



COLORADO OPERATIONS

Henderson Mine and Mill
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October 24, 2013

Sent Via Email and UPS Tracking #: 1Z 804 847 03 7845 4338

Mr. Peter Hays
Environmental Protection Specialist
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

RECEIVED

OCT 25 2013

DIVISION OF RECLAMATION
MINING AND SAFETY

**Re: Climax Molybdenum Company, Henderson Mine and Mill, Permit No. M-1977-342
Technical Revision No. 21, Seed Mix Modification**

Dear Mr. Hays,

Climax Molybdenum Company (CMC) is hereby submitting this request for a new Technical Revision (TR-21), as described below. Attached is a check in the amount of \$1,006.00 to cover fees for this Technical Revision.

1.0 INTRODUCTION

This Technical Revision (TR) modifies CMC's Henderson Operation Permit (M-1977-342) for the Henderson Mine and Henderson Mill. This TR modifies the current upland reclamation seed mixture and includes two additional special use seed mixtures, one for temporary site stabilization and one for establishing permanent wetlands. Post-mining land use priorities and specific reclamation methods and goals are not affected by this revision.

The Henderson properties range in elevation from a minimum of 8,500 feet below the tailing impoundment at the Henderson Mill in Grand County to a maximum of 10,500 feet in Clear Creek County. Most potential reclamation areas are within the upper montane and subalpine vegetation zones of Colorado. The native vegetation communities on these properties include Engelmann spruce/subalpine fir forests, aspen forests, subalpine meadow and grassland communities, subalpine wetlands, and rocky talus slopes.

The reclamation seed mixture currently approved for use on the Henderson properties has been successful at achieving vegetation cover and soil stabilization. However, it includes few native species and does not promote a diverse reclaimed vegetation community. As reclamation practices have evolved over the past several decades, native species diversity and continuity with surrounding native communities have emerged as valuable reclamation goals, along with cover and erosion control. The revised and new proposed seed mixtures presented in this TR are designed to meet this expanded goal. A field survey of adjacent undisturbed native communities and reclaimed communities on the Henderson properties was conducted and an effort was made to use locally common native species in the proposed seed mixtures.

2.0 REVISED SEED MIXTURES

Based on the characteristics of the reclamation area being reclaimed, one of the seed mixtures described below will typically be used for seeding:

- Upland Reclamation – Upland reclamation areas being permanently reclaimed will be seeded with the upland reclamation seed mixture (Section 0).
- Temporary Cover – Growth media stockpiles and reclamation areas that will be redisturbed will be seeded with the temporary seed mixture (Section 0).
- Wetlands – Reclamation areas that are planned to be reclaimed to mesic or wetland cover will be seeded with the wetland seed mixture (Section 00).

A concerted effort will be made to acquire the recommended seed mixtures; however, plant species availability and pricing varies from year to year and this may require some substitutions. When substituting becomes necessary, alternative plant species will be selected from the appropriate seed mixture plant species lists included in this TR. When substitutions are required, percentages and diversity of each life form (e.g., perennial grasses, perennial forbs, and shrubs) will be maintained in the revised seed mixture to the extent possible.

In addition to making substitutions based upon seed availability as discussed above, CMC maintains programs seeking to expand and maintain biodiversity on its property, where particular species may be determined to be useful to expand species composition, forage and habitat, or to reduce the occurrence of weedy species. In cases where native plant material may be available to accomplish these specific objectives, CMC will identify suitable substitutions and communicate these substitutions with the Division.

2.1 Upland Reclamation Seed Mixture

The upland reclamation seed mixture (Table 1) will be used to establish permanent vegetation in upland reclamation areas. This seed mixture will be broadcast or hydroseeded at a target rate of 50 pure live seeds per square foot (PLS/sf). Upland seed mixture alternate plant species are presented in Table 2.

Table 1: Upland Reclamation Seed Mixture

Species	Common Name	Desired Species Composition	Avg Seeds /Lb	Lbs PLS/ Acre	PLS /sf
Grasses					
<i>Bromus marginatus</i>	mountain brome	5%	64,000	1.70	2.5
<i>Deschampsia caespitosa</i>	tufted hairgrass	10%	2,500,000	0.09	5.0
<i>Elymus glaucus</i>	blue wildrye	10%	134,500	1.62	5.0
<i>Elymus trachycaulus</i>	slender wheatgrass	10%	159,000	1.37	5.0
<i>Festuca idahoensis</i>	Idaho fescue	10%	450,000	0.48	5.0
<i>Festuca saximontana</i>	Rocky Mountain fescue	10%	650,000	0.34	5.0
<i>Pascopyrum smithii</i>	Western wheatgrass	5%	110,000	0.99	2.5
<i>Phleum alpinum</i>	alpine timothy	5%	1,300,000	0.08	2.5
<i>Poa pratensis</i> spp. <i>agassizensis</i>	Rocky Mountain bluegrass	7%	2,177,000	0.07	3.5
<i>Poa alpina</i>	alpine bluegrass	5%	1,000,000	0.11	2.5
Graminoid Subtotal		77%	---	6.85	38.5
Forbs					
<i>Achillea millefolium</i>	common yarrow	5%	2,770,000	0.04	2.5

Species	Common Name	Desired Species Composition	Avg Seeds /Lb	Lbs PLS/ Acre	PLS /sf
<i>Linum lewisii</i>	blue flax	5%	293,000	0.37	2.5
<i>Penstemon strictus</i>	Rocky Mountain penstemon	5%	592,000	0.18	2.5
<i>Vicia americana</i>	American vetch	2%	32,800	1.33	1.0
Forb Subtotal		17%	---	1.92	8.5
Shrubs					
<i>Rosa woodsii</i>	Woods' rose	2%	45,300	0.96	1.0
<i>Ribes montigenum</i>	gooseberry currant	2%	195,500	0.22	1.0
<i>Shepherdia canadensis</i>	russet buffaloberry	2%	59,200	0.74	1.0
Shrub Subtotal		6%	---	1.92	3.0
Combined Total		100%	---	10.69	50.0

Table 2: Upland Seed Mixture Alternate Plant Species

Species	Common Name	Avg Seeds/Lb
Grasses		
<i>Achnatherum lettermanii</i>	Letterman's needlegrass	225,000
<i>Bromus anomalus</i>	nodding brome	108,500
<i>Bromus ciliatus</i>	fringed brome	80,000
<i>Calamagrostis canadensis</i>	bluejoint reedgrass	4,480,000
<i>Festuca arizonica</i>	Arizona fescue	500,000
<i>Muhlenbergia montana</i>	mountain muhly	1,600,000
<i>Poa secunda ssp. ampla</i>	Sandberg bluegrass	900,000
<i>Pseudoroegneria spicata</i>	bluebunch wheatgrass	140,000
<i>Trisetum spicatum</i>	spike trisetum	2,500,000
Forbs		
<i>Aquilegia coerulea</i>	Colorado blue columbine	399,600
<i>Arnica cordifolia</i>	heartleaf arnica	1,000,000
<i>Arnica parryi</i>	Parry's arnica	900,000
<i>Artemisia frigida</i>	prairie sage	4,500,000
<i>Campanula rotundifolia</i>	bluebell bellflower	5,000,000
<i>Chamerion angustifolium</i>	fireweed	8,000,000
<i>Erigeron elatior</i>	tall fleabane	1,000,000
<i>Erigeron speciosus</i>	aspen fleabane	1,135,000
<i>Eriogonum umbellatum</i>	sulphur-flower buckwheat	350,000
<i>Lupinus argenteus</i>	slivery lupine	25,880
<i>Phacelia sericea</i>	silky phacelia	900,000
<i>Solidago simplex</i>	Mt. Albert goldenrod	2,000,000

Species	Common Name	Avg Seeds/Lb
Shrubs		
<i>Artemisia tridentata ssp. vaseyana</i>	mountain big sagebrush	2,300,000
<i>Dasiphora fruticosa</i>	shrubby cinquefoil	1,000,000
<i>Ribes cereum</i>	wax currant	200,000

2.2 Temporary Cover/Stabilization Seed Mixture

The temporary/stabilization seed mixture (Table 3) will be used in reclamation areas that require temporary cover or stabilization. This includes all growth media stockpiles as well as reclamation areas that are anticipated to be re-disturbed within five years of the initial seeding treatment. This seed mixture should be broadcast or hydroseeded at a target rate of 100 Pure Live Seeds (PLS)/ square foot (sf). Temporary cover seed mixture alternate plant species are presented in Table 4.

Table 3: Temporary Cover/Stabilization Seed Mixture

Species	Common Name	Desired Species Composition	Avg Seeds /Lb	Lbs PLS/ Acre	PLS /sf
Grasses					
<i>Bromus marginatus</i>	mountain brome	15%	64,000	5.10	7.5
<i>Deschampsia caespitosa</i>	tufted hairgrass	15%	2,500,000	0.13	7.5
<i>Elymus trachycaulus</i>	slender wheatgrass	20%	159,000	2.74	10.0
<i>Festuca idahoensis</i>	Idaho fescue	15%	450,000	0.73	7.5
<i>Pascopyrum smithii</i>	Western wheatgrass	15%	110,000	2.97	7.5
<i>Poa pratensis spp. agassizensis</i>	Rocky Mountain bluegrass	20%	2,177,000	0.20	10.0
Totals		100%	---	11.870	50.0

Table 4: Temporary Cover/Stabilization Seed Mixture Alternate Species

Species	Common Name	Avg Seeds/Lb
<i>Bromus anomalus</i>	nodding brome	108,500
<i>Bromus ciliatus</i>	fringed brome	80,000
<i>Elymus glaucus</i>	blue wildrye	134,500
<i>Festuca arizonica</i>	Arizona fescue	500,000
<i>Festuca saximontana</i>	Rocky Mountain fescue	650,000
<i>Muhlenbergia montana</i>	mountain muhly	1,600,000
<i>Poa alpina</i>	alpine bluegrass	1,000,000
<i>Pseudoroegneria spicata</i>	bluebunch wheatgrass	140,000
<i>Trisetum spicatum</i>	spike trisetum	2,500,000

2.3 Wetland Seed Mixture

The wetland seed mixture (Table 5) will be used in areas being reclaimed as wetlands. These areas typically have either been previously classified as wetlands or designated as wetland mitigation areas. Usually they have hydric soils and saturated soil conditions for at least 10% of the growing season. This

seed mixture will be broadcast at a target rate of 50 PLS/sf. The wetland seed mixture alternate plant species are presented in Table 6.

Table 5: Wetland Seed Mixture

Species	Common Name	Wetland Indicator Status	Desired Species Composition	Avg Seeds /Lb	Lbs PLS/ Acre	PLS /sf
Graminoids						
<i>Calamagrostis canadensis</i>	Bluejoint reedgrass	FACW	15%	4,480,000	0.06	6.5
<i>Carex aquatilis</i>	water sedge	OBL	10%	1,152,250	0.19	5.0
<i>Carex utriculata</i>	Northwest Territory sedge	OBL	10%	1,000,000	0.22	5.0
<i>Deschampsia caespitosa</i>	tufted hairgrass	FACW	15%	2,500,000	0.13	7.5
<i>Juncus balticus</i>	Baltic rush	FACW	10%	10,900,000	0.11	5.0
<i>Juncus ensifolius</i>	dagger leaf rush	FACW	10%	2,914,000	0.00	5.0
<i>Phleum alpinum</i>	alpine timothy	FAC	10%	1,300,000	0.20	6.0
<i>Poa palustris</i>	fowl bluegrass	FAC	10%	3,156,000	0.00	5.0
Graminoid Subtotal			90%	---	0.91	45.0
Forbs						
<i>Delphinium barbeyi</i>	Subalpine larkspur	FAC	3%	500,000	0.09	1.0
<i>Mimulus guttatus</i>	Seep monkeyflower	OBL	4%	550,000	0.12	1.5
<i>Mertensia ciliata</i>	tall fringed bluebells	FACW	3%	225,000	0.29	1.5
Forb Subtotal			10%	---	0.50	4.0
Combined Total			100%	---	1.41	49.0

Table 6: Wetland Seed Mixture Alternate Species

Species	Common Name	Wetland Indicator Status	Avg Seeds/Lb
Graminoids			
<i>Bromus ciliatus</i>	Fringed brome	FAC	236,000
<i>Calamagrostis stricta</i>	slimstem reedgrass	FACW	2,400,000
<i>Carex scopulorum</i>	Rocky Mountain sedge	OBL	1,100,000
<i>Carex praegracilis</i>	Meadow sedge	OBL	1,816,000
<i>Glyceria striata</i>	fowl mannagrass	OBL	180,000
<i>Juncus confusus</i>	Colorado rush	FAC	12,000,000
<i>Juncus longistylis</i>	longstyle rush	FACW	16,000,000
<i>Juncus mertensianus</i>	Merten's rush	OBL	45,400,000
<i>Juncus saximontanus</i>	Rocky Mountain rush	FACW	24,000,000

Species	Common Name	Wetland Indicator Status	Avg Seeds/Lb
Forbs			
<i>Aconitum columbianum</i>	Columbian monkshood	FACW	240,000
<i>Caltha leptosepala</i>	marsh marigold	OBL	400,000
<i>Geum macrophyllum</i>	largeleaf avens	FAC	300,000
<i>Pedicularis groenlandica</i>	elephantella	OBL	550,000
<i>Rhodiola rhodantha</i>	rosecrown	FACW	1,135,000
<i>Senecio triangularis</i>	arrowleaf ragwort	FACW	1,316,600
<i>Veronica americana</i>	American speedwell	OBL	300,000
<i>Veronica wormskjoldii</i>	American alpine speedwell	FACW	300,000

Please contact me at (303) 569-3221, ext. 1233 or Bryce Romig (ext. 1204) if you have any questions regarding this submittal.

Sincerely,



Miguel Hamarat
Chief Environmental Engineer
Climax Molybdenum Company
Henderson Operations

Attachments:

1. Check #0000792666 in the amount of \$1,006.00.

cc (via email, w/o attachments):

T. Kaldenbach, DRMS
B. Romig, Climax
T. Haynes, Climax

Division of Reclamation, Mining, and Safety

Fee Receipt for M1977342

Climax Molybdenum Company

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Receipt #: 16252

Date: 10/25/2013

Permit: M1977342

Payment Method	Revenue Code	Fee Description/Notes	Amount
0000792666	4300-11	Minerals Technical Revision M1977 342 Technical Revision KJA	\$1,006.00
Receipt Total:			\$1,006.00