



POLYMET
MINING

Hoyt Lakes, Minnesota STANDARD PROCEDURE

RECLAMATION SEEDING AND MULCHING

General Manager's Approval _____

Manager's Approval _____

Initiator _____

Date
Effective

12/14/12

SP
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ER15

History:

2/14/12 – ER15 - initial version

PART I. DESCRIPTION

This work shall consist of the operations of establishing herbaceous ground cover on designated reclamation areas within the NorthMet Project including Flotation Tailings Basin (FTB), Hydrometallurgical Residue Facility (HRF), Pit Wall Overburden Slopes, Category 1 Waste Rock Stockpile, reclaimed roads, reclaimed building sites, and other disturbed areas. It shall include seeding, mulching, fertilizing, and any other work specified in conjunction therewith.

The primary objectives of establishing herbaceous ground cover are to:

- Rapidly (3-5 years) establish a self-sustaining plant community
- Control air emissions
- Control soil erosion
- Provide for wildlife habitat, and
- Minimize to the extent practicable the need for maintenance

In accomplishing these objectives, preference will be given to the establishment of plant communities consisting of native plant species and the introduction of invasive species will be avoided to the extent that such a practice does not interfere with the timely and effective accomplishment of the primary objectives for vegetation establishment.

1.01 CONSTRUCTION REQUIREMENTS

A. General

If any of the work provided for herein is performed under unfavorable conditions or contrary to the restrictions and requirements set forth, the Contractor shall assume full responsibility for the results by repairing any damages and replacing unacceptable work as the *Operations Contact* directs.

The Contractor will provide seed, fertilizer, mulch and any other materials necessary to complete the job unless notified in writing that PolyMet will provide materials.

Contracted equipment and/or substitutions from that listed herein or in the Vegetative Specifications must be approved by the *Operations Contact* before the substitution can be made.

B. Placing and Working-In Fertilizer

Fertilizers shall be applied at the rates indicated in the Vegetative Specifications, using mechanical spreading devices to the fullest extent practicable, and providing uniform distribution of the material over the designated areas.

Unless otherwise specified, immediately prior to sowing the seed, the fertilizer shall be worked into a depth of approximately eight inches on the level and four inches on all slopes, using rotovators, klodbusters, discs, harrows, etc., or as specified on the Vegetative Specifications. On slopes, the cultivating equipment shall be operated in a general direction at right angles to the direction of surface drainage wherever practical.

C. Sowing Seed

The season of planting (dates approximate) for the various seed mixtures shall be as follows:

Season of Planting

Winter: March

Spring: Fertilization will commence as soon as the ground is workable, and planting will commence as soon after May 1st as is practicable and will be completed by June 10th.

Summer: August 15 - September 15

Fall: October

On areas to be mulched after seeding, no more seed shall be sown on any day than can be mulched on the same day. In any event, the lag time between seeding and mulching shall not exceed 24 hours where the mulch is placed after seeding. Should the mulch application be delayed more than 24 hours, the *Operations Contact* may order the area reseeded at the Contractor's expense.

Seed shall be sown by means of mechanical, Truax native seed drill or hydrospreading of the seeds at the specified rate of application. The use of hand operated mechanical spreaders will be permitted only on areas which are inaccessible to, or too small for the other equipment approved herein, all as determined by the *Operations Contact*. During windy weather, no seeding shall be done with cyclone type broadcasting devices.

All legume seed used must be pre-inoculated. If a hydroseeder will be used to distribute seed, double the appropriate bacteria culture will be added to the hydroseeder tank

immediately before planting commences. The inoculant will be supplied by the Contractor and must be kept cool by the Contractor until the time of its use.

If a seed drill of the agricultural type is used, the drill shall be operated in a general direction at right angles to the direction of surface drainage, wherever practical, and the seed shall not be sown to a depth greater than 1/2 inch. Small seed species such as red top, etc., shall be sown through the grass seed attachment or by other approved means.

Broadcast seeders shall be used in wet areas where drill seeders tend to clog-up and will be followed by a cultipacker or equivalent.

If a hydroseeder is used, it shall have continuous agitation action that keeps the seed mixed in uniform distribution in the water slurry until pumped from the tank. The pump pressure shall be such that a continuous, nonfluctuating stream is maintained.

All seeded areas having slopes 3 horizontally to 1 vertically or flatter shall have the seedbed firmed or the seed worked in after seeding and prior to mulching. The soil firming shall be done with a corrugated cultipacker or other approved soil firming equipment. On slopes steeper than 3 horizontally to 1 vertically, the seed shall be covered by hand raking or other approved means prior to mulching. Soil firming or seed covering shall be accomplished within twenty-four hours after seeding.

D. Mulch Classification

Mulch material shall conform to the requirements for one of the following types, as specified in the Contract:

- Type 1 - Mulch shall consist of grain straw, hay, cutting of agricultural grasses and legumes. The material shall be relatively free of seed bearing stalks of noxious grasses or weeds, as defined by the rules and regulations of the Minnesota Department of Agriculture.
- Type 2 - Type 2 mulch shall consist of a mixture of Type 1 (straw, hay, etc.) and asphalt emulsion mulch materials.
- Type 3 - Type 3 mulch shall consist of Type 1 (straw, hay, etc.) spread on the ground and anchored using an Imco disc or comparable equipment.
- Type 4 - Type 4 mulch shall consist of approved chemical application.
- Type 5 - Type 5 mulch shall consist of wood fiber, newsprint, chopped straw, cotton fiber or any combination of the four listed materials.
- Type 6 - Type 6 mulch shall consist of an initial application of Type 1 mulch held in place with Type 5 mulch.

E. Applying Mulch

- Type 1 - Wherever possible, Type 1 mulch shall be placed with blower equipment. The rate of application shall be 2 tons/acre. Where so specified and provided for in the Vegetative Specifications, the mulch shall be anchored the same day it is placed, unless otherwise authorized by the *Operations Contact*.
- Type 2 - Type 2 mulch materials shall be applied by blowing, with asphalt emulsion being sprayed into the Type 1 material as it leaves the blower. Disc anchoring will not be required. The rates of application shall be 2 tons of Type 1 and 250 gallons of asphalt per acre.
- Type 3 - Type 3 mulch materials shall be applied by blowing or spreading. Application rates shall be 2 tons of Type 1 mulch per acre (or other approved rate). The mulch shall be anchored with an Imco disc or other approved equipment the same day it is placed.
- Type 4 - Type 4 mulch shall be applied with hydraulic spray equipment at the rate of 650 gallons per acre (four parts water to one part TREX), or 1,300 gallons per acre (9 parts water to one part Coherex) or another rate and chemicals as designated by the *Operations Contact*. The slurry mixture shall be uniformly sprayed on the prepared seed bed. The *Operations Contact* will verify, by inspection of tank loading and spray application, that materials applied correspond with the per acre requirements within reasonable limitations.
- Type 5 - Type 5 mulch shall be applied with hydraulic spray equipment at the rate of 1,500 to 2,000 lbs./acre (or other approved rate). The slurry mixture shall be uniformly sprayed on the prepared seed bed.
- Type 6 - Type 6 mulch materials shall be applied by:
- 1) Blowing on 2 tons/acre of Type 1 mulch material.
 - 2) Application over the Type 1 mulch of 1000 lbs./acre Type 5 mulch.

F. Litter Reduction

Litter reduction will be a spring treatment used on interior areas displaying an excessive amount of organic material from previous year's growth. A brush hog, weed chopper or other equipment approved by the *Operations Contact* shall be used to chop and scatter the existing vegetative material. This treatment will normally be used alone.

G. Plowing

Plowing will be a fall treatment used on interior areas choked with root-bound vegetation or containing excessive amounts of litter. Unless otherwise specified, this treatment shall be done immediately prior to placing and working in fertilizer. Approximate depth of cut shall be eight (8) inches.

1.02 METHOD OF MEASUREMENT

A. Seeding (Areas)

Seeding will be measured by the area seeded, regardless of the seed mixture or quantity of seed used, and regardless of whether the seed was furnished by the Contractor or PolyMet. Areas reseeded by order of the *Operations Contact*, after the original seeding of the area was accepted, will be measured and added to the area originally seeded.

B. Mulch (Mulch - Tons)

(Non-Petro Binder - Pounds or Gallons)
(Dust Retarding Chemicals - Gallons)

Mulch material of Type 1 will be measured by the weight furnished and applied acceptably.

C. Disc Anchoring (Acres)

Disc anchoring of Type 1 mulch will be measured by the area in acres of mulch disced acceptably.

D. Plowing (Acres)

Plowing will be measured by the area in acres treated acceptably.

PART 2 VEGETATIVE SPECIFICATIONS

2.01 TREATMENT A - FERTILIZING AND PLANTING FLAT AREAS

This treatment, described below, will be done on

- the flat, fine tailings found at the FTB and HRF interior areas
- on some coarse tailing FTB and HRF dams with slopes flatter than 3:1
- top and benches of Category 1 Waste Rock Stockpile
- reclaimed roads and building sites
- other disturbed areas

A. Fertilization

1. Application will be made using a mechanical spreader, hydro-seeder, or other equivalent device approved by the *Operations Contact*.
2. Fertilizer will be 400 pounds of 20-20-0 per acre (or equivalent) applied at a uniform rate, unless otherwise specified.
3. After application, the fertilizer will be worked and thoroughly mixed with the tailing using a disc (or equivalent) to an approximate depth of six (6) inches.

B. Sowing of Seed

1. Seed Mixtures for temporary dust control on FTB beaches.

Mixture Number	Species	Rate (lbs/acre)
A1 ^[1]	Oats (<i>Avena sativa</i>)	100
	Total	100
A2 ^[2]	Winter Wheat (<i>Triticum aestivum</i>)	100
	Total	100
A3 ^[3]	Annual Rye (<i>Lolium italicum</i>)	20
	Sweet Clover (<i>Trifolium repens</i>)	5
	Redtop (<i>Agrostis stolonifera</i>)	5
	Alsike Clover (<i>Trifolium hybridum</i>)	5
	Total	35
A4	Any substitute mixture or individual species designated by the <i>Operations Contact</i> . Substitutes may become necessary due to seed availability or suitability.	

[1] State Seed Mix*21-111. Temporary cover for spring and summer plantings.

[2] State Seed Mix* 21-112. Temporary cover for fall plantings.

[3] Seed mix used by LTVSMC for temporary dust control.

2. Seed Mixtures for permanent reclamation cover on FTB upland beaches, Category 1 Waste Rock Stockpile top, bench and reclaimed roads, building sites and other disturbed areas.

Mixture Number	Species	Rate (lbs/acre)
B1 ^[1]	Fringed Brome (<i>Bromus ciliates</i>)	2.00
	Bluejoint (<i>Calamagrostis Canadensis</i>)	0.13
	Poverty Grass (<i>Danthonia spicata</i>)	0.50
	Nodding Wild Rye (<i>Elymus Canadensis</i>)	1.25
	Slender Wheatgrass (<i>Elymus trachycaulus</i>)	2.00
	Fowl Bluegrass (<i>Poa palustris</i>)	0.87
	False Melic (<i>Schizachne purpurascens</i>)	0.25
	Total Grasses	7.00
	Common Yarrow (<i>Achillea millefolium</i>)	0.03
	Pearly Everlasting (<i>Anaphalis margaritacea</i>)	0.02
	Flat-topped Aster (<i>Doellingeria umbellata</i>)	0.04
	Tall Cinquefoil (<i>Drymocallis arguta</i>)	0.06
	Large-leaved Aster (<i>Eurybia macrophylla</i>)	0.02
	Stiff Goldenrod (<i>Oligoneuron rigidum</i>)	0.14
	Smooth Wild Rose (<i>Rosa blanda</i>)	0.16
	Black-eyed Susan (<i>Rudbeckia hirta</i>)	0.26
	Gray Goldenrod (<i>Solidago nemoralis</i>)	0.06
	Upland White Aster (<i>Solidago ptarmicoides</i>)	0.04
	Lindley's Aster (<i>Symphyotrichum ciliolatum</i>)	0.03
	Smooth Aster (<i>Symphyotrichum leave</i>)	0.14
	American Vetch (<i>Vicia Americana</i>)	0.50
	Total Forbs	1.68
	Oats or Winter Wheat (season dependent)	25.00
	Total Cover Crop	25.00
	Totals:	33.50

Mixture Number	Species	Rate (lbs/acre)
B2 ^[2]	Meadow Brome (Bromus biebersteinii)	8.0
	Canada Wild Rye (Elymus Canadensis)	8.0
	Switchgrass (Panicum virgatum)	8.0
	Canada Bluegrass (Poa compressa)	5.0
	Intermediate Wheatgrass (Thinopyrum intermedium)	8.0
	Red Fescue (Festuca rubra)	5.0
	Timothy (Phleum pretense)	3.0
	Alfalfa (Medicago sativa)	12.0
	White clover (Trifolium repens)	3.0
	Grass and Legume Total	60.0
	Oats or Winter Wheat (season dependent)	25.0
	Totals:	85.0
B3 ^[3]	Canada Bluegrass (Poa compressa)	10
	Redtop (Agrostis stolonifera)	5
	Cicer Milvetch (Astragalus cicer)	10
	Birdsfoot Trefoil (Lotus corniculatus)	20
	Perennial Ryegrass (Lolium perene)	10
	Alsike Clover (Trifolium hybridum)	10
	Total	65
B4	Any substitute mixture or individual species designated by the <i>Operations Contact</i> . Substitutes may become necessary due to seed availability or suitability.	

[1] State Seed Mix* 36-311. Woodland Edge for reclamation in NE MN.

[3] Adapted from "Guidelines for Reclamation Plantings on Taconite Tailings Basins and Stockpiles". MDNR Lands and Minerals. January 2012.

[2] Used by LTVSMC for permanent taconite tailings reclamation.

- Wetland Seed Mixtures for permanent reclamation cover on wet tailing soils near FTB pond; and wet soils atop the East Pit backfill and/or depressions associated with former temporary stockpile footprints.

Mixture Number	Species	Rate (lbs/acre)
C1 ^[1]	Fringed Brome (Bromus ciliates)	2.00
	Bluejoint (Calamagrostis Canadensis)	0.10
	Virginia Wildrye (Elymus virginicus)	1.50
	Tall Manna Grass (Glyceria grandis)	0.25
	Fowl Bluegrass (Poa palustris)	<u>0.65</u>
	Total Grasses	4.50

Mixture Number	Species	Rate (lbs/acre)
	Tussock Sedge (<i>Carex stricta</i>)	0.04
	Pointed Broom Sedge (<i>Carex Scoparia</i>)	0.05
	Dark Green Bulrush (<i>Scirpus atrovirens</i>)	0.20
	Woolgrass (<i>Scirpus cyperinus</i>)	<u>0.06</u>
	Total Sedge and Rushes	0.35
	Canada Anemone (<i>Anemone Canadensis</i>)	0.10
	Marsh Milkweed (<i>Asclepias incarnate</i>)	0.24
	Flat-topped Aster (<i>Doellingeria umbellata</i>)	0.10
	Common Boneset (<i>Eupatorium perfoliatum</i>)	0.09
	Grass-leaved Goldenrod (<i>Euthamia graminifolia</i>)	0.04
	Spotted Joe Pye Weed (<i>Eutrochium maculatum</i>)	0.14
	Blue Monkey Flower (<i>Mimulus ringens</i>)	0.03
	Giant Goldenrod (<i>Solidago gigantea</i>)	0.03
	Eastern Panicked Aster (<i>Symphotrichum lanceolatum</i>)	<u>0.03</u>
	Total Forbs	0.80
	Oats or Winter Wheat (season dependent)	<u>6.85</u>
	Total Cover Crop	<u>6.85</u>
	Totals	12.50
C2	Any substitute mixture or individual species designated by the <i>Operations Contact</i> . Substitutes may become necessary due to seed availability or suitability.	

[1] State Seed Mix* 34-371. Wet meadow NE MN.

4. The individual species or mixtures will be sown in one application in areas clearly designated by the *Operations Contact*.
5. Method of Application If the seed is not premixed, it will be mixed by the contractor in the proper proportions and sown using a hydroseeder, Truax native seed drill, broadcast seeder or equivalent.
6. Soil firming using a cultipacker or equivalent will be required for all Treatment "A" acres and will follow seeding as soon as possible. In all cases, packing will be complete within 24 hours of seeding.

C. Mulching – Type 3

2.02 TREATMENT B - FERTILIZING AND PLANTING SLOPES

This treatment, described below, will be done mainly on the FTB and HRF dam slopes and benches, Pit Wall Overburden Slopes and Category 1 Waste Rock Stockpile slopes but some may be done on natural ground.

A. Fertilization

1. Application will be made using a mechanical spreader, hydroseeder, or another equivalent device approved by the *Operations Contact*.
2. Fertilizer will be 600 pounds of 11-55-0 per acre and 100 pounds of 0-46-0 per acre (or equivalent) applied at a uniform rate, or any other rate designated by the *Operations Contact*.
3. After application, the fertilizer will be worked and thoroughly mixed into the tailing or topsoil with a klodbuster or equivalent to an approximate depth of 4 inches (6 passes over a given area).

B. Sowing of Seed

1. Seed Mixtures for permanent cover on FTB and HRF dam slopes and benches. Pit Wall Overburden Slopes and Category 1 Waste Rock Stockpile slopes:

Mixture Number	Species	Rate (lbs/acre)
D1 ^[1]	Fringed Brome (<i>Bromus ciliates</i>)	2.00
	Bluejoint (<i>Calamagrostis Canadensis</i>)	0.13
	Poverty Grass (<i>Danthonia spicata</i>)	0.50
	Nodding Wild Rye (<i>Elymus Canadensis</i>)	1.25
	Slender Wheatgrass (<i>Elymus trachycaulus</i>)	2.00
	Fowl Bluegrass (<i>Poa palustris</i>)	0.87
	False Melic (<i>Schizachne purpurascens</i>)	0.25
	Total Grasses	7.00
	Common Yarrow (<i>Achillea millefolium</i>)	0.03
	Pearly Everlasting (<i>Anaphalis margaritacea</i>)	0.02
	Flat-topped Aster (<i>Doellingeria umbellata</i>)	0.04
	Tall Cinquefoil (<i>Drymocallis arguta</i>)	0.06
	Large-leaved Aster (<i>Eurybia macrophylla</i>)	0.02
	Stiff Goldenrod (<i>Oligoneuron rigidum</i>)	0.14
	Smooth Wild Rose (<i>Rosa blanda</i>)	0.16
	Black-eyed Susan (<i>Rudbeckia hirta</i>)	0.26
	Gray Goldenrod (<i>Solidago nemoralis</i>)	0.06
	Upland White Aster (<i>Solidago ptarmicoides</i>)	0.04
	Lindley's Aster (<i>Symphyotrichum ciliolatum</i>)	0.03
	Smooth Aster (<i>Symphyotrichum leave</i>)	0.14
	American Vetch (<i>Vicia Americana</i>)	0.50
	Total Forbs	1.68

Mixture Number	Species	Rate (lbs/acre)
	Oats or Winter Wheat (season dependent)	25.00
	Total Cover Crop	25.00
	Totals:	33.50
D2 ^[2]	Smooth Brome (Bromus inermis)	10
	Red Fescue (Festuca rubra)	10
	Perennial Ryegrass (Lolium perene)	10
	Cicer Milvetch (Astragalus cicer)	10
	Birdsfoot Trefoil (Lotus corniculatus)	20
	White Clover (Trifolium repens)	10
D3	Any substitute mixture or individual species designated by the <i>Operations Contact</i> . Substitutes may become necessary due to seed availability or suitability.	

[1] State Seed Mix* 36-311. Woodland edge for reclamation in NE MN.

[2] Used by LTVSMC for permanent taconite tailings reclamation

State Seed Mixes

Standard seed mixtures used by Mn/DOT, BWSR, and some divisions of the DNR have been revised and consolidated into one list of State Seed Mixes. Standards for the mixes have also been combined, with both BWSR and Mn/DOT requiring that mixes be sold as pure live seed (PLS), Source Identified (Yellow Tag) when available, and specific labeling requirements. Please

see: http://www.bwsr.state.mn.us/native_vegetation/state_seed_mixes.pdf.

- Method of Application - if seed is not premixed, it will be mixed by the Contractor in the proper proportions and sown using a hydroseeder or similar equipment approved by the *Operations Contact*.
- The seed will be covered by dragging a light chain over the surface, one (1) pass of the klodbuster or covering by a similar method approved by the *Operations Contact*.
- All legume seed will be pre-inoculated and supplemented in hydroseeder tank.

2.03 TREATMENT C - MULCHING ONLY

These are fertilized and seeded areas which require additional mulching or areas mulched for dust control.

A. Mulching

- Mulch will be distributed at a rate provided in Part I of the general specifications and uniformly spread to provide the most adequate vegetative protection on all treatment acres as directed by the *Operations Contact*.