EDI ENVIRONMENTAL DYNAMICS INC.
Natural Resource Consultants

FARO MINE COMPLEX – 2009 REVEGETATION TRIALS AND MONITORING

PREPARED FOR:

YUKON GOVERNMENT

ASSESSMENT AND ABANDONED MINES BRANCH

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1 EXECUTIVE SUMMARY

The Faro Mine Complex (FMC) Closure Plan and Remediation Plan - Revegetation Plan outlines different ground covers, surface treatments, and vegetation treatments, variable upon location at the mine such as the nature of the underlying material and slope. Trials are necessary prior to large-scale implementation to determine if the selected species, application rates, and physical soil treatment methods would meet general site reclamation objectives or if modifications to the plan are needed.

EDI completed several revegetation monitoring and trial activities in 2009 at the FMC. The work included the following:

- Monitoring of the 2007 Waste Rock Lysimeter Plot No.1
- Monitoring of the 2008 Grum Overburden Dump trials
- Implementation of a large trial at the .Grum Overburden Dump
- Revegetation of the Vangorda Cover Waste Rock area.

This year's main effort involved the implementation of a large trial at the Grum Overburden Dum. Different revegetation grass mixes and physical soil treatment outlined in the FMC Revegetation Plan were tried out. The grass mixes were applied with and without fertilizer; and woody species (alder, willow, and poplar) were inter-planted in the seeded plots.

Initial monitoring results show variable survival rates of the poplar and willow cuttings planting in 2007 and 2008. However, it is too early and the trials were too small to draw conclusions on reclamation application for these species at FMC.

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2 ACKNOWLEDGEMENTS

EDI developed the design of the 2009 reclamation studies in cooperation with Justin Straker with Stantec Consulting Ltd.) and with further input from Maritz Rykaart (SRK Consulting). Denison Environmental completed the site preparation at the Grum Overburden Trail site and assisted with site logistics.

EDI staff members Ben Snow and Meghan Marjanovic completed the July monitoring of the test plots. Ben, Meghan, Mike Setterington, and Toos Omtzigt from EDI and seasonal hires Roberta Dick, Glen Ollie, and Vashti Etzel completed the trial works later in fall.

A final thanks to Rob Legare from the Yukon Government Forestry Branch for providing the spruce seed.

3 INTRODUCTION

The Anvil Range Mine (or Faro Mine Complex) was a zinc-lead-silver open pit and underground mine located in central Yukon. The mine operated under various owners from 1968 to 1998, eventually expanding to a footprint of approximately 25 km^2 including three open pits, water treatment facilities, numerous waste rock dumps, a tailings impoundment, ore processing facilities and related buildings. Since 1998 the mine has been in a "care and maintenance state" and in January 2003, the federal and territorial government formally recognized that the Anvil Range Mine was no longer economically viable and would not be operated again.

Formal closure of the Fare Mine Complex is proceeding with the Final Closure and Remediation Plan (FMC Closure Office, 2009) nearly completed. The general closure objectives for FMC are to:

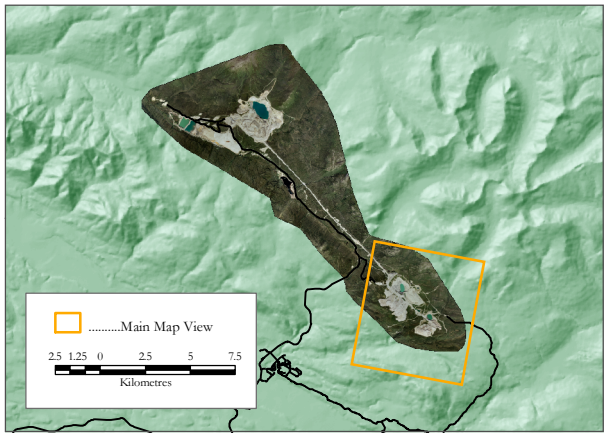
1. Protect human health and safety;
2. Protect and, to the extent practicable, restore the environment including land, air, water, fish and wildlife;
3. Return the mine site to an acceptable state of use that reflects pre-mining land use where practicable;
4. Maximize local and Yukon socio-economic benefits; and
5. Manage long-term site risk in a cost-effective manner.

The FMC Revegetation Plan (Omtzigt, 2010) is part of the Final Closure and Remediation Plan and incorporates these objectives. It focuses on items 2 and 3, with the protection of the environment as the primary goal. And where practicable, restoration of the environment and land use to reflect pre-mining conditions are the secondary goals. The plan includes ways to establish vegetation that develops into productive, self-sustaining ecosystems integrated with the surrounding area with considerations for aesthetics, ecosystem integrity, biological diversity, wildlife habitat, and use by people.

The FMC Revegetation Plan implementation involves active revegetation of the site. Initial vegetation and soil treatment prescriptions were outlined in *Faro Mine Site Revegetation Study: Waste Rock Dumps and Tailings* (Jacobson *et al.* 2008). Based on this work, EDI initiated small size trials in 2007 and 2008 to investigate site-specific revegetation techniques.

After further discussions of the Faro Mine Closure Partners earlier in 2009, more detailed surface treatment and revegetation prescriptions were developed (Rykaart 2009 and Miskolczi 2009). In the fall, EDI completed a large trial at the Grum Overburden Dump site with the updated treatment prescriptions. The objective of this trail is to determine which surface and revegetation treatments are viable or most suitable for the site, and to refine surface treatment methods, planting prescriptions, and soil amendments.

This report summarizes this year's trial work and the monitoring results of previous trials. Section 4 and 5 describe the monitoring results for the 2007 and 2008 trials, respectively. Section 6 describes the revegetation trials at the Grum Overburden Dump implemented this year. Additional seeding and fertilizing at the Vangorda Waste Rock Pile completed in 2009 is described in Section 7. The report concludes with an evaluation of the revegetation efforts completed so far with suggestions for follow-up work.



Revegetation Trial Locations

- 1 - 2007 Vangorda Waste Rock Lysimeter Plot #1
- 2 - 2008 Trial A
- 3 - 2008 Trial B
- 4 - 2009 Trials
- 5 - 2009 Vangorda Waste Rock Leeching

Data Input/Drawn by:	T. Omtzigt, G. Pelchat
Checked By:	T. Omtzigt
Date:	20 October 2009
EDI Project Number:	09-YC-0038
Map Projection:	NAD 1983 UTM Zone 8

500 250 0 500 1,000 1,500 2,000

Metres

Digital Data Sources:
- Orthophoto: August 2003, Orthoshop, Calgary AB
- Base Map Files: NTDB Canada 1: 50,000, www.geogratis.ca
- Landsat: CTIS CanImage, www.geogratis.ca
- Borrow Locations adapted from SRK Consulting (2002)
- Organic Soil Locations adapted from Bond (2001)

Inset Mapping Source:
- Base Files: NTDB Canada 1: 2,000,000 www.geogratis.ca

Figure 1: Revegetation Trial Locations at the Faro Mine Complex.

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4 MONITORING: 2007 VANGORDA WASTE ROCK LYSIMETER PLOT NO. 1

The 2007 revegetation trial is located at the Vangorda Waste Rock test area, Lysimeter plot No. 1 (Figure 1). The trial included planting the site with live balsam poplar and willow stakes and seeding with alder seed. The plot is 25 by 25 m and was tilled mechanically prior to planting to create a rolling topography. Due to shallow cover depth, live stakes were planted only to an average depth of 0.5 m, rather than the preferred 1 m.

Revegetation success of the live stakes was monitored by counting the stakes and identifying them as living (signs of sprouting with no signs of drying out) or dead (signs of drying out with no signs of sprouting) in 2008 (September) and 2009 (July). In 2009, 18% of the originally planted willow stakes and 67.3% the poplar stakes were still alive (Table 1). The larger diameter cuttings (>3 cm) of both species appear to be growing more successfully than smaller diameter cuttings.

We observed no sign of germination of the alder seed in either year. The soil surface is hard when dry and difficult to penetrate.

Table 1. Survival of willow and poplar stakes at Vangorda Lysismeter Plot No. 1.

Species	Number Planted	% Living 2008	% Living 2009
Willow	54	28	18.5
Balsam Poplar	47	74	67.3

Figure 2. Lysimeter plot No. 1 in 2008, one year after planting the stakes.

Figure 3. Lysimeter plot No. 1 in 2009. Photo insert shows willow stake with second year growth.

5 MONITORING: 2008 GRUM OVERBURDEN DUMP TRIALS

In 2008, EDI completed trials in two locations at the Grum Overburden Dump. Figure 1 shows the general location of the trials (2008 Trial A and 2008 Trial B).

5.1 TRIAL A

Trial A is located near the bottom of the northeast side of the Grum Overburden Dump. The area is 5m wide x 96.5 m long. It was loosened to a depth of about 30 to 40 cm prior to planting. Figure 4 shows a schematic overview of the site. The site was planted in the fall of 2008 as follows:

- 110 willow (55%) and balsam poplar (45%) stakes in one-third (36m) of the treatment area.
- Alder seed was applied in a portion of this area (20 m).
- Another portion of the site (10 m) received 'alder organics', where whole cones and leaves were scattered over the area.
- Approximately 100 willow and balsam poplar poles were planted vertically in 2 lines of shallow trenches, covering 12 m of the treated site.
- The remaining 38 m was left untreated.

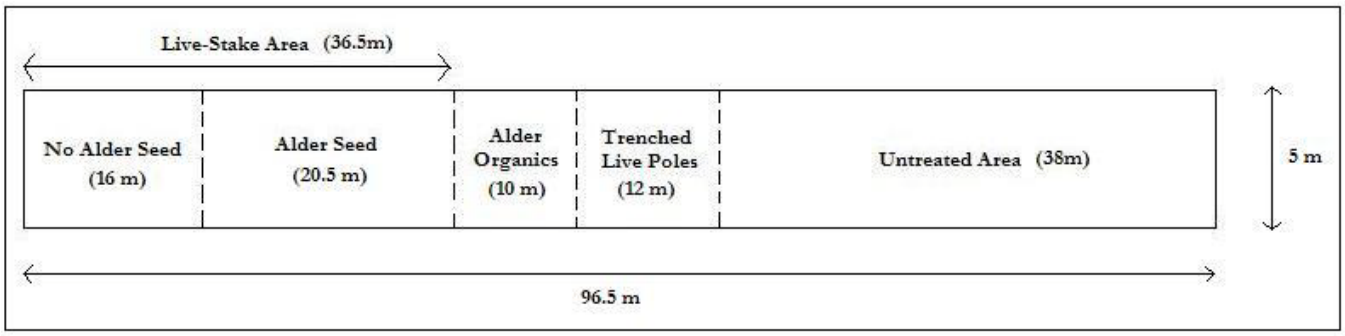

Figure 4: Schematic diagram with the 2008 Trial A revegetation treatments at the Grum Overburden Dump.

EDI checked the site in July 2009 and observed reasonably good growth of the live stakes: 72 % of the willows and 58 % of the poplar stakes, all planted vertically were alive. Numerous branches grew from the horizontally planted cuttings (in the trenches). Success is harder to quantify here, but based on experience, we would describe the growth to be good.

Table 2. Survival of willow and poplar stakes at 2008 Trial A Grum Overburden Dump.

Species	Number Planted	% Living 2009
Willow	36	72
Balsam Poplar	58	58

Upon return to the site in August, we found numerous alder seedlings at both areas seeded with alder (i.e., alder seed and alder organics). The plants were only in the 4- to 6-leaf stage and rather small. Future monitoring will provide further insight in shrub success.

Figure 5. First-year growth on the horizontal stakes.

Figure 6. Alder cones surrounded by alder seedlings. Detail of seedlings shown in photo insert.

5.2 TRIAL B

The Trial B site consists of nine 20 m x 20 m test plots and one control on top of the Grum Overburden Dump. The trial work consisted of applying four different grass seed mixes, at different rates and mixed with alder seed. A schematic with the study design is shown in Figure 7.

A summary of the observations in July 2009 is included in Table 3. In general, grass emergence at all plots was sporadic and provided little cover. Willow, fireweed, and other mature plants noted at the site were likely present because of natural introduction from the surrounding area and incomplete turning of the soil last year during site preparation.

The soil surface is hard and difficult to penetrate when dry. When wet, the surface clumps and becomes muddy quickly.

The less than ideal growing conditions (higher altitude, poor soil) are likely contributors to the lack of grass cover. Additional monitoring and soil testing in future years should provide more insight.

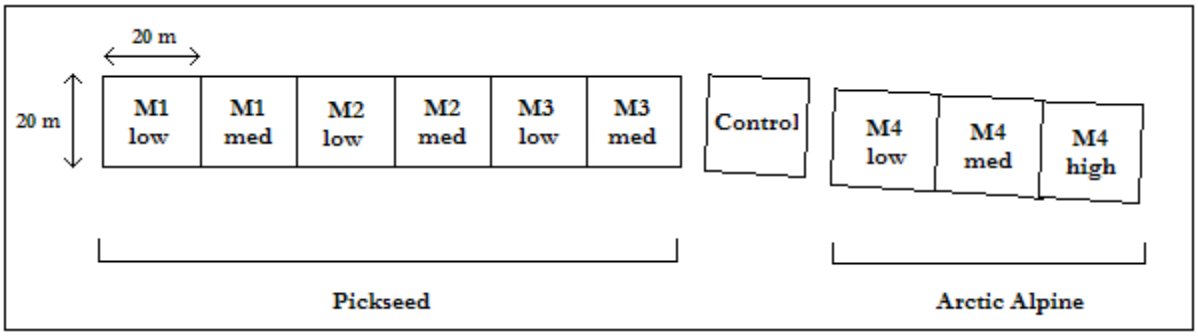

Figure 7: Study design for 2008 Trial B, four seed mixes (M1, M2, etc.) and three different application rates.

Figure 8. Trail B area. Plot 1 with small grass plants emerging.

Table 3. Summary results of vegetation growth observation (July 2009) of Grum Overburden Trial B.

Grass Mix	Plot #	Application Rates	2009 Observations
Mix 1 (M1): Highlander slender wheatgrass (20 %) Alpine bluegrass (20%) Tufted hairgrass (15%) Fringed brome (15%) Fowl bluegrass (10%) Rocky Mountain fescue (10%)Spike trisetum 10%)	1	Low: 25 kg/ha	Grass plants 1- 5 cm tall with purple leaves. Foxtail barley seed blown in. Approx. 12 fireweed and similar amounts of willow seedlings. Cover 0.5% grass, <0.5% fireweed and willow.
	2	Med: 50 kg/ha	Higher grass coverage than plot 1. Similar amounts of willow as plot 1, largest 60 cm tall. Fireweed (5 plants). Cover 0.5 to1% grass, <0.5% willow, <0.25% fireweed
Mix 2 (M2): Awned wheatgrass (25%) Tufted hairgrass (20%) Fringed brome (15%) Fowl bluegrass (10%) Alkali grass (10%) Alpine bluegrass (10%) Spike trisetum (10%)	3	Low : 25 kg/ha	Grass cover low. One horsetail present, similar amount of willow as plots 1 and 2. Five fireweed plants. Cover 0.25% grass, <0.5% willow, <0.25% fireweed.
	4	Med: 50 kg/ha	Grass cover 0.25% to 0.5%. Willow <30cm tall, less abundant then Plot 3. Approx 7 fireweed. About 0.25 m² of horsetail in Northwest plot corner. several individuals of foxtail barley and other grasses.
Mix 3 (M3): Spike trisetum (25%), Slender wheatgrass (20%), Tufted hairgrass (15%), Fringed brome (10%), Fowl bluegrass (10%) June grass (10%), Tickle grass (10%)	5	Low: 25 kg/ha	Grass emergence nearly zero. 2 willows, some clumps of foxtail barley, 2 fireweed, 1 yarrow plant (~10 cm).
	6	Med: 50 kg/ha	Grass cover minimal (<0.25%). 5 to 10 fireweed individuals, with some broad fireweed. Some purple rye outside of the plot. 1 willow (20cm).
Mix 4 (M4): Violet wheatgrass (40%) Slender wheatgrass (10%) Tickle grass (5%) Sheep fescue (20%) Arctic fescue (25%)	8	Low: 10 kg/ha	Some small grass, 2cm to 6 cm, 0.25 to 0.5% cover. 10-15 fireweed plants. Same species as seen in other plots. 2 horsetails, several foxtail barleys. 1 tufted hairgrass and 1 slender wheatgrass plant.
	9	Med: 20 kg/ha	Slightly more grass than in plot 8 (<0.5%). 3 tufted hairgrass plants. Fireweed (*E. Latifolium* and *E.latifolium*) plants, 2 willow, 2 horsetail plants.
	10	High: 30 kg/ha	Grass growth slightly higher than plots 8 and 9. Several foxtail barley individuals. 3 fireweed plants. 2 horsetails. Several yarrow and 1 hairgrass plant.

6 2009 GRUM OVERBURDEN DUMP TRIALS

6.1 BACKGROUND INFORMATION

The FMC Closure and Remediation Plan and the Revegetation Plan outline different ground covers, surface treatments, and vegetation treatments, variable upon location at the mine such as the nature of the underlying material and slope. A final soil cover will be applied to most of the FMC to provide a medium that allows for revegetation. The fill material at the Grum Overburden Dump will be used as this final cover.

The FMC Revegetation Plan (EDI 2010) specifies several potential plant species suitable for reclamation. Although selected plant species are expected to grow at the FMC, soil conditions are poor (Jacobsen *et al.* 2008) and growth rates are expected to be slow. Trials are therefore necessary prior to large-scale implementation to determine if the selected species, application rates, and physical soil treatment methods would meet general site reclamation objectives or if modifications to the plan are needed.

The trials at the Grum Overburden Dump emphasize the requirement to develop stable slopes and ground to minimize infiltration through the cover to underlying materials. The objectives of the trails are to:

1. Determine growth rate and/or plant cover for grass mixes prescribed in the FMC Revegetation Plan.
2. Determine if prescribed application rates of the grass mixes provide erosion protection, but also allow for the colonization of native woody and herbaceous plants.
3. Evaluate how inter-planting the grass mixes with woody species will improve the seral success rate of the revegetation.
4. Evaluate planting and propagation methods for large-scale implementation and site suitability.
5. Evaluate the physical surface treatment options of the cover fill material.

6.2 SITE SELECTION & PREPARATION

The trial site is located on the northeast side of the Grum Overburden Dump (Figure 1). This area was selected because it provides representative material as intended for final cover during reclamation of the FMC. The site is approximately 260 m wide and has a 70 m long slope with a gradient of about 3:1. Average altitude is 1285 m.

To get a reasonably sized trail area, part of the site had to be resloped. As a result, the site is divided into two areas: (1) an area that was resloped and reworked. For about 10 days two dozers moved the fill material around to make a gradually sloped site (Figure 10) to create a sufficiently sized trial area; (2) The second area is adjacent to it but did not require resloping. Rocky/schist-like material was lying on top of the second area. The material had a light gray color, compared to the darker resloped section (Figure 16). Because the soil particle analysis (section 6.4) shows a similar composition of sand, silt, and clay particles, we suspect the different look may be a result of washing down of fines, which exposes the grey rocks.

6.3 COVER TREATMENT

The final cover at the FMC has to provide stable slopes and ground to minimize infiltration through the covers to the underlying material. This means maximizing the other water balance factors, like runoff, evaporation, and evapotranspiration. The physical treatment of the cover material is important in how the material will perform and for the success of the revegetation effort. In this year's trials, we tried three different surface treatments prescribed in the FMC Revegetation Plan. The treatments have different levels of compaction, runoff potential, and typography.

The cover treatments include (Figures 15 and 16):

1. Planar: nominally a treatment of the slope as a planer sheet without purpose-built rills or mounds. In reality this treatment will be roughened due to the need to leave a non-compacted growth medium for revegetation.

   Site preparation: after resloping the site the dozer walked up and down the site. This created track imprints perpendicular to the slope and compacting the soil. See Figures 14 and 19.

2. Downslope (Micro-scale) Rills: create corrugated (downslope parallel ridge/swale patterned) features using a dozer with a special attachment creating 10 to 20 cm deep and 5 to 10 cm wide, with similarly sized ridges separating the rills.

   Site preparation: a dozer with a 5-toothed ripper attachment ran down slope creating rough rills. See Figures 11 and 12.

3. Rough and Loose: excavator-roughened surface, potentially mixed with coarse woody debris to create loose mounds of material.

   Site preparation: as an excavator walked backed up or down the slope, the bucket scooped up loads of fill and immediately dumped this again. This created a pattern of loose mounts and valleys. See Figure 13.

The entire trial area contained many rocks, which made the site rather rough (Figures 9, 11, 13 and 17). The material would also tend to concrete up a few days after a rainfall, making it very difficult to work with hand tools or machinery. As soon as it got wet, the material turned into a wet mud, likely due to the presence of fines/clay.

6.4 SOIL CONDITIONS

Jacobsen *et al.* (2008) described the Grum Overburden Dump as a pile consisting of glacial till materials originally overlying the Grum pit. The texture of the Grum material ranged from sandy loams to loams with coarse fragment contents of 15–75%. Ten samples were collected randomly throughout the overburden pile. Although the results indicated elevated zinc levels, the report noted that there were no substantial chemical limitations to use the material for surface capping.

While previous sampling provided insight in metal content in the soil and possible toxicity issues, we supplemented this information with soil nutrient analysis and additional metals analysis. Composite surface samples, one each, from the Planar, Rills and Rough and Loose cover treatment areas were collected after completion of the soil preparation treatments. Pacific Soil Analysis Inc completed the basic soil chemistry, soil macro and micronutrient, and particle size analysis. Cantest Ltd. completed the metals analysis. Methodology and detailed results are included in Appendix A.

The three samples confirmed the high pH (around 8) and the nature of the fill as sandy loams - loams material. The percentage of soil organics and the total nitrogen give an indication of the nitrogen supplying capability of soil. In terms of the ability to support plant life (drawn from agricultural and horticultural applications), both indicators are low; the organic matter is between 0.8% and 2.2% and total nitrogen around 0.03%. The conductivity levels in the soil samples indicate no salinity issue. Phosphorus varied from 4 to 7ppm and is considered to be in the low to medium range; and potassium varied in the medium range from 48 to 85ppm. In addition, calcium levels varied from 1550 to 2300ppm and were in the medium range as well in terms of supporting plant growth.

Important micro-nutrients that affect plant success include magnesium, copper, zinc, iron, manganese and boron. Magnesium varied between 85 and 210ppm; copper between 15.0 and 7.8ppm; zinc between 15 and 305ppm; iron between 415 and 450ppm; manganese between 107 and 126ppm; and boron was less than 1ppm. All these nutrient levels show above adequate levels in terms of ability to support plant growth, except boron for which the actual content was not measurable.

The metals/elemental testing of the soil helps determine if there are any toxicity issues in terms of the protection of the environment and human health. The reference guidelines used to evaluate the data are the Yukon Contaminated Sites Regulations (CSR) 2002 for soil and the Canadian Soil Quality Guidelines from the Canadian Council of Ministers of the Environment (CCME) 1999. For both references we selected the agricultural standard and ingestion of soil and fodder. In addition, the Swim Lake data for subsurface mineral soils was used as a local reference of naturally occurring elemental concentrations. This information is derived from the Anvil Range Terrestrial Effects study by Gartner Lee, 2006.

- Two (Rough & Loose and Rills) of the three samples showed elevated zinc levels of 525 and 919µg/g compared to the CCME and CSR standard of 200 µg/g. The local reference for zinc is 253µg/g. Sampling in 2007 (Jacobsen *et al.* 2008) also showed elevated zinc concentration of 609µg/g and 278µg/g of two samples collected in the same general location as in the 2009 samples.
- Lead levels in the same two of samples were high (154µg/g and 443µg/g) compared to the CCME guideline of 70µg/g and the local reference of 61µg/g, but within range of the CSR standard of 350µg/g.
- Arsenic levels in these two samples were high (64µg/g and 88µg/g) compared to the CCME guideline of 12µg/g, the CRS standard of 25µg/g , and the local reference of 17.8µg/g.
- Boron levels in all three samples were high (17µg/g, 22µg/g, and20 µg/g) in comparison with the CRS standard and local reference of 2µg/g.

6.5 REVEGETATION TREATMENT

The trials include revegetation species selected based on known success growing them in similar climatic, latitude, and site conditions. Alder is an exception, as it is not typically used as a reclamation species in Yukon, but is being tried here.

We seeded three different grass mixes, with and without fertilizer, on each of the three surface cover treatments. We also planted willow and poplar cuttings (horizontally and vertically) and alder seedlings in smaller plots throughout the trial site. Finally, we spread a limited amount of spruce and dwarf birch seed in two locations. Figures 15 and 16 show the layout of the trial area with the different treatment plots.

The selected grass mixes consisted of the following:

1. Agronomic-legume mix: a commercial seed mix consisting of Red Fescue (Arctared) 15%, Meadow Foxtail (Common) 11%, Kentucky Bluegrass (Nugget), 5% Slender Wheatgrass (Adanac) 49%, Alsike clover (Common) 20%. Application rate: 40 kg/ha.
2. Native grass mix: a commercial seed mix consisting of Slender Wheatgrass 10%, Northern (Rocky Mountain) Fescue 20%, Glaucous Bluegrass 37%, Tufted Hairgrass 33%. Application rate: 29 kg/ha.
3. Native grass mix with annual nurse crop species: a commercial seed mix consisting of Slender Wheatgrass (14%), Northern (Rocky Mountain) fescue 27%, Glaucous Bluegrass 58%, Barley 0.5%. Application rate: 33.5 kg/ha.

Tickle grass was initially included in both native seed mixes, but was not available when placing the seed order.

The woody species consisted of:

1. Willow and balsam poplar cuttings planted as stakes horizontally and vertically at a planting density 25–35 per 150 m^2.
2. Alder seedlings. Planting density was 25–30 alder seedlings per 150 m^2.
3. Spruce and dwarf birch seed spread at a density of 12 g and 10 g per 1,350 m^2, respectively.

We obtained weed and purity analysis certificates for all the commercial seed species. There were no restricted, noxious or other unacceptable weed seeds and purity of the seed was acceptable.

Fertilizer – each grass mix was seeded with and without fertilizer (400kg/ha of 8-38-15 the first year) to compare the response of the grasses to the different nutrient regimes.

6.6 TIMING AND METHODOLOGY

Denison Environmental was responsible for the cover treatment preparation. This work started in the middle of August and was complete prior to commencement of the revegetation works. The planting and seeding work took place between September 2 and 17. Throughout this time, the crew consisted of two to three EDI staff and one to three labourers.

Seeding and fertilizing: commercially available mixes were ordered from Pickseed, Edmonton AB. Seed analysis certificates for purity and germination potential are included in Appendix B. The material arrived on site a few days prior to start of the work and was kept out of the weather until application. Calculated volumes for each area were measured and the seed and fertilizer were applied using hand spreaders.

Alder – EDI collected alder seed at the FMC in 2007 and kept this in cold storage until sending 10 grams to a nursery for propagation. In February 2009 Arbutus Grove Nurseries in North Saanich, B.C. direct seeded the alder into plugs. Seedlings were moved for outside acclimation and continued monitored growth in May. After dormancy induction, the seedlings were lifted from the plugs in late August and shipped to Whitehorse on September 1. At that time, the seedlings were between 15 and 30 cm tall. Most of the shrubs had numerous bursting leaf buds, possibly due to very warm weather during the inducted dormancy period in July/August.

At the rough & loose and the rills treatment plots, the alder seedlings were planted by digging a small depression into the ground with a shovel and packing down loose soil around the plugs (Figure 17). Due to the compacted nature of the Planar trial area, holes had to be drilled with a hand-held 2" gas-powered auger after which the plugs were placed in the hole and packed down with loose soil.

1. Willow and Poplar – EDI collected willow and poplar cuttings in a few locations at the FMC and soaked them in water for 3 to 7 days prior to planting. The cuttings varied in diameter from 2 to 5 cm and were 50 to 150 cm long.
    - Vertical planting of cuttings – stakes were planted at 75 to 100 cm depth by drilling holes with a 2" hand-held power auger (Figure 18). After placing a stake into a hole, the soil was packed down. Where needed, the stakes were cut off at 15 to 20 cm was above ground level.
    - Horizontal planting – 1 or 2 stakes (75 to 125 cm long), were placed in a small trench that was dug using a shovel. The stakes were then covered with 2 to 5 cm of fill (Figure 19).
2. Spruce – YG Forestry provided EDI with 12 grams of white spruce (*Picea glauca*) seed form the locality of Ross River/Magundy River. The seed was spread by hand in the central section of the planar trial area.
3. Dwarf birch – EDI collected about 10 grams of birch (*Betula glandulosa*) seed from shrubs adjacent to the Grum site. The seed was spread by hand in the central section of the rills trial area.

Figure 10. Detail of fill material.

Figure 9. Reworking of slope at the Grum Overburden Dump

Figure 11. Planting in the micro-rills.

Figure 12. Creating micro-rills with dozer and ripper

Figure 13. Planting in the rough & loose section.

Figure 14. Planting in the planar section.

Distance from toe of slope	Surface Treatment	Planar						Micro Rills						Rough and Loose					
	Fertilizer	x			x	x			x	x			x	x			x	x	
	Seed Mix:	agronomic		nurse+native		native		native		agronomic		nurse+native		nurse + native		native		agronomic	
70 m																			
60 m		horiz.	alder	vert.	horiz.	vert.	alder	alder	vert.	alder	vert.	horiz.	alder	vert.	horiz.	alder	alder	horiz.	vert.
50 m		not planted	horiz	alder	vert.	alder	vert.	vert.	alder	vert.	horiz.	vert.	horiz.	alder	alder	horiz.	horiz.	alder	vert.
40 m		alder	vert.	horiz.	vert.	horiz.	horiz.	horiz.	horiz.	horiz.	alder	alder	vert.	horiz.	vert.	alder	vert.	vert.	alder
30 m		white spruce seed, alder and horiz.						dwarf birch, alder, and horiz.						alder and horiz.					
20 m		horiz.	alder	vert.	alder	vert.	horiz.	alder	horiz.	horiz.	vert.	alder	vert.	alder	vert.	horiz.	vert.	horiz.	alder
10 m		alder	horiz.	alder	horiz.	horiz.	vert.	horiz.	vert.	vert.	alder	horiz.	alder	vert.	horiz.	vert.	alder	vert.	horiz.
Toe of slope = 0 m		vert.	vert.	horiz.	alder	stakes	alder	vert.	alder	alder	horiz.	vert.	horiz.	horiz.	alder	vert.	horiz.	alder	horiz.
	Distance along toe of slope	90m	75m	60m	45m	30m	15m	90m	75m	60m	45m	30m	15m	78m	55m	42m	39m	26m	13m

Figure 15. 2009 Trial layout.

Each surface treatment received 3 seed mixes (agronomic, nurse + native, and native). Half of each seeded section was fertilized. In addition, woody species were planted in blocks throughout the site (alder = alder seedlings; horiz = willow and poplar stakes planted horizontally; and vert. = willow and poplar stakes planted vertically. Specifics for each application are described in the text.

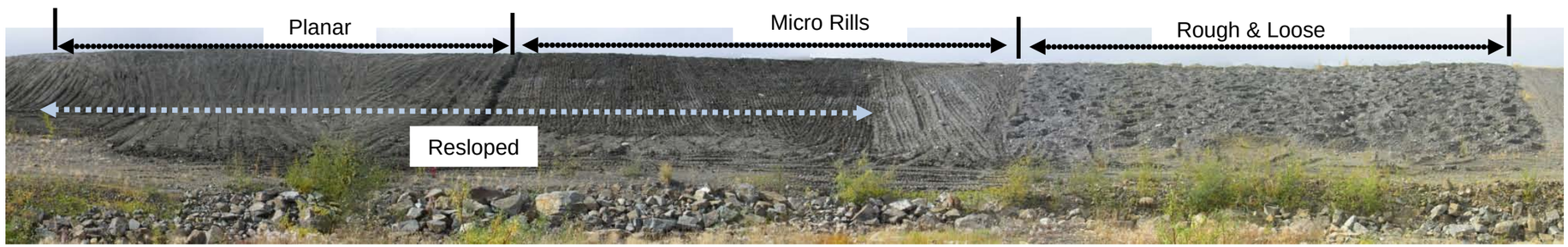

Figure 16. A panoramic overview of the trial area. Note color difference between resloped (dark) and adjacent area (grey).

Figure 17. An alder seedling ready to be planted.

Figure 18. Planting vertical stakes.

Figure 19. A horizontal stake nearly buried in planar section.

Figure 20. Hauling stakes to the site.

7 2009 VANGORDA WASTE ROCK PILE

SRK Engineering maintains a series of cover plots as part of an ongoing testing program at the Vangorda Waste Rock Pile. The plots needed to be vegetated and this allowed us to apply the prescribed revegetation grass mixes from the FMC Closure Revegetation Plan in another location.

The revegetation effort included seeding and fertilizing of the test areas. We also planted alder and horizontal stakes at the 1994 cover area. Table 4 below outlines the different treatments. EDI completed the work according to the methods described in Section 4.6 in the period September 13–17, 2009.

Table 4. Vangorda Waste Rock Pile – 2009 cover treatment and revegetation prescriptions.

Location	Prescribed Surface Treatment	Actual Surface Treatment	Actual Vegetation Treatment	Fertilizer
CT#1	None	None	None	None
CT#2A	Micro-scale downslope rills	Hand rake	Agronomic grass-legume mix	8-38-15 400kg/ha
CT#2B	Micro-scale downslope rills	Hand rake	Agronomic grass-legume mix	8-38-15 400kg/ha
CT#3A	Micro-scale downslope rills	Hand rake	Agronomic grass-legume mix	8-38-15 400kg/ha
CT#3B	Micro-scale downslope rills	Hand rake	Agronomic grass-legume mix	8-38-15 400kg/ha
CT#4	Micro-scale downslope rills	Hand rake	Agronomic grass-legume mix	8-38-15 400kg/ha
Lysimeter #1; this plot was planted with willow and poplar in 2007	Rough and loose (completed in 2007)	Hand rake	Agronomic grass-legume mix	8-38-15 400kg/ha
Lysimeter #2	Micro-scale downslope rills	Hand rake	Agronomic grass-legume mix	8-38-15 400kg/ha
Vangorda waste rock cover 1994; upper section with 2.5H:1V slope	Micro-scale downslope rills	Smooth out first with dozer and then created down-slope rills	Annual nurse crop + native grass mix + alder seedlings and horizontal stakes.	8-38-15 400kg/ha

Sensitive measuring equipment near the surface in the covers trials, prevented the use of machinery for any kind of ground preparation. Soil preparation therefore consisted of raking the surface with hand rakes only instead of creating the downslope rills. Furthermore, the surface was very compacted, which made effective raking very difficult.

There is no testing equipment at the 1994 waste rock cover, so it was possible to create the rills here with a dozer. Numerous erosion gullies covered the area. The dozer bladed this smooth first, after which the downslope rills were created with a 5-toothed ripper attachment.

8 EVALUATION OF REVEGETATION ACTITIVIES

We conclude this report with an evaluation of the revegetation efforts so far and with suggestions for follow-up work.

8.1 PLANT CUTTINGS

Survival of the willow cuttings planted (vertically) in the 2007 trial decreased from 28% in 2008 to 18% in 2009. The 2008 trial showed better survival of the willow cuttings after one year with 72% of the stakes alive. Overall, the poplar cuttings performed better, where 67% of poplar stakes at the 2007 trial site were alive after two years of growth; and at the 2008 site, 58% of the stakes were alive after the first year.

The success rates of live staking as a reclamation technique appear to be variable. Our initial results show this. Willow and poplar plantings along Rose Creek at the Faro Mine (Laberge Environental 2007) and along the banks of Porter Creek (Whittle 2003) are two examples of successful projects. Both projects took place directly adjacent to streams. However, growth of stakes was much poorer at many other projects including along Mendenhall River (Sharples 2003, R&D 2007), Croucher Creek (Tuck 2008), and Noname Creek near Carmacks (Laberge Environmental 2002, 2003, 2004; Withers 2003, 2006). Diameter of the cuttings (<2cm), planting depth, and soil moisture appear to be limited factors in the survival of the stakes.

Knowing that plant cuttings can be challenging to grow; we ensured adequate planting depth at the 2009 trials by predrilling the holes for the vertical stakes. The diameter of the cuttings was larger than 2 cm, and the soil appears to contain sufficient fines to hold moisture, which should help the survival of the stakes. Future monitoring will help determine if these measures were sufficient to ensure success.

8.2 SOIL

8.2.1 SOIL ANALYSIS

The low nitrogen and to medium phosphorus and potassium levels in the soil and the slightly higher pH (which makes some nutrients less available) warrants the use of a soil amendment to improve the success rate of the revegetation effort. Straker (2009) recommended fertilizer use for at least two years (400kg/ha the first; 200kg/ha the second year). He recommended the use of a low-nitrogen and high-phosphorus fertilizer (11-52-0 or 11-48-3 mix) to stimulate rapid ground-cover establishment. In this year's work the initial fertilizer application was implemented during planting. It and should be followed with another application in late 2010 or early 2011. Soil sampling in late summer or fall of the second year (2011) will help determine if a third application is needed.

Most micro-nutrient levels were considered to be more than adequate in terms of providing sufficient essential nutrients to support plant growth. It is not clear if these levels are so high that they would inhibit plant growth.

Metals and elemental soil analysis indicates elevated lead, zinc, arsenic and boron levels. The elevated levels originated from the two samples from the Rills and Rough & Loose areas. It is possible that this is an indication of the material in these locations which was not reworked and stirred in, like for the entire planar

area. However, we feel that extensive analysis of this information is not feasible due to the limited number of samples. Future monitoring work with additional soil and plant tissue analysis for metals should provide more insight.

8.2.2 WORKABILITY

The soil at the Grum Overburden Dump trial site was tough to work with. The material would concrete up when dry and quickly become muddy when wet. There was a narrow window where the material was reasonably workable – when it was slightly moist, but not too wet. This applied particularly to the reworked areas that included the planar and the rills sections. The rough and loose section had only been touched on the surface with fewer fines exposed.

For moving and working this fill, it may be best to handle it fewest times as possible to avoid clumping and packing down the ground. For seeding and fertilizing purposes, standard equipment may have difficulty moving across the slopes and through the fill material. Seeding equipment may have to be limited to broadcast spreading using all-terrain-vehicles. Aerial seeding could be an option.

8.3 PRACTICAL ISSUES

The work involved with cutting and preparing willow and poplar stakes is labour-intensive. It involves cutting long and thick stems from shrubs with loppers and hauling the stakes out. The work is slow, repetitive and physical (see Figures 18, 20). Added to this was the time-consuming work of planting the stakes, particularly the vertical ones where the holes had to be drilled prior to planting.

When compared to the stake cutting and planting, the ease of just planting the alder seedling plugs was evident. Planting rates were at least twice or three times as fast for the plug planting.

Related to the labor-intensive nature of the work, is finding people to do the work. EDI was successful in finding local workers, but only after considerable effort. The work is straightforward and does not require special skills, only a person in reasonable physical shape. Therefore, it is not a matter of capacity building, but finding enough people with an interest in this type of work. In addition, the timing of the work, in this case, September, interfered with hunting and ending of the snow-free-season activities that occupied possible workers.

8.4 FOLLOW-UP WORK

8.4.1 FOLLOW-UP MONITORING

We recommend a rigorous monitoring program for the existing revegetation trials and new trials at the FMC. This will help to determine the best and most effective methods to meet the mine reclamation objectives.

Future monitoring of the revegetation progress of the trials should follow the guidelines set out in the FMC Revegetation plan include the following:

- A description of the percentage of vegetation cover.
- A description of the species composition, noting the seeded and colonizing species. Identification of the willow species that were planting needs to be completed as well.
- A count of survival of the stem cuttings and tree plantings.
- Soil analysis for macro- and micronutrients. Soil bacterial and fungal composition would also be helpful in describing the progress of developing a functioning soil.
- Tissue analysis of plants once they are mature to determine potential toxicity to humans or other animals.
- An evaluation of the revegetation success and functional soil conditions.

8.4.2 IMPROVE WILLOW AND POPLAR SURVIVAL

Willow and poplar are important early establishers of disturbed areas. Current experience with live staking however is variable in Yukon and initial results show the same may be the case for our trials. Improving the success of willow and poplar would help the overall objectives of the mine closure.

One way of doing this is to plant rooted stock, instead of the bare cuttings. A plant that already has roots at time of planting is simply more likely to survive. Rooted stock can be grown in a nursery from seed or cuttings. We suggest developing additional trials with rooted willow and poplar stock and comparing their growth with the live stake plantings. This evaluation should also include a comparison of cost and labour requirements.

8.4.3 EXPAND RECLAMATION SPECIES LIST

Finally, there are other pioneering species currently growing at FMC but not considered in the Revegetation Plan. These include for instance fireweed (*Epilobium angustifolium* and *E. latifolium*), white spruce (*Picea glauca*), several oxytrope species, and dwarf birch (*Betula glandulosa*). Several of these species have been growing reportedly with success at the Ekati Mine in the N.W.T. (Martens 2009b, 2007, 2005) and are propagated under nursery conditions from seed (Wick *et al.* 2008; Schultz *et al.* 2001). Furthermore, Martens (Personal Communication 2009a) thinks *Betula glandulosa* is a good reclamation species that is easily propagate from seed (under nursery conditions).

We think FMC reclamation would benefit from broadening the revegetation options and, therefore, suggest an evaluation of available species suitable for reclamation that are growing at the site in combination with additional trials with rooted stock grown from seed (or other plant parts) of these species.

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Appendix A Soil Analysis Results

Soil Sample Results - Grum Overburden Dump

		2009 Results			2007 Results (Jacobsen et al. 2008)									
Sample		**Planar**	**Rough & Loose**	**Rills**	**VP-004**	**VP-005**	**Grum-2**	**Grum-3**	**Grum-5**	**Grum-6**	**Grum-7**	**Grum-8**	**Grum-9**	**Grum-10**
pH (1)		7.5	7.6	7.5	7.8	7.6	7.9	7.9	8.0	8.0	7.8	7.8	8.1	7.9
Est. E.C.	mmhos cm	1.48	1.68	2.96	0.58	1.08	0.60	0.50	0.40	0.46	1.10	1.02	0.34	0.94
Organic Matter	%	0.8	2.2	1.5										
Total Nitrogen (N)	%	0.032	0.028	0.030										
Phosphorus P	Available ppm	7	4	5										
Potassium K		85	48	60										
Calcium Ca		2300	1550	2300										
Magnesium Mg		120	210	85										
Copper Cu		7.8	5.7	15.0										
Zinc Zn		15	103	305										
Iron Fe		420	450	415										
Manganese Mn		126	107	121										
Boron B		<1	<1	<1										
Gravel	> 2 mm %	23.30	50.40	50.40	44.6	33.8	40.0	49.4	15.3	57.1	41.8	74	49.2	32.9
	< 2 mm %	76.7	49.6	49.6	55.4	66.2	60	50.6	84.7	42.9	58.2	26	50.8	67.1
Sand	< 2 mm %	42.1	59.6	47.0	47.2	41.5	47.5	63.9	46.5	42.4	41.2	55.8	45.6	41.0
Silt	< 53 µm %	49.4	31.9	42.9	35.4	43.7	36.9	26.8	36	39.3	40.1	31.7	40.0	41.5
Clay	< 2 µm %	8.5	8.5	10.1	17.4	14.8	15.6	9.3	17.5	18.3	18.7	12.5	14.4	17.5
pH (2)		8.3	8.3	8.0										
Antimony Sb	µg/g	<	<	<	<0.1	1.9	<0.1	<0.1	<0.1	0.5	0.6	0.7	<0.1	<0.1
Arsenic As	µg/g	11	64	88	9	36.9	10.4	14.6	8.6	8.8	26.6	12.7	9.2	8.3
Barium Ba	µg/g	209	153	153	186	279	199	111	216	211	211	142	103	225
Beryllium Be	µg/g	<	<	<	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium Cd	µg/g	<	0.9	1.8	0.4	1.1	0.4	0.3	0.3	0.4	0.5	0.4	<0.2	0.4
Chromium Cr	µg/g	31	34	45	29	35	29	30	21	24	33	35	38	21
Cobalt Co	µg/g	11	21	17	11	14	12	14	8	10	15	13	11	11
Copper Cu	µg/g	28	38	62	26	41	23	24	16	21	31	24	24	18
Lead Pb	µg/g	26	154	443	20.3	312	20.3	11.6	28.6	12.7	20.2	60.2	16.2	12.3
Mercury Hg	µg/g	0.03	0.23	0.7	0.03	0.41	0.03	0.02	0.05	0.03	0.04	0.08	0.01	0.03
Molybdenum Mo	µg/g	<	<	<	0.6	0.9	0.5	0.4	0.5	0.6	0.7	0.7	0.3	0.9
Nickel Ni	µg/g	30	51	51	29	41	31	33	22	24	40	37	32	22
Selenium Se	µg/g	<	<	<	0.5	0.7	0.5	0.4	0.5	0.5	0.8	0.5	0.3	0.6
Silver Ag	µg/g	<	<	<	0.1	0.5	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1

		2009 Results			2007 Results (Jacobsen et al. 2008)									
Sample		**Planar**	**Rough & Loose**	**Rills**	**VP-004**	**VP-005**	**Grum-2**	**Grum-3**	**Grum-5**	**Grum-6**	**Grum-7**	**Grum-8**	**Grum-9**	**Grum-10**
Tin Sn	µg/g	<	<	<	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vanadium V	µg/g	30	22	28	28	30	30	23	26	31	31	23	24	28
Zinc Zn	µg/g	99	525	919	84	609	115	71	72	67	86	278	71	65
Aluminum Al	µg/g	14400	12200	13300	13300	12100	13200	13800	10500	12200	13600	11500	12800	11600
Boron B	µg/g	17	22	20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Calcium Ca	µg/g	8330	12700	12100	7200	7230	7430	6880	6570	7760	13200	11300	6090	7350
Iron Fe	µg/g	24500	32300	29300	25300	29300	23900	27300	18300	22300	27100	26700	23500	21100
Magnesium Mg	µg/g	7830	11800	10800	6940	7620	6720	8140	5260	5970	8290	8990	7050	5480
Manganese Mn	µg/g	410	476	470	385	463	369	392	299	350	445	381	297	349
Phosphorus P	µg/g	699	605	661	572	624	556	474	533	595	724	524	498	539
Potassium K	µg/g	2010	934	1280	1630	1310	1610	1110	1340	1530	1580	1190	2300	1520
Sodium Na	µg/g	166	59	101	182	91	152	139	166	178	149	102	87	194
Strontium Sr	µg/g	42	53	49	30	33	30	27	28	31	52	38	30	30
Thalium Tl	µg/g				0.2	0.3	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1
Titanium Ti	µg/g	308	85	168	266	231	301	143	274	303	176	189	326	289
Zirconium Zr	µg/g	8	9	7	5	6	7	4	6	6	5	7	7	6

Test Methods:

Soil particle size analysis by Pacific Soil Analysis Inc. (PSAI) in Richmond, B.C.: Particle size distribution was determined in accordance to McKeague (1978) and Soil Sampling and Methods of Analysis (Carter 1993) by standard dry sieve to determine gravel content, wet sieve to determine sand content, pipetting to determine silt and clay content, and reported on a percent by weight basis. Sedimentation times were determined using the Tanner and Jackson Nomograph I (Tanner and Jackson 1947). Particle size limits used to define size fractions were given according to the Canadian Soil Survey Committee classification scheme.

Electrical conductivity by PSAI : Electrical conductivity was measured on a saturated paste extract according to the methods in Manual of Soil Sampling and Methods of Analysis (McKeague 1978).

Total soil Nitrogren by PSAI is dermined colorimetrically using a Technicon Autoanalyser on a semi-micro Kjeldahl digest.

Available Phosphorus by PSAI is dermined colormetrically using the ascorbic acid color development method on a 1:10 soil to Bray (NH4F) extract.

Available Ca, Mg, Na, K by PSAI are determined by Perkin-Elmer atomic absorption spectorphotometer on a 1:5 soil to ammonium acetate extract.

Available Cu, Zn, Fe, Mn by PSAI are determined by Perkin-Elmer atomic absorption spectrophotometer on a 1:5 soil to 0.1 N HCl extract.

Available Boron by PSAI is dermined colormetrically on a hot water soluble soil extract using the azomethine-H method.

pH (1) by PSAI: Soil pH is determined potentiometrically using a radiometer pH meter on a 1:1 soil to distilled water slurry. (Methods Manual Pedology Laboratory, 1977)

pH (2) by Cantest: ananlysis was performed based on procedures described in the "Manual on Soil and Sampling and Methods of Analysis" (1993), Canadia Society of Soil Science. The test was performed using a deionized water leach with measurement by pH meter.

Mercury in soil by Cantest: analysis was performed using cold vapour atomic fluorescence.

Strong Acid Leachable Metals in soil by Cantest: analysis was performed using B.C. MOELP Method "Strong Acid Leachable Metals in Soil, Version 1.0". The method involves drying the sample at 60 C, sieving using a 2mm (10 mesh) sieve and idgestion using a mixture of hydrochloric and nitric acids. Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

Appendix B Seed Certificates

NATIVE GRASSES ONLY

SEEDCHECK TECHNOLOGIES INC.

101, 5906-50 Street
Leduc, Alberta T9E 0R6
Phone: (780) 980-8324
Fax: (780) 980-8375
www.seedcheck.net

Report of Seed Analysis
CFIA Accredited Laboratory No. 1215

LAB#: 09-30082

Customer: Pickseed (Nipawin)
P.O. Box 100
Nipawin, Sask. S0E 1E0

Sender Information:	
SeedType:	Slender Wheatgrass
Variety:	Common
Lot#:	310228

Analyzed According to Canadian Methods & Procedures for Testing Seed

Tests: Germination, Canadian Purity,

	Per		Per
Total Grams Analyzed: 50	25	Date Received: Jun 12, 2009 Purity Date: Jun 12, 2009	25
Prohibited Noxious:	0	**Other Crop Seeds:**	
		(Bromus spp.) Bromegrass	
		(Poa pratensis) Kentucky Bluegrass	
		(Agropyron cristatum/desertorum) Crested	
Primary Noxious:		Wheatgrass	
Total Primary	0		
Secondary Noxious:		**Total Other Crop Seeds**	<1%
		Sweet Clover	0
		Brassica spp.	0
		Ergot Bodies	<1%
Total Primary & Secondary Noxious	0		
Other Weed Seeds:		**Percentage Test:**	2.0511g
(Persicaria spp.) Smartweed	2	Pure seed %	97.3
		Other crop %	0.0
		Weed Seed %	0.0
		Inert matter%	2.7
		Jun 26, 2009 **Germination:**	92%
		%Abnormal Seedlings	3
		%Dead Seed	5
		%Pure Living Seed	89
Total Noxious & Other Weed Seeds	2		

Advisory Tests & Remarks:

SENIOR MEMBER OF

SEED COMMERCIAL ANALYSTS ASSOCIATION OF CANADA INC.

98
Morgan Webb

Mar. 03 2009 09:51AM P1

Report of Analysis

Report No: **BVGP-025128**

BioVision seed labs

Received: Aug 29, 2008 Completed: Sep 23, 2008

This sample of: Rocky Mountain Fescue

Designated Lot # 409 502192

Received from ATTN: SHAUN

780.464.0305

Tested at BioVision Seed Labs
12803 100 Street
Grande Prairie, Alberta, Canada
T8V 4H3
Tel. (780) 532-8890, Fax (780) 513-0115
Email: biovisiongp@biovision.ca

with the following results:

Weed Seeds: Number per 25 grams | Test: ☑ Canadian ☐ AOSA ☐ ISTA ☐ Other | **Accreditation No: 1213**

NOXIOUS WEED SEEDS	OTHER WEED SEEDS	OTHER CROP SEEDS
Prohibited Noxious		
Total Prohibited: 0		
Primary Noxious		
Primary: 0		
Secondary Noxious		

Total Primary + Secondary:		0	**Total Weed Seeds**		0			**Total Other Crop Seeds:**	0
Pure Seed:	98.0	%	Pure Living Seed:	92	%	TZ:	%	Germination:	94%
Other Crop Seeds	0.0	%	Multiple Seed Units	0.0	%	Ergot:	0.00%	Hard Seeds:	-
Weed Seeds:	0.0	%	Incl. in Pure Seed:	0.0	%	Sclerotia:	-	Germination, incl. Hard Seeds:	-
Inert Matter:	2.0	%	Sweet Clover:	0.00		Brassica:	0	Germination Date	Sep 23, 2008

REMARKS:

Analyzed 25 grams

Abnormal: 1.0% Dead: 5.0%

GERM METHOD: SAMPLE TESTED FOR 21 DAYS, TOP OF BLOTTER, 15-1:5C

SENIOR MEMBER OF

COMMERCIAL SEED ANALYSTS ASSOCIATION OF CANADA

82

Michele Kulba

Authorized Signature

Sep 23, 2008

Date

Form BIO-QF-012

lot 501 628

20/20 SEED LABS INC.

Report of Seed Analysis

GOVERNMENT ACCREDITED LABORATORY

Accreditation No. 1068

This designates

Date: Apr 26, 2005

that a sample of GLAUCOUS BLUEGRASS (TUNDRA)

TS-04-17-1

Lab No. 04-45135

was received from:

and was tested at:

20/20 Seed Labs Inc.
Suite #201, 509 - 11 Avenue
Nisku, Alberta, Canada T9E 7N5
Tel: 780-955-3435 Fax: 780-955-3428
Website: http://clients.2020seedlabs.com/
E-Mail: reports@2020seedlabs.com

WEED SEEDS: NO. PER 10 GRAMS					
NOXIOUS WEED SEEDS		OTHER WEED SEEDS		OTHER CROP SEEDS	
Prohibited Noxious	0				
Primary Noxious					
Total Primary	0				
Secondary Noxious					
Total Noxious	0	Total Weed Seeds of All Kinds	0	Total Other Crop Seeds	0
				Sweet Clover	
				Brassica Spp.	
				Sclerotia Bodies	
				Ergot Bodies	
Pure Seed	93.35%	Pure Living Seed	80.7%	Germination	87%
Other Crop Seeds	0.0%	Multiple Seed Units	---	Hard Seeds	---
Weed Seeds	0.0%	Ergot	---	Germ. Incl. Hard Seeds	---
Inert Matter	6.65%	True Loose Smut	---		

Tests Requested: American Germination, American Purity, American Pure Seed

Remarks (data provided is for informational purposes only):
Number of Foreign Seeds Found in -10- Grams
0- Found

SENIOR MEMBER OF

SEED COMMERCIAL ANALYSTS ASSOCIATION CANADA INC.

#076

Brenda Winnicki

Accredited Analyst

Report Of Seed Analysis

Accreditation No. 1068

GOVERNMENT ACCREDITED LABORATORY

Life starts with seed

Date: Jun 15, 2009

This designates

that a sample of Hairgrass, Tufted - Nortran 502190

CC# 07-8055023-403, Lot# 1357-9-059941

was received from:

and was tested at:

20/20 Seed Labs Inc.
Suite #201, 509 - 11 Avenue
Nisku, AB, CA T9E 7N5
p 780-955-3435 f 780-955-3428
w http://clients.2020seedlabs.ca/
e reports@2020seedlabs.ca

This sample was analyzed according to Canadian Methods and Procedures (CFIA)* for:

GERMINATION *

Germination (%)	89	Hard Seeds (%)	0	Germ. Incl. Hard Seeds (%)	N/A
Abnormals (%)	4	Deads (%)	7	Fresh (%)	0

Method: ISTA Germination Method: TP 20°C, 3 day prechill 5°C, KNO3

ACCREDITED REMARKS

Total extended pre-chill days that were used to break dormancy: 7

SENIOR MEMBER OF

SEED ANALYSTS ASSOCIATION OF CANADA INC.

#128
Yan Li
Accredited Analyst

The responsibility for any seed sold under this Report with respect to Grade or any other specification rests entirely with the seller.

Report Of Seed Analysis

Accreditation No. 1068

GOVERNMENT ACCREDITED LABORATORY

20/20 Seed Labs Inc.

Life starts with seed

Date: Mar 19, 2009

This designates

that a sample of Hairgrass, Tufted - Nortran 502190

CC# 07-8055023-403, Lot# 1357-9-059941

Lot No. AB1090901087

and was tested at:

20/20 Seed Labs Inc.
Suite #201, 509 - 11 Avenue
Nisku, AB, CA T9E 7N5
p 780-955-3435 f 780-955-3428
w http://clients.2020seedlabs.ca/
e reports@2020seedlabs.ca

This sample was analyzed according to Canadian Methods and Procedures (CFIA)* for:

% PURE SEED *

Pure Seed	97.2	Other Crop Seeds	0.1	Weed Seeds	Trace	Inert Matter	2.7
Ergot	0.0	Multiple Seed Units	N/A			Pure Living Seed	

PURITY *

WEED SEEDS: No. PER 25 GRAMS — **TOTAL GRAMS ANALYZED FOR PURITY: 10**

NOXIOUS WEED SEEDS		OTHER WEED SEEDS		OTHER CROP SEEDS	
Prohibited Noxious		Slough grass	27.5	Fowl bluegrass	0.0
Total Prohibited	0.0	Sedge	5.0		
Primary Noxious					
Total Primary	0.0				
Secondary Noxious					

Total Noxious	Total Weed Seeds of All Kinds	Total Other Crop Seeds
0.0	32.5	Less than 2% by mass

Sweet Clover	n/a	Brassica Spp.	n/a	Sclerotia Bodies	n/a	Ergot Bodies	0.0

SENIOR MEMBER OF SEED COMMERCIAL ANALYSTS ASSOCIATION OF CANADA, INC.

#192
Yan Li
Accredited Analyst

The responsibility for any seed sold under this Report with respect to Grade or any other specification rests entirely with the seller.

NATIVE GRASSES AND ANNUAL NURSE CROP

SEEDCHECK TECHNOLOGIES INC.

Report of Seed Analysis
CFIA Accredited Laboratory No. 1215

LAB#: 09-30082

101, 5906-50 Street
Leduc, Alberta T9E 0R6
Phone: (780) 980-8324
Fax: (780) 980-8375
www.seedcheck.net

Customer: Pickseed (Nipawin)
P.O. Box 100
Nipawin, Sask. S0E 1E0

Sender Information:

SeedType:	Slender Wheatgrass
Variety:	Common
Lot#:	310228

Analyzed According to Canadian Methods & Procedures for Testing Seed

Tests: Germination, Canadian Purity,

	Per		Per
Total Grams Analyzed: 50	25	Date Received: Jun 12, 2009 Purity Date: Jun 12, 2009	25
Prohibited Noxious:	0	**Other Crop Seeds:**	
		(Bromus spp.) Bromegrass	
		(Poa pratensis) Kentucky Bluegrass	
		(Agropyron cristatum/desertorum) Crested	
Primary Noxious:		Wheatgrass	
Total Primary	**0**		
Secondary Noxious:		**Total Other Crop Seeds**	**<1%**
		Sweet Clover	0
		Brassica spp.	0
		Ergot Bodies	<1%
Total Primary & Secondary Noxious	**0**		
Other Weed Seeds:		**Percentage Test:**	2.0511g
(Persicaria spp.) Smartweed	2	Pure seed %	97.3
		Other crop %	0.0
		Weed Seed %	0.0
		Inert matter%	2.7
		Jun 26, 2009 **Germination:**	92%
		%Abnormal Seedlings	3
		%Dead Seed	5
		%Pure Living Seed	89
Total Noxious & Other Weed Seeds	**2**		

Advisory Tests & Remarks:

SENIOR MEMBER OF

SEED COMMERCIAL ANALYSTS ASSOCIATION CANADA INC.

98
Morgan Webb

Mar. 03 2009 09:51AM P1

Report of Analysis

Report No: **BVGP-025128**

BioVision seed labs

Received: Aug 29, 2008 Completed: Sep 23, 2008

This sample of: Rocky Mountain Fescue

Designated Lot # 409 502192

Received from ATTN: SHAUN

Tested at BioVision Seed Labs
12803 100 Street
Grande Prairie, Alberta, Canada
T8V 4H3
Tel. (780) 532-8890, Fax (780) 513-0115
Email: biovisiongp@biovision.ca

780.464.0305

with the following results:

Weed Seeds: Number per 25 grams | Test: ☑ Canadian ☐ AOSA ☐ ISTA ☐ Other

Accreditation No: 1213

NOXIOUS WEED SEEDS	OTHER WEED SEEDS	OTHER CROP SEEDS
Prohibited Noxious		
Total Prohibited: 0		
Primary Noxious		
Primary: 0		
Secondary Noxious		

Total Primary + Secondary:	0		Total Weed Seeds	0		Total Other Crop Seeds:	0		
Pure Seed:	98.0	%	Pure Living Seed:	92	%	TZ:	%	Germination:	94%
Other Crop Seeds	0.0	%	Multiple Seed Units	0.0	%	Ergot:	0.00%	Hard Seeds:	-
Weed Seeds:	0.0	%	Incl. in Pure Seed:	0.0	%	Sclerotia:	-	Germination, incl. Hard Seeds:	-
Inert Matter:	2.0	%	Sweet Clover:	0.00		Brassica:	0	Germination Date	Sep 23, 2008

REMARKS:

Analyzed 25 grams

Abnormal: 1.0% Dead: 5.0%

GERM METHOD: SAMPLE TESTED FOR 21 DAYS, TOP OF BLOTTER, 15-15C

SENIOR MEMBER OF SEED ANALYSTS CANADA

82
Michele Kulba

Authorized Signature

Sep 23, 2008
Date

Form BIO-QF-012

Lot 501 628

20/20 SEED LABS INC.

Report of Seed Analysis

GOVERNMENT ACCREDITED LABORATORY

Accreditation No. 1068

This designates

that a sample of GLAUCOUS BLUEGRASS (TUNDRA)

TS-04-17-1

Date: Apr 26, 2005

Lab No. 04-45135

was received from:

and was tested at:

20/20 Seed Labs Inc.
Suite #201, 509 - 11 Avenue
Nisku, Alberta, Canada T9E 7N5
Tel: 780-955-3435 Fax: 780-955-3428
Website: http://clients.2020seedlabs.com/
E-Mail: reports@2020seedlabs.com

WEED SEEDS: No. PER 10.0 GRAMS					
NOXIOUS WEED SEEDS		OTHER WEED SEEDS		OTHER CROP SEEDS	
Prohibited Noxious	0				
Primary Noxious					
Total Primary	0				
ondary Noxious					
				Total Other Crop Seeds	0
				Sweet Clover	
				Brassica Spp.	
				Sclerotia Bodies	
Total Noxious	0	Total Weed Seeds of All Kinds	0	Ergot Bodies	
ure Seed	93.35%	Pure Living Seed	80.7%	Germination	87%
Other Crop Seeds	0.0%	Multiple Seed Units	---	Hard Seeds	---
Weed Seeds	0.0%	Ergot	---	Germ. Incl. Hard Seeds	---
Inert Matter	6.65%	True Loose Smut	---		

Tests Requested: American Germination, American Purity, American Pure Seed

Remarks (data provided is for informational purposes only):
Number of Foreign Seeds Found in -10- Grams
0- Found

SENIOR MEMBER OF

SEED COMMERCIAL ANALYSTS ASSOCIATION CANADA INC.

#076

Brenda Winnicki

Accredited Analyst

ıple analyzed according to A.O.S.A. Rules and Regulations.

responsibility for any seed sold under this Report with respect to Grade or any other specification rests entirely with the seller.

Series OAPA June 1, 2005

-B

AGRONOMIC SEED MIX

SEEDCHECK TECHNOLOGIES INC.

Report of Seed Analysis
CFIA Accredited Laboratory No. 1215

LAB#: 09-29741

1B, 5904B-50 Street
Leduc, Alberta T9E 6J4
Phone: (780) 980-8324
Fax: (780) 980-8375
www.seedcheck.net

Customer: Pickseed
Box 3230
21 Streambank Avenue
Sherwood Park, AB T8H 2T2

Sender Information:	
SeedType:	Creeping Red Fescue
Variety:	Boreal
Crop Cert#:	06-8050764-401
Lot#:	519887

Analyzed According to Canadian Methods & Procedures for Testing Seed

Tests: Germination, Canadian Purity,

Total Grams Analyzed: 25	Per 25g	Date Received: Apr 22, 2009 Purity Date: Apr 22, 2009	Per 25g
Prohibited Noxious:	0	**Other Crop Seeds:**	
Primary Noxious:			
Total Primary	0		
Secondary Noxious:		**Total Other Crop Seeds**	0%
		Sweet Clover	0
		Brassica spp.	0
		Ergot Bodies	0%
Total Primary & Secondary Noxious	0		
Other Weed Seeds:		**Percentage Test:**	1.0570g
		Pure seed %	97.9
		Other crop %	0.0
		Weed Seed %	0.0
		Inert matter%	2.1
		May 13, 2009 **Germination:**	87%
		%Abnormal Seedlings	5
		%Dead Seed	8
		%Pure Living Seed	85
Total Noxious & Other Weed Seeds	0		

Advisory Tests & Remarks:

SENIOR MEMBER OF

SEED COMMERCIAL ANALYSTS ASSOCIATION CANADA INC.

98
Morgan Webb

MAY 19 2009

North West Seed Testing, LLC
1130 SE 37th Ave
Hillsboro, Oregon 97123
E-mail: pglanz@integra.net
Phone: (503) 352-3622
Fax: (503) 352-3623

REPORT OF SEED ANALYSIS: FINAL

DATE RECEIVED	DATE COMPLETED	TEST #
2/25/2009	3/11/2009	NW7867

Attn:
CC:
Grower:

Kind: Meadow Foxtail
Variety: <VNS>
Genus/Species: Not Stated
Lot Number: WS-S-MF-288
Size of Lot: Not stated
Sample Type: Submitted Sample
Grower: Lehman Farms
Other Information: Plain poly bags

502153

*Information provided from a list of the sender and not of the laboratory

VIABILITY ANALYSIS

Germination %	Hard Seed %	Total Viable %	No. Seeds (Germ)	Days Tested	TFL %	TZ %	PLS %	Misc
92	x	92	400	14	x	x	x	x

COMMENTS: None

PURITY ANALYSIS [3.054] grams analyzed

PURE SEED COMPONENT(S)
Meadow Foxtail *Alopecurus pratensis* 97.25 %

OTHER CROP SEED:	1.10 %
INERT:	1.65 %
WEED SEED:	0.00 %

OTHER CROP SEED	# per Lb
Slender Foxtail	2970
Ryegrass *Lolium sp.*	148
Rough Bluegrass	148

INERT MATTER
Single Sterile Florets, Stems, Chaff

WEED SEED # Per Lb
- None found -

ALL STATES NOXIOUS WEED SEEDS
(except Hawaii and Undesirable Grass Seed)

[50.55] grams analyzed

Weed Seed	# Found	# Per Lb
- None found -		

OTHER DETERMINATIONS
Not Conducted

COPY

Date Issued: 3/11/2009

Registered Seed Technologist - Seal No. 112

The purity and germination test results reported on this form have been carried out in accordance with AOSA rules unless otherwise specified. Test results reflect condition of the submitted sample and may not reflect the condition of the seed lot from which the sample was taken.

ENTERED 3/12/09

Report of Analysis

BioVision seed labs

Report No: **BVED-150879**

Received: Jul 30, 2008 Completed: Aug 27, 2008

This sample of **Alpine Bluegrass**

Designated **Lot # 887-500638, Ref 5662**

Received from

Pickseed Canada Inc. (Edmonton)
P.O. Box 3230
Sherwood Park, AB
T8A 2A6
Tel 780 464-0350, Fax 780 464-0305

with the following results:

Tested at BioVision Seed Labs
7225 B Roper Road
Edmonton, Alberta, Canada
T6B 3J4
Tel. (780) 436-8822, Fax (780) 437-6875
Email: biovision@biovision.ca

Weed Seeds: Number per - grams | Test: ☑ Canadian ☐ AOSA ☐ ISTA ☐ Other | **Accreditation No: 1172**

NOXIOUS WEED SEEDS	*OTHER WEED SEEDS*	*OTHER CROP SEEDS*
Prohibited Noxious		
Total Prohibited: -		
Primary Noxious		
Total Primary: -		
Secondary Noxious		

Total Primary + Secondary:	-	**Total Weed Seeds**	-			**Total Other Crop Seeds:**	-		
Pure Seed:	- %	Pure Living Seed:	- %	TZ:	%	Germination:	83%		
Other Crop Seeds:	- %	Multiple Seed Units	- %	Ergot:	- %	Hard Seeds:	-		
Weed Seeds:	- %	Incl. in Pure Seed:	- %	Sclerotia:	-	Germination, incl. Hard Seeds:	-		
Inert Matter:	- %	Sweet Clover:	-	Brassica:	-	Germination Date	Aug 27, 2008		

REMARKS:

Abnormal: 2.0% Dead: 15.0%

GERMINATION ONLY

SENIOR MEMBER OF

SEED ANALYSTS ASSOCIATION OF CANADA, INC.

119

CRYSTAL DENTMAN

GOVERNMENT ACCREDITED SEED TESTING LABORATORY

Authorized Signature

The responsibility for any seed sold under this certificate with respect to Grade, Variety, or any other specification rests entirely with the Client.

* Advisory Test - Method not officially prescribed.

Variety information supplied by the sender.

Aug 27, 2008
Date

Form BIO-QF-012 Rev Date 10.02.05

SEP 0 8 2008

SEEDCHECK TECHNOLOGIES INC.

REPORT OF SEED ANALYSIS
CFIA Accredited Laboratories

500630
LOATED 500633

LAB# L04-4792

Customer: [redacted]

Sender information:	
Kind of Seed:	Alpine Bluegrass
Variety:	None
LOT#	03-1438-124
Crop Certificate#:	None
Grower:	None
Purity Date: January 29, 2004	

Tests Requested: Purity, % Pure Seed, Tetrazolium Chloride
Total Grams Analysed: 10 grams

	per
Prohibited Noxious	25g
	0
Primary Noxious	
Total Primary	0
Secondary Noxious	
Total Primary & Secondary Noxious	0
Other Weed Seeds	
Total Other Weed Seeds	<0.5%
Total Noxious & Other Weed Seeds	<0.5%

	per
Other Crop Seeds	25g
Orchardgrass	
Total Other Crop Seeds	<1%
Sweet Clover	n/a
Brassica spp.	n/a
Ergot Bodies	0%
Sclerotia Bodies	n/a
Percentage Test:	
Pure Seed	95.2%
Other Crop	0.1%
Weed Seeds	0.0%
Inert Matter	4.7%
Multiple Seed Units	n/a

GERMINATION: Not Requested **% Pure Living Seed**

Analysed According to Canadian Methods and Procedures for testing seed.
Advisory Tests/ Remarks:
Sample Meets Minimum Purity Standards
Analyzed According to Table 12
Tetrazolium Chloride Test Result January 30, 2004: 92%

ASSOCIATE MEMBER
OF
SEED COMMERCIAL ANALYSTS ASSOCIATION CANADA INC.

A-35
LISA BEHNKE
Accredited Seed Analyst

Accreditation No. 1215
#220, 5904B - 50 Street
Leduc, Alberta T9E 6J4
Phone: (780) 980-8324
Fax: (780) 980-8375

Accreditation No. 1214
110 Gymnasium Road
Saskatoon, Sask. S7N 0W9
Phone: (306) 975-0990
Fax: (306) 975-0991

SEEDCHECK TECHNOLOGIES INC.

Report of Seed Analysis
CFIA Accredited Laboratory No. 1215

LAB#: 09-30082

101, 5906-50 Street
Leduc, Alberta T9E 0R6
Phone: (780) 980-8324
Fax: (780) 980-8375
www.seedcheck.net

Customer: Pickseed (Nipawin)
P.O. Box 100
Nipawin, Sask. S0E 1E0

Sender Information:	
SeedType:	Slender Wheatgrass
Variety:	Common
Lot#:	310228

Analyzed According to Canadian Methods & Procedures for Testing Seed

Tests: Germination, Canadian Purity,

Total Grams Analyzed: 50	Per 25	Date Received: Jun 12, 2009 Purity Date: Jun 12, 2009	Per 25
Prohibited Noxious:	0	**Other Crop Seeds:**	
		(Bromus spp.) Bromegrass	
		(Poa pratensis) Kentucky Bluegrass	
		(Agropyron cristatum/desertorum) Crested	
Primary Noxious:		Wheatgrass	
Total Primary	**0**		
Secondary Noxious:		**Total Other Crop Seeds**	**<1%**
		Sweet Clover	0
		Brassica spp.	0
		Ergot Bodies	<1%
Total Primary & Secondary Noxious	**0**		
Other Weed Seeds:		**Percentage Test:**	2.0511g
(Persicaria spp.) Smartweed	2	Pure seed %	97.3
		Other crop %	0.0
		Weed Seed %	0.0
		Inert matter%	2.7
		Jun 26, 2009 **Germination:**	92%
		%Abnormal Seedlings	3
		%Dead Seed	5
		%Pure Living Seed	89
Total Noxious & Other Weed Seeds	**2**		

Advisory Tests & Remarks:

SENIOR MEMBER OF

98
Morgan Webb

SEEDCHECK TECHNOLOGIES INC.

Report of Seed Analysis
CFIA Accredited Laboratory No. 1215

101, 5906-50 Street
Leduc, Alberta T9E 0R6
Phone: (780) 980-8324
Fax: (780) 980-8375
www.seedcheck.net

LAB#: 09-30062

Customer: Pickseed
Box 3230
21 Streambank Avenue
Sherwood Park, AB T8H 2T2

Sender Information:

SeedType:	Alsike Clover
Variety:	Frida
Crop Cert#:	07-7034091-402
Lot#:	0089-8-08177

Tests: Tetrazolium,

Test Results According to Canadian Methods & Procedures

Germination Result: Not Requested

Advisory Test / Remarks

TetrazoliumViable: 87%+Hard:9%=96% Jun 05, 2009

SENIOR MEMBER OF

SEED COMMERCIAL ANALYSTS ASSOCIATION CANADA INC.

124
Lisa Behnke

JUN 15 2009

DISCOVERY
SEED LABS LTD.

Box 1180, 701 Railway Avenue
Nipawin SK S0E 1E0
Ph.: (306) 862-4212
Fax: (306) 862-4440
E-mail: info@seedtesting.com

Report No. N-208194

REPORT OF SEED ANALYSIS

Nipawin C.F.I.A. Accreditation # 1234

TO:

FarmPure Seeds
Box 100
Nipawin, Sk
S0E 1E0

Variety: Frida	
Kind: Alsike Clover	Sample #
Crop Certificate # 07-7034091-402	Lot # 0089-8-08177
Sequence #	Grower:

Above information has been provided by the sender and not the laboratory

Date Received: 4/24/2008 Date Completed: 05/02/2008

CONTAMINANTS PER: 25 GRAMS

NOXIOUS WEED SEEDS		OTHER WEED SEEDS		OTHER CROP SEEDS	
Prohibited Noxious:		Lamb's-quarters	6.0	Sweet clover	0.0
				Brassica crops inc S. alba	
				Total Brassica crops inc S. alba	0.0
Total Prohibited	0.0			Other Crops	
Primary Noxious:					
Total Primary	0.0				
Secondary Noxious:					
				Total Other Crops	Less than 0.5%
Total Primary & Secondary	0.0	Total Weeds	6.0	Ergot or Sclerotia bodies %	0

Pure Seed:	99.72 %	Other Crop Seeds:	0.19 %	Weed Seeds:	0.0 %	Inert Matter:	0.09 %
Multiple Seed Units	— %	Incl. in Pure Seed:	— %	Ergot:	— %	Pure Living Seed:	— %
Germination:	87 %	Hard Seeds:	10 %	Germ Inc. Hard Seeds:	97 %	1000 Kernel Weight*:	— g
Smut - Ustilago nuda:	— %	Fusarium graminearum*:	— %	Fusarium culmorum*:	— %	Total Fusarium*:	— %
Ascochyta:	— %	Green Seed Count*:	— %	Vomitoxin*:	—	Cochliobolus sativus*:	— %
Anthracnose*:	— %	Hagberg Falling Number*:	—	Protein*:	— %	Herbicide Tolerance:	— %
Botrytis*:	— %						
Sclerotinia*:	— %						
Blackleg, weakly virulent*:	— %						
Blackleg, virulent*:	— %						
Alternaria brassicae*:	— %						
Alternaria raphani*:	— %						
Alternaria alternata*:	— %						
Vigor*:	— %						
Tetrazoleum*:	— %						
Moisture*:	— %						

Comments

Nitragin Gold B

* Advisory Tests

This certifies that the sample of seed submitted from the lot designated above has been analyzed according to:

(1) X Methods and Procedures of Seed Testing, C.F.I.A
(2) ___ Rules for Testing Seeds, A.O.S.A.
(3) ___ International Rules for Seed Testing, I.S.T.A
(4) ___ As specified on Contract

☐ Official Sample Received

Senior Member Of

SEED COMMERCIAL ANALYSTS ASSOCIATION CANADA INC.

93
Shirley Baraniski

5/2/2008
Date Issued

Accredited Analyst

The responsibility for any seed sold under this Report with respect to Grade or any other specification rests entirely with the seller.