HISTORICAL SUMMARY REPORT
on the
FOUR J Gypsum Mine

Mines Act Permit Number: M-162
Mine Number: 0600255
Latitude 50°05.688N; Longitude 115°31.187W
UTM 605841E 5550412N ZONE 11
NTS 82J/04E BCGS – 82J003

For

Homegold Resources Ltd.
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by

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Permit to Practice 1000611

March 31, 2023

Looking east Pit #2 November 2022

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Summary

The Four J mineral claims were staked in March 2022. Prospecting and geological sampling was completed after June 2022 which mainly focussed on the quarry area. Previous work indicated the presence of gypsum over a length of 200 metres. The quality of the gypsum is high averaging over 85%. Gypsum is overlain by limestone of the Devonian Harrogate Formation and underlain by limestone of the Cedared Formation. Further work will be required to fully evaluate the resource potential of these deposits.

Assays for 16 samples collected in the main pit are contained in Appendix III and plotted on Figure 7.

Gypsum has several beneficial effects on soil structure and soil chemistry. It is also a source of plant available calcium and sulfur.

It is important to understand that gypsum does not change soil pH, even though it contains sulfur. The sulfur in gypsum is in a soluble sulfate form and is readily available to plants and soil microbes. Elemental sulfur, which is not soluble, is used to reduce the pH of alkaline soils.

Gypsum is soluble and dissolves and moves into the soil rapidly. It dissolves more quickly than limestone after surface application.

Gypsum improves water infiltration in soils, reducing runoff and erosion potential. It helps to reduce soil crusting after rainfall or irrigation. Crusted soil can reduce seed emergence and seedling establishment.

Particularly in clay soils, gypsum helps soil particles to create stable aggregates, improving soil structure and ensuring there is good air and water content in the soil. Good soil structure promotes strong growth of plant roots and soil microbes.

Gypsum is soluble and can be applied at any time in spring through fall to lawns, gardens or landscape plantings. Up to two applications can be made in a year and applications are usually made in spring and in fall if a second application is needed. Gypsum can be surface applied or tilled into soil.

For general lawn maintenance, apply 25 pounds of gypsum per 5,000 square feet to establish lawns. Vegetable, herb and flower gardens can benefit from 1 pound of gypsum for every 100 square feet of bed. For shrubs and small trees, apply 1 cup surround the base of the plant. Larger trees can receive 1 cup per inch of diameter. For container plants, gypsum can be applied at 1 teaspoon for every 6 inches of pot diameter.

Gypsum is usually white to greyish white, hardness about 2.0, specific gravity of 2.2. Most rock gypsum is granoblastic. In many deposits there is usually a correlation between grain size and calcium sulphate content.

Gypsite deposits usually occur in semi-arid and arid climates and result from the solution of existing Gypsum deposits by ground water, which evaporates at the surface by capillary action as a porous aggregate of gypsum and considerable impurities. The extent of hydration is an important parameter in the evaluation of an economic deposit of gypsum.

Gypsum ($CaSO_4 + H_2O$) contains 32.6% CaO, 46.5% SO_3 and 20.9% H_2O. Anhydrite contains 41.2% CaO, 58.8% SO_3, zero H_2O. These two minerals have a metastable relationship. Gypsum gives water in closed tube and turns white; soluble in hot dilute hydrochloric acid, the solution giving, with barium chlorite, a white precipitate of barium sulfate; gives a silver coin test for sulfur as do other sulfates.

The Four J Mine was in production for about 25 years supplying wall board plants in Edmonton, Alberta and New Westminster, BC.

Assays of samples collected in 2022 varied from 25.73% Ca in Sample 4J-6 to 35.94% Ca in sample 1b with 19.17% S.

Respectfully submitted,

J. T. Shearer, M.Sc., P.Geo. (BC & Ontario)
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1 Introduction

This document presents a Historical Summary on the Four J Mine property. The plan has been prepared in accordance with the following:

- BC Mines Act (1996);
- Health, Safety, and Reclamation Code for Mines in British Columbia (2008) or the "Code;
- Requirements outlined in Mines Act Permit M-162; and
- Ministry of Energy and Mines (MEM) reporting requirements for Five Year/Conceptual Reclamation Reports (2009).

1.1 Reclamation Objectives

The objective of the reclamation is to return the disturbed areas of the operation to an acceptable post-closure land use capability. The end land use and capability objectives are based on pre-development site conditions and the post-closure landscape would be, as far as practical, capable of productively supporting a range of land uses similar to the pre-development site condition. The following goals were set to meeting the objective stated above:

- Long-term stability of permanent mine-related landforms including the quarry pits and overburden dumps;
- Demolition and disposal of the permanent structures and roads on site not required after closure;
- Re-establish productive land use of the disturbed areas after mining ceases to the best practical extent, and
- Establishment of a self-sustaining cover of vegetation consistent with existing ecosystem and wildlife needs.

2 Mine Overview

2.1 Location

Access to the 4J mineral claims is via Highway 95 approximately five kilometres south of the village of Canal Flats, east on the Whiteswan Forest Service Road (FSR) to kilometre 21 km, then south on the Lussier Road for 4.5 kilometres, where a locked access gate leads to the mine site (Figure 2-1).. The northern boundary of GPC's Mining Lease #323024 lies 750 metres south of the Whiteswan Provincial Park. The property lies within Electoral Area F of the Regional District of East Kootenay (RDEK), and is zoned A-1 Rural Resource. The forest license for the area is tenured to Canadian Forest Products Ltd. (Canfor - formerly Slocan Forest Products Ltd., Radium Division).

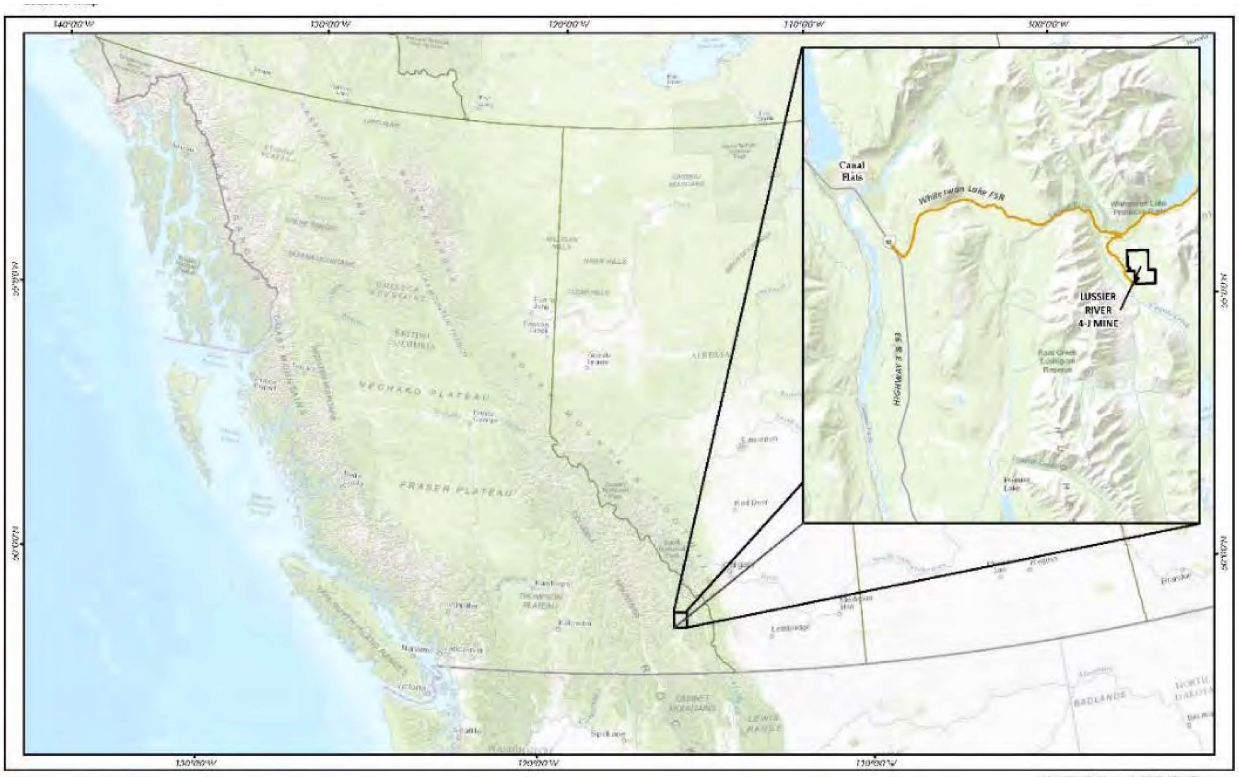

Figure 2-1. Regional map showing location of the 4J Mine operation.

2.2 Geological and Mineral Resources

Gypsum deposits within the Stanford Range of the Rocky Mountains are rich in high purity gypsum. The gypsum deposit which this group is part of is distributed from the south boundary of Kootenay National Park south to the U.S. border, within the Rocky Mountain Trench. As mineral rich waters receded during the Devonian Age, thick sedimentary beds of gypsum were deposited and buried under layers of limestone and mudstone. As the Rocky Mountains were formed, these layers were uplifted and folded to form the current deposits.

The 4J deposit is covered by a shallow overburden of glacial cover, with outcrops of limestone, gypsite, and anhydrite. The gypsum deposit contains seams of limestone, anhydrite and clays throughout. These seams tend to be thin relative to the ore body and are not recovered with the ore.

2.3 Mineral Tenure

The previous Lussier River Four J Mining Lease comprised 15 units covering approximately 358.7 hectares (Figure 2-2). The mine is located on Crown land and licensed under a 30-year mine lease, No. 323024, expired in 2022.

Current Mineral Title shown below:

Table 1
List of Claims

Name	Tenure #	Area (ha)	Issue Date	Current Expiry Date*	Registered Owner
Former Lease (Four J Mine)	1093623	82.91	March 4, 2022	December 29, 2026	J. T. Shearer
Two T	1093659	165.85	March 7, 2022	December 26, 2026	J. T. Shearer
Four J	1093660	207.24	March 7, 2022	December 26, 2026	J. T. Shearer
		Total 456 ha			

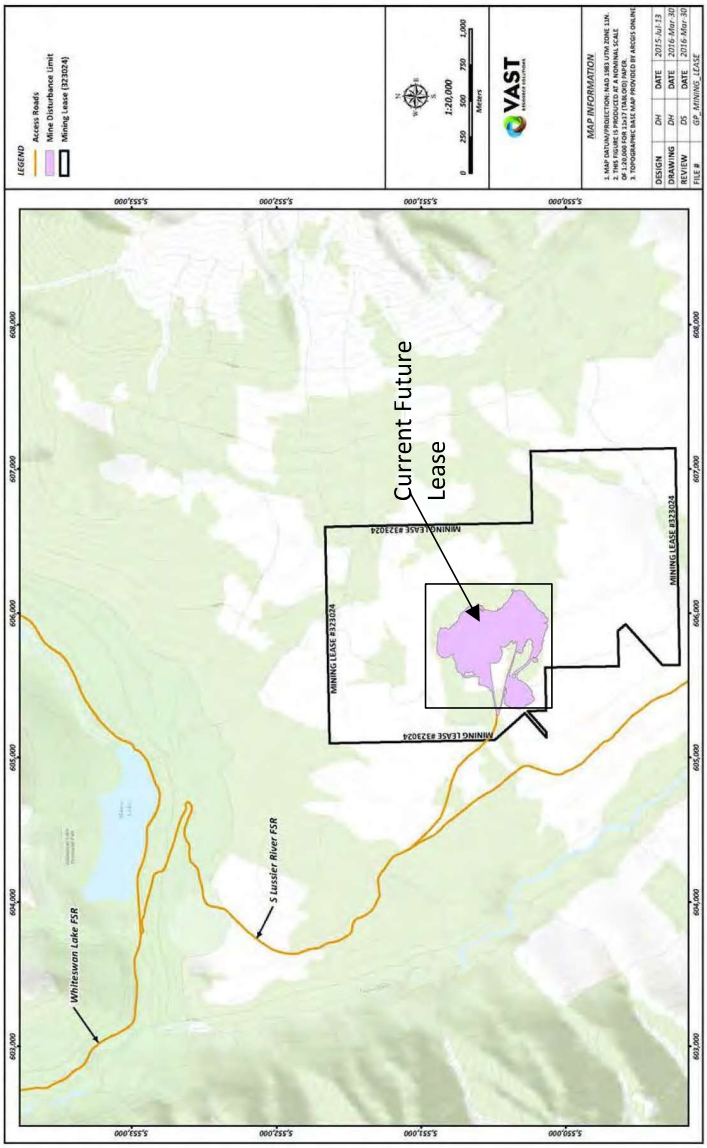

Figure 2-2. Previous 4J Mine lease boundary

2.4 Mine History

The 4J Mine area was first staked as the "Aztec" claims in the 1960's. Seismic surveys over the sink hole area indicated deep overburden depths and the property was dropped. In 1983, Domtar Gypsum Inc., staked the "Four J" and "Two T" claims, which later became Lot Numbers 16975 & 16976. These were later converted to Mining Lease #323024. An exploration drill hole drilled in 1985 on the 4J claim encountered gypsum bedrock at shallow depth. Subsequent diamond drilling defined a gypsum resource in the order of 20 million tonnes.

In 1993, an existing Mines Act permit for Domtar's South Quarry development, M-162, was amended to authorize the surface works and reclamation program for the 4J Lussier River Mine. In April 1997 the permit was revised to a change of ownership to Georgia-Pacific Canada Inc.

2.5 Mine Operations

Since Domtar Construction Materials Ltd., (later Domtar Gypsum Inc) began the 4-J mining operation in 1983 a total surface disturbance of 19.71 Ha has occurred to date.

Mining operations are focused on gypsum extraction. Current site development at the 4J Mine consists of two (2) open pits, eight (8) overburden dumps, soil stockpiles and access roads. An overview map of the mine features is provided as Figure 2-3.

Mining operations were conducted on non-continuous basis by a third-party contractor, Speers Construction, under the direct supervisions of a Mine Manager. Conventional drill, blast and haul open pit mining was used to expose and extract ore from the two pits developed on the mine site. During periods of operation, approximately 150,000 tonnes of gypsum were extracted annually. Pit benches were developed at 10 m intervals following geotechnical guidelines. Pit contours and cross-sections are provided in attached current Mine Plan.

No processing or crushing was conducted on site. "Run-of- mine" gypsum rock was trucked off-site via the Lussier and Whiteswan FSRs to Highway 95 and then into GPC's crushing and rail loading facilities located at Canal Flats. Processing consisted of two-stage crushing and screening followed by placement on stockpiles. Gypsum rock was then loaded into rail cars or highway trucks via conveyor and shipped to various customers and GPC's wallboard production facilities. There will be no significant quantities of overburden to contend with as all mined gypsum is shipped off site. Historically there has proven to be no watercourses or runoff water of concern in the mining area so that no drainage plans are necessary.

Overburden material was placed onto one of eight engineered dumps on the mine property. WD1, WD2, WD3 and WD4/5 were recontoured to stable slopes, covered with soil/growth medium and revegetated with a grass/legume seed mixture. WD6, WD7 and WD8 are also recontoured and reclaimed.

2.6 ARD/ML Considerations

Since gypsum is non-ARD producing, long-term water treatment and monitoring should be straight forward. Discharge to ground drainage structures are proposed as runoff water is not significant and there are no nearby watercourses.

Experience at Domtar's North Quarry (located 5 km south) has shown that gypsum benches are favoured by Rocky Mountain Bighorn sheep and ungulates as birthing areas and places of refuge. In addition, the animals concentrate at the old gypsum exposures to lick mineral salts from the rock. Gypsum is a benign mineral and supports life.

Gypsum is a neutral salt and does not increase or decrease acidity. Dissolving gypsum in water or soil results in the following reaction: $CaSO_4 \bullet 2H_2O = Ca_2+ + SO_42- + 2H_2O$. It ads calcium ions ($Ca_2+$) and sulfate ions ($SO_42-$), but does not add or take away hydrogen ions (H+). Therefore, it does not act as a liming or acidifying material. The Ca2+ ions simply interact with exchange sites in soil and sulfate remains dissolved in soil water.

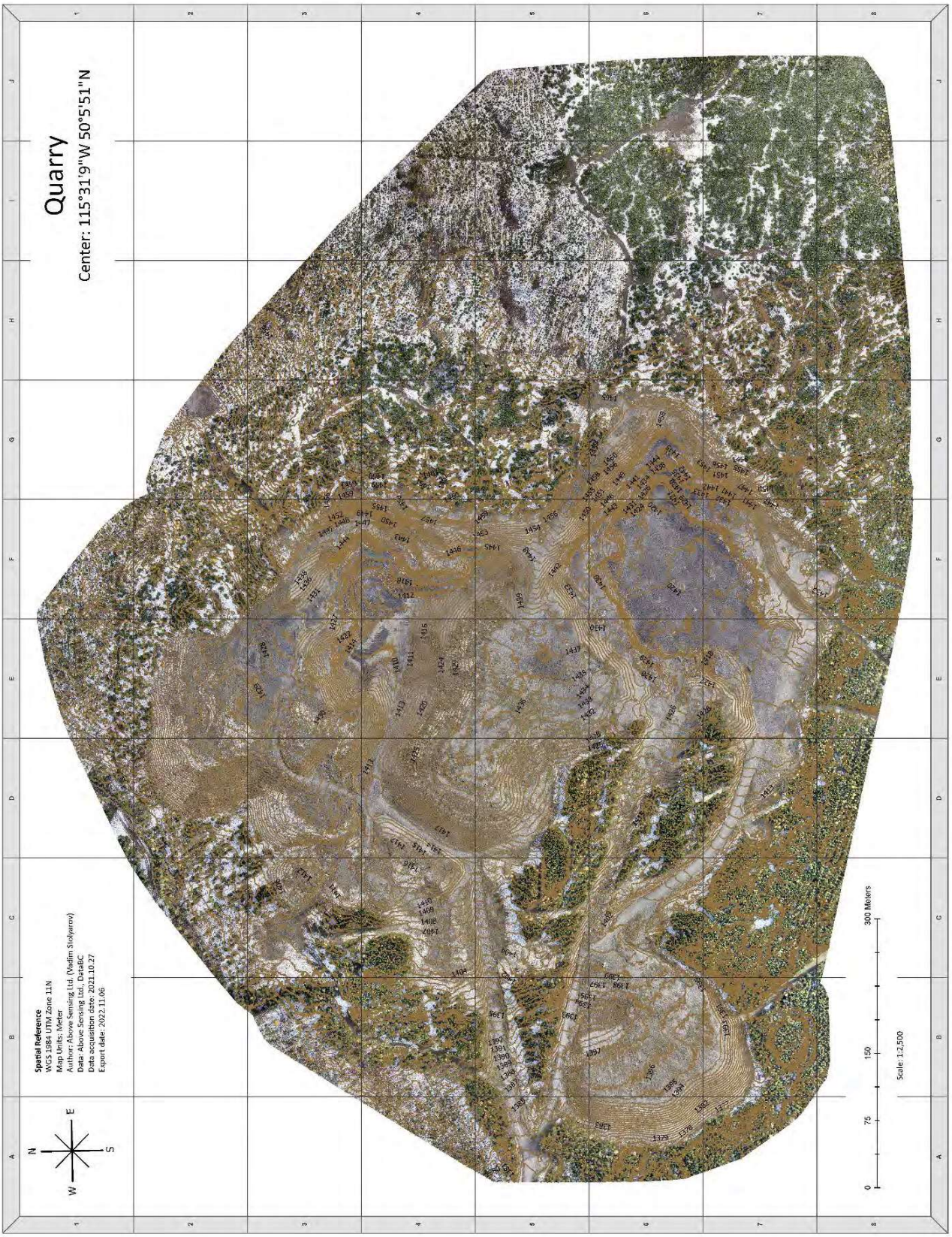

Figure 2-3 Recent Drone Composite of Quarry Area 2022, Detail Topography

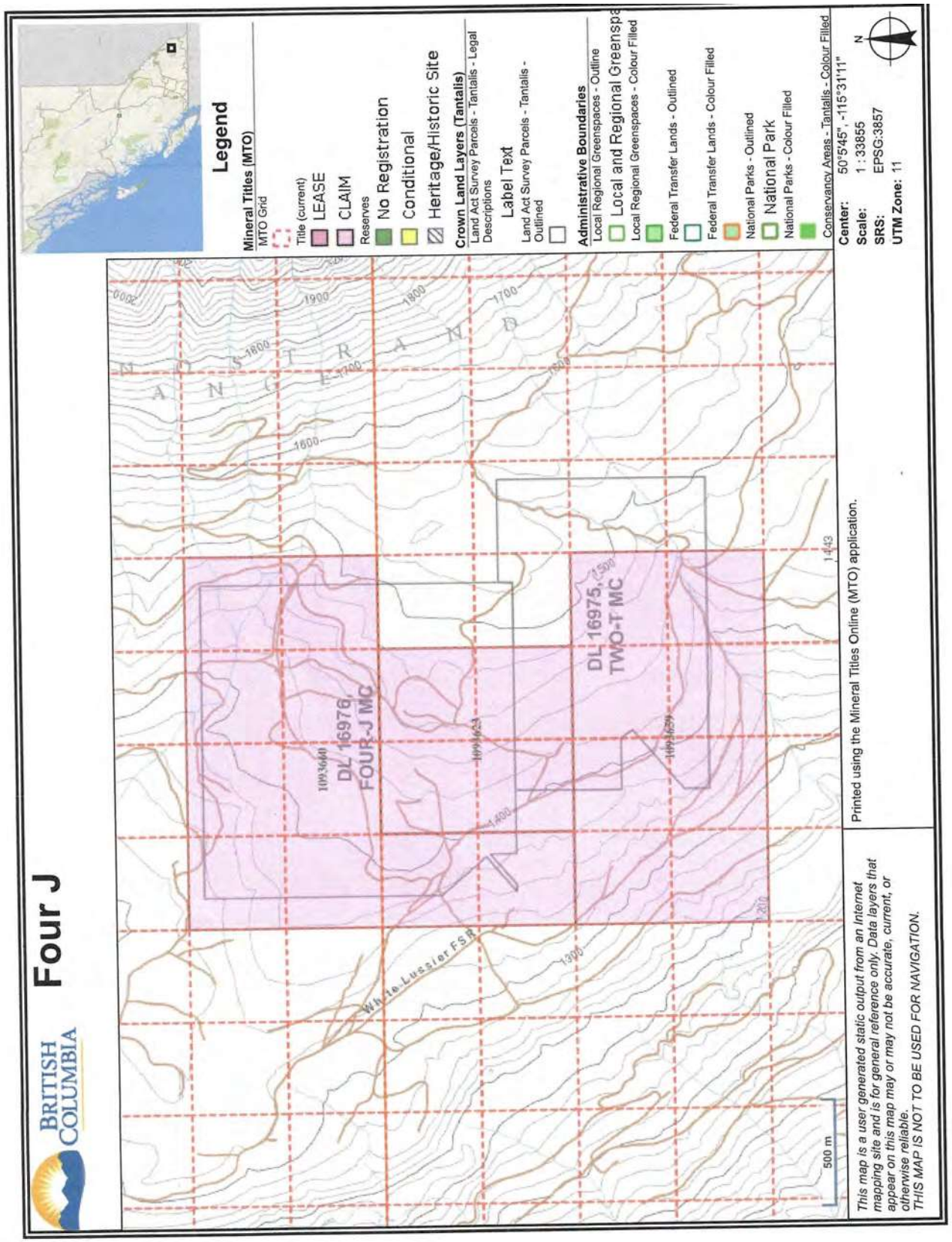

Figure 2-4 Current Claim Map

3 Biophysical Overview

The 4J Mine is situated within the Stanford Range of the Rocky Mountains. The mine site is 2.5 km south of Alces (Moose) Lake in the valley between the Shark Tooth and Melvin mountains, at an approximate elevation of 1400 metres (Figure 3-1).

Figure 3-1. Local/regional setting of the Lussier River 4J Mine (Google Earth, 2011)

The mine property is within the Montane Spruce (MSdk2) dry cool biogeoclimatic zone (BEC). The MSdk2 zone is mostly forested but also contains many wetland areas. The cool, dry climate draws many different species of wildlife and vegetation and makes the area an attractive site for recreation activities. The climate is cool, with cold, snowy winters, and short dry summers. The average temperature reaches above 10 degrees for only 2-4 months of the year, and for five months of the year the average temperature is below zero. Precipitation is low; typically below 500 mm a year, the majority being snow. May and June are the wettest months of the growing season. The extended period of drought in the summer often leads to large, stand-destroying fires.

The Montane Spruce Zone is dominated by lodgepole pine forests that have replaced forests after fires. Many of the species in this zone have adapted to the zone's fire regime, often taking advantage of the dead lodgepole pine or the young shrub dominated plant communities that occupy burned lands for 10-20 years after the disturbance. Wildlife in this zone is adapted to the deep winter snows or they avoid it all together by migrating during the winter months like most ungulates (hooved animals). This zone is home to ungulates like moose and mule deer, different species of Woodpecker, and other varieties of birds and fur-bearing mammals like grizzly bears, bighorn sheep and the golden-mantled ground squirrel. Water birds and amphibians are located in the wetland areas. The food in fast-moving streams attracts the American Dipper, the spotted frog, western toad and long-toed salamander.

3.1 Vegetation

The 4J Mine property is within the Montane Spruce (MSdk2) dry cool BEC zone. On zonal sites, with "average" amounts of moisture and nutrients, mature stands contain lodgepole pine and Interior douglas fir as the predominant forest species. Black cottonwood, trembling aspen and prickly rose are also evident.

3.2 Wildlife and Wildlife Habitat

The 4J Mine site has moderate to high biophysical capability to overwinter ungulates. As well, this area receives considerable fall and early winter use by elk, mule deer and moose. Experience at Domtar's North Quarry (located 5 km south of the 4J Mine) has shown that gypsum benches are favoured by Rocky Mountain Bighorn sheep as birthing areas and places of refuge. In addition, these animals concentrate at the old gypsum exposures to lick mineral salts from the rock.

3.3 Aquatic Resources

There are no watercourses, wetlands or other aquatic resources associated with the 4J Mine property.

3.4 Surficial Geology and Soils

Detailed pre-disturbance investigation and mapping of surficial geology and soil map units was not conducted prior to the initial development of the 4J Mine in the early 1990s. According to available soil survey data compiled by Lacelle (1990) and confirmed by on-site inspections, soils on the mine site developed in silty sandy fluvial or aeolian veneers overlying gently to moderately rolling (de) gravelly fluvioglacial outwash plains and terraces derived from limestone and dolomite (Figure 3-2). Gagnebin (GB) soils are predominant on the site. GB soils are well drained and moderately pervious. Textures range from silt loam to fine sandy loam in the thin (<5 cm) surface and gravelly loam to gravelly loamy sand in the fluvioglacial subsoil. Coarse fragments in the subsoil range from 50 to 80% and consist of rounded gravels and cobbles. Seepage (v) is a significant occurrence.GB soils have moderate capability for forestry production and high potential for natural forest regeneration.

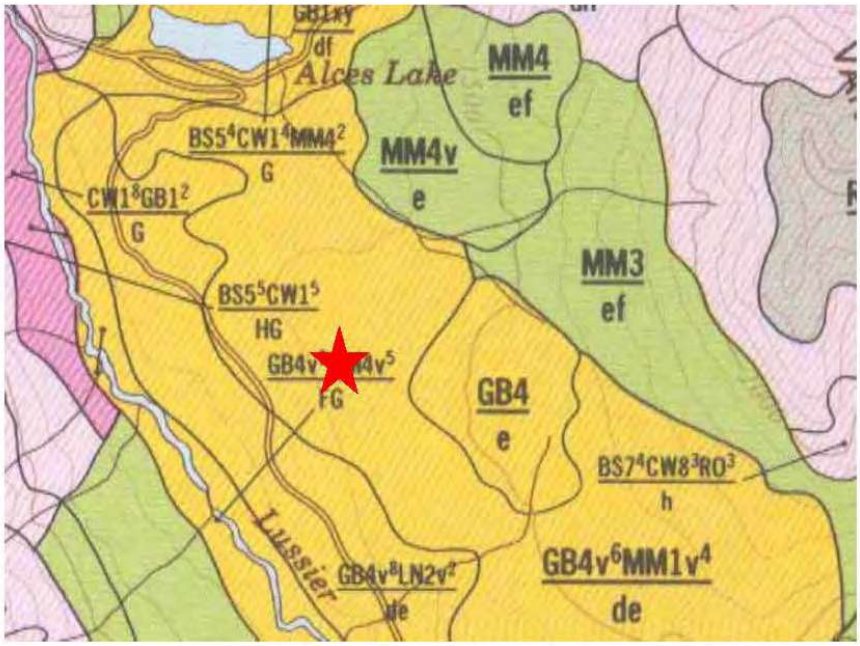

Figure 3-2 Soil survey map units on the 4J Mine (Lacelle, 1990).

4 Land Uses

4.1 Current Land Uses

Land use types in the vicinity of the 4J Mine include an integrated mixture of previously disturbed lands (mining and forestry), forested slopes, lakes (Whiteswan, Alces), open meadows, wetlands and riparian areas. Primary land uses include forestry, mining, recreation (camping, fishing, hiking, etc.) and wildlife habitat. Secondary land uses include trapping and guided outfitting.

4.2 End Land Use Objectives

The closure and reclamation plan for the 4J Mine includes measures to facilitate the establishment of self-sustaining vegetation communities to foster the return to functional ecosystems that provide habitat values for wildlife (especially ungulates) and reduces the long-term impact of mine development on wildlife and wildlife habitat.

Although the post-mining landscape will not be identical to pre-mining conditions, the closure and reclamation plan aims to establish conditions that create a successional trajectory which will lead to vegetation communities with ecological diversity and productivity similar to pre-mining ecosystems. Closure and reclamation objectives for 4J include:

- Where possible, preserving pockets of existing vegetation within the mine footprint to retain wildlife habitat values and maintain remnant populations of native plant species that will increase the speed with which reclaimed areas are recolonized;
- Re-establishing land capability such that the targeted end land uses of forestry and wildlife habitat are achieved; and
- Establishing vegetative covers that meet targeted end land uses and provide long-term stability.

Reclamation of the post-mining landscape will re-establish basic ecological processes, relatively simple plant communities, and some wildlife populations, but it may take many decades or centuries to re-establish the complexity that existed prior to mine development. None the less, the over-riding objective for all reclamation treatments is to establish a diverse landscape with habitats that will persist and continue successional development over time.

5 Soil Management and Revegetation

5.1 Soil Material Balance

Approximately 20,115 m3 of soil is currently stockpiled for use in final site reclamation (see map in Appendix A for stockpile locations). The entire volume of salvaged material is required for reclamation purposes (Table 5-1). Current stockpile locations are located outside of operational areas and are clearly identified with signage to prevent accidental disturbance.

Table 5-1: Estimate of soil volumes for reclamation of current disturbances.

Mine Feature	Surface area to be reclaimed (m^2)	Average soil replacement depth (m)	Soil required based on surface area (m^3)
Maintenance Area – concrete pad	185	0.10	19
Pit 1 – floor	6,078	0.10	608
Pit 1 – pre-stripped areas[1]	15,000	Replace sidecast soil	0
Pit 2 – floor	26,367	0.10	2,637
Pit 2 – pre-stripped areas[1]	45,000	Replace sidecast soil	0
Roads – access and haulage[2]	23,000	0.10	2,300
TSP – Topsoil stockpile areas	3,297	0	0
WD6 – Overburden Dump[3]	6,000	0.15	900
WD7 – Overburden Dump[3]	52,000	0.15	7,800
WD8 – Overburden Dump[3]	39,000	0.15	5,850
Totals:	215.927		20,114
Current soil stockpile volume available (m3):			20,115

1 Pre-stripped areas will be recontoured/reclaimed with existing sidecast/bermed materials

2 In order to ensure access for post-closure monitoring not all road surfaces may be decommissioned and reclaimed

3 Approximate surface area to reclaim following recontouring

5.2 Soil Replacement Strategy

Soil replacement depth will vary according to the specific mine feature being revegetated. Following decompaction and recontouring of areas requiring reclamation, stockpiled soils will be end dumped and spread to the prescribed average thickness shown in Table 5-1. Specific soil replacement requirements for each mine facility are described in Section 6.

5.3 Revegetation Methods

The following section provides an overview of revegetation methods for the 4J Mine including site preparation, use of fertilizer, and revegetation. Specific prescriptions for each mine facility are provided in Section 6.

5.3.1 Site Preparation

Revegetation sites will require preparation (e.g. recontouring, decompaction, etc.) to provide suitable conditions for reclamation success. Stockpiled soil material will be used to cover reclaimed surfaces to provide a growing medium for revegetation treatments.

5.3.2 Fertilizers and Amendments

Fertilizers will be used to enhance the capability of the reclamation material to support vegetation. Samples will be taken from the salvaged soil stockpiles to determine specific nutrient deficiencies. This information will be used to determine where and when fertilizers and/or other amendments may be required.

5.3.3 Reclamation Plant Species Selection

The seed blend (Table 5-2), which has been used successfully for all existing revegetation treatments at the 4J Mine, will be broadcast seeded at 25 kg/ha on all areas requiring final reclamation, with the exception of areas identified for tree planting.

Table 5-2. Possible seed blend.

Species	% by weight	% by species
Dahurian Wild Ryegrass	25	9
Slender Wheatgrass	22	16
Alfalfa	15	15
Crested Wheatgrass	15	12
Perennial Ryegrass	10	11.5
Dryland Orchard grass	5	15
Hard Fescue	4	10.5
Creeping Red Fescue	4	11

Block plantings of adapted woody species (Lodgepole pine, Interior douglas-fir, Black cottonwood, Trembling aspen and Prickly rose) will be incorporated into the revegetation plan for 30% of the final surface area of overburden dumps WD7 and WD8, and the floor of Pit 2 to achieve end last use objectives, enhance structural diversity (vertical and horizontal), provide browse potential and improve overall site productivity for key wildlife species.

Rock piles and coarse woody debris will be placed on the surface of all reclaimed overburden dumps, pit floors and road surfaces to provide further structural diversity and habitat elements for small mammals, snakes, birds and insects.

5.3.4 Invasive Species Monitoring

In 2015, GPC prepared an invasive species management plan that included identification, mapping and prescription development (see Appendix C). This plan was created to direct the management of invasive plant species (weeds) during reclamation and closure. The current invasive species inventory was mapped for all soil stockpiles, haul roads, rock dumps and quarries on the mine property, and control recommendations for different species were developed. The field survey identified minor and localized infestations of Canada thistle, Oxeye daisy and Mullein on topsoil stockpiles, and Yellow hawkweed along deactivated roadways within the mine site. The low density and number of noxious species at the 4J Mine is the result of an effective weed prevention program accomplished by:

- Seeding disturbed areas as soon as the recontouring work is completed;
- Using good quality, clean seed used for all reclamation seeding in order to maximize germination success and ensure the establishment of a vigorous forage crop that aggressively outcompetes weeds;
- Using only certified weed free seed;
- Selecting species for high forage value for ungulates (wildlife end use) and suited to the growing condition at the site to ensure high ground cover to reduce bare ground area which allows weed establish; and

- Routine visual surveys to identify any potential problems so mitigation can occur immediately before weed species can spread and colonize an area.

A local licensed herbicide application contractor implemented the first phase of the plan in 2015, which involved treating noxious weeds found on the reclaimed areas. Subsequent phases include treatment of topsoil stockpiles and deactivated roadways within the mine property.

5.3.5 Soil Erosion and Sediment Control

The potential for soil erosion results from surface disturbance and exposure during reclamation activities. Reclamation activities at 4J that have the potential to cause or increase erosion, and subsequently increase the generation of sediment at the site, include exposure of soils during recontouring, soil replacement and revegetation. Reduction of erosion risk will be achieved through re-sloping reclamation sites below the angle of repose; seeding for the development of maintenance-free self-sustaining vegetation communities; decommissioning, de-compaction, recontouring and seeding of unused access roads; and the construction of erosion resistant drainage ditches as required.

6 Reclamation (See Separate Reclamation Plan)

The focus of reclamation at 4J is to ensure that reclaimed mine facilities are geologically stable, soil erosion by wind and water is minimized and controlled, aesthetic and environmental impacts are mitigated, desired end land use objectives are achieved over time and the mine site is safe for people and wildlife. The land capability objective is to achieve average land capability on reclaimed lands that is equivalent to pre-mining conditions. Short-term reclamation goals include control of surface erosion, and management of invasive plant species.

Table 6-1 summarizes the projected areas of mining disturbance at the 4J Mine to the end of 2016. As individual mining phases have been completed disturbed areas have been recontoured to stable slopes, a soil cover applied, and a groundcover of grasses and forbs has been seeded. Pit development disturbances (floor, walls and pre-stripped areas) total 14.15 ha. Of this, approximately 4.9 ha are pit walls constructed in rock and are exempt from reclamation requirements. A total of 6.93 ha of overburden dumps and other disturbances (areas WD1, WD2, WD3, WD4/5 and O1) has been recontoured, covered with a soil layer and revegetated. The overburden dumps WD6, WD7 and WD8, totaling 9.7 ha, have not reclaimed.

Table 6-1. Summary of 4J Mine Features and Reclamation Status

Mine Feature	Description	Reclamation Status	Area (m^2)*
Maintenance Area	Concrete pad	Pending	185
O1 - Other	Stripped/logged for powder mag	Complete	15,817
Pit 1 (North)	Pit floor	Pending	6,078
Pit 1 (North)	Pit walls	Exempt	25,559
Pit 1 (North)	Pre-stripped areas above pit	Pending	15,000
Pit 2 (South)	Pit floor	Pending	26,367
Pit 2 (South)	Pit walls	Exempt	23,461
Pit 2 (South)	Pre-stripped areas above pit	Pending	45,000
Roads	Internal mine roads	Pending	23,000
TSP1, TSP2, TSP3	Topsoil Stockpile	Pending	3,597
WD1	Overburden Dump	Complete	7,072
WD2	Overburden Dump	Complete	12,983
WD3	Overburden Dump	Complete	10,386
WD4/5	Overburden Dump	Complete	23,098
WD6	Overburden Dump	Pending	6,000
WD7	Overburden Dump	Pending	52,000
WD8	Overburden Dump	Pending	39,000
Total Projected Mine Disturbance (after recontouring): 334,303			334,303
Total Area reclamation completed: 69,356			69,.23
Total Area exempt from reclamation: 49,020			49,020
Total Area pending reclamation: 215,927			215,927

* – All area measurements represent approximate final footprints after recontouring

Reclamation activities was initiated in 2017. Overburden dumps and surface disturbances will be reclaimed and any remaining infrastructure was removed.

Reclamation, plan for the 4J Mine will ensure that:

- Mining operations are managed in accordance with the regulations set out in *the Health, Safety and Reclamation Code for Mines in British Columbia*;
- Reclamation techniques are employed to revegetate all dormant, mine-disturbed areas to self-sustaining plant communities;
- Pit areas, overburden dumps, roads, processing sites and associated infrastructure are effectively managed;

- Land capability will be equal to pre-disturbance capability and comparable to surrounding undisturbed lands; and
- There will be no post-closure liability.

Detailed reclamation prescription maps for the main mine features are provided in Appendix D.

6.1 Pits/Quarries

A total of 14.15 hectares of disturbance is associated with two open pits, including pre-stripped areas, pit floors and pit highwalls. Reclamation will include:

Pre-stripped areas above pits (approximately 6.0 ha following resloping)

- Decompaction and resloping to the pit edges (maximum 2:1 slope)
- Pullback and recontouring of sidecast/bermed soil and overburden material
- Fertilizer application as per soil analysis of stockpiled soils
- Broadcast seed/incorporate (harrow) 25 kg/ha GPC seed blend
- Posting of appropriate warning signage to prevent pit access

Pit floors (approximately 3.25 ha)

- Scarify/decompact surface
- Recontour to provide positive drainage
- Placement and contouring of 10 cm soil cover
- Fertilizer application as per soil analysis of stockpiled soils
- 70% of area: broadcast seed/incorporate (harrow) 25 kg/ha GPC seed blend
- 30% of area: block plantings of woody species (Pit 2 only)
- Rock piles and coarse woody debris will be placed on the surface around planted areas to protect against over-browsing by ungulates and to provide further structural diversity and habitat elements for small mammals, snakes, birds and insects.

Pit walls and benches (approximately 4.9 ha)

- These areas do not require reclamation. However, it may be possible to seed portions of the pit wall benches after the material has weathered. This could provide additional forage as well as escape terrain for bighorn sheep. Pit walls may also provide habitat for bats and raptors

6.2 Overburden Dumps

Overburden dumps occupy a total of 15.05 hectares. As of December 31, 2016, a total of 5.35 hectares of overburden dumps have been successfully revegetated. Specific reclamation treatments for the overburden dumps include:

WD1 thru WD5:

- Broadcast seed/ incorporate (harrow) GPC seed blend (15 kg/ha) and fertilizer (18-18-18 @ 100 kg/ha) on all areas with poor vegetation establishment WD6, WD7 and WD8 (approximately 9.7 ha following resloping):
- Decompaction and recontouring to stable slopes (less than 2:1)
- Placement and contouring of 15 cm soil cover
- Fertilizer application as per soil analysis of stockpiled soils
- 70% of area: broadcast seed/incorporate (harrow) 25 kg/ha GPC seed blend
- 30% of area: woody species plantings (excluded WD6)
- Rock piles and coarse woody debris will be placed on the surface around planted areas to protect against over-browsing by ungulates and to provide further structural diversity and habitat elements for small mammals, snakes, birds and insects.

6.3 Soil Stockpile Areas

The soil stockpiles will be depleted and the remaining associated surface disturbances (approx. 0.33 ha) will be reclaimed as follows:

- Decompaction and recontouring to establish positive drainage
- Fertilizer application as per soil analysis
- Broadcast seed/incorporate (harrow) 25 kg/ha GPC seed blend

6.4 Roads

Internal mine roads encompass approximately 2.30 ha. Reclamation will consist of:

- Ripping road surfaces to reduce compaction and increase water infiltration
- Recontouring to provide positive drainage
- Placement of 10 cm of soil cover
- Fertilizer application as per soil analysis of stockpiled soils
- Broadcast seed/incorporate (harrow) 25 kg/ha GPC seed blend

Access for light vehicle traffic will be maintained to accommodate maintenance and monitoring requirements where necessary. Water control will be an important component of the road closure plan to ensure that runoff and erosion are effectively controlled. Cross ditching, as well as erosion control structures will be installed as needed to mitigate runoff.

Access roads will continue to be signed and gated to prevent unauthorized access. All vehicles entering the site will be inspected and cleaned to prevent introduction of weeds and/or invasive plant species.

6.5 Maintenance/Admin Areas

All buildings, infrastructure and equipment have been removed. The only remaining infrastructure is a small concrete pad (approx. 185 m2) associated with a former maintenance/storage building. The pad will be broken up in place to improve water infiltration, covered with 10 cm of soil and hand broadcast seeded with the seed blend @ 25 kg/ha.

6.6 Access Management

All external roads other than the main access road, which is gated and locked, have been ditched and blocked with boulders and dirt mounds to prevent inadvertent access to the mine property. Signage indicating “DANGER OPEN PIT MINE DROP OFF” and “ACTIVE MINE” has been posted along the mine boundary near the logging roads operated/maintained by Canfor to the rear (east) of the open pits.

7 Maintenance and Monitoring

Monitoring is required under Section 10.7.30 of the Code to demonstrate that reclamation and environmental protection objectives are being achieved. Monitoring activities will be carried out by qualified professionals and the results provided in annual reclamation and environmental monitoring reports (per Section 10.1.5 of the Code; BC MEM 2008). Overview of Post-Closure Activities

The level of monitoring effort will be determined by the success of reclamation activities and the results of site observations and data collected. Monitoring activities will include:

- reclamation monitoring (vegetation establishment, composition and productivity);
- invasive plant management; and
- geotechnical monitoring of overburden dumps.

The objective of maintenance and monitoring is to evaluate the success of closure and reclamation activities considering key indicators such as vegetation growth, soil replacement, erosion and sediment control, drainage control, and overall landform design.

7.1 Monitoring

Monitoring at the 4J Mine is assumed to occur annually for a maximum period of five years following final reclamation to determine the success in meeting closure objectives and ensure the site is physically stable and safe. Post-closure monitoring will ensure that:

- The physical structures intended to convey surface runoff water (e.g., channels, ditches and ponds) are stable and functioning properly; and
- Revegetation of disturbed areas is completed and successful in returning mine property to an acceptable and compatible end land use with the surrounding area.

Inspections and monitoring programs will be conducted by staff semi-annually to assess overall site security and access management, the physical stability of mine components and ensure that any remaining mine infrastructure including access roads, ditches and water management structures are performing as designed.

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APPENDIX I

STATEMENT of QUALIFICATIONS

March 31, 2023

STATEMENT of QUALIFICATIONS

I, Johan T. Shearer of Unit 5 – 2330 Tyner Street, in the City of Port Coquitlam, in the Province of British Columbia, do hereby certify:

1. I graduated in Honours Geology (B.Sc., 1973) from the University of British Columbia and the University of London, Imperial College, (M.Sc. 1977).

2. I have practiced my profession as an Exploration Geologist continuously since graduation and have been employed by such mining companies as McIntyre Mines Ltd., J.C. Stephen Explorations Ltd., Carolin Mines Ltd. and TRM Engineering Ltd. I am presently employed by Homegold Resources Ltd.

3. I am a fellow of the Geological Association of Canada (Fellow No. F439). I am also a member of the Canadian Institute of Mining and Metallurgy, the Geological Society of London and the Mineralogical Association of Canada. I am a member in good standing of the Association of Professional Engineers and Geoscientists of British Columbia (P.Geo., Member Number 19,279).

4. I am an independent consulting geologist employed since December 1986 by Homegold Resources Ltd. At Unit #5 2330 Tyner Street, Port Coquitlam, British Columbia.

5. I am the author of the report entitled "Historical Summary Report on the Four J Gypsum Mine" dated March 31, 2023.

6. I have visited the property on June 8, September 16-17 + 30, 2022. I have carried out mapping and sample collection and am familiar with the regional geology and geology of nearby properties. I have become familiar with the previous work conducted on the Four J Gypsum Project by examining in detail the available reports and maps and have discussed previous work with persons knowledgeable of the area.

Dated at Port Coquitlam, British Columbia, this 31st day of March, 2023.

J.T. Shearer, M.Sc., P. Geo. (BC & Ontario)
Permit to Practice 1000611

APPENDIX II (A)

MINE OVERVIEW MAP

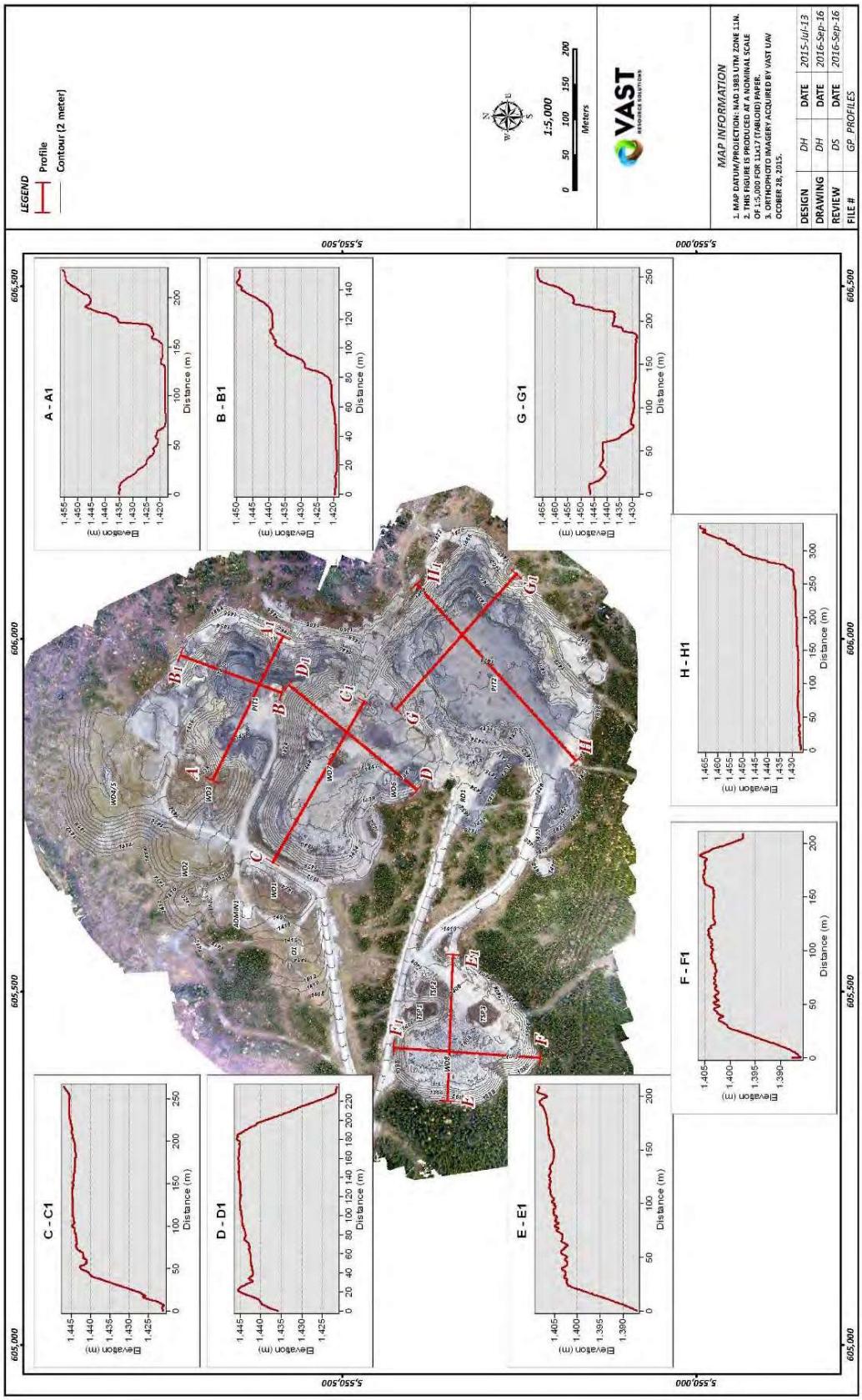
March 31, 2023


LEGEND
Maintenance Area
Non-Reclaimed Dump
Other
Pit
Planned Production Area
Reclaimed Dump
Road
Stockpile
DRAFT
1:3,500
Meters
VAST
MAP INFORMATION
1. MAP DATUM/PROJECTION: NAD 1983 UTM ZONE 13N.
2. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:3,500 FOR 11x17 (TABLOID) PAPER.
3. AERIAL PHOTO IMAGERY ACQUIRED BY VAST UAV OCOBER 28, 2015.
DESIGN DH DATE 2015-Jul-13
DRAWING DH DATE 2016-Mar-29
REVIEW DRAFT DATE 2016-Mar-29
FILE # GP_MINE_PLAN
PPA1
PIT6
PIT4
PIT5
PIT2
PIT3
PIT1
WD7
WD6
RD1
WD4/5
WD3
WD2
WD1
ADMIN1
O1
TSP1
TSP2
TSP3
WD8

APPENDIX III (B)

PIT and OVERBURDEN DUMP CONTOURS and CROSS-SECTIONS

March 31, 2023


LEGEND
Profile
Contour (2 meter)
1:5,000
Meters
VAST
MAP INFORMATION
1. MAP DATUM/PROJECTION: NAD 1983 UTM ZONE 11N.
2. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:5,000 FOR 11x17 (TABLOID) PAPER.
3. ORTHOPHOTO IMAGERY ACQUIRED BY VAST UAV OCTOBER 28, 2015.
DESIGN DH DATE 2015-Jul-13
DRAWING DH DATE 2016-Sep-16
REVIEW DS DATE 2016-Sep-16
FILE # GP PROFILES
A - A1
B - B1
C - C1
D - D1
E - E1
F - F1
G - G1
H - H1
Elevation (m)
Distance (m)
605,000
605,500
606,000
606,500
5,550,000
5,550,500

APPENDIX IV (C)

VAST Invasive Species Management Report

March 31, 2023

4-J Gypsum Mine

INVASIVE SPECIES MANAGEMENT PLAN

Final

Prepared By: VAST Resource Solutions Inc.
PO Box 538
Cranbrook, BC
V1C 4J1

December, 2015

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1.0 SCOPE

This Invasive Species Management Plan is intended to direct the management of invasive plant species (weeds) during reclamation of the 4-J Gypsum Project. The current invasive species inventory were mapped for soil stockpiles, haul roads, rock dumps and quarries on the mine property. Control recommendations for different species have also been developed.

The *B.C. Weed Control Act* classifies weeds into two groups: 1) Noxious weeds within all regions of BC, including 39 designated species classified as noxious within the boundaries of specific regional districts, and six additional species for the East Kootenay region; and 2) Nuisance weeds that are not regulated by the *BC Weed Control Act,* including 43 designated species listed on the BC Ministry of Agriculture web site (http://www.agf.gov.bc.ca/cropprot/weedguid/weedguid.htm). The *BC Weed Control Act* imposes a duty on all land occupiers to control designated noxious plants.

2.0 METHODS

A field survey was completed at the 4-J Gypsum Mine site on July 1, 2015. The weed survey consisted of walking through reclaimed dumps, topsoil stockpiles, along deactivated roads and closed roads, native vegetation areas (no mining impact but adjacent to mining activities), and quarries (active and inactive). Areas were assessed for presence and abundance of noxious and nuisance weed species. GPS coordinates were collected in order to map infestations (Appendix 1) and direct weed control treatment efforts required for problem areas.

3.0 INVASIVE SPECIES PROBLEM AREAS

Preventing invasive plant species infestations while controlling and reducing species already on site will directly influence the success of reclamation efforts. The following section outlines where the established invasive plants occur, the species type, and the steps that may be taken to control weeds on the 4-J Gypsum Mine site. Preventative measures have been included that would help reduce the spread of the existing invasive plants into areas not currently affected.

3.1 Topsoil Stockpiles

Stockpiled soils have been colonized by Canada thistle (*Cirsium arvense*), which is designated as a noxious weed as per the *BC Weed Control Act*. The presence of established plants means that Canada thistle seed is already part of the seed bank in the stockpiled soils. Therefore, control will require a number of years of treatment to exhaust the existing seed bank. Control measures should be implemented before the soil stockpiles are used in new reclamation projects at the mine site. There are some nuisance weedy species also occurring on soil stockpiles, but the noxious weeds should be the first priority for control/eradication treatments. The most common nuisance weed was oxeye daisy (*Chrysanthemum leucanthemum*). Some piles also had prickly rose (*Rosa acicularis*) as well as very low densities of common or great mullein (*Verbascum thapsus*). Figure 1 is representative of the topsoil stockpiles.

Species of Concern

Canada thistle: An aggressive and persistent perennial weed that causes significant crop yield losses. It reproduces through both seed and root regeneration, storing food energy in its extensive root system to survive the winter and support the plant's reproductive growth the following season. Because of its contribution to the persistence of the weed, Canada thistle's extensive root system must be the target of an effective control program. Refer to Appendix 2 for a fact sheet on Canada thistle.

Oxeye daisy: A perennial that spreads primarily by seed, but also by shallow, creeping roots (rhizomes). Individual plants can produce over 500 seeds that are viable in the soil for 2-3 years or more. Refer to Appendix 2 for a fact sheet on Oxeye daisy.

Mullein: A biennial weed that threatens natural meadows and forest openings, where it adapts easily to a wide variety of site conditions. Once established, it grows more vigorously than many native herbs and shrubs. Common mullein is a prolific seeder and its seeds last a very long time in the soil, making it extremely difficult to eradicate.

All noxious and nuisance weeds have the potential to greatly reduce plant biodiversity by negatively impacting the establishment and growth of desirable native vegetation. Weeds compete for moisture, light and nutrients, reducing the biomass of grasses and forbs used for reclamation cover.

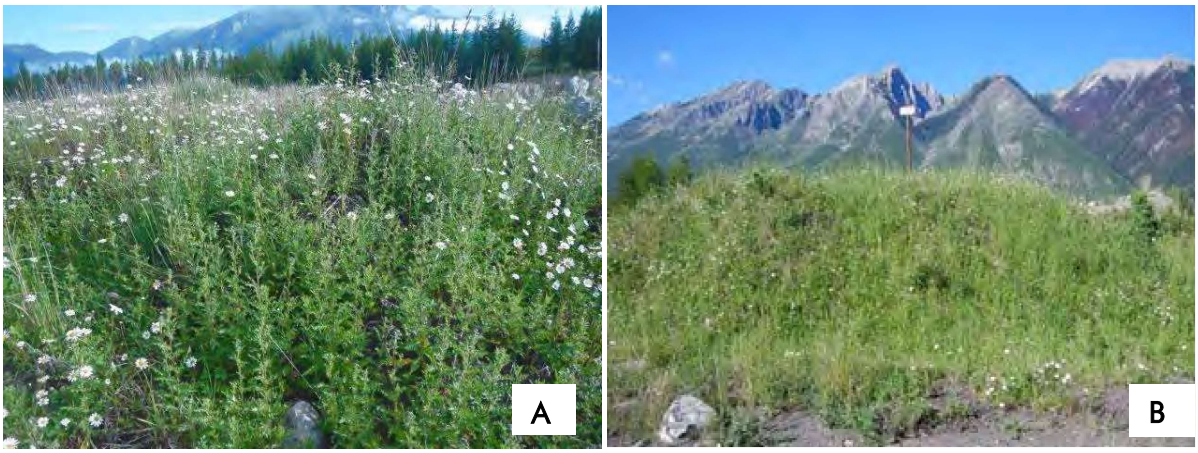


Figure 1. A & B – Canada thistle and oxeye daisy on topsoil stockpiles; B – Prickly rose bushes growing on stockpile as well as thistle and daisy. Locations are indicated on the map (Appendix 1) at 114, 116, and 121.

3.2 Deactivated Roads

Most deactivated roads had no or very low densities of Canada thistle and variable infestations of oxeye daisy (Figure 2). One deactivated and revegetated road had dense patches of yellow hawkweed (*Hieracium pretense*) along the road edges (Figure 3). The location of this road is marked on the map in APPENDIX 1. Orange hawkweed (*Hieracium aurantiacum*) is listed as noxious for the East Kootenay region. However, yellow hawkweed is just as aggressive and should be targeted before it can spread to other locations on site. During the site survey only six yellow hawkweed plants were noted on one topsoil stockpile. These were removed (pulled by hand, not dug out to ensure all of the roots were removed), but it is an indication that hawkweed is starting to move from the old roadway into the mine site. Additional reclamation and revegetation work on deactivated roads will be addressed in the Reclamation and Closure Plan.

Species of Concern

Yellow hawkweed: Hawkweeds spread through aboveground runners, horizontal roots, seeds, and root buds. They can invade natural open areas and disturbed sites, including roadsides, pastures, and clearings. Hawkweeds' main impact is on the forest industry, with the risk of establishment and spread along roads or areas that are not reforested. They can replace native vegetation in open, undisturbed natural areas such as meadows, reducing forage and threatening biodiversity. Refer to Appendix 2 for a fact sheet on hawkweed species.

Figure 2. A deactivated road, standing approximately in the middle looking down and up the road. Oxeye daisy is the dominant weed for this deactivated road (waypoint picture was taken from is 117 on map).

Figure 3. The vegetated deactivated road with yellow hawkweed (yellow flowers in photo) looking up and down the road. Enlargement of one of the patches shown below (waypoint 120).

4.0 OTHER AREAS OF CONCERN

4.1 Rock Dumps

No noxious weeds were observed on the reclaimed rock dumps (Figure 4) during the field survey, although some isolated nuisance plants were noted. Small patches and/or individual Canada thistle plants were observed along the edge of the roadways to the reclaimed dumps. These locations should be targeted during control measures.

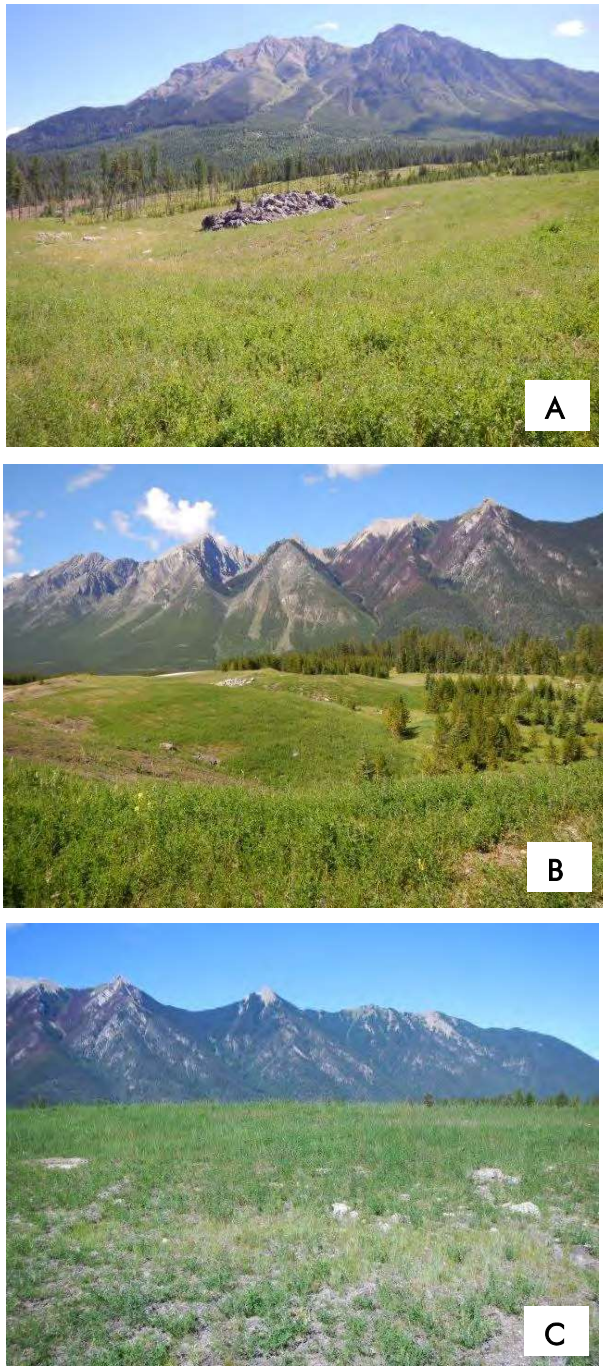


Figure 4. Photo A – Reclaimed dump #1; B – Reclaimed dump #2; C – Reclaimed dump #3. See Appendix 1 for dump locations.

The non-reclaimed rock dumps, #7 and #8, have very little vegetation cover other than limited natural colonization by Interior Douglas fir (*Pseudotsuga menziesii* var. *glauca*), black cottonwood (*Populus trichocarpa*), and trembling aspen (*Populus tremuloides*) seedlings along with the occasional prickly rose shrub. Small patches of grasses from past seeding efforts occur along the bottom edges of the dumps where there are sufficient fine-textured materials to support plant germination and establishment. Some common mullein was observed, but not at high densities. Figure 5 illustrates the current level of vegetation recruitment and the lack of Canada thistle. Additional reclamation and revegetation work of the rock dumps will be addressed in the Reclamation and Closure Plan.

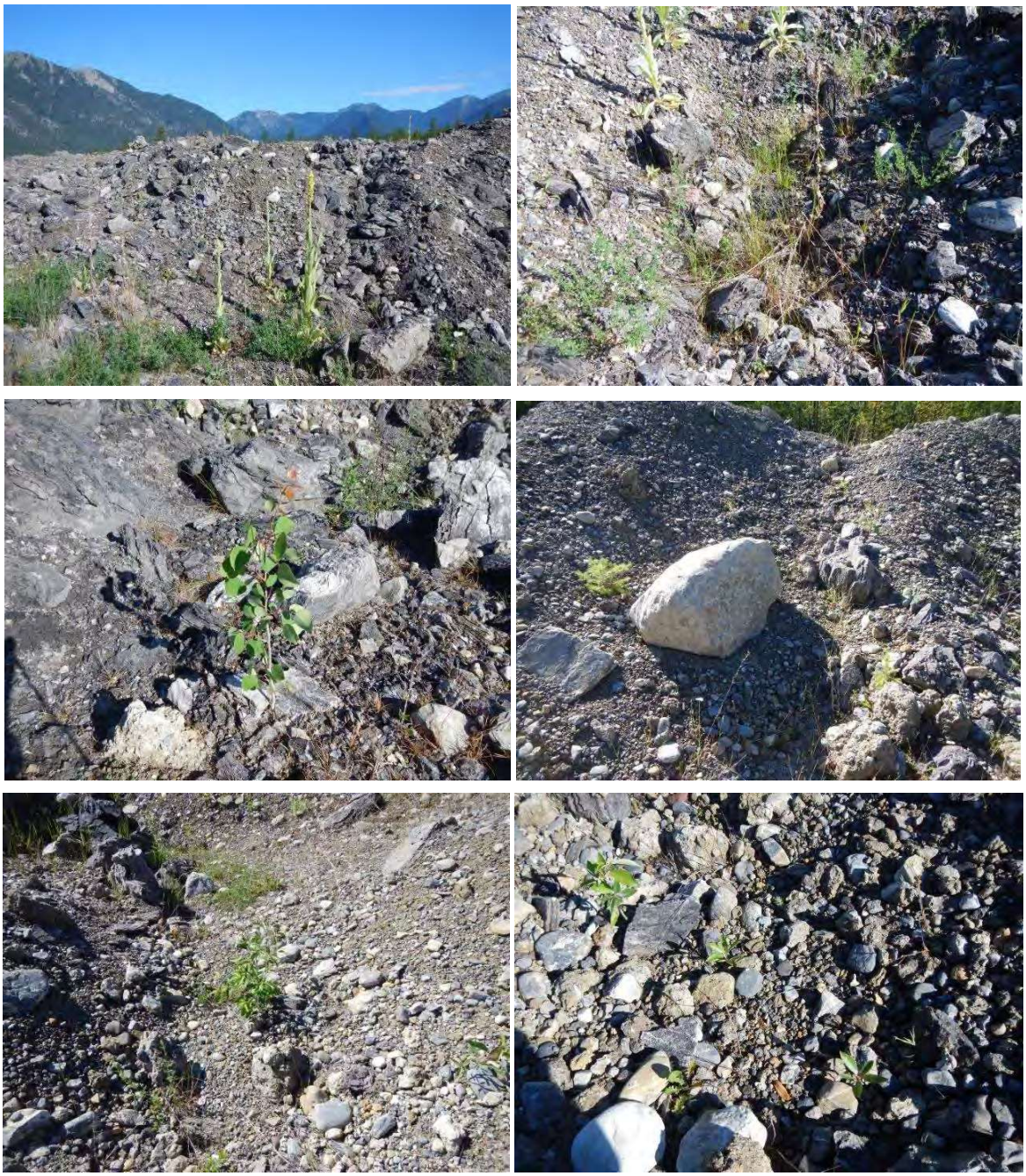


Figure 5. The non-reclaimed dump #8, illustrating the level of revegetation occurring at the bottom of pockets created within the roughened surface of the dump. The top left hand photo is looking at the dump.

4.2 Haul Roads

The haul roads did not have established infestations of Canada thistle or other listed noxious weeds. There were low densities of some nuisance weeds, but most road sides were grass covered with some native shrubs starting to encroach. During monitoring for weeds and/or while on site to treat identified problem areas, small patches or individual Canada thistle plants will be targeted where noted along road ways. Additional reclamation and revegetation work on the haul roads will be addressed in the Reclamation and Closure Plan.

4.3 Quarries

The two quarries on site did not have an established noxious weed problem with Canada thistle, except for small patches along the edges where the access roads ended. Grass cover has established on some of the gentle slopes within the inactive quarry. Figure 6 shows the active quarry and Figure 7 shows the inactive quarry.

Figure 6. The active quarry with a patch of Canada thistle on the access road edge bank. See Appendix 1 for location.

Figure 7. The inactive quarry showing the patches of grass with no thistle. There is a "fines pile" indicated by arrow which may be removed and processed. See Appendix 1 for location.

5.0 INVASIVE SPECIES MANAGEMENT

5.1 Integrated Weed Management Plan

An integrated weed (invasive species) management approach is recommended for the 4-J Gypsum Mine site, focusing on the following priorities:

- Removal/suppression of existing weed growth;
- Prevention/suppression of weed seed production;
- Reduction of weed seed reserves in the soil; and
- Prevention/reduction of weed spread.

Effective weed control programs integrate a number of control measures including prevention, sanitation, cultural, physical, biological and chemical practices. An integrated weed management strategy selects the most appropriate combination of these measures that will provide effective, economical control without harm to desirable plant species and/or the environment.

5.1.1 Prevention

An effective weed control program begins with preventing the introduction of weeds and their seeds onto the mine site. There are two primary considerations:

- *Seed Quality and Purity* - Good quality, clean seed will be used for all reclamation seeding programs in order to maximize germination success and ensure the establishment of a uniform stand of vigorous forage crop seedlings that will aggressively compete with weeds. Seed testing certificates, which indicate the germination and purity of each species in a seed mixture, will be examined before finalizing the purchase of any seed.
- *Equipment/Material Handling* – All vehicles and equipment brought onto the mine site must be clean and will be subject to an inspection for the presence of weeds, seeds and soil. Soil, fill and other materials that may be transported to the mine site for use in reclamation will be inspected for the presence of weeds and seeds at the source site prior to being hauled and placed on the mine site.

5.1.2 Sanitation

There is significant overlap between the activities carried out in prevention and sanitation. Sanitation, from the perspective of weed management, refers to the practice of minimizing the movement of weeds found in one area of the mine site to other areas. The primary activities will involve: keeping equipment free of seed or other reproductive parts of weeds; ensuring that property boundaries, roads and transportation corridors are kept free of weeds capable of reproducing; and ensuring that materials moved within the site are weed-free. As noted in Section 3.1, topsoil stockpiles on the mine site are already infested with Canada thistle, oxeye daisy and mullein. These materials will not be relocated to other areas of the mine for use in reclamation until appropriate control measures have been implemented and an inspection of the stockpiles confirms the soil poses a minimal risk of transporting weeds.

5.2 Types of Controls Available

5.2.1 Cultural Controls

Cultural controls include any practice that increases the competitive advantage of desirable vegetation over weeds that are already present. Practices that promote rapid plant establishment and dense, vigorous crop stands will reduce the impacts of weed competition. Specific considerations include:

- *Crop/Species Selection* – Forage species (grasses and/or legumes) and plants selected for use in reclamation seeding programs will be evaluated to ensure they are adapted to local/regional soil and climatic conditions. Each seed mix and plant will be carefully matched to end land use and limiting factors. Where aggressive weed species are already present, slow establishing native species are not well suited for reclamation compared with the more competitive agronomic species. Species selection will also consider other weed control practices such as herbicide use. For example, there is no benefit in using nitrogen fixing legume species in an area where a broadleaf-specific herbicide may be required for effective weed control.
- *Seeding Practices* – Seeding practices will be managed to promote rapid germination, emergence and establishment of desirable species. Important considerations include: site preparation; seeding date, rate and method; and plant nutrition (fertilizer). As a general rule, new soil disturbances and all reclaimed bare ground will be seeded immediately following soil placement and site preparation activities while the soil remains loose and friable, preferably in the spring or late fall.

Site-specific seeding and planting prescriptions developed as part of the Reclamation and Closure Plan will be implemented in order to optimize the competitiveness of desired vegetation over existing weed species.

5.2.2 Physical Controls

Physical controls include hand weeding, tillage, mowing, grazing, burning and mulching. The success of these methods depends largely on the timeliness of repeated treatments to deplete the plant's food reserves. Where appropriate and feasible, these practices may be incorporated into the overall weed management strategy.

5.2.3 Biological Controls

Biological control or "biocontrol" refers to the use of natural agents such as insects, nematodes, fungi and viruses to control weeds. To date, most biocontrol programs are focused on the use of insects that are natural enemies (predators) of specific weed species. Research on biocontrol agents has been underway in BC for many years, with Canada thistle being one of the weed species of interest. Further experimentation and screening has to be done before this method can be used to the exclusion of alternate control measures. Where appropriate and feasible, biocontrol may be considered for inclusion in the 4-J mine weed management strategy. However, at this time the small point sources and low density of weeds, biological controls would not be recommended for weed control.

5.2.4 Chemical Controls

Where necessary, herbicides should be used to supplement prevention, sanitation, cultural and physical control measures. Application of pesticides on Crown land must be carried out in accordance with the *Invasive Plant Pest Management Plan for Provincial Crown Lands in the Southern Interior of British Columbia*[1] and under the supervision of a certified pesticide applicator. Information on herbicide selection and use, and contact information for certified applicators is available from the East Kootenay Invasive Plant Council[2]. Chemical could be a first year strategy to greatly reduce Canada thistle density on stock piles. Depending on the results subsequent years may not require chemical control.

5.3 Invasive Plant Control Strategies

This section identifies integrated weed management strategies for the specific invasive noxious and weedy species of concern that were identified during the field inspection. Areas identified with very low densities of weeds such as haul roads, access road edges along reclaimed dumps and quarries, should be included in the proposed control treatments. Reducing or eliminating these isolated patches will help to reduce the likelihood of the weeds spreading into reclaimed areas that do not have a problem at the present time. Deactivated roads or access roads that have a known weed problem should not be traveled on until weeds are effectively controlled. This will help reduce the spread of weeds to areas with little or no weed problems. The strategies outlined below will be complemented by reclamation and revegetation prescriptions developed as part of the Reclamation and Closure Plan.

5.3.1 Canada thistle

Canada thistle is the only listed noxious weed on the mine site and therefore is the top priority for the implementation of control measures. Integrated management of Canada thistle must involve combinations of cultural, physical and chemical controls in order to deplete the aggressive creeping root system. Eradication requires persistent and timely control practices implemented over multiple growing seasons.

[1] https://www.for.gov.bc.ca/hra/plants/publications/PMPs/FLNR_Southern_Interior_PMP_confirmed.pdf
[2] http://ekipc.com/

Possible Control Strategies

- Cultural
  - Newly disturbed or recontoured soils should be seeded with a competitive and aggressive agronomic grass species mixture, combined with a cover crop of fall rye, preferably into moist, friable soils in the early spring. Avoid the use of legumes (e.g., alfalfa and clovers) in areas with significant pre-existing Canada thistle infestations (i.e. topsoil stockpiles) as this will limit herbicide options in subsequent treatment periods. The existing 4-J Mine reclamation seed mixture, without the legume components, is appropriate. A balanced blend of fertilizer (e.g., 18-18-18) should be applied at seeding to encourage rapid germination and establishment.
- Physical
  - Canada thistle will continue to draw from root reserves during the flowering period, so physical removal of top-growth with either tillage or mowing, just prior to flower bud break is effective in reducing seed-set and depleting root reserves. Repeated mowing with a gas-powered string trimmer or brush cutter every three to four weeks from June through September and/or intensive cultivation (where feasible) is recommended. If tillage is used, equipment must be thoroughly cleaned between treatment sites to avoid the potential to move root pieces to new locations. At the present time tillage would not be a viable option.
- Chemical
  - Numerous herbicides are registered for the control or suppression Canada thistle. Table 1 provides some of the common products used and the variations in application timing and follow-up treatments. Systemic herbicides, absorbed by the leaves and then translocated throughout the entire plant in the sap, generally provide better long-term Canada thistle control. Certified pesticide applicators can provide specific information on product rates, timing and suitability based on local conditions.

Table 1. Herbicides to control Canada thistle in pastures, rangeland, natural, and non-crop areas.

Herbicide	Application timing	Comments
Tordon	Anytime when weeds are rapidly growing.	Fall applications provide consistent results; may need re-treatment in 1 to 2 years.
Milestone	Spring at pre-flower-bud growth stage; or fall.	Use higher rate for older or dense stands; Milestone may be used to edge of ponds or streams; may need re-treatment in 1 to 2 years.
Transline	Rosette to early bud growth stages; or fall.	Apply in spring or fall; may need re-treatment in 1 to 3 years.
Perspective	Spring rosette to flower bud growth stage; or fall.	Use with a non-ionic surfactant at 0.25% v/v.
Telar	Spring bolting to bud growth stages; or fall.	Fall applications most consistent results; essential to use non-ionic surfactant at 0.25% v/v; may need re-treatment in 1 to 2 years.
Banvel, Clarity	Spring rosette growth stage; or fall.	Fall applications provide most consistent results; may need re-treatment in 2 to 4 years.
Glyphosate*	Rosette to early bud growth stages; or fall.	Glyphosate is non-selective and should only be used in non-crop areas to avoid damage to desirable plant species.

** Glyphosate is the active ingredient in Credit, Factor, Glyfos, Maverick, Renegade, Roundup, Touchdown iQ, and Vantage*

Various techniques have been developed to maximize effectiveness of herbicide applications on Canada thistle. The *Bud Method* involves allowing the thistle grow to the bud stage (just prior to flowering), when the plant is at a weak point in its life cycle, then applying a systemic herbicide. The ample foliage at this stage allows for good uptake and the circulation of sap carries the herbicide to the roots with the storage sugars. Rates of herbicides used at this stage tend to be higher than with the *Rosette Method.*

The *Rosette Method* combines the use of tillage or mowing and a systemic herbicide. Tilling or mowing thistles (as described in "Physical Controls") will drain the root of more reserves than if the first flowering stem was left. New shoot growth emerging during periods when day-length is less than 15 hours will form a rosette and continue to produce carbohydrates for storage in the roots. Herbicides are readily translocated within the plant at the rosette stage, providing effective control. Assuming seven to 10 days for emergence of new shoots, the last tillage or mowing date before herbicide application should generally occur any time after August 1st to induce rosette formation. Wait four to six weeks to allow maximum rosette emergence before spraying with a systemic herbicide. Rosettes should be five to eight cm across at treatment. The herbicide is actively moved to the root in the sap, and the thistle plant is in a severely weakened state from the continued defoliation it has endured through the summer.

The Rosette Method, which combines physical and chemical treatments, and is one possible treatment recommended for the topsoil stockpiles in order to get the Canada thistle problem under control and help to shorten the recovery time period for the stockpiles so they are available for reclamation use. Mowing of existing weeds should be completed as soon as possible in August, followed by herbicide application in 4 to 6 weeks once the plants have recovered and new rosettes have formed. Depending on the herbicide selected for use, it may be practical to seed the stockpiles in order to provide ground cover and weed competition (i.e., non-selective herbicides will damage seeded grasses and legumes so there is no value in temporary seeding of the stockpiles if these types of herbicides will be used for weed control). Timing and slight changes in methods can be changed to correspond to the chemical control recommended by the certified pesticide applicator.

The stockpiles should be monitored for thistle regrowth during 2016 and retreated with the rosette method again if required. Mowing may begin in late June or when the plants reach the bud stage, and continue at appropriate time intervals based on plant regrowth and is dependent on the chemical method used as well as seasonal growth time frames.

5.3.2 Yellow hawkweed

While not currently listed as an invasive species in the East Kootenay region, Yellow hawkweed presents a substantial risk to the success of ongoing reclamation efforts at the 4-J Mine site. Integrated management strategies should focus on detecting and eradicating infestations as early as possible, and on implementing land use practices that promote a competitive cover of perennial vegetation.

Possible Control Strategies

- Cultural
  - Hawkweeds are adapted to nutrient-poor soils. Where competitive grass species are already growing in areas with hawkweed infestations, such as the deactivated roadway at Waypoint 120, annual spring fertilizer applications of a balanced N-P-K-S blend are recommended to reduce hawkweed populations.
  - Bare/thin spots in already reclaimed areas, and any newly disturbed or recontoured soils, should immediately be seeded and fertilized to establish competitive desirable vegetation.
- Physical
  - Hand pulling or digging of individual plants can be effective on small patches where there are competitive desirable plants growing, but only if complete rosettes are removed as regrowth from roots, stolons and rhizomes can occur. This would only be appropriate if hawkweed moves from the one deactivated road to any of the top soil stock piles.
  - Mowing or cutting is ineffective for long-term reduction of hawkweed populations because of the low-growing rosettes, stolons, and rhizomes. Mowing can prevent seed production by removing pre-flower heads and stems in situations where other measures cannot be

implemented on a timely basis, but should be used with caution as it encourages vegetative spread. Not recommended at this time for the one population on site.

- Chemical
  - Actively growing plants can be effectively controlled with clopyralid, picloram, picloram plus 2,4-D, aminopyralid, or aminopyralid plus 2,4-D. Clopyralid and glyphosate give short term control to suppression of hawkweed. Application early in the growing season when hawkweeds are in the rosette stage are generally preferred (in conjunction with fertilizer applications noted above); however, fall treatments are also effective.

A combined method is the best way to manage hawkweed. One of the key points for successful eradication/control of hawkweed is competitive desirable plants. On the small hawkweed population currently at the mine site, aggressive herbicide control should be followed with fertilization and possibly seeding if bare patches develop and no existing desirable plants colonize the bare patches in the following year of the initial treatment.

5.3.3 Oxeye daisy

While not currently listed as an invasive species in the East Kootenay region, Oxeye daisy presents a low to moderate risk to the success of ongoing reclamation efforts at the 4-J Mine site. Integrated management strategies and could include a combination of cultural and chemical treatments.

Possible Control Strategies

- Cultural
  - Oxeye daisy is shade-intolerant and a poor competitor against dense grass stands, Routine fertilization to maintain healthy, competitive communities of desirable plants will help to reduce oxeye daisy populations.
  - Bare/thin spots in already reclaimed areas, and any newly disturbed or recontoured soils should be seeded (aggressive agronomic species blend) and fertilized to establish competitive desirable vegetation. Future reclamation work may use cultural control of planting grass species which could reduce or eliminate oxeye daisy colonization of new areas.

- Physical
  - Hand pulling or digging of individual plants can be effective on small patches where there are competitive desirable plants growing; however, it is important to remove the entire root system or new shoots may emerge from remaining root materials.
  - Mowing may effectively reduce seed production, but may require repeated treatments as it stimulates vegetative growth.
  - At this point in time physical control is not recommended because of the sparse population and the wide spatial distribution of oxeye daisy.

- Chemical
  - Clopyralid controls of oxeye daisy when applied to shoots that are young and actively growing. Metsulfuron methyl and picloram/2,4-D provide effective control of oxeye daisy. 2,4-D applied alone provides short term control unless it is used in combination with picloram. Targeting oxeye daisy is not recommended for the first year of implementation of the plan because of the low density and wide spatial distribution on site.

Oxeye daisy when it occurs in combination with either Canada thistle or Yellow hawkweed, will be controlled by the same strategies recommended for use on these higher priority weed species. Therefore, oxeye daisy infestations will be monitored to see if populations are reduced by thistle and hawkweed treatments.

6.0 MONITORING AND EVALUATION

It is important to monitor the implementation and effectiveness of this invasive species management plan over time. Monitoring results will be used to guide future program direction and ensure the plan is effectively managing invasive plants on the 4-J Mine site. Key aspects of the monitoring program include:

6.1 Species Monitoring

Since there is always a risk that new weeds may invade the site in future years, invasive plant species inventory surveys should be repeated over time in order to provide a record of invasive plant occurrence, density, spatial distribution, and population characteristics. This will ensure the early identification and treatment of species before they become a problem on the mine site. Early diagnosis and early treatment are key for successful weed control.

6.2 Treatment Monitoring and Evaluation

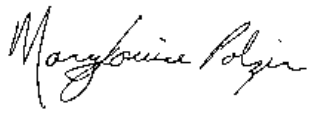
All cultural, physical and chemical treatment sites should be routinely monitored to evaluate:

- Efficacy of control methods used;
- Protection of environmentally sensitive areas;
- Potential or actual impacts to non-target vegetation or soils;
- Regrowth of invasive plants;
- Re-treatment requirements, if any; and
- Cost-effectiveness of the treatment program.

7.0 REPORT CLOSURE

VAST Resource Solutions trusts that this report meets your current requirements. Should you have any questions, please contact us at your convenience. Thank you for the opportunity to provide our services to you.

Prepared By:

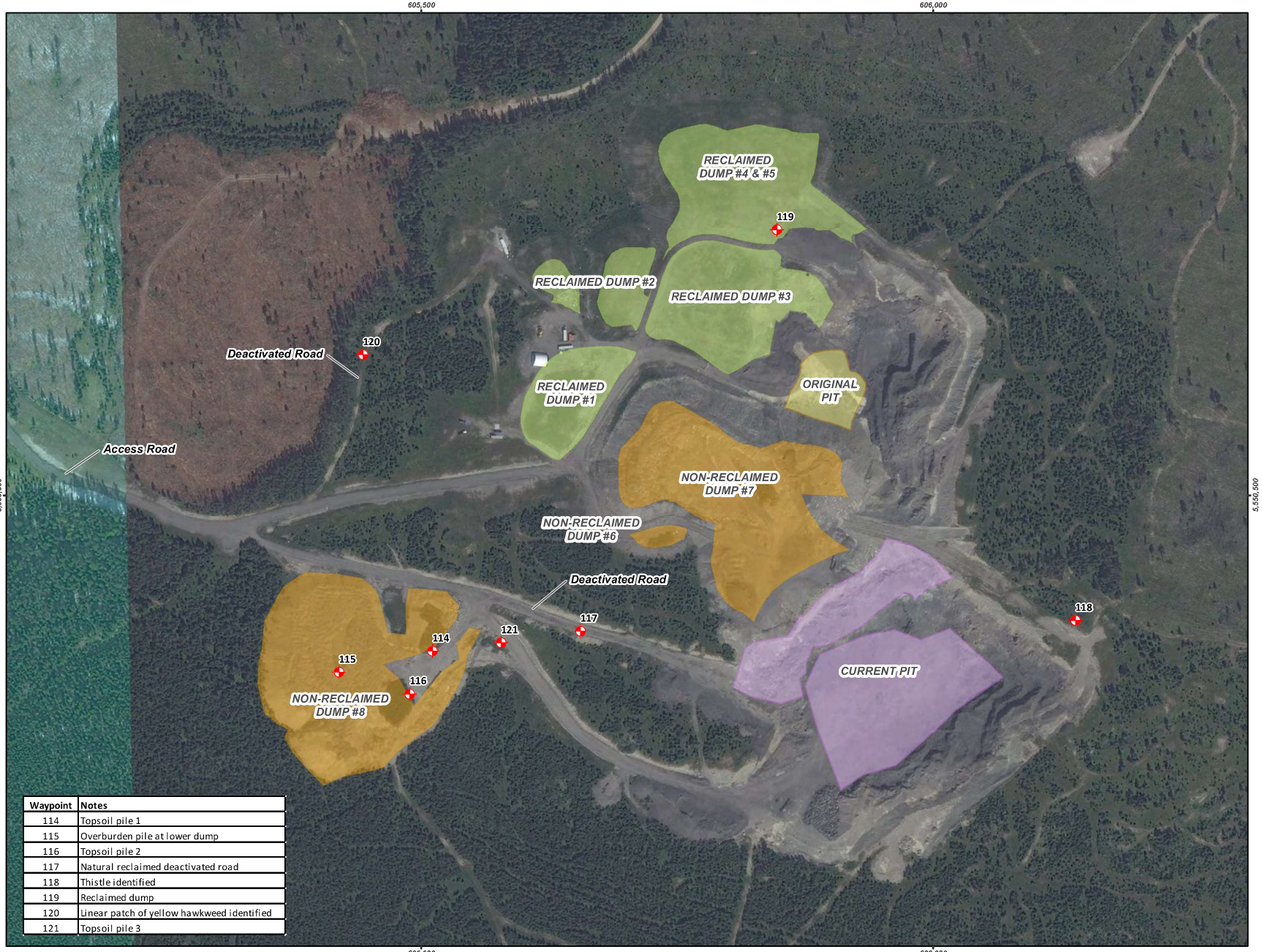


Dr. Mary-Louise Polzin, PhD, RPBio
Senior Ecologist/Riparian Specialist

Reviewed By:

David Struthers, BSc, PAg
Senior Agrologist/Reclamation Specialist

APPENDIX 1: Invasive Species Map for the 4-J Mine



Waypoint	Notes
114	Topsoil pile 1
115	Overburden pile at lower dump
116	Topsoil pile 2
117	Natural reclaimed deactivated road
118	Thistle identified
119	Reclaimed dump
120	Linear patch of yellow hawkweed identified
121	Topsoil pile 3

Georgia Pacific - Canal Flats, BC
4J Gypsum Mine

INVASIVE SPECIES MAP

LEGEND

GPS Waypoint

FEATURE

- Current Pit
- Original Pit
- Reclaimed Dump
- Non-Reclaimed Dump

1:3,500

0 50 100 150 Meters

DATA SOURCES

4J Gypsum Mine features provided by Georgia Pacific.
Orthophoto provided by ArcGIS Online.

MAP INFORMATION

1. MAP DATUM/PROJECTION: NAD 1983 UTM ZONE 11N.
2. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:3,500 FOR 11x17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.

DESIGN	DH	*DATE*	7/31/2015
DRAWING	DH	*DATE*	7/31/2015
REVIEW	MLP	*DATE*	7/31/2015
FILE #	4J_WeedControl		

VAST RESOURCE SOLUTIONS

APPENDIX 2: Invasive Species Information

Invasive Species Council of British Columbia

Canada Thistle

Cirsium arvense

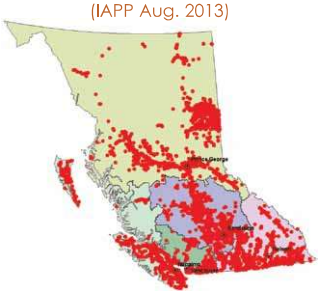
TIPS

Updated July 2014

Legal Status

Invasive Plants Regulation, *Forest and Range Practices Act;* Noxious Weed (Provincial), *Weed Control Act.*

Distribution in BC
(IAPP Aug. 2013)



Distribution

Canada thistle is widespread in all areas of BC. It is commonly found on roadsides, cultivated fields and pastures, logged forests, and other disturbed areas. It is considered to be a major concern in the Peace River, Omineca, and Skeena areas.

Identification

Flowers: Flower heads are white to purple, about 1 cm in diameter, borne on clusters of 1-5 at branch tips, and have a sweet vanilla scent. Flower bracts are spineless.

Stems: Mature plants range from 0.3-2.0 m in height.

Leaves: 5-17 cm long, narrow, and alternate on the stem with crinkled, deeply lobed, and spiny edges. Base leaves are stalkless and clasping, or extended down the stem.

Fruits: One-seeded, pale yellow (straw) or light brown in colour; straight or slightly curved.

Similar Native Species: Wavy leaf thistle *(Cirsium undulatum)*. See non-native species for distinguishing characteristics of Canada thistle.

Similar Non-Native Species: (i) Bull thistle *(Cirsium vulgare)*; (ii) Scotch thistle *(Onopordum acanthium)*; (iii) plumeless thistle *(Carduus acanthoides)*; (iv) musk thistle *(Carduus nutans)*; and (v) marsh thistle *(Cirsium palustre)*. Canada thistle can be differentiated from all similar species by the lack of spines on the main stem, small flowers, and height (less than 2 m tall).

Ecological Characteristics

Habitat: Canada thistle is found in almost every plant community over a wide range of elevations where there is soil disturbance or bare ground including roadsides, railway embankments, lawns, gardens, cultivated and non-cultivated fields, margins of forests, meadows, wetlands, and native plant communities. Best adapted to rich, heavy loam, clay loam, and sandy loam. Grows poorly in shaded conditions. Can tolerate saline, wet, or dry soils, but does not tolerate waterlogged or poorly aerated soils.

Reproduction: Perennial that reproduces by seed and vegetatively through creeping, horizontal roots, the fragments of which are capable of forming new plants. Seed viability may be low; mature seeds germinate most readily in mid-spring. Non-germinated seeds may remain dormant for up to 3 years.

Dispersal: Plants are male or female (dioecious) and grow in circular patches that are often one clone and sex. Canada thistle develops seed sparingly and may produce 1,000 to 1,500 seeds per flowering shoot. Dispersed primarily by wind, seeds can also be dispersed by water, animals, clothing, equipment, and vehicles. Generally, vegetative reproduction from its root system contributes to local spread and seed to long distance dispersal.

Invasive Species Council of British Columbia

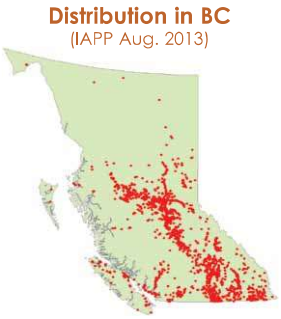
Hawkweeds

(Hieracium spp.*)*

TIPS

Updated July 2014

About Hawkweeds



There are 14 species of native hawkweeds in western North America, of which 8 have been recorded in BC. There are also 14 species of invasive, non-native hawkweeds in western North America, of which 13 have been recorded in BC. Twelve of the 13 invasive species have yellow flowers. Hawkweeds are readily hybridizing in BC, which can make identification very difficult. Most invasive hawkweed species have similar biology, ecological characteristics, impacts, distributions, and recommended management techniques; as a result, they are discussed as a complex in this document. Where necessary for identification purposes, the complex is divided into either 'orange' or 'yellow' invasive hawkweeds.

Legal Status

Orange hawkweed is currently the only invasive hawkweed species regulated by the *Weed Control Act*. Both meadow and orange hawkweed are identified in the *Forest and Range Practices Act*.

Distribution

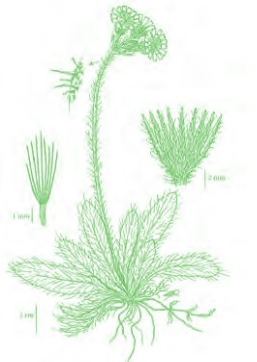
Invasive hawkweeds are currently distributed throughout most forest regions and regional districts in BC. The regional districts east of the Rocky Mountains, Northern Rockies, and Peace River Regional Districts only have a few known invasive hawkweed sites and efforts to prevent further establishment and spread are actively underway. Orange hawkweed is regionally noxious in the East Kootenay, Central Kootenay, Columbia-Shuswap, Thompson-Nicola, Bulkley Nechako, and Cariboo Regional Districts.

Identification

Flowers: Bright orange, orange-red, or yellow ray flowers with several flower heads in clusters atop each stem.

Stems: Orange hawkweed stems are usually single and un-branched; leafless; contain a milky fluid; covered in black hairs; 0.3-1.2 m tall. Yellow hawkweed stems, like orange hawkweed, have short, stiff hairs with the upper portion of the stem often black and gland tipped.

Leaves: Found at base of stem in rosette formation. Orange: 4-20cm long; hairy on both upper and lower surfaces. Yellow: no leaves or greatly reduced stem leaves, whereas native yellow species have true leaves all the way up their stems; some species have glaborous leaves (no hairs).



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Fruits: Dark ribbed achenes; tiny, approximately 2 mm long.

Similar Species: Further information on hawkweed identification: www.for.gov.bc.ca/hra/Publications/invasive_plants/Hawkweed_key_PNW_2007.pdf

Ecological Characteristics

Habitat: Flourishes in well-drained, coarse-textured soils. Can invade natural open areas and disturbed sites, including roadsides, pastures, and clearings.

Reproduction: Perennial species that reproduces through four mechanisms: (i) above-ground runners (called stolons), (ii) rhizomes, (iii) seed, and in some cases (iv) buds on the roots. Established populations expand in size primarily via stolons.

Dispersal: Spreads by intentional and accidental human activities, wind, animals, and in contaminated hay and soil.

Invasive Species Council of British Columbia

Oxeye Daisy

Leucanthemum vulgare

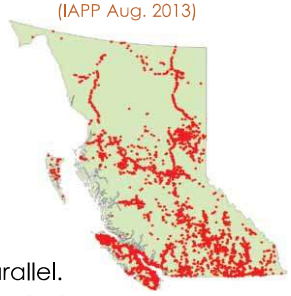
TIPS

Updated July 2014

Legal Status

Invasive Plants Regulation, *Forest and Range Practices Act;* Noxious Weed (Regional), BC *Weed Control Act.*

Distribution in BC
(IAPP Aug. 2013)



Distribution

Common in BC south of the 56th parallel. Of major concern in: Cariboo, Okanagan, Peace River, Thompson, and Omineca.

Identification

Flowers: Typical daisy appearance; single flower heads at end of branches have white ray flowers and yellow disc flowers. Flower head diameter is approximately 5 cm. White petal tips are notched.

Stems: Single to a few erect stems. Sometimes branched. Height 0.2–0.8 m.

Leaves: Basal leaves are stalked, coarsely divided, and 4-15 cm long. Leaves are smaller and clasping toward the shoot.

Fruits: Ribbed black achenes (simple, dry, one-seeded fruit).

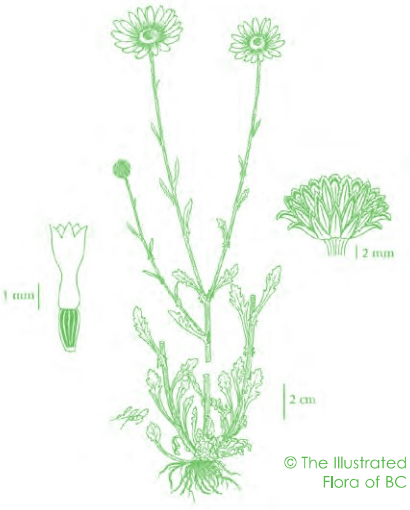
Similar Species: (i) Scentless chamomile (*Matricaria perforata*) has smaller flowerheads (2–3 cm diameter) and has finely divided leaves (almost fern-like); (ii) Shasta daisy, an ornamental, is larger (approximately 6-12 inches taller) and has flower heads with greater diameter.

Ecological Characteristics

Habitat: Resides in mesic to dry areas such as roadsides, pastures, waste areas, grasslands, and forested areas within low to mid-elevations.

Reproduction: Perennial plant that reproduces by seed and underground stems. A single plant can produce up to 26,000 seeds.

Dispersal: Primarily by seeds that are dispersed near the parent plant. Due to its unpleasant taste, most grazers tend to avoid it, allowing it to spread easily within grazed grasslands, pastures, and rangelands.



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Impacts

Economic: Economic impacts of oxeye daisy infestations to the forest industry are not well known and require further research. Economic costs of control may be reduced by matching silviculture brushing activities with brushing/ mowing of daisy infestations to reduce seed production. Impacts to agriculture are better understood. Infestations decrease available forage for grazing livestock, especially when dense.

Ecological: Infestations can also decrease forage for wildlife, decrease local plant biodiversity, and may decrease vegetative ground cover due to its growth form, thereby increasing the area of exposed soil on site.


S. Atherton


S. Atherton


S. Dewey, bugwood.org

Integrated Pest Management

IPM is a decision-making process that includes identification and inventory of invasive plant populations, assessment of the risks that they pose, development of well-informed control options that may include a number of methods, site treatment, and monitoring.

Prevention

- Avoid wildflower seed mixes that contain oxeye daisy.
- Resist invasion of oxeye daisy by managing tenured areas appropriately to maintain healthy plant communities.

Mechanical Control

- Mowing may effectively reduce seed production, but should be repeated as it may stimulate vegetation growth.
- Grazing by sheep and goats may reduce oxeye daisy populations.
- Pulling or digging up plants, ensuring that all roots are removed, may reduce oxeye daisy populations. New shoots may emerge from remaining root portions.
- Follow-up treatments will be required as seeds can remain viable in the soil for many years.

Biocontrol

- No biocontrol agents are currently available for oxeye daisy in BC. Further research is required.

Chemical Control

Herbicide recommendations and use must consider site characteristics and be prescribed based on site goals and objectives. Herbicide labels and other sources of information must be reviewed before selecting and applying herbicides.

- Clopyralid is recommended for control of oxeye daisy, but should be applied when shoots are young and growing.
- Metsulfuron methyl and picloram/2,4-D provide effective control of oxeye daisy.
- 2,4-D applied alone provides short-term control unless it is used in combination with picloram.
- Application of pesticides on Crown land must be carried out following a confirmed Pest Management Plan (Integrated Pest Management Act) and under the supervision of a certified pesticide applicator. www.env.gov.bc.ca/epd/ipmp/
- Fertilizer applied after herbicide treatment increases growth of desirable vegetation and reduces re-invasion of oxeye daisy. There is evidence that shading can reduce oxeye daisy biomass.
- 2006/07 field trials by the BC Ministry of Agriculture indicate that aminopyralid, picloram, picloram plus 2,4-D, or dicamba can give excellent to very good control.

References/Links

- *A Guide to Weeds in British Columbia.* Oxeye Daisy. www.weedsbc.ca/weed_desc/oxeye.html
- BC Ministry of Agriculture. *Field Guide to Noxious Weeds and Other Selected Invasive Plants of British Columbia. Oxeye Daisy.* www.agf.gov.bc.ca/cropprot/weedguid/oxeyed.htm
- BC Ministry of Forests, Lands, and Natural Resource Operations, Invasive Alien Plant Program (IAPP). www.for.gov.bc.ca/hra/Plants/application.htm
- E-Flora BC, an Electronic Atlas of the Plants of BC. www.eflora.bc.ca/
- Montana State University Extension Service. *Oxeye Daisy.* www.montana.edu/wwwpb/pubs/mt200002.pdf
- Strathcona County. Weeds and Their Control. *Oxeye Daisy.* www.strathcona.ca/files/files/at-tas-oxeyedaisy.pdf

BRITISH COLUMBIA

Thank you to the BC Ministry of Environment for providing project funding, and to those who advised the development of these management recommendations.

ADDITIONAL CONTACT INFO

Impacts

Economic: Forms dense mats of rosettes; out-competes forage plants in hay fields and pastures. Main impact on forest industry is the risk of establishment and spread along roads or areas that are not reforested.

Ecological: Invasive hawkweed species can replace native vegetation in open, undisturbed natural areas, such as meadows, and in disturbed areas, such as roadsides, thereby reducing forage and threatening biodiversity.

Integrated Pest Management

IPM is a decision-making process that includes identification and inventory of invasive plant populations, assessment of the risks that they pose, development of well-informed control options that may include a number of methods, site treatment, and monitoring.

Prevention

- Fertilizer and soil fertility management.
- Minimize soil disturbance and promptly re-vegetate disturbed areas.
- Do not purchase wildflower seed mixes that contain invasive hawkweed species.

Mechanical Control

- Dig out rosettes and their shallow roots in new, small infestations.
- Take care not to spread any of the vegetative parts of the plant as re-growth from roots, stolons and rhizomes can occur.
- Although mowing removes flower stems and may prevent seed set, it should be used with caution as it encourages enhanced vegetative spread.

Biocontrol

- Currently no biocontrol agents are available for orange hawkweed; however, research is underway.

Chemical Control

Herbicide recommendations and use must consider site characteristics and be prescribed based on site goals and objectives. Herbicide labels and other sources of information must be reviewed before selecting and applying herbicides.

- In soils with low nitrogen and sulphur levels (such as pastures and range areas), where grass species are growing amongst the hawkweed, the competitive ability of grasses can be increased through application of fertilizer with nitrogen and sulphur components.
- Spring treatments with both nitrogen fertilizer and herbicide are recommended; however, fall herbicide treatments are also effective for control.
- Actively growing plants can be effectively controlled with clopyralid, picloram, picloram plus 2,4-D, aminopyralid, or aminopyralid plus 2,4-D.
- Clopyralid and glyphosate give short term control to suppression of orange hawkweed.


B. Stewart


L. Wilson


B. Stewart


B. Stewart


L. Scott

- Application of pesticides on Crown land must be carried out following a confirmed Pest Management Plan (*Integrated Pest Management Act*) and under the supervision of a certified pesticide applicator. www.env.gov.bc.ca/epd/ipmp/

References/Links

- Antos, J., et al. 1996. *Plants of southern interior British Columbia*. Lone Pine Publishing, Vancouver, BC.
- BC Ministry of Agriculture. 2001. www.agf.gov.bc.ca/cropprot/ipm.htm
- BC Ministry of Forests, Lands, and Natural Resource Operations, Invasive Alien Plant Program (IAPP). www.for.gov.bc.ca/hra/Plants/application.htm
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- E-Flora BC, an Electronic Atlas of the Plants of BC. www.eflora.bc.ca/
- *Field Guide to Noxious and Other Selected Weeds of British Columbia*. 2002. http://www.agf.gov.bc.ca/cropprot/weedguid/orangehw.htm
- University of Idaho Hawkweed Website. www.cals.uidaho.edu/hawkweed/

ADDITIONAL CONTACT INFO

Thank you to the BC Ministry of Environment for providing project funding, and to those who advised the development of these management recommendations.

Impacts

Economic: Plants can crowd out forage grasses in pastures and rangelands, reducing yields and productivity.

Ecological: Single plants can spread rapidly (up to 5.5 m per season) and form dense patches, particularly in riparian areas, thus out-competing native plants.

Integrated Pest Management

IPM is a decision-making process that includes identification and inventory of invasive plant populations, assessment of the risks that they pose, development of well-informed control options that may include a number of methods, site treatment, and monitoring.

Prevention

- Monitor for Canada thistle in both disturbed and undisturbed areas.
- Ensure soil, gravel, and other fill material are not contaminated.
- Avoid unloading, parking, or storing equipment and vehicles in infested areas.
- Minimize soil disturbance during activities and re-vegetate exposed soil as soon as possible.
- Remove plants, plant parts, and seeds from personal gear, clothing, pets, vehicles, and equipment. Wash vehicles, including tires and undercarriage, and equipment at designated cleaning sites before leaving infested areas.
- Bag or tarp plants, plant parts, and seeds before transporting to a designated disposal site (e.g. landfill).
- Take special care when controlling Canada thistle near streams, or ditch lines, to prevent the movement of plant parts downstream.
- Maintain or establish healthy plant communities that are resistant to invasion by invasive plants.

Mechanical Control

- Mowing is most effective when completed at the bud stage.
- Regular cutting or tillage can help wear down plant reserves, reduce plant growth, and reduce populations, but is not likely to kill the plant.
- Disposal: If plants are cut prior to flowering, the plant material can be left on the site to decompose. If plants are cut post flowering, all plant parts, including flower heads, should be bagged and deeply buried at a landfill. Care should be taken to ensure that plant parts are not distributed during transport.

Biocontrol

- A seed weevil *(Larinus planus)*, stem gall fly *(Urophora cardui)*, leaf-eating beetle *(Altica carduorum)*, and stem and root mining weevil *(Hadroplontus litura)* have been released. *L. planus* is showing particular promise in suppressing Canada thistle.

Chemical Control

Herbicide recommendations and use must first consider site characteristics and be prescribed based on site goals and objectives. Herbicide labels and other sources of information must be reviewed before selecting and applying herbicides.

- 2,4-D is effective when used in the spring on new germinants, and will achieve suppression of mature plants with repeated treatments.
- Picoloram and glyphosate give good control when applied in the fall after the first hard frost.
- Spring applications of aminopyralid or clopyralid give good control and suppression of top growth.
- Applications of metsulfuron-methyl give good control up to the early bud stage.
- Application of pesticides on Crown land must be carried out following a confirmed Pest Management Plan *(Integrated Pest Management Act)* and under the supervision of a certified pesticide applicator. www.env.gov.bc.ca/epd/ipmp/

References/Links

- *A Guide to Weeds in British Columbia.* Canada thistle. www.weedsbc.ca/weed_desc/canada.html
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- *Biological Control Agent Matrix: Canada Thistle.* www.for.gov.bc.ca/hfp/publications/00199/canada.htm
- E-Flora BC, an Electronic Atlas of the Plants of BC. www.eflora.bc.ca/
- *Field Guide to Noxious Weeds and Other Selected Invasive Plants of British Columbia*. BC Ministry of Agriculture. www.agf.gov.bc.ca/cropprot/weeds.htm#field
- *King Country Noxious Weed Control Program Weed Alert: Canada Thistle.* King County, Washington. http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/Brochures/CanadaThistle_factsheet.pdf

ADDITIONAL CONTACT INFO

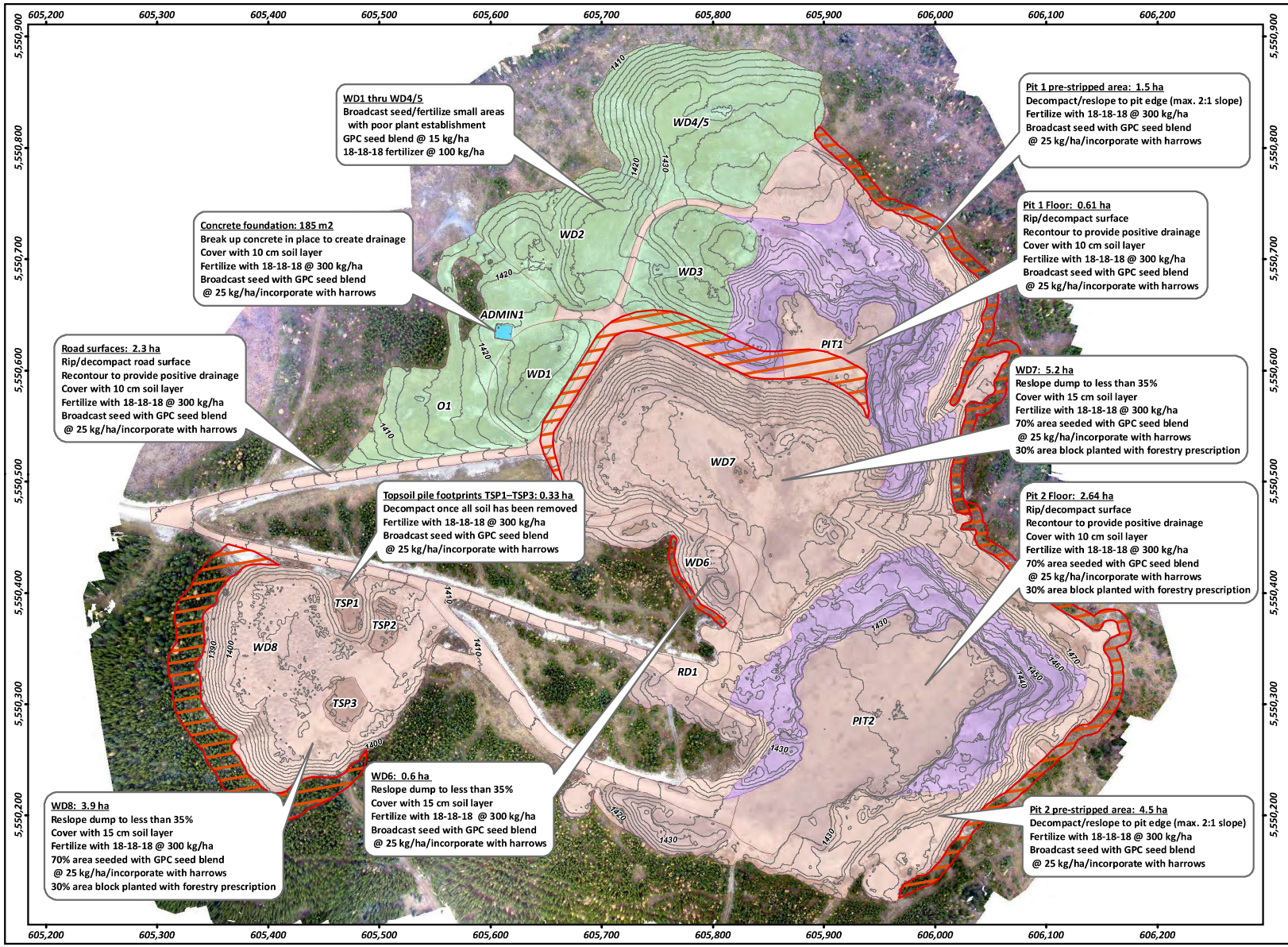
BRITISH COLUMBIA

Thank you to the BC Ministry of Environment for providing project funding, and to those who advised the development of these management recommendations.

Appendix D: Closure/Reclamation prescription map

Reclamation Status and Closure Prescriptions

Georgia-Pacific



LEGEND

- Contour (2 meter)
- Reslope Footprint

Reclamation Status

- Complete
- Exempt
- Ongoing
- Required

N
W
E
S

1:3,500

0 50 100 150

Meters

VAST RESOURCE SOLUTIONS

MAP INFORMATION

1. MAP DATUM/PROJECTION: NAD 1983 UTM ZONE 11N.
2. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:3,500 FOR 11x17 (TABLOID) PAPER.
3. ORTHOPHOTO IMAGERY ACQUIRED BY VAST UAV OCOBER 28, 2015.

DESIGN	DH	DATE	2015-Jul-13
DRAWING	DH	DATE	2017-Feb-07
REVIEW	DS	DATE	2017-Feb-07
FILE #	GP_RECL_CLOSURE		

MXD Path: P:\15.0088 GP_4J Mine Closure Plan\GIS\MXD_DATA\GP_RECL_CLOSURE.mxd