

1990 Final Report of
Data and Observations
Obtained From the Red Dog Mine
Evaluation and Demonstration Plots

Presented to:

Cominco Alaska

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

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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 Production Project with test areas at the Red Dog Mine site and port site for advance testing of potential and existing reclamation grasses. Additionally, Cominco provided a disposal site and a series of river crossings for demonstration plantings.

Advanced Evaluation Plots

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:

Three evaluation plots were established in the vicinity of the Port Site and the Mine Site. The first plot site (seeded on July 6, 1987) was simply a sandy-gravel beach area north of the port. See Figure 1 for typical plot layout. 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. One plot was a dormant seeding which was established on September 8, 1987. Space limitations required that the plot dimensions be reduced slightly and 12 of the 52 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.

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 yukonense
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

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).

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.
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.

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
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52									52

Figure 2. Sample Advanced Evaluation Page.

Advanced Evaluation Plot Results:

This report is intended to produce information on performance of commercially available species for revegetation at the Red Dog project. While some initial information is available in the 1988 Interim Report, final recommendations should be based on information in this 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 were only evaluated for three growing seasons. The Port Site plot also was only evaluated for three years because the plot was destroyed by a storm prior to the 1990 evaluation.

After one season, the Port Site plot lost the least adapted accessions. Out of the fifty-one accessions planted, only 18 remained. This was a relatively high loss of accessions for a one-year period.

The Port Site is located on exposed sandy gravel on the leeward side of a foredune. Close proximity to the Chuckchi Sea shore undoubtedly had some effect on survival. Between June and September 1988, storm surges or spray appear to have topped the foredune 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.

By August 30, 1989, only nine accessions remained. These accessions, as noted on Figure 3, are roughly equal in performance.

The fall-seeded plot (planted September 8, 1987) originally contained 40 accessions. Only 34 produced measurable stands by September 9, 1988. This site differed from the other planting sites, because the soils were composed of overburden as opposed to sand or gravel.

By the conclusion of the study in September, 1990, only 12 accessions remained (See Figure 4). The best performance was recorded for 'Tundra' Glaucous Bluegrass, 'Sourdough' Bluejoint and 'Alyeska' Polargrass. Good performance was also recorded for 'Gruening' Alpine Bluegrass, 'Norcoast' Bering Hairgrass and 'Egan' American Sloughgrass. The remaining accessions exhibited a poor or marginal performance.

The spring-planted plot at the Exploration Camp (planted June 15, 1988) contained 50 accessions. At the end of the first growing season, 48 accessions produced measureable stands. At the end of the evaluation period on September 4, 1990, only 20 accessions remained (Figure 5). Eight exhibited outstanding performance: 'Tundra' Glaucous Bluegrass, 'Gruening' Alpine Bluegrass, 'Norcoast' Bering Hairgrass, 'Sourdough' Bluejoint, 'Arctared' Red Fescue, 'Egan' American Sloughgrass, Boreal Wheatgrass T12048 and Bluejoint AKPMC5. The latter two accessions are not released or commercially available.

Port Site Evaluation Plot		09-08-87		09-06-88		08-30-89		09-04-90		
	One Block Planted 07-06-87	vigor	% stand	vigor	% stand	vigor	% stand	vigor	% stand	
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	1	90	-		12
13	Glaucus Bluegrass T08867	1	25	-	-	-	-			13
14	'Gruening' Alpine Bluegrass	1	90	1	90	3	70	-		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	1	90			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	3	15			33
34	Tufted hairgrass 372690	1	20	1	80	1	75			34
35	Bluejoint	3	10	5	15	3	80			35
36	'Sourdough Bluejoint	-	-	3	20	3	30			36
37	Meadow foxtail	1	50	-	-	-	-			37
38	Genuculated foxtail 314565	5	25	-	-	-	-			38
39	Garrison Creeping foxtail	-	-	-	-	-	-			39
40	'Arctared' Creeping red fescue	5	30	1	30	1	50	-		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	3	20			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		08-30-89		09-04-90			
	One Block Planted 09-08-87	vigor	% stand	vigor	% stand	vigor	% stand		
1	'Nugget' Kentucky Bluegrass	3	70	3	80	7	30		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	5	30	-	-		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	1	75	1	100		12
13	Glaucus Bluegrass T08867	3	15	-	-	-	-		13
14	'Gruening' Alpine Bluegrass	3	50	5	20	3	60		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	3	40	-	-		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	5	30	7	20		29
30	Siberian wildrye 345600	3	75			-	-		30
31	Siberian wildrye 2144	-	-	-	-	-	-		31
32	'Nortran' Tufted hairgrass	3	80	1	100	5	80		32
33	'Norcoast' Bering hairgrass	1	100	1	100	3	100		33
34	Tufted hairgrass 372690	1	65	1	100	5	80		34
35	Bluejoint	1	100	1	100	-	-		35
36	'Sourdough Bluejoint	1	100	1	100	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	5	4-	5	30		41
42	'Pennlawn' Creeping red fescue	3	40			-	-		42
43	Rough fescue 236849	1	100	3	80	5	80		43
44	'Egan' American Sloughgrass	3	95	1	90	3	100		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	1	100	1	100		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		08-30-89		09-04-90			
	One Block Planted 06-15-88	vigor	% stand	vigor	% stand	vigor	% stand		
1	'Nugget' Kentucky Bluegrass	3	30	5	45	5	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	3	80	5	70		6
7	'Troy' Kentucky Bluegrass	5	60			-	-		7
8	Big Bluegrass 387931	3	60	3	75	3	80		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	1	100	1	100		12
13	Glaucus Bluegrass T08867	1	80	5	100	3	90		13
14	'Gruening' Alpine Bluegrass	3	90	3	100	1	100		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	1	100	3	100		21
22	Boreal wheatgrass T12048	3	40	5	50	1	90		22
23	Yukon wheatgrass T12051	7	<10	3	80	3	90		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	1	75	3	70		29
30	Siberian wildrye 345600	1	40						30
31	Siberian wildrye 2144	NP							31
32	'Nortran' Tufted hairgrass	3	50	1	100	3	100		32
33	'Norcoast' Bering hairgrass	1	60	1	100	1	100		33
34	Tufted hairgrass 372690	NP							34
35	Bluejoint	3	55	1	100	1	100		35
36	'Sourdough' Bluejoint	3	75	3	100	1	100		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	1	100	1	100		40
41	'Boreal' Creeping red fescue	1	80	3	95	3	100		41
42	'Pennlawn' Creeping red fescue	3	45	-	-	-	-		42
43	Rough fescue 236849	1	50	-	-	-	-		43
44	'Egan' American Sloughgrass	5	30	1	100	1	100		44
45	'Durar' Hard fescue	7	15	7	80	7	60		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	1	100	3	100		50
51	'Tilley Sage T12052	3	30	3	70	3	90		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, the PMC developed a restoration plan that relied exclusively on native herbaceous species.

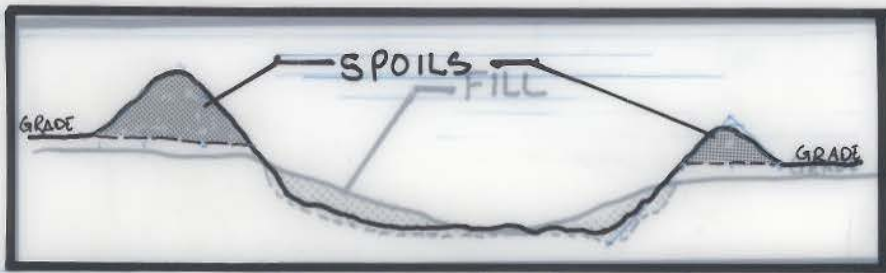
Within the pit itself, different seed mixes were planted depending on microtypic conditions.

Prior to seeding in 1988, the existing berms of spoil along the edges of the pit were pushed back into the pit. The pit was then contoured in a manner to reshape cut slopes and the visually objectionable features (See Figures 6 and 7).

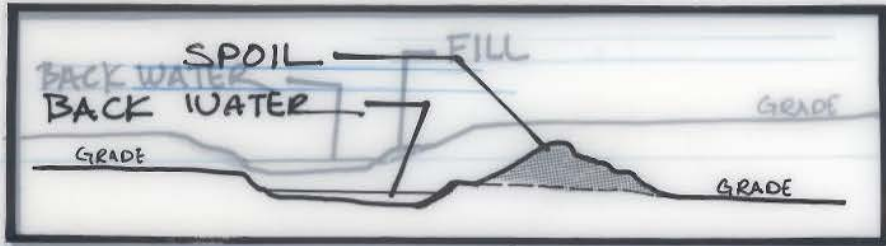
Following the necessary earth work, the site was fertilized with 450 pounds of 20-20-10 fertilizer per acre. Two Cominco laborers distributed the fertilizer with standard, shoulder-held, broadcast spreaders.

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

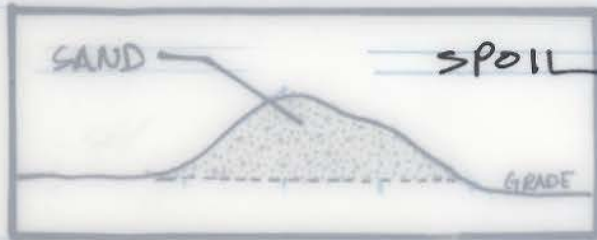
As stated earlier, the actual pit area was seeded with three different seed mixes. These mixes were developed to respond to differing levels of available moisture in the recontoured pit. Figure 8 lists these mixes and Figure 7 notes the areas where the mixes were intended to be used.



CROSS SECTION A-A' AS-BUILT BB'

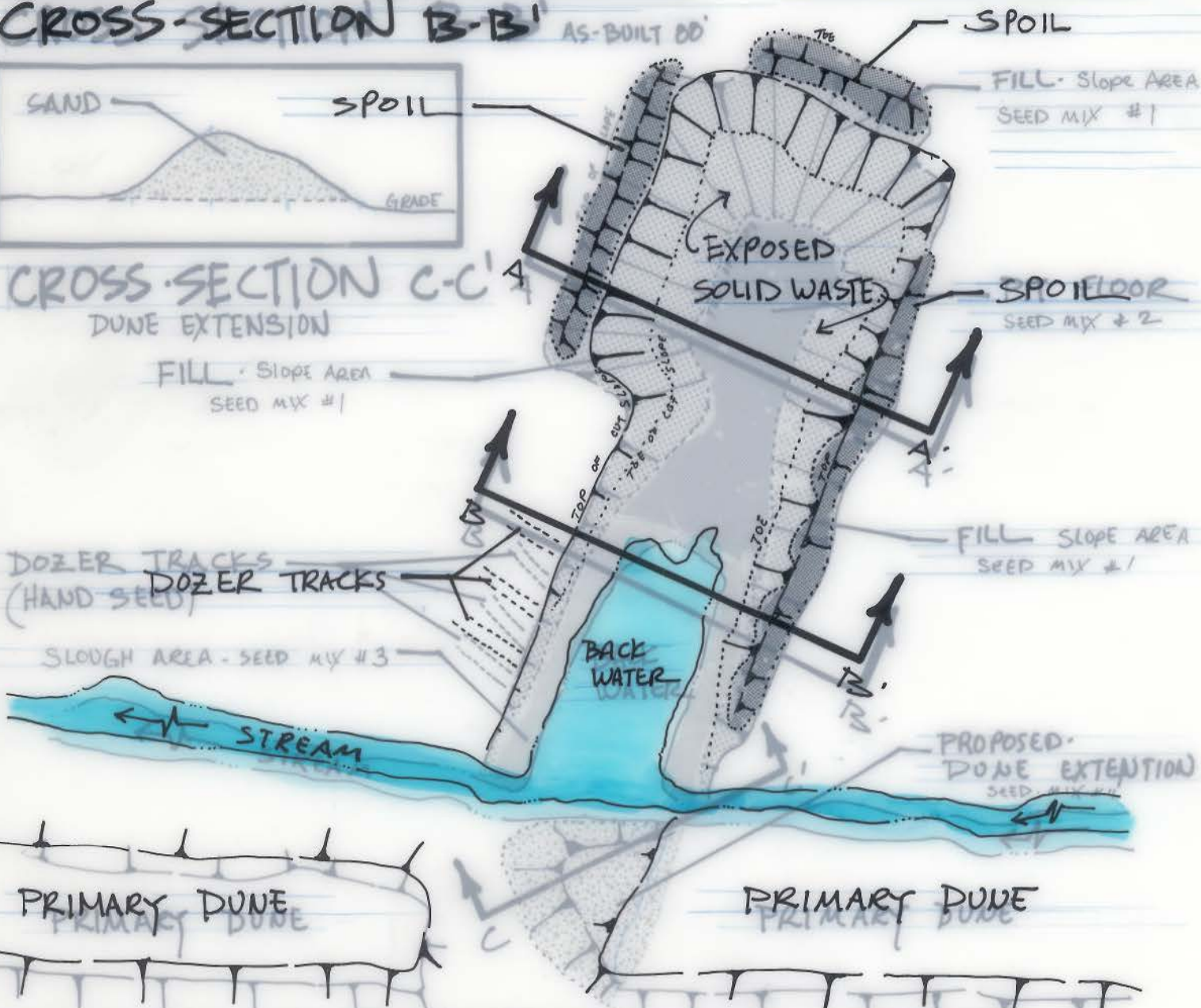


CROSS-SECTION B-B' AS-BUILT BB'



CROSS-SECTION C-C' DUNE EXTENSION

SEEDING KEY	
	SEED MIX #1
	SEED MIX #2
	SEED MIX #3
	SEED MIX #4



SOLID WASTE DISPOSAL SITE

NORTH OF COMINICO PORT SITE FOR 9-9-87

Figure 6.

Figure 8. Listing of seed mixes.

Mix 1	40% 'Tundra' Glaucous Bluegrass 30% 'Arctared' Red Fescue 30% Polar Grass <i>Arctagrostis latifolia</i>
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

The area was seeded at a rate of 40 pounds per acre, then 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, so only a light seeding (20 pounds per acre) was applied. The tracks were also fertilized (20-20-10) at a rate of 200 pounds per acre.

Initially, a plan was developed to recreate a portion of the breached foredune that existed between the disposal pit and the shoreline (Figure 7). This plan was suggested as a method to prevent vehicles from entering the restored pit. Upon further investigation, it appeared that this effort would be futile since 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 Wildrye (Elymus mollis) communities were reconnected using transplanted sprigs and overseeded by 'Norcoast' Bering Hairgrass and 'Arctared' Red Fescue. 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. This growth is considered excellent for a seedling year.

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

By August, 1989, the disposal pit was well covered with vegetation. Evaluation indicated that the site had approximately 90% ground cover. The transplanted Beach Wildrye community was well established and had spread so that surrounding natural stands were reconnected. The Beach Wildrye planting presented the appearance that no break or damage had occurred to the foredune.

When the disposal site was evaluated for the final time on September 4, 1990, an excellent stand of native vegetation was established on the site. Cover was estimated at 95%. 'Egan' American Sloughgrass and 'Norcoast' Bering Hairgrass predominated in the wetter areas of the site. 'Tundra' Glaucous Bluegrass and 'Alyeska' Polargrass were more evident in drier sites. 'Arctared' Red Fescue and 'Caiggluk' Tilesy Sage and 'Sourdough' Bluejoint also performed well.

The reconnected Beach Wildrye community was destroyed by storm action. This problem was not limited to the transplanted dune community; the entire natural dune formation in the area was destroyed by the violent storm action. The results noted earlier in this study however, did indicate that transplanting Beach Wildrye was possible in coastal areas of the Chuckchi Sea.

River Crossing Seedings

On June 14, 1989, six of the nine major river crossings were scheduled for revegetation (Table 1). A seed mix was developed relying entirely on native species (Table 2). This mix was hand broadcast at a rate of 40 pounds per acre. Following seeding, fertilizer 20-20-10 was applied at a rate of 450 pounds per acre and the areas were hand raked.

Table 1.

River Crossings Scheduled for Revegetation	
1. Aufeis Creek	4. Tutak
2. Mud Creek	5. Little Creek
3. Ailuuraq (PP855)	6. Anxiety Ridge

Table 2.

River Crossing Seed Mix	
'Gruening' Alpine Bluegrass <i>Poa alpina</i>	25%
'Alyeska' Polargrass <i>Arctagrostis latifolia</i>	25%
'Egan' American Sloughgrass <i>Beckmannia syzigachne</i>	20%
'Norcoast' Bering Hairgrass <i>Deschampsia caespitosa</i>	20%
'Caiggluk' Tilesy Sage <i>Artemisia tilesii</i>	5%
'Sourdough' Bluejoint <i>Calamagrostis canadensis</i>	5%

Because snow remained in some areas of the river crossings which were scheduled to be revegetated, seeding was somewhat discontinuous. However, the seedings proceeded as scheduled.

During the August, 1989 evaluation, all seeded areas had produced measurable growth. By September, 1990, these areas were well vegetated.

'Egan' American Sloughgrass, 'Tundra' Glaucous Bluegrass and 'Alyeska' Polargrass exhibited the best performance. 'Norcoast' Bering Hairgrass and 'Caiggluk' Tilesy Sage also produced measurable stands.

A complete photographic record of the bridge crossings is available at the Plant Materials Center. Further evaluation of the river crossings is desirable.

Conclusions and Recommendations

This study has allowed the Plant Materials Center to develop revegetation guidelines for Chuckchi coastal areas of Alaska and the northwest region of Alaska. The study was also intended to provide revegetation data to Cominco Alaska, allowing the company to make sound decisions regarding any potential revegetation along the highway corridor or the mine site.

Based on the information contained in this report, the following commercially available species should be considered if revegetation is planned:

Figure 9.

Suitable Revegetation Species	
'Tundra' Glaucous Bluegrass Poa glauca	'Nortran' Tufted Hairgrass Deschampsia caespitosa
'Gruening' Alpine Bluegrass Poa alpina	'Sourdough' Bluejoint Calamagrostis canadensis
'Norcoast' Bering Hairgrass Deschampsia beringensis	'Alyeska' Polargrass Arctagrostis latifolia
'Arctared' Red Fescue Festuca rubra	'Caiggluk' Tilesy Sage Artemisia tilesii
'Egan' American Sloughgrass Beckmannia syzigachne	

A revegetation mix need not contain all species listed in Figure 9. However, this will provide a variety of species for mixes to be developed for specific conditions.

This study also indicated that Fall seeding (dormant seeding) is a viable option. Traditionally, Fall seedings occur after September 1, and prior to four inches of snow accumulation. It is unlikely that any major changes in this seeding period are needed in the area.

The activities with Beach Wildrye indicated that transplanting the species can be successfully accomplished in the region. This may prove to be a valuable erosion control and coastal protection measure on the Chuckchi coast as further development occurs in the area.

The Alaska Plant Materials Center appreciates Cominco Alaska's assistance in developing and conducting this study. Cooperation of this nature allows the Plant Materials Center to conduct work that would otherwise not be possible.