

# Appendix 33-A

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Post-Mine TEM Ecosystem Unit  
Descriptions

Table 33-A.1: Post-Mine TEM Ecosystem Unit Descriptions

Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species Common Name	Species Latin Name	Reclamation Comments
ESSFdkw Warm Steep	>1950 m >50% 135°-270°	relatively sparse 30% cover, grass dominated, low cover shrubs and trees			
		tree	Whitebark pine (Pa)	<i>Pinus albicaulis</i>	federally endangered species, keystone species
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		shrub	Common juniper	<i>Juniperus communis</i>	hard to propagate from seed/cutting
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer
		forb	Pearly everlasting	<i>Anaphalis margaritacea</i>	
		graminoid	Rocky mountain fescue	<i>Festuca saximontana</i>	
		graminoid	Idaho fescue	<i>Festuca Idahoensis</i>	
		graminoid	timber oatgrass	<i>Danthonia intermedia</i>	
		graminoid	Bluebunch wheatgrass	<i>Pseudoroegneria spicata</i>	
		graminoid	spike trisetum	<i>Trisetum spicatum</i>	
		graminoid	sedges	<i>Carex spp</i>	local upland species, including dunhead sedge, <i>Carex phaeocephala</i>
		forb	mountain arnica	<i>Arnica latifolia</i>	
		forb	pussytoes	<i>Antennaria spp.</i>	
		forb	strawberry	<i>Fragaria spp.</i>	
		forb	locoweed	<i>oxytropis spp.</i>	N-fixer
		forb	timber milk-vetch	<i>Astragalus miser</i>	N-fixer
		forb	bent-flowered milk-vetch	<i>Astragalus vexilliflexus</i>	N-fixer, or other local milk-vetches
forb	yarrow	<i>Achillea millefolium</i>			
forb	penstemons	<i>Penstemon ellipticus or fruticosus</i>			
forb	Pearly everlasting	<i>Anaphalis margaritacea</i>			

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Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species Common Name	Species Latin Name	Reclamation Comments
ESSFdk1, Warm Steep	1600-1950m >50% 135°-270°	relatively sparse approximately 30% cover, grass dominated, low cover shrubs and trees.			
		tree	Whitebark pine (Pa)>1750m	<i>Pinus albicaulis</i>	federally endangered species, keystone species
		tree	Lodgepole pine (Pl) >1750m	<i>Pinus contorta</i>	tolerant of nutrient poor sites
		tree	Douglas fir (Fd) <1750m	<i>Pseudotsuga menziesii</i>	
		shrub	Saskatoon	<i>Amelanchier alnifolia</i>	
		shrub	Prickly rose	<i>Rosa acicularis</i>	<1750m
		shrub	Silverberry	<i>Elaeagnus commutata</i>	N fixer <1750m
		shrub	soopolallie	<i>Shepherdia canadensis</i>	N fixer <1750m
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N-fixer
		forb	Pearly everlasting	<i>Anaphalis margaritacea</i>	
		forb	Timber milk-vetch	<i>Astragalus miser</i>	N-fixer
		graminoid	Rough fescue	<i>Festuca campestris</i>	
		graminoid	Idaho fescue	<i>Festuca Idahoensis</i>	
		graminoid	Bluebunch wheatgrass	<i>Pseudoroegneria spicata</i>	
		graminoid	June grass	<i>Koeleria macrantha</i>	
		graminoid	spike trisetum	<i>Trisetum spicatum</i>	
		graminoid	sedges	<i>Carex spp</i>	local upland species, including dunhead sedge <i>Carex phaeocephala</i>
		forb	round-leaved alumroot	<i>Heuchera cylindrica</i>	
		forb	mountain arnica	<i>Arnica latifolia</i>	could be cordifolia at these elevations<1750m
		forb	pussytoes	<i>Antennaria spp.</i>	
forb	strawberry	<i>Fragaria spp.</i>			
forb	locoweed	<i>Oxytropis spp.</i>	N-fixer		
forb	yarrow	<i>Achillea millefolia</i>			

Table 33-A.1: Post-Mine TEM Ecosystem Unit Descriptions

Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species Common Name	Species Latin Name	Reclamation Comments
ESSFdkw Warm, Moderate	>1950 m 25-50% 135°-270°	denser cover 60%, still grass dominated, higher tree and shrub component			
		tree	Whitebark pine (Pa)	<i>Pinus albicaulis</i>	federally endangered species, keystone species
		tree	Lodgepole pine	<i>Pinus contorta</i>	tolerant of nutrient poor sites
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		forb	Pearly everlasting	<i>Anaphalis margaritacea</i>	
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N-fixer
		graminoid	Rocky mountain fescue	<i>Festuca saximontana</i>	
		graminoid	Idaho fescue	<i>Festuca Idahoensis</i>	
		graminoid	spike trisetum	<i>Trisetum spicatum</i>	
		graminoid	timber oatgrass	<i>Danthonia intermedia</i>	
		graminoid	sedges	<i>Carex spp</i>	local upland species, including dunhead sedge <i>Carex phaeocephala</i>
ESSFdk1 Warm Moderate	1600-1950m 25-50% 135°-270°	denser cover 60%, still grass dominated, higher tree and shrub component			
		tree	Whitebark pine (Pa) >1750m	<i>Pinus albicaulis</i>	federally endangered species, keystone species
		tree	Lodgepole pine (Pl) >1750m	<i>Pinus contorta</i>	tolerant of nutrient poor sites
		tree	Douglas fir (Fd) <1750m	<i>Pseudotsuga menziesii</i>	
		shrub	Saskatoon	<i>Amelanchier alnifolia</i>	
		shrub	Prickly rose	<i>Rosa acicularis</i>	
		shrub	Silverberry	<i>Elaeagnus commutata</i>	N fixer <1750m
		shrub	soopolallie	<i>Shepherdia canadensis</i>	N fixer <1750m
		shrub	Douglas maple	<i>Acer glabrum</i>	
		shrub	ceanothus	<i>Ceanothus sanguineus or C. velutinus</i>	N fixer <1750m
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer
		forb	Pearly everlasting	<i>Anaphalis margaritacea</i>	
		forb	Timber milk-vetch	<i>Astragalus miser</i>	N fixer
		graminoid	Rough fescue	<i>Festuca campestris</i>	
graminoid	Idaho fescue	<i>Festuca Idahoensis</i>			
		graminoid	sedges	<i>Carex spp</i>	local upland species, including dunhead sedge <i>Carex phaeocephala</i>

Table 33-A.1: Post-Mine TEM Ecosystem Unit Descriptions

Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species Common Name	Species Latin Name	Reclamation Comments
ESSFdkw, Steep Cool, Neutral	>1950m >50%	relatively even mix of tree, shrub and grass cover to 60%			
		tree	Subalpine fir (BI)	<i>Abies lasiocarpa</i>	
		tree	Lodgepole pine (PI)	<i>Pinus contorta</i>	tolerant of nutrient poor sites
		tree	Engelmann spruce (Se)	<i>Picea engelmannii</i>	
		shrub	White-flowered rhododendron	<i>Rhododendron albiflorum</i>	
		shrub	Black huckleberry	<i>Vaccinium membranaceum</i>	prefers acidic soil
		shrub	red elderberry	<i>Sambucus racemosa</i>	
		shrub	false azalea	<i>Menziesia ferruginea</i>	
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		graminoid	spike trisetum	<i>Trisetum spicatum</i>	
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
		graminoid	wood rush	<i>Luzula spp</i>	
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer
forb	mountain arnica	<i>Arnica latifolia</i>			
ESSFdk1 Steep Cool Neutral	1600-1950m >50%	relatively even mix of tree, shrub and grass cover to 60%			
		tree	Subalpine fir (BI)	<i>Abies lasiocarpa</i>	
		tree	Lodgepole pine (PI)	<i>Pinus contorta</i>	
		tree	Engelmann spruce (Se)	<i>Picea engelmannii</i>	
		shrub	Sitka alder	<i>Alnus viridis</i>	
		shrub	Scouler's willow	<i>Salix scouleri</i>	
		shrub	Black huckleberry	<i>Vaccinium membranaceum</i>	
		shrub	black elderberry	<i>Sambucus racemosa</i>	
		shrub	false azalea	<i>Menziesia ferruginea</i>	
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		graminoid	pinegrass	<i>Calamagrostis rubescens</i>	
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
		graminoid	spike trisetum	<i>Trisetum spicatum</i>	
		forb	mountain arnica	<i>Arnica latifolia</i>	
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer
		forb	fireweed	<i>Epilobium angustifolium</i>	
forb	mountain arnica	<i>Arnica latifolia</i>			
forb	purple peavine	<i>Lathyrus nevadensis</i>	N fixer		
forb	bracted lousewort	<i>Pedicularis bracteosa</i>			

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Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species	Species Latin Name	Reclamation Comments
			Common Name		
ESSFdkw Moderate Cool Neutral	>1950m 25-50%	tree and shrub dominated, forbs with few grasses to 60% cover			
		tree	Subalpine fir (Bl)	<i>Abies lasiocarpa</i>	
		tree	Lodgepole pine (Pl)	<i>Pinus contorta</i>	
		tree	Engelmann spruce (Se)	<i>Picea engelmannii</i>	
		shrub	White-flowered rhododendron	<i>Rhododendron albiflorum</i>	
		shrub	false azalea	<i>Menziesia ferruginea</i>	
		shrub	black elderberry	<i>Sambucus racemosa</i>	
		shrub	black huckleberry	<i>Vaccinium membranaceum</i>	
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		graminoid	Pinegrass	<i>Calamagrostis rubescens</i>	
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
		graminoid	spike trisetum	<i>Trisetum spicatum</i>	
		graminoid	wood rush	<i>Luzula spp</i>	
		forb	mountain arnica	<i>Arnica latifolia</i>	
forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer		
ESSFdk1 Moderate Cool Neutral	1600-1950m 25-50%	tree and shrub dominated, forbs with few grasses to 90% cover			
		tree	Black cottonwood (Act)	<i>Populus balsamifera</i>	
		tree	Lodgepole pine (Pl)	<i>Pinus contorta</i>	
		tree	Subalpine fir (Bl)	<i>Abies lasiocarpa</i>	
		tree	Engelmann spruce (Se)	<i>Picea engelmannii</i>	
		shrub	Sitka alder	<i>Alnus viridis</i>	N fixer <1750m?
		shrub	White-flowered rhododendron	<i>Rhododendron albiflorum</i>	
		shrub	black elderberry	<i>Sambucus racemosa</i>	
		shrub	black elderberry	<i>Sambucus racemosa</i>	
		shrub	Black huckleberry	<i>Vaccinium membranaceum</i>	
		shrub	Common snowberry	<i>Symphoricarpos albus</i>	<1750m
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		graminoid	pinegrass	<i>Calamagrostis rubescens</i>	
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer
		forb	purple peavine	<i>Lathyrus nevadensis</i>	N fixer <1750m
forb	fireweed	<i>Epilobium angustifolium</i>			
forb	bracted lousewort	<i>Pedicularis bracteosa</i>			

Table 33-A.1: Post-Mine TEM Ecosystem Unit Descriptions

Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species Common Name	Species Latin Name	Reclamation Comments
ESSFdkw Gentle	>1950m <25%	relatively even mix of tree, shrub and grass cover, to about 60% cover			how to diff from warm mod high or cool mod high
		tree	Whitebark pine (Pa)	<i>Pinus albicaulis</i>	
		tree	Lodgepole pine (Pl)	<i>Pinus contorta</i>	
		tree	Subalpine fir (Bl)	<i>Abies lasiocarpa</i>	
		tree	Engelmann spruce (Se)	<i>Picea engelmannii</i>	
		shrub	Black huckleberry	<i>Vaccinium membranaceum</i>	
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
		graminoid	Rocky mountain fescue	<i>Festuca saximontana</i>	
		graminoid	Idaho fescue	<i>Festuca Idahoensis</i>	
		graminoid	timber oatgrass	<i>Danthonia intermedia</i>	
		graminoid	spike trisetum	<i>Trisetum spicatum</i>	
		graminoid	wood rush	<i>Luzula spp</i>	
		graminoid	sedges	<i>Carex spp.</i>	
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer
forb	fireweed	<i>Epilobium angustifolium</i>			
forb	Pearly everlasting	<i>Anaphalis margaritacea</i>			
ESSFdk1 Gentle	1600-1950m <25%	relatively even mix of tree, shrub and grass cover, to about 90% cover			
		tree	Whitebark pine (Pa) >1750m	<i>Pinus albicaulis</i>	
		tree	Black cottonwood (Act) <1750m	<i>Populus balsamifera</i>	
		tree	Lodgepole pine (Pl)	<i>Pinus contorta</i>	
		tree	Subalpine fir (Bl)	<i>Abies lasiocarpa</i>	
		tree	Engelmann spruce (Se)	<i>Picea engelmannii</i>	
		shrub	Sitka alder	<i>Alnus viridis</i>	N fixer
		shrub	Saskatoon	<i>Amelanchier alnifolia</i>	
		shrub	Common snowberry	<i>Symphoricarpos albus</i>	arcticus
		shrub	Silverberry	<i>Elaeagnus commutata</i>	N fixer <1750m?
		shrub	soopolallie	<i>Shepherdia canadensis</i>	N fixer <1750m?
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	very similar species
		graminoid	Idaho fescue	<i>Festuca Idahoensis</i>	
		graminoid	pinegrass	<i>Calamagrostis rubescens</i>	
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer		
forb	bracted lousewort	<i>Pedicularis bracteosa</i>			

Table 33-A.1: Post-Mine TEM Ecosystem Unit Descriptions

Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species	Species Latin Name	Reclamation Comments
			Common Name		
Wind Exposure High	>1950m	relatively sparse 30% ground cover, grass dominated, low cover shrubs and forbs			
		shrub	Common juniper	<i>Juniper communis</i>	
		dwarf shrub	penstemons	<i>Penstemon ellipticus or fruticosus</i>	
		graminoid	Rocky mountain fescue	<i>Festuca saximontana</i>	
		graminoid	Idaho fescue	<i>Festuca Idahoensis</i>	
		graminoid	timber oatgrass	<i>Danthonia intermedia</i>	
		graminoid	Bluebunch wheatgrass	<i>Pseudoroegneria spicata</i>	
		graminoid	sedges	<i>Carex spp</i>	local upland species, including dunhead sedge <i>Carex phaeocephala</i>
		forb	Arctic lupine	<i>Lupinus arcticus</i>	N fixer
		forb	Pearly everlasting	<i>Anaphalis margaritacea</i>	
		forb	bent-flowered milk-vetch	<i>Astragalus vexilliflexus</i>	N-fixer, or other local milk-vetches
ESSFdK1, Riparian	1600-1950m <15%	Shrub and deciduous tree dominated sites			
		tree	Black cottonwood (Act)	<i>Populus balsamifera</i>	
		shrub	Sitka alder	<i>Alnus viridis</i>	
		shrub	willow	<i>Salix spp.</i>	use local material
		shrub	black twinberry	<i>Lonicera involucrata</i>	Gillette's checkerspot host
		shrub	black gooseberry	<i>Ribes lacustre</i>	
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
		graminoid	Bluejoint reedgrass	<i>Calamagrostis canadensis</i>	
		forb	cow parsnip	<i>Heracleum maximum</i>	
		forb	mountain arnica	<i>Arnica latifolia</i>	
		forb	western meadowrue	<i>Thalictrum occidentale</i>	
MSdw Warm	<1600m >25% 135°-270°	open forest, dry shrub, grass, forb mixed understorey			
		tree	Douglas-fir (Fd)	<i>Pseudotsuga menziesii</i>	
		tree	Lodgepole pine (PI)	<i>Pinus contorta</i>	
		shrub	Silverberry	<i>Elaeagnus commutata</i>	N fixer
		shrub	Saskatoon	<i>Amelanchier alnifolia</i>	
		shrub	Common juniper	<i>Juniperus communis</i>	
		shrub	soopolallie	<i>Shepherdia canadensis</i>	N fixer
		graminoid	pinegrass	<i>Calamagrostis rubescens</i>	N fixer
		forb	showy aster	<i>Eurybia conspicua</i>	
		forb	strawberry	<i>Fragaria spp.</i>	N fixer
		forb	silky lupine	<i>Lupinus sericeus</i>	N fixer

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Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species		Reclamation Comments
			Common Name	Species Latin Name	
MSdw Gentle	<1600m <25%	closed mixed forest, shrub, forb and grass mixed understorey			
		tree	Douglas-fir (Fd)	<i>Pseudotsuga menziesii</i>	
		tree	Lodgepole pine (Pl)	<i>Pinus contorta</i>	
		tree	trembling aspen (At)	<i>Populus tremuloides</i>	
		shrub	soopolallie	<i>Shepherdia canadensis</i>	N fixer
		shrub	Scouler's willow	<i>Salix scouleri</i>	
		shrub	thimbleberry	<i>Rubus parviflorus</i>	
		dwarf shrub	Grouseberry/dwarf billberry	<i>Vaccinium scoparium/myrtillus</i>	
		graminoid	pinegrass	<i>Calamagrostis rubescens</i>	
		graminoid	Blue wildrye	<i>Elymus glaucus</i>	
		forb	heart-leaved arnica	<i>Arnica cordifolia</i>	
forb	showy aster	<i>Eurybia conspicua</i>			
MSdw Moist	<1600m <25%	open canopy deciduous forest, shrub, forb mix			
		tree	trembling aspen (At)	<i>Populus tremuloides</i>	
		tree	Black cottonwood (Act)	<i>Populus balsamifera</i>	
		shrub	willow	<i>Salix spp.</i>	obtained from local material
		shrub	speckled alder	<i>Alnus incana</i>	
		shrub	red-osier dogwood	<i>Cornus stolonifera</i>	
		shrub	thimbleberry	<i>Rubus parviflorus</i>	
		shrub	black twinberry	<i>Lonicera involucrata</i>	Gillette's checkerspot host
		graminoid	Bluejoint reedgrass	<i>Calamagrostis canadensis</i>	
		forb	bunchberry	<i>Cornus canadensis</i>	
		forb	heart-leaved arnica	<i>Arnica cordifolia</i>	
forb	western meadowrue	<i>Thalictrum occidentale</i>			
ESSFdkw Mine Rock veneer Sparse veg	>1950m <35%	sparse vegetation, established in moisture retaining microsities			will attempt to use finer textured mine rock as growing medium
		graminoid	Rocky Mountain fescue	<i>Festuca saximontana</i>	
		graminoid	alpine fescue	<i>Festuca brachyphylla</i>	
		graminoid	alpine timothy	<i>Phleum alpinum</i>	
		graminoid	alpine bluegrass	<i>Poa alpina</i>	
		graminoid	sedges	<i>Carex spp</i>	local upland species, including dunhead sedge <i>Carex phaeocephala</i>
		forb	silky locoweed	<i>Oxytropis sericea</i>	N fixer
forb	bent-flowered milk-vetch	<i>Astragalus vexilliflexus</i>	N-fixer, or other local milk-vetches		

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Ecosystem Unit	Elevation (m) Slope % Aspect	Vegetation Objectives / Layer	Species Common Name	Species Latin Name	Reclamation Comments
Wetland swamp	>1950m <35%	tall shrub dominated, dense sedge and forb understory			
		shrub	willow	Salix spp.	local willow species, S. barclayi, S. commutata
		shrub	red-osier dogwood	Cornus sericea	
		shrub	black twinberry	Lonicera involucrata	Gillette's checkerspot host
		graminoid	beaked sedge	Carex utriculata	other local sedges, locally wetland sedges not seen so high typically
		graminoid	water sedge	Carex aquatilis	
		forb	arrow-leaved groundsel	Senecio triangularis	
		forb	globeflower	Trollius albiflorus	
Wetland marsh	>1950m <35%	graminoid dominated			forb component dependant on seasonal water fluctuations
		graminoid	bluejoint reedgrass	Calamagrostis canadensis	
		graminoid	beaked sedge	Carex utriculata	other local sedges, locally wetland sedges not seen so high typically
		graminoid	water sedge	Carex aquatilis	
		forb	Sitka valerian	Valeriana sitchensis	
		forb	arrow-leaved groundsel	Senecio triangularis	
Wetland Shallow Open Water	>1950m level	aquatic	pondweed species yellow pond-lily species	Potamogeton spp. Nuphar spp.	