

1988 Interim Report of
Initial Data and Observations
Obtained From the Red Dog Mine
Evaluation and Demonstration Plots

Presented to:

Cominco Alaska

Prepared by:

Stoney Wright

of the State of Alaska
Department of Natural Resources
Division of Agriculture
Alaska Plant Materials Center

January 1989

Index
Evaluation Plots

	<u>Page</u>
Introduction	1
Purpose	1
History & Site Description	2
Methods	2
Results	6
Demonstration Plantings - Solid Waste Disposal Site	11
Closing Comments	16

List of Figures

Typical Plot Layout	3
Sample Advanced Evaluation Sheet	5
Evaluation Results	
Port Site Plot	8
Mine Site Plot (Dormant)	9
Mine Site Plot (1988 Spring)	10
Listing of Seed Mixes	12
Disposal Site 09/09/89	13
Disposal Site Reclamation Plan	14

Introduction

The North Latitude Revegetation and Seed Project at the Alaska Plant Materials Center (PMC), in the Alaska Department of Natural Resources, Division of Agriculture, is responsible for developing new plant varieties (cultivars) for land reclamation, habitat enhancement, and erosion control. In addition to the development of new plant cultivars, this project also is responsible for developing techniques for erosion control and reclamation. In order to accomplish these goals, it is beneficial for the PMC to work with industry. Resource extraction industries usually have disturbances on which these new varieties or techniques can be tested.

In the spring of 1987, Cominco Alaska provided the North Latitude Revegetation and Seed Project with two sites at the Red Dog Mine and Port Site for advance testing of potential and existing reclamation grasses.

Purpose

In order for new varieties to be released for commercial production, they must be tested throughout a region. The PMC required western arctic test sites to complement the test sites elsewhere in Alaska.

Cominco Alaska needed answers to two questions; 1) what species and varieties would perform best in future Red Dog Mine revegetation programs; and, 2) how successful is dormant seeding in the arctic? Cominco also required assistance in developing methods for disposal pit restoration and riparian revegetation along stream crossings.

History & Site Description:

With the first two questions in mind, three evaluation plots were established from the Port Site to the Mine Site. See Figure 1 for typical plot layout. The first plot site (seeded on July 6, 1987) was simply a sandy-gravel beach area north of the port. The second plot site was at the original camp site fuel bladder containment area and the staging area next to the containment pit. Two plots were established at this site. The first, a dormant seeding was established on September 8, 1987. Because of space limitations, the plot dimensions were slightly reduced and 12 accessions were dropped from the plot. The accessions that were eliminated are species that have failed elsewhere in Alaska, and should not compromise the value of the information obtained from these plots.

This plot was established on native soil that had been scraped clear of vegetation. The second plot was planted June 15, 1988, on highly compacted gravel fill.

Methods:

Each plot (Figure 1), was hand-seeded with pre-measured amounts of seed. The seeding rates of each block were approximately 40 pounds per acre. Following seeding, the entire plots were fertilized with 20-20-10 fertilizer at a rate of 450 pounds per acre (100 pounds actual nitrogen, 100 pounds actual phosphorus, and 50 pounds actual potash).

Typical Plot Layout

<-----> 10' <----->	
Nugget Kentucky Bluegrass	Merion Kentucky Bluegrass
Park Kentucky Bluegrass	Banff Kentucky Bluegrass
Sydsport Kentucky Bluegrass	Fylking Kentucky Bluegrass
Poa ampla	Troy Kentucky Bluegrass
Sherman Big Bluegrass	(Not Planted In Fall Plot)
Tundra Bluegrass	Canbar Canby Bluegrass
Poa glauca T08867	(Not Planted In Fall Plot)
(Not Planted In Fall Plot)	Reubans Canada Bluegrass
Agropyron subsecundum 371698	Poa alpina
(Not Planted In Fall Plot)	(Not Planted In Fall Plot)
Nordan Crested Wheatgrass	Sodar Streambank Wheatgrass
Fairway Crested Wheatgrass	(Not Planted In Fall Plot)
Summit Crested Wheatgrass	Agropyron subsecundum Canada
Critana Thickspike Wheatgrass	Agropyron violaceum
(Not Planted In Fall Plot)	Agropyron boreal
Fulfs Alkaligrass	Agropyron yukonese
Climax Timothy	(Not Planted In Fall Plot)
Elymus arenarius	Vantage Reed Canarygrass
Nortran Tufted Hairgrass	Engmo Timothy
Norcoast Bering Hairgrass	Elymus sibiricus 34560
Sourdough Bluejoint	Elymus sibiricus 2144
Meadow Foxtail	Tufted Hairgrass
(Not Planted In Fall Plot)	Calamagrostis canadensis Delta
Garrison Creeping Foxtail	(Not Planted In Fall Plot)
Boreal Red Fescue	Alopecurus geniculatus
Beckmannia	Arctared Red Fescue
(Not Planted In Fall Plot)	Festuca scabrella
Durar Hard Fescue	Pennlawn Red Fescue
(Not Planted In Fall Plot)	Highlight Red Fescue
Covar Sheep Fescue	Manchar Smooth Brome
Alyeska	Carlton Smooth Brome
Tilesey Sage	Pumpelly Brome

Figure 1. Typical Plot Layout

After each plot was seeded and fertilized, the area was raked by hand to incorporate the seed and fertilizer.

These advanced evaluation plots are evaluated at least once a year. The accessions are rated for vigor, percent stand, and numerous other hardiness and disease-resistant, related characteristics. However, we have found that vigor and percent stand give a reliable indication of how the different accessions compare with each other. The next page is an example of the evaluation sheets that will be presented in this report (Figure 2). The following numbers, followed by brief explanations, correspond to numbers on the example evaluation sheet:

1. Location and title of evaluation plot.
2. Number of evaluation blocks. This number may range from 1 to 3 blocks.
3. Year of Record--the year that evaluation data was collected.
4. Vigor--this number can range from 1 to 9. One is best and 9 is the worst rating. If possible, this rating is determined by comparison with other accessions of the same species. The rating is based on color, height, health, flowering and/or seed production and on the evaluator's knowledge of the plant and its expected performance. If more than one block is planted, this number will be an average of the ratings for each block.

1		3							
	2 # of Blocks	4	5						
1	6								1
2	'Merion' Kentucky Bluegrass								2
3	'Banff' Kentucky Bluegrass								3
4	'Park' Kentucky Bluegrass								4
5	etc.								5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21									21
22									22
23									23
24									24
25									25
26									26
27									27
28									28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
39									39
40									40
41									41
42									42
43									43
44									44
45									45
46									46
47									47
48									48
49									49
50									50
51									51
52									52

Figure 2. Sample Advanced Evaluation Page.

5. Percent Stand--this number represents the percentage of the ground that is covered by the accession. Only live plant material is included, litter from previous years' growth and other species are not included. If more than one block is planted, this number will be an average of the ratings for each block.

6. The accession that is being rated. The accession is identified by its varietal and common name or its common name and its accession number.

Results:

This report is intended to be informative, describing the evaluation process during the two years. While the information contained in this report is interesting, it is premature to draw any conclusion at this time. Conclusions will be included in the 1990 report.

The initial evaluation results can be found on Figures 3, 4 and 5. To interpret this data, please refer to the methods section which describes the numerical ratings.

The dormant seeded plot and spring plantings at the Exploration Camp Site have only been evaluated for one growing season, therefore, hardiness has not been determined for any of the accessions. Six accessions did not produce reasonable stands during 1988.

This may be a result of delayed germination, a phenomenon exhibited by some plantings elsewhere in the arctic. If these accessions do not germinate and produce measurable stands in 1989, it will be assumed that either the accession is not adapted to the site or the seedlings were destroyed early in development.

The Port Site plot has gone through one winter and has lost the least adapted accessions. Out of the fifty-one accessions planted, only 18 remain. This is a relatively high loss of accessions for a one-year period.

This site is located on exposed sandy gravel on the leeward side of a fore dune. Close proximity to the Chuckchi Sea shore undoubtedly has had some effect on survival. Between June and September 1988, storm surges or spray appear to have topped the fore dune and exposed the plot to saltwater. Newly deposited driftwood and other debris was found on the plot and small water erosion rills had formed in the plot. In addition to exhibiting arctic hardiness, these accessions must also exhibit a degree of tolerance to saltwater spray.

The three plots will be evaluated through the 1990 growing season at which time a comprehensive final report will be prepared.

Port Site Evaluation Plot		09-08-87		09-06-88					
	One Block Planted 07-06-87								
1	'Nugget' Kentucky Bluegrass	3	30	5	10				1
2	'Merion' Kentucky Bluegrass	7	10	-	-				2
3	'Banff' Kentucky Bluegrass	3	25	-	-				3
4	'Park' Kentucky Bluegrass	1	15	-	-				4
5	'Sydsport' Kentucky Bluegrass	7	5	-	-				5
6	'Fylking' Kentucky Bluegrass	1	30	-	-				6
7	'Troy' Kentucky Bluegrass	7	10	-	-				7
8	Big Bluegrass 387931	5	10	5	15				8
9	'Sherman' Big Bluegrass	3	20	-	-				9
10	'Canbar' Canby Bluegrass	3	40	-	-				10
11	'Reubans' Canada Bluegrass	5	30	-	-				11
12	'Tundra' glaucus Bluegrass	1	30	1	95				12
13	Glaucus Bluegrass T08867	1	25	-	-				13
14	'Gruening' Alpine Bluegrass	1	90	1	90				14
15	'Sodar' Streambank wheatgrass	1	25	-	-				15
16	Bearded wheatgrass 371698	-	-	-	-				16
17	Bearded wheatgrass 236693	-	-	-	-				17
18	'Nordan' Crested wheatgrass	1	15	-	-				18
19	'Fairway' Crested wheatgrass	7	10	-	-				19
20	'Summit' Crested wheatgrass	5	10	-	-				20
21	Violet wheatgrass T12050	3	20	3	30				21
22	Boreal wheatgrass T12048	1	40	1	50				22
23	Yukon wheatgrass T12051	-	-	5	10				23
24	'Critana' Thickspike wheatgrass	5	20	1	90				24
25	'Fults' Alkaligrass	1	20	-	-				25
26	'Vantage' Reed Canarygrass	1	10	-	-				26
27	'Engmo' timothy	5	5	-	-				27
28	'Climax' timothy	1	25	-	-				28
29	Beach wildrye 345978	1	5	1	15				29
30	Siberian wildrye 345600	7	10	1	10				30
31	Siberian wildrye 2144	-	-	-	-				31
32	'Nortran' Tufted Hairgrass	7	5	-	-				32
33	'Norcoast' Bering hairgrass	5	5	1	30				33
34	Tufted hairgrass 372690	1	20	1	80				34
35	Bluejoint	3	10	5	15				35
36	'Sourdough Bluejoint	-	-	3	20				36
37	Meadow foxtail	1	50	-	-				37
38	Geniculated foxtail 314565	5	25	-	-				38
39	Garrison Creeping foxtail	-	-	-	-				39
40	'Arctared' Creeping red fescue	5	30	1	30				40
41	'Boreal' Creeping red fescue	1	60	3	15				41
42	'Pennlawn' Creeping red fescue	3	50	-	-				42
43	Rough fescue 236849	1	80	-	-				43
44	American Sloughgrass T12053	5	20	3	25				44
45	'Durar' Hard fescue	7	10	-	-				45
46	'Highlight' Sheep fescue	3	30	-	-				46
47	'Covar' Sheep fescue	3	75	-	-				47
48	'Manchar' Smooth Brome	9	10	-	-				48
49	'Carlton' Smooth Brome	7	10	-	-				49
50	'Alyeska' Polar grass	7	10	-	-				50
51	Tilesey Sage T12052	1	100	1	10				51
52									52

Figure 3.

Mine Site Fall Plot		09-06-88							
	One Block Planted 09-08-87								
1	'Nugget' Kentucky Bluegrass	3	70						1
2	'Merion' Kentucky Bluegrass	5	60						2
3	'Banff' Kentucky Bluegrass	5	30						3
4	'Park' Kentucky Bluegrass	1	100						4
5	'Sydsport' Kentucky Bluegrass	3	20						5
6	'Fylking' Kentucky Bluegrass	3	40						6
7	'Troy' Kentucky Bluegrass	-	-						7
8	Big Bluegrass 387931	9	20						8
9	'Sherman' Big Bluegrass	5	20						9
10	'Canbar' Canby Bluegrass	NP*							10
11	'Reubans' Canada Bluegrass	NP							11
12	'Tundra' glaucus Bluegrass	3	70						12
13	Glaucus Bluegrass T08867	3	15						13
14	'Gruening' Alpine Bluegrass	3	50						14
15	'Sodar' Streambank wheatgrass	NP							15
16	Bearded wheatgrass 371698	NP							16
17	Bearded wheatgrass 236693	NP							17
18	'Nordan' Crested wheatgrass	NP							18
19	'Fairway' Crested wheatgrass	-	-						19
20	'Summit' Crested wheatgrass	7	10						20
21	Violet wheatgrass T12050	5	10						21
22	Boreal wheatgrass T12048	7	15						22
23	Yukon wheatgrass T12051	7	10						23
24	'Critana' Thickspike wheatgrass	5	25						24
25	'Fults' Alkaligrass	NP							25
26	'Vantage' Reed Canarygrass	NP							26
27	'Engmo' timothy	7	40						27
28	'Climax' timothy	3	90						28
29	Beach wildrye 345978	3	60						29
30	Siberian wildrye 345600	3	75						30
31	Siberian wildrye 2144	-	-						31
32	'Nortran' Tufted hairgrass	3	80						32
33	'Norcoast' Bering hairgrass	1	100						33
34	Tufted hairgrass 372690	1	65						34
35	Bluejoint	1	100						35
36	'Sourdough' Bluejoint	1	100						36
37	Meadow foxtail	5	20						37
38	Geniculated foxtail 314565	NP							38
39	Garrison Creeping foxtail	NP							39
40	'Arctared' Creeping red fescue	1	90						40
41	'Boreal' Creeping red fescue	1	100						41
42	'Pennlawn' Creeping red fescue	3	40						42
43	Rough fescue 236849	1	100						43
44	'Egan' American Sloughgrass	3	95						44
45	'Durar' Hard fescue	NP							45
46	'Highlight' Sheep fescue	5	30						46
47	'Covar' Sheep fescue	NP							47
48	'Manchar' Smooth Brome	-	-						48
49	'Carlton' Smooth Brome	-	-						49
50	'Alyeska' Polar grass	1	90						50
51	Tilesy Sage T12052	1	90						51
52	Pumpelly Brome	-	-						52

* NP indicates accession not planted

Figure 4.

Mine Site Spring Plot		09-16-88							
	One Block Planted 06-15-88								
1	'Nugget' Kentucky Bluegrass	3	30						1
2	'Merion' Kentucky Bluegrass	5	50						2
3	'Banff' Kentucky Bluegrass	5	55						3
4	'Park' Kentucky Bluegrass	3	60						4
5	'Sydsport' Kentucky Bluegrass	3	40						5
6	'Fylking' Kentucky Bluegrass	3	80						6
7	'Troy' Kentucky Bluegrass	5	60						7
8	Big Bluegrass 387931	3	60						8
9	'Sherman' Big Bluegrass	1	30						9
10	'Canbar' Canby Bluegrass	3	70						10
11	'Reubans' Canada Bluegrass	1	50						11
12	'Tundra' glaucus Bluegrass	3	90						12
13	Glaucus Bluegrass T08867	1	80						13
14	'Gruening' Alpine Bluegrass	3	90						14
15	'Sodar' Streambank wheatgrass	3	75						15
16	Bearded wheatgrass 371698	-	-						16
17	Bearded wheatgrass 236693	-	-						17
18	'Nordan' Crested wheatgrass	1	75						18
19	'Fairway' Crested wheatgrass	3	40						19
20	'Summit' Crested wheatgrass	5	10						20
21	Violet wheatgrass T12050	5	<10						21
22	Boreal wheatgrass T12048	3	40						22
23	Yukon wheatgrass T12051	7	<10						23
24	'Critana' Thickspike wheatgrass	5	15						24
25	'Fults' Alkaligrass	7	30						25
26	'Vantage' Reed Canarygrass	7	<10						26
27	'Engmo' timothy	5	25						27
28	'Climax' timothy	5	25						28
29	Beach wildrye 345978	7	<5						29
30	Siberian wildrye 345600	1	40						30
31	Siberian wildrye 2144	NP							31
32	'Nortran' Tufted hairgrass	3	50						32
33	'Norcoast' Bering hairgrass	1	60						33
34	Tufted hairgrass 372690	NP							34
35	Bluejoint	3	55						35
36	'Sourdough' Bluejoint	3	75						36
37	Meadow foxtail	1	65						37
38	Geniculated foxtail 314565	1	95						38
39	Garrison Creeping foxtail	3	30						39
40	'Arctared' Creeping red fescue	3	75						40
41	'Boreal' Creeping red fescue	1	80						41
42	'Pennlawn' Creeping red fescue	3	45						42
43	Rough fescue 236849	1	50						43
44	'Egan' American Sloughgrass	5	30						44
45	'Durar' Hard fescue	7	15						45
46	'Highlight' Sheep fescue	5	30						46
47	'Covar' Sheep fescue	9	10						47
48	'Manchar' Smooth Brome	9	<10						48
49	'Carlton' Smooth Brome	7	<10						49
50	'Alyeska' Polar grass	3	20						50
51	Tilesey Sage T12052	3	30						51
52									52

Figure 5.

Demonstration Plantings
Solid Waste Disposal Site

In 1987, the solid waste disposal pit north of the Cominco port was selected as a demonstration site. This trial is intended to demonstrate practical methods of restoration and revegetation using adapted native species.

During the winter of 1988 a restoration plan was developed by the PMC. This plan relied exclusively on native herbaceous species.

Within the pit itself, different seed mixes were utilized depending on microtypic conditions.

Prior to seeding in 1988, the existing berms of spoil along the edges of the pit pushed back into the pit. The pit was then contoured in a manner to reshape cut slopes and the visually objectionable features (See Figures 7 and 8).

Following the necessary earth work, the site was fertilized with 450 pounds of 20-20-10 fertilizer per acre. This was accomplished by two Cominco laborers using standard shoulder held spreaders.

Two special treatment areas received different amounts of fertilizer and will be addressed later in this report.

As stated earlier, the actual pit area was seeded with three different seed mixes. These mixes were developed to respond to differing levels of available moisture in the recontoured pit. Figure 6 addresses these mixes and Figure 8 notes the areas where the mixes were intended to be used.

Figure 6. Listing of seed mixes.

Mix 1	40% 'Tundra' Glaucous Bluegrass
	30% 'Arctared' Red Fescue
	30% Polar Grass <u>Arctagrostis latifolia</u>
Mix 2	50% 'Norcoast' Bering hairgrass
	30% 'Arctared' Red Fescue
	15% 'Egan' American Sloughgrass
	5% Tilesy Sage
Mix 3	50% 'Egan' American Sloughgrass
	40% 'Norcoast' Bering hairgrass
	10% 'Tundra' Glaucous Bluegrass
Mix 4	70% 'Norcoast' Bering hairgrass
	30% 'Arctared' Red Fescue

Following seeding at a rate of 40 pounds per acre, the area was raked so that the seed and fertilizer was incorporated into the soil.

Adjacent to the pit, a series of bull dozer tracks required reseeding. These scars only superficially damaged the tundra. Because of the minimal damage, it was determined that a light seeding (20 pounds per acre) would suffice. The tracks also received fertilizer (20-20-10) at the rate of 200 pounds per acre.

Between the pit and the shoreline, the plan called for the rebuilding of a portion of the breached fore dune. This was suggested as a method to prevent vehicles from entering the restored pit. Upon further investigation, it was determined that this effort would be futile as the recreated dune segment would not be able to withstand storm forces. This assumption was later verified. Instead of the rebuilding of the dune, the breached Beach Wild Rye (Elymus mollis) communities were reconnected using transplanted sprigs and by seeding coastal species. This area was fertilized with 20-20-10 at a rate of 600 pounds per acre.

After one growing season, the disposal pit seedings were performing very well. The September 9, 1988 evaluation indicated that roughly 75% of the pit was supporting good to excellent stands of grass. For a seedling year, this is considered excellent.

The Beach Wild Rye sprigs and seeded coastal grass did not fare as well. Storm surges washed cover the plantings causing some dislodging and rill erosion. Even so, roughly 70% of the sprigs seemed to have become established.

This disposal site will be monitored through the 1990 growing season.

During the September, 1988 evaluation trip, the nine stream crossings on the haul road were examined and documented. Prior to the 1988 planting season, the PMC will prepare revegetation plans for these sites.

Closing Comments

This report is intended to inform the reader as to what has occurred as of the close of 1988. Using this information and data at this stage could result in error. The final report to be prepared during the winter of 1990-1991 will provide reliable information.

The PMC wishes to thank Cominco for its support in obtaining this important information on arctic revegetation.