VEGETATION ANALYSIS FOR THE CACHE CREEK EIS

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INTRODUCTION

The recognition of plant species and plant communities across a landscape is an integral part of land management. The vegetation that is found on a site may have a dominant function in that ecosystem. As such, it can help describe the site in terms of environmental factors, succession, productivity, and management constraints and concerns. The vegetation of the combined Cache Creek and Bear Thrust oil and gas lease units is extremely varied and diverse as a result of rugged topography, complex and diverse geology and soils due to thrusting and folding, and different successional stages and trends.

In order to describe the variability in the vegetation within the lease units, the land was surveyed and classified into different discrete habitat types for all forested areas, and the vegetation classified into community types for the remaining non-forest vegetation. Forested lands were, in addition, classified according to the current timber type or dominance type. The presence and distribution of threatened and endangered plant species was determined. Detailed on-site vegetation surveys were made of two proposed drill locations. Revegetation procedures and standards are suggested for each of the habitat types and community types described.

METHODOLOGY

Approximately three weeks were spent in the field classifying the vegetation in the lease units. A majority of the time was spent in mapping the habitat

types 1/ to the phase level 2/ and community types. 3/ Habitat types follow those of Steele and others (1979); community types are described by Youngblood (1979) for aspen or within this paper for non-forest types. Mapping consisted of delineating types based upon field reconnaissance on color aerial photography (scale 1:15,840). The units were then transcribed to orthophotos (scale 1:24,000) for duplication. Habitat types and community types are named after the dominant overstory and most representative undergrowth plant species; abbreviations consist of the first two letters of the genus and species.

Timber stands have previously been delineated by USDA Forest Service personnel on orthophotos (scale 1:24,000). The criteria for classification was overstory dominance and crown cover density. These mapping units portray existing timber stand conditions under natural and managed conditions; successional trends and productivities are not implied.

Presence of threatened or endangered plant species was evaluated throughout the course of the field work. The search also included those species listed as sensitive (USDA, Bridger-Teton National Forest 1979). The technique involved determining the type locality and known distribution (USDA, Bridger-Teton National Forest 1979, Clark and Dorn 1979, Shultz and

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1/ A habitat type is an aggregation of all units of land potentially capable of producing a similar plant community type at climax. It is not a plant community but rather a unit of land with the environment responsible for producing a particular plant community.

2/ A phase is a subdivision of a habitat type representing a minor difference in environmental conditions and management considerations.

3/ A community type is an aggregation of all plant communities based upon floristic and structural similarities of all layers (undergrowth and overstory) and represents the current assemblages of plants.

Shultz 1979, Lichvar 1979), then searching those areas within the lease units that would appear similar based upon geologic material, topography, soils, aspect, or elevation.

The two proposed drill sites were examined extensively for plant species composition and cover. The actual drill location as proposed was not known at the time of the field examination; therefore, the area that was sampled was enlarged accordingly. Sampling occurred within a $375m^2$ circular plot.

Revegetation procedures and suggestions necessary to comply with the Wilderness Act and RARE II - Final Environmental Statement were derived from previous project work on the Bridger-Teton National Forest (USDA, Bridger-Teton National Forest) and the surrounding area (Brown and Johnston 1978; Brown, Johnston and Johnson 1978; USDA Forest Service - SEAM 1979).

RESULTS

Habitat Types.

Habitat types define the environment necessary to produce a particular plant community at climax. Thus, most management constraints or concerns should remain constant across all units of land that belong to the same habitat type. Habitat types, as defined for the Bridger-Teton National Forest (Steele and others 1979) were mapped for all units of land within the lease units capable of supporting or growing conifer trees (Appendix 1). The following is a brief description of the habitat types and their management constraints. Complete descriptions appear in "Forest habitat types of Eastern Idaho-Western Wyoming" (Steele and others 1979).

Map Unit 11 - Pinus flexilis/Hesperochloa kingii (Pifl/Heki)

Open stands of Pinus flexilis and Pseudotsuga menziesii occur throughout the lease units on exposed southerly aspects. These droughty sites may contain small amounts of Juniperus scopulorum in the understory; the undergrowth consists of Hesperochloa kingii (Leucopoa kingii), Agropyron spicatum, Balsamorhiza sagittata and Ribes cereum. This type represents the warmest and dryest sites that can support timber.

Map Unit 21 - Abies lasiocarpa/Spiraea betulifolia (Abla/Spbe)
Map Unit 22 - Abies lasiocarpa/Osmorhiza chilensis (Abla/Osch)

These two minor types occur within the Cache and Horse Creek drainages at mid-elevations on usually southerly or westerly aspects. Abies lasiocarpa is the indicated climax overstory, with Populus tremuloides, Pinus contorta, Pseudotsuga menziesii, and Picea engelmannii occurring as seral species. The undergrowth of both types have a low shrub and forb composition.

Map Unit 23 - Abies lasiocarpa/Arnica latifolia (Abla/Arla)

The Abies lasiocarpa/Arnica latifolia habitat type is fairly common throughout both lease units. It occurs at mid- to upper elevations on cool, northern aspects. These sites are usually associated with steep slopes, and are often the upper-most limit of commercial timber stands; higher-elevation sites usually support only Pinus albicaulis. Within this type, Picea engelmannii is a major seral species. The undergrowth is dominated by Arnica latifolia, Ribes montigenum, and Aquilegia coerulea.

Map Unit 24 - Abies lasiocarpa/Actaea rubra (Abla/Acru)
Map Unit 41 - Picea/Galium triflorum (Picea/Gatr)

This first type represents low-elevation riparian and gentle toeslope or alluvial terrace sites. Along with the climax Abies lasiocarpa, Picea engelmannii and Picea pungens occur in the overstory. Within the Horse Creek drainage, Populus angustifolia is also a long-lived seral associate. The diverse undergrowth may have a wide variety of shrubs and forbs; Actaea rubra is the characteristic species and may tend to increase in density in the absence of disturbance. This type, when present on any amount of slope, usually represents soil instability, due to high ground moisture.

The Picea/Galium triflorum habitat type is similar to the Abla/Acru habitat type in that it occurs on a flood plain or lower toeslope. Picea engelmannii and Picea pungens are more tolerant of the higher watertable; any Abies lasiocarpa present is usually due to a microsite influence. The high watertable in the alluvial deposit of limestone and sandstones may prevent any surface disturbance.

Map Unit 25 - Abies lasiocarpa/Physocarpus malvaceus (Abla/Phma)
Map Unit 26 - Abies lasiocarpa/Acer glabrum (Abla/Acgl)

Abies lasiocarpa/Acer glabrum h.t. in upper Cache Creek.

The Abies lasiocarpa/Acer glabrum and the closely related Abies lasiocarpa/Physocarpus malvaceus habitat types describe a majority of the two lease units that are dominated by steep mid-elevation slopes with northerly aspects. The Abla/Phma habitat type occurs just above the Pseudotsuga menziesii/Physocarpus malvaceus habitat type; this type represents the warmest environment that Abies lasiocarpa can withstand. The Abla/Acgl habitat type is slightly more mesic. Both Abla/Phma and Abla/Acgl occur on loose unconsolidated material,

usually limestone. The average slopes are 50% for Abla/Phma and 35% for Abla/Acgl. Pseudotsuga menziesii, Picea engelmannii and Pinus contorta are major seral components in the overstory. The undergrowth of both types is dominated by a variety of tall shrubs. The cooler Abla/Acgl does not have the Physocarpus malvaceus that may dominate in the Abla/Phma. Both types, however, usually support Acer glabrum, Sorbus scopulina, Amelanchier alnifolia, and Vaccinium globulare.

Map Unit 27 - Abies lasiocarpa/Vaccinium globulare - Pachistima myrsinites (Abla/Vagl-Pamy)

Map Unit 28 - Abies lasiocarpa/Vaccinium globulare - Vaccinium scoparium (Abla/Vagl-Vasc)

Map Unit 210 - Abies lasiocarpa/Vaccinium scoparium - Vaccinium scoparium (Abla/Vasc-Vasc)

Map Unit 211 - Abies lasiocarpa/Vaccinium scoparium - Pinus albicaulis (Abla/Vasc-Pial)

Abies lasiocarpa/Vaccinium globulare - Pachistima myrsinites h.t. in Cache Creek.

The above four types are grouped together because they represent those sites having Pinus contorta as a major seral species. They are arranged in order of increasing elevation and decreasing temperature. Within the lease units, the Abla/Vasc-Vasc type may also occur in small amounts at elevations below

Abla/Vagl-Pamy because of cold air drainage. The low shrub undergrowth in these types is often dominated by a single species, either Vaccinium globulare or V. scoparium.

Map Unit 212 - Abies lasiocarpa/Ribes montigenum - Pinus albicaulis (Abla/Rimo-Pial)

Map Unit 51 - Pinus albicaulis/Vaccinium scoparium (Pial/Vasc)

These two types represent the highest elevation (above 9000 feet) conifer stands within the lease units. Both types occur on granitics and tend to have a high amount of exposed rock on the surface. Individual stands are usually isolated; the surrounding non-forest vegetation is primarily influenced by temperature--snow accumulation and the length of growing season. Both types represent noncommercial timber productivities; however, the wildlife value as cover and watershed protection feature make these units important.

Map Unit 31 - Pseudotsuga menziesii/Physocarpus malvaceus (Psme/Phma)
Map Unit 32 - Pseudotsuga menziesii/Acer glabrum (Psme/Acgl)
Map Unit 34 - Pseudotsuga menziesii/Calamagrostis rubescens (Psme/Caru)
Map Unit 35 - Pseudotsuga menziesii/Spiraea betulifolia (Psme/Spbe)

Pseudotsuga menziesii/Acer glabrum h.t. in Horse Creek.

The four habitat types having Pseudotsuga menziesii as the climax species in the overstory generally occur in the lower elevations of Cache, Horse, and Little Horse Creeks. They represent conditions too warm and dry for growth of Abies lasiocarpa. The Psme/Phma habitat type occurs only on the steep north aspects of Horse Creek; slopes may exceed 60% in loose, unconsolidated limestone. The Psme/Acgl habitat type describes low elevation sites with a variety of aspects, but lacks the moisture necessary for Physocarpus

malvaceus. The remaining Psme/Caru and Psme/Spbe are minor types that are usually a result of moisture stress within an Abla/Acgl or Psme/Acgl habitat type; this usually occurs as a result of prevailing wind along an exposed ridge.

Community Types

Map Unit 61 - Populus tremuloides/Ligusticum filicinum (Potr/Lifi)
Map Unit 62 - Populus tremuloides/Heracleum lanatum (Potr/Hela)
Map Unit 63 - Populus tremuloides/Calamagrostis rubescens (Potr/Caru)

These three community types represent units of vegetation which are dominated by Populus tremuloides. The Potr/Caru type appears as a seral stage in the Abla/Spbe habitat type, and is dominated by a graminoid undergrowth of Calamagrostic rubescens and Carex geyeri. Potr/Hela is a tall forb community type which occurs in depressions, flats and gentle slopes having high water tables. The undergrowth consists of a variety of tall forbs, but Heracleum lanatum is the primary indicator. Soils within this type may be unstable and represent severe hazards for road building. The Populus tremuloides/Ligusticum filicinum community type is another tall forb complex under Populus but is dryer than Potr/Hela. The diverse forb undergrowth is usually dominated by Ligusticum, Delphinium occidentale, Rudbeckia occidentalis and Osmorhiza occidentalis.

Map Unit 71 - Ligusticum filicinum - Delphinium occidentale - Rudbeckia occidentalis (Lifi-Deoc-Ruoc)

Map Unit 72 - Heracleum lanatum - Mertensia ciliata (Hela-Meci)

Map Unit 73 - Helianthella uniflora - Agastache urticifolia - Balsamorhiza sagittata (Heun-Agur-Basa)

Heracleum lanatum - Mertensia ciliata c.t. in Cache Creek.

These three community types describe tall forb vegetation within the lease units. The Hela-Meci type is similar to Potr/Hela; however, it lacks the overstory of Populus tremuloides. This type occurs throughout the lease units on sites with a high watertable. These sites commonly occur directly above riparian areas on flat benches, on toeslopes or bottoms of avlaanche chutes, or along side slopes with perennial springs and seeps. Soils are usually

unstable and experience occasional slumps. The Hela-Meci type consists of a variety of tall forbs and wet-site graminoids such as Heracleum lanatum, Mertensia ciliata, Actaea rubra, Mimulus lewisii and Elymus glaucus.

The Lifi-Deoc-Ruoc community type represents tall forb vegetation on sites warmer and drier than that supporting Mertensia or Heracleum. This type typcially occurs on deep undeveloped soils at mid-elevations throughout the lease units. All aspects except northern are represented. Big game use this type for bedding ground and forage areas; there is also a high amount of gopher activity. Along with the indicator species, common associates include Osmorhiza occidentalis, Geranium viscosissimum, Perideridia gairdneri and Valeriana occidentalis.

Sites slightly drier than those supporting Lifi-Deoc-Ruoc usually support the Heun-Agur-Basa community type. These are typically on more exposed ridges and steep south-facing slopes with more coarse rock fragments near the surface. Both Helianthella uniflora and H. quinquenervis are usually present, along with Agastache urticifolia, Balsamorhiza sagittata and Geranium viscosissimum. The higher percentage of coarse fragments near the soil surface usually prevent concentrations of gophers.

Map Unit 74 - Arnica latifolia - Aquilegia coerulea (Arla-Aqco)

The Arnica latifolia - Aquilegia coerulea community type is found throughout the lease units at mid- to upper elevations. It is typically found on steep, north-facing slopes, and is usually in the upper portion of active avalanche chutes. Surrounding vegetation usually belongs to the Abla/Vasc or Abla/Arla

habitat types. Common associates include the two indicator species along with Ribes montigenum, Salix glauca, Juncus ensifolius, Poa alpina and Gentiana calycosa.

Map Unit 76 - Geum rossii - Leucopoa kingii (Gero-Leki)

Map Unit 77 - Leucopoa kingii - Agropyron spicatum - Festuca idahoensis (Leki-Agsp-Feid)

Map Unit 78 - Artemisia tridentata - spiciformis - Symphoricarpos oreophilus (Arsp-Syor)

Artemisia tridentata - speciformis - Symphoricarpos oreophilus c.t. north of Cream Puff Peak.

The above three community types describe different dry-site shrub and grass types. The Geum rossii - Leucopoa kingii community type is found at high

elevations, usually above 9500 feet. Typical sites are along open exposed ridgelines which receive intense solar radiation and desiccating winds, along with sheering from ice particles. The Leucopoa kingii - Agropyron spicatum - Festuca idahoensis type is found at lower elevations on warm and dry south-facing slopes. Along with the bunchgrass indicator species, there is usually a wide variety of forbs including Balsamorhiza sagittata, Astragalus miser and Crepis acuminata. This type has a high percentage of bare ground and exposed rock at the surface. Surrounding vegetation usually belongs to the Psme/Osch or Pifl/Heki habitat types. The Artemisia tridentata subspecies vaseyana form spiciformis - Symphoricarpos oreophilus community type is a shrub-dominated steppe that occurs at elevations above 9000 feet. This type is found on windward slopes, usually directly below the Gero-Leki community type. Neighboring conifer stands usually belong to the Abla/Rimo-Pial habitat type. Associated species include Berberis repens, Balsamorhiza sagittata, Eriogonum umbellatum and Geranium viscosissimum.

Map Unit 79 - Alpine
Map Unit 710 - Rock - Talus

These last two types are used to describe plant communities with a high percentage of surface rock. The alpine type is confined to the northeastern portions of the Bear Thrust lease unit at elevations above 10,000 feet. Coarse granitics dominate the site; small microsites are usually frost pockets that collect and retain soil and moisture. The common plant species include Vaccinium scoparium, Phleum alpinum, Gentiana calycosa, Veronica wormskjoldii, Silene acaulis, Pedicularis groendlandica, and Juncus parryi. The rock-talus

type is scattered throughout the two lease units at a variety of aspects and elevations. The talus slopes, rock glaciers or rock outcrops that make up this type consist of both limestone and sandstones, and support only limited vegetation or microsites. Plants that can survive the harsh environment associated with this type include Penstemon montanus, Physaria didymocarpa, Polemonium viscosum, Telesonix jamesii and Pedicularis contorta. Although these two types account for only a minor amount of total acreage, they represent the harshest sites for plant growth. They should be avoided by any road or drill pad location.

Mosaics

Habitat types or community types with significant inclusions (at least 25%) of different types were treated as mosaics. These usually represent a dominant type with microsites belonging to a different type. The complex was mapped as a mosaic when the individual units of land became too small to distinguish at the mapping scale. Mosaics appear on the map (Appendix A) as units with two vegetation types entitled; the first code number belongs to the dominant type.

Timber Stand Inventory

Results of the timber stand inventory are as follows:

Timber (code,	Type species,	max. density - %)	Acres	Percent
11	Pinus	25	3,696	11.3
12	Pinus	40	300	0.9
13	Pinus	70	579	1.8
14	Pinus	100	3,984	12.2
21	Abla-Picea	25	2,211	6.8
22	Abla-Picea	40	609	1.9

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Timber (code, species, max. density - %)	Type		Acres	Percent
23	Abla-Picea	70	1,329	4.1
24	Abla-Picea	100	4,064	12.5
31	Pseudotsuga	20	2,814	8.6
32	Pseudotsuga	35	636	2.0
33	Pseudotsuga	70	748	2.3
34	Pseudotsuga	100	1,675	5.1
41,42,43	Populus	50	840	2.6
61	Non-Forest		9,112	27.9

The timber inventory (Appendix 2) indicates the current overstory composition within the Cache Creek and Bear Thrust lease units. The percentage of total acres in Pinus (26.2%), Pseudotsuga (18.8%) and Populus (2.0%) indicate the dominance of seral conditions.

Threatened and Endangered Plants

The following plant species were considered in the search for threatened and endangered plants:

Aquilegia jonesii Parry (Ranunculaceae). Proposed threatened. Present distribution is northeast of the study area in Sheridan, Big Hole, Hot Springs and Sublette Counties on exposed limestone talus and cliffs at high elevations.

Astragalus paysonii (Rydb.) Barneby (Fabaceae). Proposed sensitive. Found scattered throughout the Wyoming and Salt River Ranges in Sublette and Lincoln Counties. Most commonly occurs in burned-over areas, usually resulting from timber sales. Most recently (Shultz and Shultz 1979) found on old natural burns, in the advanced stage of reforestation.

Draba borealis DC. (Brassicaceae). Proposed as sensitive. Known from only two sites in Wyoming, north of the study area near the mouth of the Gros Ventre and Sheep Creek Rivers.

Although the lease units contain numerous exposed limestone cliffs and outcrops at high elevations, Aquilegia jonesii was not found within the unit boundary. Astragalus paysonii appears to occur as an invader following disturbance such as slash fires after timber sale. There is currently no similar habitat within the lease units. Draba borealis was not found either, presumably because of unsuitable habitat.

Proposed Drill Sites

A detailed investigation of the proposed drill sites was conducted for the purpose of determining the current vegetation and revegetation procedures necessary if the site was disturbed.

The NCRA (Cache Creek) site is on a flat bench supporting a mixture of Populus tremuloides/Ligusticum filicinum and Populus tremuloides/Heracleum lanatum community types. This mosaic is a result of soils with different moisture-holding capacities. As previously noted, the Populus tremuloides/Heracleum lanatum community often occurs on recent slumps or areas that have potential for mass failure. The Populus tremuloides/Ligusticum filicinum community represents slightly dryer site conditions. The following species list and percent ground cover indicates the dominance of the tall-forb species. A "T" denotes a trace amount.

Species	% Canopy Cover	Species	% Canopy Cover
Lupinus argenteus	40	Osmorhiza occidentalis	1
Rudbeckia occidentalis	20	Valeriana occidentalis	1
Thalictrum fendleri	15	Castilleja miniata	T
Ligusticum filicinum	10	Senecio serra	T
Heracleum lanatum	5	Fragaria vesca	T
Geranium viscosissimum	5	Achillea millefolium	T
Perideridia gairdneri	5	Hedysarum boreale	T
Delphinium occidentale	3	Galium boreale	T
Helianthella quinquenervis	2	Elymus glaucus	3
Aster integrifolius	1	Phleum pratense	2
Senecio crassulus	1	Agropyron caninum	T
		Calamagrostis rubescens	T
		Symphoricarpos oreophilus	T

Populus tremuloides provides an overstory for a major portion of this proposed drillsite. The stand is breaking up as a result of over-maturity and beaver activity. Currently there are about 5,000 suckers per acre.

The Getty Reserve (Bear Thrust) site is on the hydrologic divide between Horse Creek and Rough Hollow (a tributary of Little Granite Creek). The site was mapped as supporting a mosaic of Ligusticum filicinum - Delphinium occidentale - Rudbeckia occidentalis and Helianthella uniflora - Agastache urticifolia - Balsamorhiza sagittata community types. Again, tall forbs dominate. However, this site is much drier than the proposed NCRA test site. The following species list indicates the tall forb complex present.

Species	% Canopy Cover	Species	% Canopy Cover
Ligusticum filicinum	10	Agropyron caninum	1
Delphinium occidentale	5	Agropyron dasystachyum	5
Senecio crassulus	5	Melica spectabilis	5
Helianthella uniflora	5	Bromus carinatus	5
Geranium viscosissimum	3		
Lupinus argenteus	2		
Eriogonum umbellatum	2		
Castilleja miniata	1		
Potentilla glandulosa	T		
Potentilla gracilis	T		
Hackelia floribunda	T		

Because this site is on a ridge, deep snow accumulates on the lee slope. A cornice is usually present in late May or early June, providing additional moisture for such species as Ranunculus alismaefolius and Orogenia linearifolia.

Revegetation

Forest Service Policy (Final Environmental Statement - RARE II, page 9, FSM 2321.31b, 2323.24b, 2323,71a) gives direction for requiring complete rehabilitation and revegetation for any man-caused disturbance within areas proposed for wilderness classification. The objective of rehabilitation and revegetation is to return the site to its preconstruction condition in the least amount of time and to prevent damage to the soil and water resource. The following general recommendations pertain to all rehabilitation and

revegetation procedures within the combined lease units. Finally, there are site-specific recommendations, including seed mixtures, which correspond to the different vegetation types as previously described.

Rehabilitation of all roads and drill pad sites involves returning slopes, cuts and fills to their natural contour. Recent projects involving revegetation throughout the Bridger-Teton National Forest have shown the necessity for stockpiling topsoil for redistribution before planting. The redistribution of topsoil after recontouring constitutes in many cases the major site preparation necessary to secure adequate revegetation. Some sites may need to have additional preparation such as fertilizing and harrowing. This work should be timed to correspond with the optimum planting period, usually spring or fall. Some sites may not be accessible in the spring when ground moisture is optimum for germination and establishment; this will require a fall planting such that seeds and plants remain dormant until the following year. All planting stock and seeding mixtures should meet Forest Service standards for germination and purity. Sites having disturbance requiring revegetation should be closely monitored following the planting. The first year after planting, sites should be examined to ensure adequate reshaping and contouring to prevent soil and water damage. Three years after planting, the sites should be reevaluated to ensure sufficient establishment of the vegetation and the presence and procedures necessary to control noxious weeds.

Group One

Map Unit 11 - Pinus flexilis/Hesperocholoa kingii (Pifl/Heki)

Map Unit 73 - Helianthella uniflora - Agastache urticifolia - Balsamorhiza sagittata (Heun-Agur-Basa)

Map Unit 76 - Geum rossii - Leucopoa kingii (Gero-Leki)

Map Unit 77 - Leucopoa kingii - Agropyron spicatum - Festuca idahoensis (Leki-Agsp-Feid)

Map Unit 78 - Artemisia tridentata - spiciformis - Symphoricarpos oreophilus (Arsp-Syor)

The above five vegetation types represent some of the most severe sites for revegetation within the Cache Creek - Bear Thrust lease units. As a group, they represent exposed south and west facing slopes and ridges that receive high solar radiation, allow for high wind dessication, and develop soils with low moisture retention. The result is plant moisture stress at any time of the year. Revegetation potential will be dependent upon the amount of topsoil retained and redistributed. In some cases, such as sites belonging to Pifl/Heki and Gero-Leki, the high coarse fragment of the surface will result in patchy seedling establishment. A soil analysis may be necessary to establish the need for fertilization to correct any mineral deficiences and to ensure adequate seedling establishment within a reasonable time span. In addition, some form of mulching may be necessary because of the steeper slopes and exposed aspects associated with this group of vegetation types. Planting should consist of 25 pounds per acre (5 pounds per species) of drought-tolerant species. The following seed mixture should protect the site from soil loss and allow for a rapid invasion of additional native species.

Festuca ovina (Sheep fescue)
Agropyron dasystachyum (Thickspike wheatgrass)
Agropyron caninum (A. trachycaulum) (Slender wheatgrass)
Trisetum spicatum (Spike trisetum)
Agropyron spicatum (Bluebunch wheatgrass)
Leucopoa kingii (Hesperochloa kingii) (Spike fescue)

Group Two

Map Unit 21 - Abies lasiocarpa/Spiraea betulifolia (Abla/Spbe)
Map Unit 22 - Abies lasiocarpa/Osmorhiza chilensis (Abla/Osch)
Map Unit 34 - Pseudotsuga menziesii/Calamagrostis rubescens (Psme/Caru)

Map Unit 35 - Pseudotsuga menziesii/Spiraea betulifolia (Psme/Spbe)
Map Unit 61 - Populus tremuloides/Ligusticum filicinum (Potr/Lifi)
Map Unit 63 - Populus tremuloides/Calamagrostis rubescens (Potr/Caru)
Map Unit 71 - Ligusticum filignum - Delphinium occidentale - Rudbeckia occidentalis (Lifi-Deoc-Ruoc)

The above seven vegetation types represent warm, low elevation sites with abundant soil moisture. Most of these sites support tree growth to some degree; revegetation should therefore be directed toward achieving rapid reestablishment of a tree canopy. In general, soils on sites of these types are fairly deep and there should be no problems associated with stockpiling sufficient amounts for revegetation. Unless a site-specific soil analysis shows otherwise, there should be no need to fertilize.

Plant species used for revegetation should stabilize the site and encourage natural regeneration of either Populus tremuloides, Pinus contorta or Pseudotsuga menziesii. Revegetation should be adequate with 15 pounds per acre of seed, with a mixture of about 5 pounds per species for grasses and 1-2 pounds per species for forbs. Plant species suitable for this group of vegetation types include:

Bromus carinatus (Mountain brome)
Elymus cinereus (Great Basin wildrye)
Elymus glaucus (Blue wildrye)
Poa ampla (P. juncifolia) (Big bluegrass)
Lupinus argenteus (L. alpestris) (Mountain lupine)
Potentilla glandulosa (Cinquefoil)
Osmorhiza occidentalis (Sweet anise)
Helianthella uniflora (Single flower helianthella)
Achillea millefolium (White yarrow)

In addition, Map Unit 61 (Potr/Lifi) and Map Unit 63 (Potr/Caru) should have 400-500 Populus tremuloides stems per acre planted. This is necessary because any site disturbance that involves soil removal of more than 18 inches will

usually result in the removal of most Populus tremuloides roots capable of resprouting.

Group Three

Map Unit 24 - Abies lasiocarpa/Actaea rubra (Abla/Acru)
Map Unit 41 - Picea/Galium triflorum (Picea/Gatr)
Map Unit 62 - Populus tremuloides/Heracleum lanatum (Potr/Hela)
Map Unit 72 - Heracleum lanatum/Mertensia ciliata (Hela/Meci)

The above four vegetation types describe hydric conditions throughout the combined lease units. As a result, they represent unique and special problems for revegetation. High ground moisture, slumpy soils and microsites that favor frost heaving and cold air drainage require that sites be revegetated almost immediately after disturbance in order to prevent damage to the soil and water resources. Sites that have slope gradients exceeding 10% may require some form of structural support to prevent soil movement such as an anchor mulch, fiber mat or jute netting. Specific sites should be analyzed by a Plant Ecologist and a Soil Scientist. The following species, applied at a rate of 5 pounds per acre per species for a total of 25 pounds per acre, should reduce that natural erodibility of soils on these sites and allow for rapid invasion of additional native species. The last three species are shrubs; they may be included either as seeds or container-grown nursery stock at 50-100 plants per acre.

Deschampsia caespitosa (Tufted hairgrass)
Phleum alpinum (Alpine timothy)
Bromus carinatus (Mountain brome)
Agrostis alba (Red top)
Lupinus argenteus (L. alpestris) (Mountain lupine)
Potentilla glandulosa (Cinquefoil)
Iliamna rivularis (Streambank globemallow)
Cornus stolonifera (Redosier dogwood)
Potentilla fruticosa (Shrubby cinquefoil)
Sambucus racemosa (Scarlet elderberry)

Group Four

Map Unit 25 - Abies lasiocarpa/Physocarpus malvaceus (Abla/Phma)
Map Unit 26 - Abies lasiocarpa/Acer glabrum (Abla/Acgl)
Map Unit 27 - Abies lasiocarpa/Vaccinium globulare - Pachistima myrsinites (Abla/Vagl-Pamy)
Map Unit 28 - Abies lasiocarpa/Vaccinium globulare - Vaccinium scoparium (Abla/Vagl-Vasc)
Map Unit 31 - Pseudotsuga menziesii/Physocarpus malvaceus (Psme/Phma)
Map Unit 32 - Pseudotsuga menziesii/Acer glabrum (Psme/Acgl)

As previously described, the above six habitat types describe forest sites in which either Pinus contorta or Pseudotsuga menziesii are seral species. In addition, these sites are dominanted by tall shrubs, many of which can be used for revegetation. However, the objective of revegetation should be to return the site to predisturbance conditions, which would result in favoring the establishment, either by natural or artificial means, of the associated confier species. In some cases recontouring the site and redistributing topsoil, along with planting Pinus contorta or Pseudotsuga menziesii, may be all that is necessary. However, the steep slopes associated with sites belonging to this group will usually require some revegetation with shrub species to assist in stabilizing the site. The shallow rocky soils belonging to Psme/Phma and Abla/Phma habitat types will require special care in stockpiling sufficient topsoil. A mixture of any of the following species, planted either as container-grown nursery stock or wildlings removed directly from adjacent sites, should result in the establishment of 400-500 individual plants per acre.

Pinus contorta (Lodgepole pine)
Pseudotsuga menziesii (Douglas-fir)
Acer glabrum (Mountain maple)
Amelanchier alnifolia (Serviceberry)
Sorbus scopulina (Mountain ash)
Sambucus racemosa (Red elderberry)
Prunus virginiana (Chokecherry)
Physocarpus malvaceus (Mallow ninbark)

Group Five

Map Unit 23 - Abies lasiocarpa/Arnica latifolia (Abla/Arla)
Map Unit 210 - Abies lasiocarpa/Vaccinium scoparium - Vaccinium scoparium (Abla/Vasc-Vasc)
Map Unit 211 - Abies lasiocarps/Vaccinium scoparium - Pinus albicaulis (Abla/Vasc-Pial)
Map Unit 212 - Abies lasiocarpa/Ribes montigenum - Pinus albicaulis (Abla/Rimo-Pial)
Map Unit 51 - Pinus albicaulis/Vaccinium scoparium (Pial/Vasc)
Map Unit 74 - Arnica latifolia - Aquilegia coerulea (Arla-Aqco)

The above six vegetation types represent sites usually above 8500 feet in elevation; all but the Arla-Aqco community type will support Pinus contorta. These sites can be generalized as having deep snow accumulations which are retained through the first half of June. Killing frosts may occur at any time through the summer and snow usually is present in September. As a result of this short growing season, any revegetation must rely upon native vegetaion adapted to these sites. Those sites that have disturbance in timber stands should favor the reestablishment of Pinus contorta.

In addition, the following species may be mixed to achieve a seeding of 25 pounds of seed per acre, and 400 to 500 trees per acre.

Pinus contorta (Lodgepole pine)
Picea engelmannii (Engelmann spruce)
Abies lasiocarpa (Subalpine fir)
Hedysarum boreale (Northern sweetvetch)
Achillea millefolium (White yarrow)
Lupinus argenteus (L. alpestris) (Mountain lupine)
Deschampsia caespitosa (Tufted hairgrass)
Phleum alpinum (Alpine timothy)
Trisetum spicatum (Spike trisetum)
Bromus carinatus (Mountain brome)

Group Six

Map Unit 79 - Alpine
Map Unit 710 - Rock-Talus

As previously noted, these two community types represent unusually harsh sites for any plant growth, and should be avoided by any action resulting in surface disturbance. There are only limited opportunities for rehabilitation and revegetation following any disturbance on these types.

Drill Site Revegetation

In general, the proposed NCRA and Getty Reserve drill sites would require revegetation depending upon the specific community type in which they occur. Therefore, the NCRA (Cache Creek) site should be revegetated as per Group Two, and the Getty Reserve (Bear Thrust) site belongs to Group One.

SUMMARY

The current and potential vegetation of the Cache Creek-Bear Thrust oil and gas lease units is diverse and variable, resulting in different habitat types and community types. These habitat types and community types are described in terms of their site location and potential and present vegetation. These different types range from warm and dry grass communities (Leki-Agsp-Feid) through mesic forested sites (Abla/Acgl) to cold timberline situations (Alpine). Each of the types have different implications for roading and drill pad location; Picea/Gatr, Abla/Acru, Potr/Hela and Hela-Meci describe sites with high erosion potential and inherent road instability. The higher elevation sites (Arla-Aqco, Pial/Vasc, Abla/Rimo-Pial, Abla/Vasc-Pial, Gero-Leki and Arsp-Syor) have special problems for revegetation because of the harshness of these sites.

Current timber types were mapped, based upon the overstory composition and density. This inventory indicates the high percentage of seral stands throughout the lease units.

There are currently no known populations of threatened or endangered plant species within the lease units.

Revegetation methods and species mixtures are suggested for each of the described vegetation types. The objective of the revegetation, as expressed by the species mixtures recommended, will be to protect the site from soil and water resource damage, and hasten in development of the site to its predisturbance condition through the use of native species adapted to the site. Revegetation methods and species mixtures are also given for the two proposed drill pad sites.

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APPENDICES