauca*	2016

7.1.23 Legacy Seismic Line Treatment Summary: A28

[redacted]	[redacted]
Length of Legacy Seismic Line	1.94 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	5040

Figure 29. Legacy Seismic Line A28.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.87 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	Bebb's willow	*Salix bebbiana*	5040

7.1.24 Legacy Seismic Line Treatment Summary: A29

[redacted]	[redacted]
Length of Legacy Seismic Line	1.08 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	3018

Figure 30. Legacy Seismic Line A29.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at entrance to restrict access.
Installation Specifications	Seedling planting density: 0.80 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	450
Planted Eco-Cultural Seedlings	white spruce	*Picea glauca*	1728
	lodgepole pine	*Pinus contorta*	840

7.1.25 Legacy Seismic Line Treatment Summary: A30

[redacted]	[redacted]
Length of Legacy Seismic Line	0.21 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	870

Figure 31. Legacy Seismic Line A30.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at entrance to restrict access.
Installation Specifications	Seedling planting density: 0.66 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	450
Planted Eco-Cultural Seedlings	lodgepole pine	*Pinus contorta*	420

7.1.26 Legacy Seismic Line Treatment Summary: A31

[redacted]	[redacted]
Length of Legacy Seismic Line	1.03 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	No
Total Installed Stem Count	1680

Figure 32. Legacy Seismic Line A31.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.55 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	lodgepole pine	*Pinus contorta*	1680

7.1.27 Legacy Seismic Line Treatment Summary: A32

Figure 33. Legacy Seismic Line A32.

[redacted]	[redacted]
Length of Legacy Seismic Line	0.44 km
Approx. Width	5 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	1800

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.82 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	trembling aspen	*Populus tremuloides*	1080
	Bebb's willow	*Salix bebbiana*	720

7.1.28 Legacy Seismic Line Treatment Summary: A33

[redacted]	[redacted]
Length of Legacy Seismic Line	0.80 km
Approx. Width	5 m
OHV Trail Present	Yes
High-Density Staking at Line Access	No
Total Installed Stem Count	1220

Figure 34. Legacy Seismic Line A33.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with eco-cultural seedlings installed in continuous distribution in between.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart; Seedling planting density: 0.18 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	500
Planted Eco-Cultural Seedlings	mountain alder	*Alnus incana ssp. Tenufolia*	360
	trembling aspen	*Populus tremuloides*	360

7.1.29 Legacy Seismic Line Treatment Summary: A34

[redacted]	[redacted]
Length of Legacy Seismic Line	0.87 km
Approx. Width	8 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	2450

Figure 35. Legacy Seismic Line A34.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 50 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	2450
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.30 Legacy Seismic Line Treatment Summary: A35

[redacted]	[redacted]
Length of Legacy Seismic Line	0.44 km
Approx. Width	10 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	2400

Figure 36. Legacy Seismic Line A35.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 50 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	willow species	*Salix spp.*	2400
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.31 Legacy Seismic Line Treatment Summary: A37

[redacted]	[redacted]
Length of Legacy Seismic Line	0.30 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	2280

Figure 37. Legacy Seismic Line A37.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 2.57 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	mountain alder	*Alnus incana ssp. Tenufolia*	990
	red-osier dogwood	*Cornus sericea*	90
	white spruce	*Picea glauca*	300
	trembling aspen	*Populus tremuloides*	810
	Bebb's willow	*Salix bebbiana*	90

7.1.32 Legacy Seismic Line Treatment Summary: A38

[redacted]	[redacted]
Length of Legacy Seismic Line	1.01 km
Approx. Width	3 m
OHV Trail Present	No
High-Density Staking at Line Access	No
Total Installed Stem Count	2610

Figure 38. Legacy Seismic Line A38.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings installed in a continuous distribution throughout the line.
Installation Specifications	Seedling planting density: 0.86 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	N/A	N/A	N/A
Planted Eco-Cultural Seedlings	mountain alder	*Alnus incana ssp. Tenufolia*	810
	balsam poplar	*Populus balsamifera*	990
	Bebb's willow	*Salix bebbiana*	810

7.1.33 Legacy Seismic Line Treatment Summary: A39

[redacted]	[redacted]
Length of Legacy Seismic Line	0.74 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	2170

Figure 39. Legacy Seismic Line A39.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with eco-cultural seedlings installed in continuous distribution in between. Live stakes installed in high density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart; Seedling planting density: 0.52 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	1000
Planted Eco-Cultural Seedlings	paper birch	*Betula papyrifera*	630
	Bebb's willow	*Salix bebbiana*	540

7.1.34 Legacy Seismic Line Treatment Summary: A40

[redacted]	[redacted]
Length of Legacy Seismic Line	0.71 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	1800

Figure 40. Legacy Seismic Line A40.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	550
	willow species	*Salix spp.*	1250
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.35 Legacy Seismic Line Treatment Summary: A41

[redacted]	[redacted]
Length of Legacy Seismic Line	0.86 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	1800

Figure 41. Legacy Seismic Line A41.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at both ends of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	1800
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.1.36 Legacy Seismic Line Treatment Summary: A42

[redacted]	[redacted]
Length of Legacy Seismic Line	0.63 km
Approx. Width	3 m
OHV Trail Present	Yes
High-Density Staking at Line Access	Yes
Total Installed Stem Count	3390

Figure 42. Legacy Seismic Line A42.

Treatment Description:

Planting Installation Design	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at end to restrict access.
Installation Specifications	Seedling planting density: 1.55 stems/m^2

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	450
Planted Eco-Cultural Seedlings	lodgepole pine	*Pinus contorta*	2940

7.1.37 Legacy Seismic Line Treatment Summary: A44

[redacted]	[redacted]
Length of Legacy Seismic Line	0.48 km
Approx. Width	5 m
OHV Trail Present	No
High-Density Staking at Line Access	Yes
Total Installed Stem Count	750

Figure 43. Legacy Seismic Line A44.

Treatment Description:

Planting Installation Design	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.
Installation Specifications	Islands: 25 live stakes per island, spaced 10 m apart.

Species Installed:

Treatment	Common Name	Scientific Name	Quantity
Live Stakes	balsam poplar	*Populus balsamifera*	750
Planted Eco-Cultural Seedlings	N/A	N/A	N/A

7.2 Creation of Shapefiles and Attribute Tables

The shapefiles were created in a program called QGIS. Initially, the legacy seismic lines selected for the project were added and were then followed by the restoration activities. Specifically, progress was spatially tracked for:

- Reconnaissance data
- Final selection
- Stake scouting
- Location of sites harvested for live stakes
- Monitoring data (collected using the Fulcrum app)

The spatial data was compiled at the end of the project and organized into summary tables. The summary tables were joined with the legacy seismic line shapefiles and included with the final project summary and exported in an ESRI .shp file format.

8 CAPACITY BUILDING

Capacity building was done at every phase of the project, starting with the preliminary planning and logistical preparation process. The Silverberry team collaborated with and provided capacity building support to the Aski team in order to obtain project permits and plan project execution. Capacity building goals for the planning phase of the project are outlined in Table 9.

Table 9. Capacity Building Goals for Phase 1

Phase 1: Planning (18 Individuals)	
Capacity Building Goal	**Accomplishment**
BEC Classification knowledge.	Due to the Aski team's technical staffing and resources during the planning phase of the project, opportunities for training on BEC classification were limited.
Training on Special Use Permit Requirements and General Tenure Processes.	Two members of the Silverberry team held two meetings with a designated member of the Aski team to review SUP requirements, discuss general tenure processes and develop a list of questions for FLNROD regarding the permit requirements and processes. Meetings not only provided opportunities for feedback, but also offered training opportunities for SUP planning. SUP application documents were shared between the Aski-Silverberry team for continued learning and collaboration.
Review of acts, regulations and other permits that may be applicable to the program.	Acts, regulations and other required permits were reviewed during Silverberry led permitting meetings with the Aski team. During these meetings, applicable regulations were discussed and the need for a Section 52 authorization was reviewed. Based on

	meeting discussions and email correspondence, the Aski team provided feedback and suggestions related to applicable permits and regulations.
Entry level to stakeholder engagement.	The Silverberry team offered support and guidance for stakeholder engagement to the Aski team. The Silverberry team worked with the Aski team to develop a comprehensive Stakeholder Information Package and supported stakeholder outreach including emailing, mailing and phone calls. The Silverberry team provided training on stakeholder engagement and the best approach to adequate consultation.
Entry level to understanding GIS Layers and Attributes.	Due to the Aski team's technical staffing and resources during the planning phase of the project, opportunities for training on GIS layers and attributes was limited.
Gain understanding of performance indicators and land use capacity objectives.	The Aski-Silverberry team developed a presentation related to the project objectives and methodology for the Saulteau First Nations TREP Branch. During this meeting, Saulteau First Nations' performance indicators and capacity objectives were discussed, noted and incorporated within the project; mostly related to the types of eco-cultural seedlings to be installed. The Silverberry team supported the Aski team with presentation and PowerPoint development.
Assist and train in program coordination, organization, and logistical preparation.	The Aski-Silverberry team collaborated in program coordination and logistical preparation including scheduling and seedling management. One Silverberry team member provided 1-on-1 training with an Aski team member to review best approaches for seedling management and tracking.
Review and engage in Heath and Safety (HSE) Planning for the program to help understand risks field staff may encounter and supervisor responsibilities.	Silverberry and Aski each have their own internal HSE processes. Aski's HSE program is comprehensive and well-established so Capacity Building was not required.

Phase 2 of the program consisted of field work for the execution of live stakes and eco-cultural seedling installation. Capacity Building for this phase involved training sessions led by the Silverberry team as new tasks were introduced, as well as on-the-job training as the work was being executed. Goals for the field phase of the program are outlined in Table 10.

Table 10. Capacity Building Goals for Phase 2

Phase 2: Field Work (26 Individuals)	
Capacity Building Goal	**Accomplishment**
Review and Implementation of Health and Safety Program Plan.	Aski employees were included and encouraged to participate in daily Health and Safety meetings with the Silverberry Field Crew.
Safe work team training on the Technical Procedures for field related tasks and activities.	Instruction provided by Silverberry's professional staff to the rest of the team, including Aski employees, regarding safe work practices during each new task. Silverberry Field Lead and Vegetation Ecologist also provided mentorship and supervision in the field to further reinforce safe work practices.
Plant identification and general understanding of plant ecology to help with microsite selection.	Silverberry provided instruction at the beginning of the live stake collection, live stake installation, and eco-cultural seedling installation on plant identification and ecology. Additional information was provided from the Vegetation Ecologist to members of the Field Crew on an ongoing and individual basis to help improve planting technique and knowledge.
On-the-job training of basic field skills including field preparation requirements, driving requirements within the Groundbirch Asset, radio calling, field navigation and orientation, creating systematic efficient working routines, and introduction to new field tools and proper usage.	Aski employees received on-the-job training from Aski supervisors, as well as Silverberry's Field Lead and Vegetation Ecologist for each of the tasks listed in this Capacity Building Goal.

Throughout the final phase (Phase 3) of the program, the reporting phase, Aski's employees were to be trained and mentored for data collection, data management, and report writing by the Silverberry team. Silverberry and Aski's Field Leads collaborated for tracking daily progress and communicating daily field information to the Vegetation Ecologist who was responsible for recording the information. Aski employees were intended to participate in the monitoring program to gain experience with field data collection. However, due to a lack of staff availability during the establishment of the monitoring plots, this opportunity was missed. Capacity building goals and accomplishments in Phase 3 are summarized in

Table 11.

Table 11. Capacity Building Goals for Phase 3

Phase 3: Reporting (12 Individuals)	
Capacity Building Goal	**Accomplishment**
Field data collection skills.	Aski employees assisted with tracking live stakes and eco-cultural seedlings in the field during collection and installation. Silverberry's Vegetation Ecologist provided assistance and recommendations for effective and efficient data collection.
Field data entry.	Field data entry was complete while establishing monitoring plots, which was executed by Silverberry staff.
Basic report writing.	Aski employees had a working session with Silverberry's Vegetation Ecologist to review the reporting process and provide input. Aski employees were also guided to support the writing of a section within the report, Lessons Learned, to practice report writing.
Basic legislative reporting requirements.	Not applicable. Closure reporting for SUP not required.
Participate in Lesson's Learned directly with managers to record their own experience, as well as participate on management team's Lesson's Learned to understand the larger picture.	Aski and Silverberry each held their Lessons Learned meetings internally. The Aski team agreed that live stake collection would be more efficient if scouting was done further in advance and smaller diameter stakes were collected. As well, the Aski team saw value in having Aski Field Leads in the field on future projects.
Learn about adaptive management approaches, and other similar restoration activities ongoing within the province that may have used different techniques and had different outcomes.	Adaptive management was practiced at every stage of this project, by adjusting plans and methods to needs of the project as it progressed. Changes to plans were discussed between the Aski and Silverberry teams at every stage to collaboratively determine solutions, drawing on knowledge of similar restoration work to make informed decisions.
Participate in program debrief to set long-term career goals for each individual and investigate further available training for Aski opportunities to achieve further exposure.	Program debrief meeting with Saulteau First Nations Treaty Right and Environmental Protection will be scheduled for November 2022. Additionally, the Aski team had an internal program debrief where career goals and additional career training was discussed and the team identified the following as additional training opportunities they would be interested in: • Further training on ecology, restoration, and reclamation • Land and water resources diploma • Environmental monitoring • Site supervisor training • Construction safety training

In addition to Capacity Building, the Aski-Silverberry Field Crew received on-going training as they were learning or executing new tasks and techniques. Throughout the duration of the project, a total of 28 staff members received or were involved in a form of relevant training. Table 12 provides a summary of the training delivered to all staff members involved in the project.

Table 12. Summary of Staff Training.

Training Received	Total Number of Members/Staff Trained
Training on Special Use Permit requirements and general tenure processes. This training was led by the Silverberry team and was ongoing from February to April 2022.	2
Members of the Aski-Silverberry Field Crew participated in a three-day training course titled 'Plant Camp', developed and taught by the Silverberry team. The course focused on plant identification and ecology, as well as techniques for live stake collection, live stake installation, and eco-cultural seedling installation. Within the 'Plant Camp' curriculum, Field Crews were also provided training on basic field skills including field preparation, driving on radio-controlled roads, navigation, and safe use of field tools. The 'Plant Camp' training occurred in March 2022 and materials and concepts taught were revisited throughout the duration of the project.	26
Members of the Aski-Silverberry Field Crew were provided on-the-job instruction for live stake and eco-cultural seedling installation. Throughout the project, the Silverberry team, primarily Silverberry's Vegetation Ecologist, provided scaffolded learning that built on previous knowledge developed through 'Plant Camp'. Learning provided was a mix of group instruction as the Field Crew was introduced to new tasks, and one-on-one guided learning while executing field work.	26
Members of both the Silverberry and Aski team were included and provided training in the data management and reporting process of the project. Under the oversight of Silverberry's Vegetation Ecologist, team members received an introduction to downloading, organizing, and summarizing data, as well as presenting results in a report. They also received ongoing feedback and instruction. This training occurred in October 2022.	5

9 RECOMMENDATIONS

9.1 Lessons Learned and Adaptive Management

Eco-cultural restoration of legacy seismic lines through live stake and eco-cultural seedling installation remains a relatively new method of restoration work. Currently, there is a considerable lack of clear guidelines on best practices and methodologies; as a result, opportunities for learnings throughout each phase of the program exists. Notable lessons learned identified by the Aski-Silverberry team are summarized in Table 13 below:

Table 13. Lessons Learned

Project Phase	Lesson Learned
Planning and Permitting	The review and approval process for the SUP was much longer than anticipated. Consequently, the permit caused significant project delays which had cascading effects on all aspect of the project. If permitting is required, a longer timeframe should be expected when planning project timelines (8-12 months).
	The Section 52 Authorization Form was required to collect live stakes. The permit was granted just in time to start collection at the intended start date, however, the timelines outlined in the permit resulted in a tight timeframe for collection completion. In the future, it is recommended that applications for the Section 52 Authorization Form are submitted in advance of the anticipated start date. Likewise, it is recommended, requests for authorization are made for longer periods of time to ensure sufficient timeframes for collection.
Consultation and Engagement	Communities and stakeholders who may be impacted by project activities should be engaged 6 months prior to the anticipated field work start date. It is recommended that stakeholders are contacted a minimum of 3 times using various mediums (phone, mail, email) to maximize opportunities for engagement. Town hall meetings to explain projects to stakeholders may also be valuable to ensure all stakeholders understand project areas, impacts, and objectives.
	To ensure the general public is aware of the work being completed and to encourage respect for the restoration underway, signage should be installed at the entrance of legacy seismic lines at the same time plant installation is conducted.
Site Selection	Publicly available spatial data will only provide a limited understanding of the project area, therefore, final site selection requires extensive field verification. Additional ground reconnaissance would have allowed finalization of site selection earlier.
	Timing of field reconnaissance is important for understanding the existing vegetation on a legacy seismic line. Air and ground reconnaissance completed in the previous year, preferably in the fall, would have been more informative in obtaining a comprehensive snapshot of the vegetation

	community. In future projects of this size, it is recommended that the reconnaissance be complete the year prior to the anticipated start date.
	Eliminate legacy seismic lines with active OHV trails during ground reconnaissance to prevent increased risk for damage of live stakes and eco-cultural seedlings. During signage installation, 5 out of 18 (A05, A29, A39, A40, & A42) restored legacy seismic lines visited had notable damage to newly installed live stakes and eco-cultural seedlings. These 5 legacy seismic lines appeared to be used as active OHV trails.
	Aerial imagery is often outdated and inaccurate making the use of desktop analysis less effective on its own. This was particularly ineffective when identifying live stake collection sites since the desired age range of the species to collect was younger than what is captured in aerial imagery or available vegetation data. Site selection using desktop analysis should be used in combination with ground reconnaissance and local knowledge.
Field Work	Live stakes can only be stored for a limited amount of time after collection. Permitting delays resulted in live stakes being stored for two to three months in a refrigerated container before installation, resulting in growth and mold. Storage time should be limited as much as possible, and live stakes should be installed immediately after collection where practical.
	The refrigerated container requires daily maintenance and must be checked for fuel and proper temperature. Project delays meant that installation occurred during the warmer months of the summer, so extra attention was needed to maintain the appropriate storage temperature for the live stakes.
	Live stakes must be soaked in water before installation and requires finding suitable waterbodies. These waterbodies are not always close to the legacy seismic lines being treated, so additional time should be planned for travel.
	It was assumed all legacy seismic lines to be treated for this project would be UTV accessible, but that was not the case. This meant that the Field Crew were sometimes required to carry equipment into the legacy seismic line on foot; on some occasions, up to 1 km from the road. This meant the work was more physically demanding than anticipated requiring additional time for installation activities and further Health and Safety oversight.
	The Field Crew used different techniques for live stake installation in order to determine which was the most efficient. The most productive method was to install live stakes using a combination of a specialized pilot hole tool and hammer drills attached to small generators.

In summary, the most significant takeaways from the lessons learned throughout this project includes the need for additional time to collect data, apply for permits, and conduct site reconnaissance.

To ensure optimal success of legacy seismic line restoration, several methods for stakeholder engagement and information dissemination is recommended. Specifically, it is recommended that 3 or more engagement attempts to stakeholders are completed and several contact methods are utilized including phone calls, emails, mail and signage for public visibility and increased

information dissemination. Stakeholder engagement for this project was comprehensive and involved 2 or more contact attempts through several mediums (phone, email, mail), and public signage was posted at the entrances of legacy seismic lines with notable public trail intersections.

Overall, the Aski-Silverberry team learned several valuable lessons over the course of this project which will result in greater efficiency in future legacy seismic line restoration projects.

9.2 Sites for Future Treatment

Aski and Saulteau First Nations' goal for restoration is area-based closure in the Groundbirch and Brassey areas. Focusing efforts within this culturally significant area will have a great ecological impact for a heavily disturbed ecosystem. Moving forward, further restoration work can be completed in this area to enhance vegetation recovery.

The focus of this project was upland legacy seismic lines within the Groundbirch area, due to accessibility and chances of greatest success. Future years should expand to target wetland legacy seismic lines which were eliminated in the early stages of planning this year. Legacy seismic lines were also eliminated in the Brassey area due to high levels of natural revegetation. However, additional planning and site reconnaissance could potentially identify legacy seismic lines that could be viable for future years of the PNG Legacy Site Groundbirch-Brassey Restoration program. Furthermore, restoration would be beneficial in other nearby areas such as the Del Rio, which also has cultural significance to Saulteau First Nations and Aski.

To achieve a significant impact within these areas, extensive reconnaissance should be completed to identify as many legacy seismic lines suitable for the program as possible to plan for a multi-year restoration program. Permitting delays were one of the biggest hurdles of the project this year, therefore, planning several years in advance would allow for adequate time to acquire permits and set the program up for success.

9.3 Capacity Building Recommendations

Capacity Building was one of the main objectives of the project and several steps were taken throughout the program by the Silverberry team to train Aski's employees on live stake and eco-cultural seedling installation. Through the project, the Silverberry team supported the Aski team in building their existing knowledge for planning and executing projects of this scale. Further training and mentorship from Silverberry's professional staff should be implemented in future projects to reinforce and expand on the knowledge and skills Aski employees has gained to-date.

9.4 Monitoring

Monitoring plots were set up in 2022 and baseline photo monitoring was completed. A monitoring program should follow, and more extensive data collection completed in years 1, 3, 5, 10, 15, and 20 following plant installation. In future years, the establishment of survivorship monitoring plots or Permanent Revegetation Plots to obtain a more thorough measurement of planting success should be included. In addition, monitoring should include information for the following impacts: weather events (e.g., heavy rainfall), human disturbance (e.g., road grading impacts or recreational use), animal impacts (e.g., browsing, bedding, trampling), insect damage (e.g., herbivory), and signs of pathogens, water stress, and nutrient deficiency.

10 CLOSURE

The Aski-Silverberry team would like to extend gratitude to BC OGRIS for the opportunity to work on the PNG Legacy Site Groundbirch-Brassey Restoration Program. This program has proven successful, and numerous valuable lessons were learned along the way. The Aski-Silverberry team have accomplished eco-cultural restoration of 30 km of legacy seismic lines in the Peace Region, BC through the installation of 80,000 native plant species.

Through the PNG Legacy Site Groundbirch-Brassey Restoration Program, a step toward restoration of the Peace Region, an ecologically and culturally significant area, has been completed. The Aski-Silverberry team hopes that continued action and shared dedication to restoration within the Peace Region for years to come is possible.

The Aski-Silverberry team gratefully acknowledges the financial support of the Province of British Columbia, the Government of Canada, and BC OGRIS.

Special thanks to Saulteau First Nations; the Ministry of Land, Water and Resource Stewardship; Ministry of Forests; stakeholders; and community members for their continued support.

11 REFERENCES

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Appendix A: Stock Assessment Data Example

Below is an example of Stock Assessment Data collected for one of the seedling species received from Twin Sisters Native Plant Nursery. A full dataset from the project's Stock Assessments is available upon request.

Stock Assessment: Trembling Aspen Received from Twin Sisters Native Plants Nursery

2022-08-15

Created	2022-08-15 22:59:49 UTC by Nanette Richards
Updated	2022-08-15 23:03:39 UTC by Nanette Richards
Location	55.94991299630403, -120.75130663083407

Inspection Information

Inspection Location	Sunset prairie
Time	15:59
Date	2022-08-15
Inspector	Rosheen Tetzlaff

Stock Information

Nursery	Twin Sisters Native Plants Nursery
Seedlings Brokered from a Sub Nursery?	No
Species	Populus tremuloides (trembling aspen)
Number of Boxes	38
Seedlings Bundled?	Yes
Number of Seedlings per Bundle	10
Number of Bundles per Box	9
Seedling Age	6
Seedlings Overwintered?	No

1

Select the most representative seedlings from each box and record the following characteristics.	
Box Number	999
Container Volume	1
Stem Diameter	3
Shoot Height	30
Rootbound Plugs	Slightly rootbound
Foliar Color	Spotted, Chlorotic, Deformed, Brown, Pale-green
Form	Healthy
Moisture	Moist
Mold Present?	No
Pests or Pest Damage Present?	No
Weeds Present?	No

Photos

Appendix B: Photo Monitoring Program Data

Below is an example of photo monitoring data collected for a single legacy seismic line. A full dataset from the project's Photo Monitoring is available upon request.

Photo Monitoring Data: Legacy Seismic Line A17

Plot A17-1 Access Point: Intersection of the legacy seismic line and the road Right-of-Way	
Plot A17-2 Treatment Point: View up the legacy seismic line (away from the access point) of the plant installation treatment	
Plot A17-2 Treatment Point: View down the legacy seismic line (towards from the access point) of the plant installation treatment	

Appendix C: Legacy Seismic Line Treatment Summary – Shapefile Attribute Table

Line Number	Location	Length	Treatment Summary	Stake: Balsam poplar (*Populus balsamifera*)	Stake: Willows (*Salix spp.*)	Stake: Red-Osier Dogwood (*Cornus sericea*)	Total Stakes	White Spruce (*Picea glauca*)	Black Spruce (*Picea mariana*)	Lodgepole Pine (*Pinus contorta*)	Balsam Poplar Populus balsamifera)	Trembling Aspen (*Populus*	Mountain Alder Alnus incana ssp.	Paper Birch (Betula papyrifera)	Red-Oser Dogwood (*Cornus sericea*)	Bebb's Willow (*Salix bebbiana*)	Serviceberry Willow (*Salix pseudomonticola*)	Total Seedlings	Total Stem Count	High-Density at Access	OHV Trail Present	Plant Installation Design	Planting Specs
A01	[redacted]5	0.64	Live stake installation.	0	900	0	900	0	0	0	0	0	0	0	0	0	0	0	900	Yes	No	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart
A02	[redacted]	0.56	Live stake installation.	0	300	0	300	0	0	0	0	0	0	0	0	0	0	0	300	Yes	No	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart
A03	[redacted]	0.43	Live stake installation.	0	600	0	600	0	0	0	0	0	0	0	0	0	0	0	600	Yes	No	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart
A04	[redacted]	0.51	Live stake installation.	0	700	0	700	0	0	0	0	0	0	0	0	0	0	0	700	Yes	No	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart
A05	[redacted]	0.94	Live stake and eco-cultural seedling installation.	0	1250	0	1250	0	630	0	0	0	720	630	0	0	360	2340	3590	Yes	Yes	Live stakes installed in islands with eco-cultural seedlings installed in a continuous distribution between. Live stakes installed in higher density at the end of the line.	Islands: 25 live stakes per island, spaced 10 m apart; Seedling planting density: 0.83 stems/m2
A06	[redacted]	1.01	Eco-cultural seedling installation.	0	0	0	0	0	0	0	810	0	180	0	0	450	0	1440	1440	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.47 stems/m2
A07	[redacted]	1.67	Eco-cultural seedling installation.	0	0	0	0	0	0	2100	0	0	0	0	0	0	0	2100	2100	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.42 stems/m2
A08	[redacted]	1.06	Live stake and eco-cultural seedling installation.	450	0	0	450	2304	0	0	0	0	0	0	0	0	0	2304	2754	Yes	Yes	Eco-cultural seedlings planted with a continuous distribution, stakes installed in high density at entrance to restrict access.	Seedling planting density: 0.72 stems/m2
A09	[redacted]	0.37	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	Yes	N/A	N/A
A10	[redacted]	0.90	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	Yes	N/A	N/A
A11	[redacted]	0.60	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	Yes	N/A	N/A
A12	[redacted]	1.16	Live stake and eco-cultural seedling installation.	1500	400	0	1900	900	0	810	540	0	0	0	0	0	180	2430	4330	Yes	Yes	Live stakes installed in islands with eco-cultural seedlings in a continuous distribution installed in between.	Islands: 50 live stakes per island, spaced 10 m apart; Seedling planting density: 0.21 stems/m2
A13	[redacted]	0.60	Live stake and eco-cultural seedling installation.	300	0	0	300	1440	0	0	0	0	0	0	0	0	0	1440	1740	Yes	No	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at end to restrict access.	Seedling planting density: 0.48 stems/m2
A14	[redacted]	0.99	Live stake and eco-cultural seedling installation.	450	0	0	450	1440	0	0	0	0	0	0	0	0	0	1440	1890	Yes	No	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at end to restrict access.	Seedling planting density: 0.48 stems/m2
A15	[redacted]	0.75	Live stake and eco-cultural seedling installation.	0	1100	0	1100	1200	0	0	0	0	0	270	0	0	0	1470	2570	Yes	No	Live stakes installed in islands with eco-cultural seedlings installed in a continuous distribution in between.	Islands: 50 live stakes per island, spaced 10 m apart; Seedling planting density: 0.39 stems/m2
A16	[redacted]	0.28	Eco-cultural seedling installation.	0	0	0	0	0	0	0	0	1260	0	0	0	0	0	1260	1260	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 1.49 stems/m2

A17	[redacted]	0.44	Live stake installation.	1750	0	0	1750	0	0	0	0	0	0	0	0	0	0	0	1750	Yes	Yes	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 50 live stakes per island, spaced 10 m apart
A18	[redacted]	1.10	Eco-cultural seedling installation.	0	0	0	0	0	0	0	0	0	0	0	4860	0	0	4860	4860	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 1.47 stems/m2
A19	[redacted]	0.39	Live stake installation.	600	0	0	600	0	0	0	0	0	0	0	0	0	0	0	600	Yes	No	Live stakes installed in high density at ends to restrict access.	N/A
A20	[redacted]	0.70	Live stake and eco-cultural seedling installation.	4150	0	0	4150	0	0	0	0	0	0	0	0	0	0	0	4150	Yes	Yes	Live stakes installed in islands with sections of continuous distribution, eco-cultural seedlings installed in a continuous distribution in between islands.	Islands: 50 live stakes per island, spaced 10 m apart
A21	[redacted]	0.53	Eco-cultural seedling installation.	0	0	0	0	0	0	0	0	0	450	900	0	450	0	1800	1800	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.68 stems/m2
A22	[redacted]	2.08	Live stake installation.	0	1950	0	1950	0	0	0	0	0	0	0	0	0	0	0	1950	Yes	Yes	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 50 live stakes per island, spaced 10 m apart
A23	[redacted]	1.17	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	No	N/A	N/A
A24	[redacted]	1.09	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	No	N/A	N/A
A25	[redacted]	0.65	Live stake and eco-cultural seedling installation.	1500	0	0	1500	900	0	270	0	0	0	270	0	0	0	1440	2940	Yes	Yes	Live stakes installed in islands with eco-cultural seedlings in a continuous distribution installed in between. Live stakes installed in high density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart; Seedling planting density: 0.74 stems/m2
A26	[redacted]	1.17	Eco-cultural seedling installation.	0	0	0	0	2016	0	0	0	0	0	0	0	0	0	2016	2016	No	Yes	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.57 stems/m2
A27	[redacted]	1.42	Eco-cultural seedling installation.	0	0	0	0	2016	0	0	0	0	0	0	0	0	0	2016	2016	No	Yes	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.47 stems/m2
A28	[redacted]	1.94	Eco-cultural seedling installation.	0	0	0	0	0	0	0	0	0	0	0	0	5040	0	5040	5040	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.87 stems/m2
A29	[redacted]	1.08	Live stake and eco-cultural seedling installation.	450	0	0	450	1728	0	840	0	0	0	0	0	0	0	2568	3018	Yes	Yes	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at entrance to restrict access.	Seedling planting density: 0.8 stems/m2
A30	[redacted]	0.21	Live stake and eco-cultural seedling installation.	450	0	0	450	0	0	420	0	0	0	0	0	0	0	420	870	Yes	Yes	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at entrance to restrict access.	Seedling planting density: 0.66 stems/m2
A31	[redacted]	1.03	Eco-cultural seedling installation.	0	0	0	0	0	0	1680	0	0	0	0	0	0	0	1680	1680	No	Yes	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.55 stems/m2
A32	[redacted]	0.44	Eco-cultural seedling installation.	0	0	0	0	0	0	0	0	1080	0	0	0	720	0	1800	1800	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.82 stems/m2
A33	[redacted]	0.80	Live stake and eco-cultural seedling installation.	0	500	0	500	0	0	0	0	360	360	0	0	0	0	720	1220	No	Yes	Live stakes installed in islands with eco-cultural seedlings installed in continuous distribution in between.	Seedling planting density: 0.18 stems/m2
A34	[redacted]	0.87	Live stake installation.	0	2450	0	2450	0	0	0	0	0	0	0	0	0	0	0	2450	Yes	Yes	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 50 live stakes per island, spaced 10 m apart
A35	[redacted]	0.44	Live stake installation.	0	2400	0	2400	0	0	0	0	0	0	0	0	0	0	0	2400	Yes	Yes	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 50 live stakes per island, spaced 10 m apart
A36	0, 0	0.00	Does not exist. Numbering error.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	N/A	N/A	N/A

A37	[redacted]	0.30	Eco-cultural seedling installation.	0	0	0	0	300	0	0	0	810	990	0	90	90	0	2280	2280	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 2.57 stems/m2
A38	[redacted]	1.01	Eco-cultural seedling installation.	0	0	0	0	0	0	0	990	0	810	0	0	810	0	2610	2610	No	No	Eco-cultural seedlings installed in a continuous distribution throughout the line.	Seedling planting density: 0.86 stems/m2
A39	[redacted]	0.74	Live stake and eco-cultural seedling installation.	1000	0	0	1000	0	0	0	0	0	0	630	0	540	0	1170	2170	Yes	Yes	Live stakes installed in islands with eco-cultural seedlings installed in continuous distribution in between. Live stakes installed in high density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart; Seedling planting density: 0.52 stems/m2
A40	[redacted]	0.71	Live stake installation.	550	1250	0	1800	0	0	0	0	0	0	0	0	0	0	0	1800	Yes	Yes	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart
A41	[redacted]	0.86	Live stake installation.	1800	0	0	1800	0	0	0	0	0	0	0	0	0	0	0	1800	Yes	Yes	Live stakes installed in islands with higher density at both ends of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart
A42	[redacted]	0.63	Live stake and eco-cultural seedling installation.	450	0	0	450	0	0	2940	0	0	0	0	0	0	0	2940	3390	Yes	Yes	Eco-cultural seedlings planted with a continuous distribution, live stakes installed in high density at end to restrict access.	Seedling planting density: 1.55 stems/m2
A43	[redacted]	0.49	None	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No	No	N/A	N/A
A44	[redacted]	0.48	Live stake installation.	750	0	0	750	0	0	0	0	0	0	0	0	0	0	0	750	Yes	No	Live stakes installed in islands with higher density at the entrance of the legacy seismic line.	Islands: 25 live stakes per island, spaced 10 m apart
		35.24		16150	13800	0	29950	14244	630	9060	2340	3510	3510	2700	4950	8100	540	49584	79534				