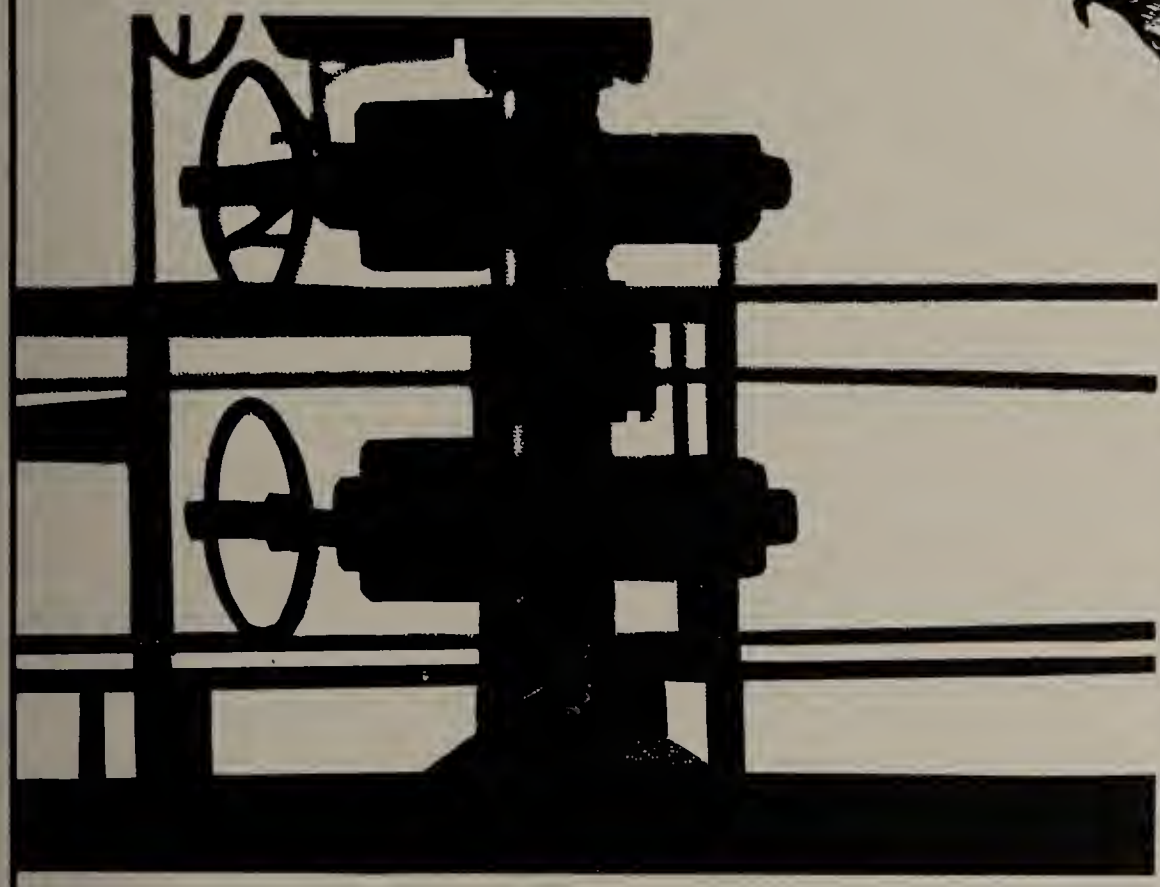
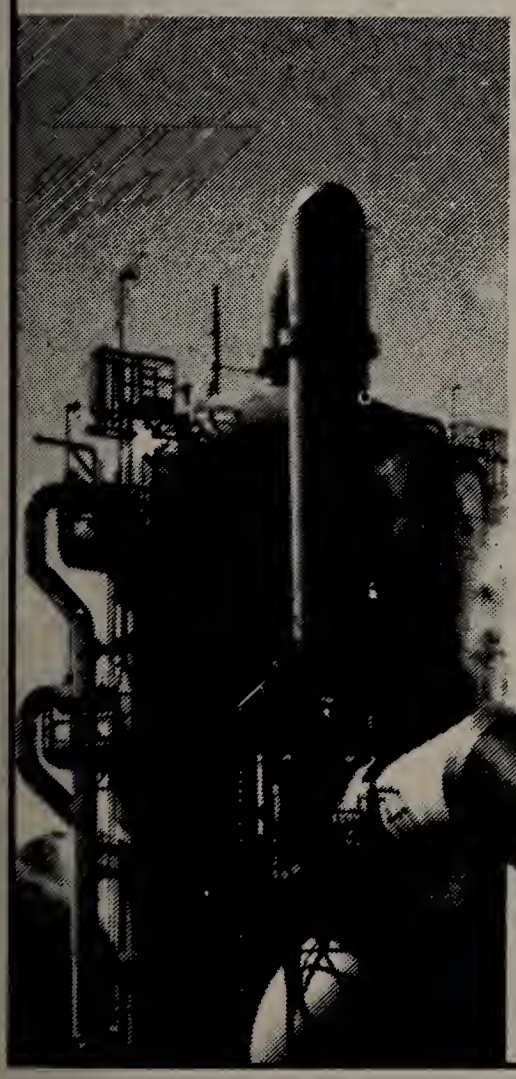
...LEY RIDGE
NATURAL GAS PROJECT
SOILS/VEGETATION/RECLAMATION TECHNICAL REPORT

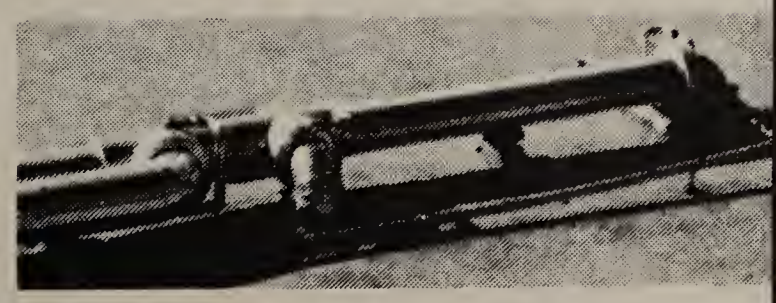
MAY 1983

Prepared by:
ENVIRONMENTAL RESEARCH
AND TECHNOLOGY, INC. for

DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
DEPARTMENT OF AGRICULTURE
FOREST SERVICE







SOILS/VEGETATION/RECLAMATION
TECHNICAL REPORT FOR
THE RILEY RIDGE EIS

May 1983

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This technical report was reviewed by agency specialists included in the List of Preparers in the Riley Ridge Draft Environmental Impact Statement.

American Quasar Petroleum Company (Quasar), Exxon Company, USA (Exxon), Northwest Pipeline Corporation (Northwest), Mobil Oil Corporation (Mobil), and Williams Exploration Company (Williams) propose to develop, produce, treat, and transport natural gas from new deep gas well fields in western Wyoming. The planned production is from previously explored but undeveloped reservoirs below 14,000 feet. The project participants are proposing to produce a significant supply of low Btu natural gas and process it to pipeline quality. The gas (called sour gas) contains methane (CH_4), carbon dioxide (CO_2), hydrogen sulfide (H_2S), nitrogen (N_2), helium (He), and other inert gases when extracted from the well fields. The sour gas would be transported by pipelines from the well fields to treatment plants where by-products and impurities would be removed and the natural (sales) gas would be prepared for shipment to available markets by sales gas pipelines. Certain by-products (CO_2, He, and sulfur) are of commercial value if markets can be identified during the life of the project and may be transported by pipeline, truck, or rail to potential markets. Sulfur dioxide (SO_2) and N_2 would be vented to the atmosphere.

The project would consist of the construction, operation, and abandonment of the proposed well fields, gathering pipelines for the transportation of sour gas within the well fields, trunk lines for the shipment of sour gas from the terminus of the well field gathering systems to the proposed treatment plants, the treatment plants, sales gas pipelines for shipment of sweet gas to existing main pipelines, and facilities for the handling and transportation of by-products removed during the treatment process to proposed markets.

The Riley Ridge Project area is located in southwestern Wyoming in Sublette, Lincoln, and Sweetwater counties. Major physiographic features of the region include the Wyoming Range extending in a north-south direction west of the proposed project, the Wind River Range east of the project area, and the Green River approximately 13 miles east of the proposed well field. Numerous creeks drain the area and flow eastward to the Green River. Nearby towns include Big Piney, Marbleton, and LaBarge, all of which are located east of the well field along U.S. Highway 189, and Opal and Kemmerer which are located southwest of the southern treatment plant sites. Portions of the proposed well field are located in the Bridger-Teton National Forest and the BLM Rock Springs District, while the balance of the project is located on other public, state, and privately owned land. The project area involves approximately 496,000 acres, 163,000 of which are within the well field.

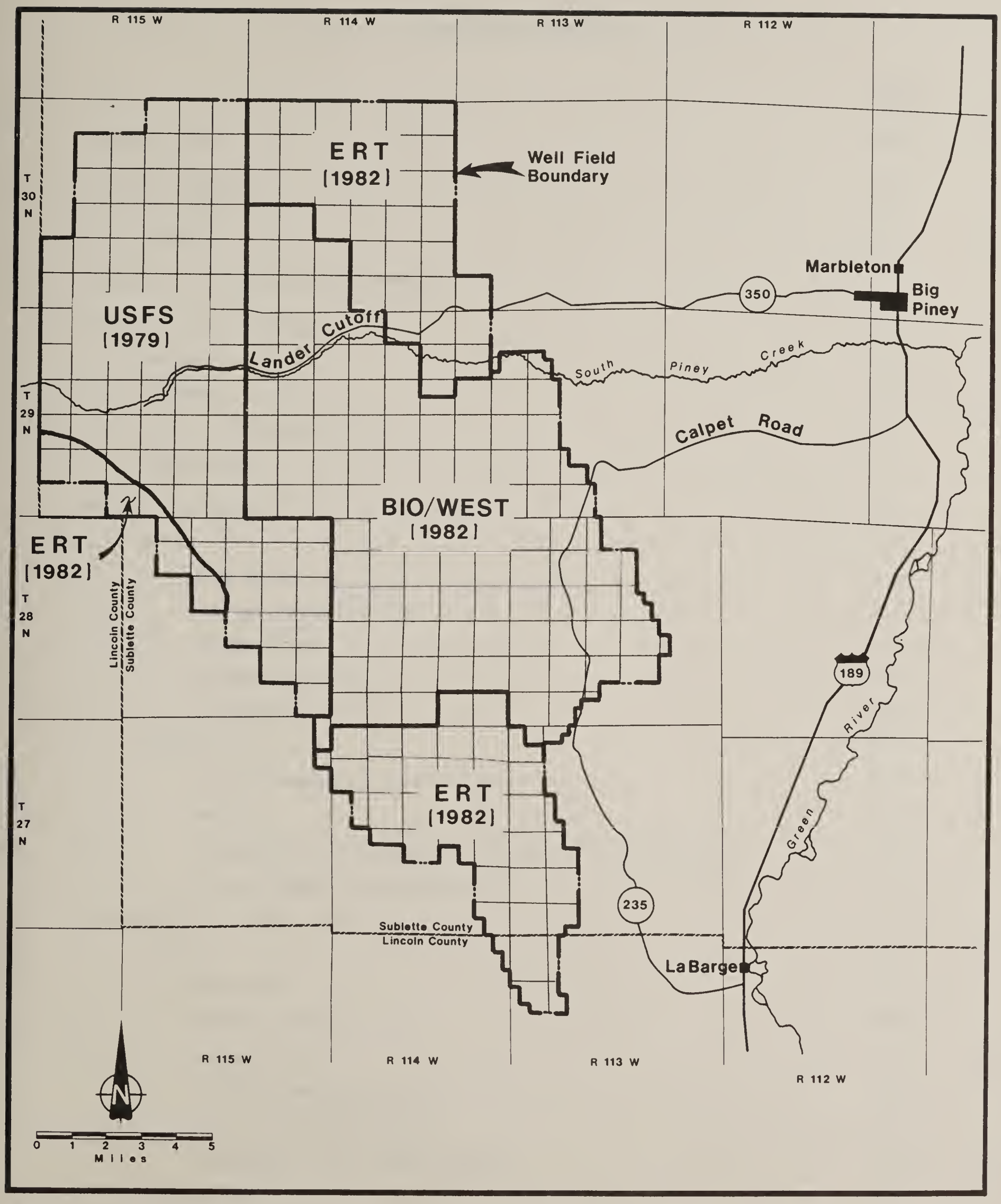
The Soils, Vegetation, and Reclamation Technical Report is one of a series of eight technical reports prepared by ERT as background and documentary material for the EIS. Each report presents a summary of studies of the affected environments and results of impact analyses. A detailed description of the project can be found in Chapter 1, "Description of Proposed Action and Alternatives", within the EIS and the Proposed Action

Technical Report. Chapter 1 of this technical report addresses soils and vegetation resources within the affected environment. Chapter 2 describes the environmental consequences of the proposed and alternative actions on those resources, Chapter 3 presents a discussion of reclamation, and Chapter 4 presents the methods used in collecting information and performing analyses.

The overall objectives of the Soils, Vegetation, and Reclamation Technical Report and the investigations conducted in support of the Riley Ridge EIS were to 1) document the existing environment and identify impacts in terms of major issues raised by agencies and the public during the scoping process (loss of productivity, effects on grazing and timber, rare plants, and reclamation); 2) provide a consistent data base for use by other disciplines (wildlife, water resources, visual resources, recreation) in developing baseline and impact assessment for the project, and 3) provide a framework for reclamation planning and data for analysis of sensitive resources that will help both the applicants and the agencies plan environmentally sound development for the entire well field throughout the life of the project.

Because of the differences in resource management goals and classification systems used by federal agencies, a uniform vegetation classification system was developed for the Riley Ridge EIS. Since adequate soils information was not available for the entire well field area, an Order 3 soil survey was conducted by ERT for part of the well field that had not been previously surveyed; in addition, a geomorphic terrain analysis and reconnaissance survey was conducted for the corridors.

The soils information reported in this technical report includes the ERT survey (1982), surveys done by the Forest Service (1975-79), and a survey done by Bio/West, Inc. (1982). Map 1-1 illustrates the extent and location of the three different surveys. Information from all three surveys has been integrated and correlated along with geomorphology, climate, and vegetation to define "rehabilitation units" for the project.



Map 1-1. Soil Survey Areas Within the Riley Ridge Well Field.

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CHAPTER 1

AFFECTED ENVIRONMENT

REGIONAL DESCRIPTION

GEOLOGY

The Riley Ridge Project area lies within two major geologic regions of Wyoming, the Green River (or Bridger) Basin and the Overthrust Belt. Most of the project area lies within the Green River Basin or along its edges, but portions of the proposed well fields or corridors would lie within the Overthrust Belt to the west.

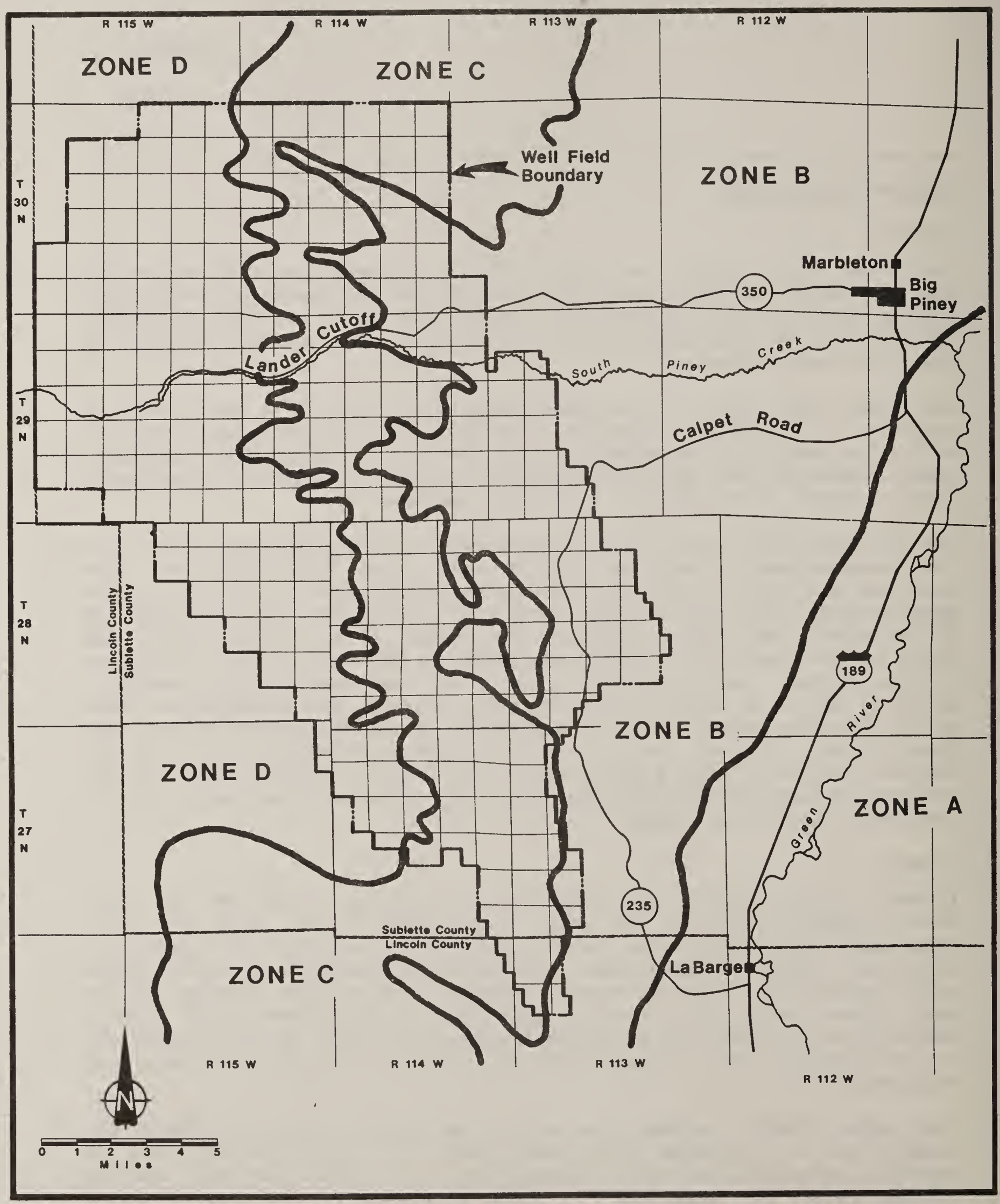
The Green River Basin is comprised generally of fluviatile and lacustrine sediments of primarily Eocene age. The most widely distributed formations within the basin are the Wasatch, Green River, and the Bridger Formations. These formations are generally composed of shales, mudstones, sandstones, and marlstones, with occasional tuffs and limestones.

The Overthrust Belt forms the western boundary of the Green River Basin. It is characterized by massive folding and thrust faulting, which have generated two major north-south trending mountain ranges in the region. The Wyoming Range, and the Salt River Range to its west, are comprised primarily of up-thrust limestones, dolomites, and quartzites of Paleozoic age. The Darby and Absaroka thrust faults are among the major deformational features in the region. Major movement along these westward-dipping, mountain-building faults is thought to have occurred during late Cretaceous through middle Paleocene times, prior to deposition of the formations in the Green River Basin.. The Moxa Arch, a gently dipping anticline, occurs in the western portion of the project area. Its axis crosses the Darby Thrust between the Hogsback and Cretaceous Mountain, and extends southward into the Green River Basin from LaBarge.

CLIMATE

Climatic factors within the region follow a gradient from the dry, cool areas south and east to the moist, cold areas in the north and west. Temperature and precipitation levels generally correspond to differences in elevation. Zones of temperature, precipitation, and growing season change significantly over short distances westward from LaBarge, Wyoming, to the Salt River Range. At lower elevations in the Green River Basin, temperatures are cool and precipitation levels are low. At high elevations in the Overthrust Belt, temperatures are cold and precipitation levels are high (Map 1-2).

Four major climatic regimes occur within the project region (see Map 1-2). Within most of the Green River Basin, east of a line from Big Piney to Kemmerer, precipitation levels range from 7 to 9 inches per year, and the average annual air temperature is about 42 degrees F. The growing season ranges from 90 to 100 days. LaBarge is situated in this typical Green River Basin zone. This zone is shown on Map 1-2 as Zone A.



Map 1-2. Precipitation and Growing Season for the Riley Ridge Well Field.

Along the extreme western edge of the basin, a narrow zone occurs in which the precipitation ranges from 10 to 14 inches per year. The average annual air temperature is 37 to 40 degrees F, and the growing season is 75 to 90 days. This zone is shown on Map 1-2 as Zone B.

Transitional mid-elevations (7,400 to 8,800 feet) along the eastern front of the Overthrust Belt are characterized by 15 to 19 inches of annual precipitation and an average annual air temperature of 34 to 37 degrees. The growing season is 70 to 85 days. This zone is shown on Map 1-2 as Zone C.

Still farther westward, but within Sublette County, forested north-south trending ridges occur above 8,500 to 9,000 feet. They receive 20 to 25 inches of precipitation or more, and have a 60 to 75-day growing season. The mean annual air temperature ranges from 32 to 35 degrees F. This zone is shown on Map 1-2 as Zone D.

SOILS AND GEOMORPHOLOGY

Soils within the well field vary in physical and chemical characteristics as determined primarily by geologic, topographic, vegetative, and climatic factors. The geologic nature of the area is dominated by uplifted fault blocks which form the major ridges, and relatively flat-lying clay shales and siltstones forming the intervening valleys and side ridges. The major ridges, such as the Hogsback and Deadline Ridge, generally trend north and south. They are composed of limestones, dolomites, and quartzites of Paleozoic and older Mesozoic age. Side ridges and valleys are formed by the Wasatch Formation, primarily of Eocene age (Lines and Glass 1975). Very gravelly colluvium and alluvium mantles most of the area.

Geomorphic surfaces within the well field are composed of steep, high-elevation major ridges, lower side ridges which extend from their flanks, alluvial fans, and alluvial terraces along stream drainages. Elevations range from about 7,000 feet in the extreme southeastern portion of the well field to over 10,600 feet at Mount Darby in the northwest. Elevational changes of 1,000 to 2,000 feet are common within horizontal distances of 2 or 3 miles, especially in the vicinities of the Hogsback, Cretaceous Mountain, Deadline Ridge, and Mount Darby. These areas typify the major high-elevation ridges within the well field; generally elevations are over 8,500 feet.

The soils occurring at the crests and shoulder slopes of these ridges are typically shallow over hard bedrock such as quartzite, limestone, or dolomite. These soils have textures of very gravelly to very cobbly sandy loams or loams. Starman and Starley soils are examples. They are well drained to somewhat excessively drained. These textural, depth, and drainage characteristics limit the amount of water that these soils can hold and make available for plant growth. The soils on adjacent sideslopes have similar internal drainage and textural characteristics, but are deep over bedrock. Farlow, Pishkun, and Hobacker soils are examples. Some soils in the Deadline Ridge to Mount Darby area have similar drainage and position, but textures are clay to very gravelly clay. The Bead soil is an example.

The soils on these high ridges occur under a cold and moist climate, with mean annual air temperatures ranging from 32° to 34°F., and mean annual precipitation ranges of about 17 to over 30 inches, depending on location (SCS 1977). Climatic data reported for soils were taken from Soil Conservation Service information which is more applicable to growing season and revegetation than regional meteorological data reported in the Air Quality Technical Report. Slopes on the high ridges range from strongly sloping (10 percent) on the shoulders and crests to very steep (50 percent and greater) on the sideslopes. Site rehabilitation potential on these soils is limited by cold temperatures, steep slopes, very gravelly or very cobble soil textures, and areas of shallow to outcropping non-rippable bedrock.

A system of side ridges extends eastward across much of the well field from the higher north-south trending uplifts. Johnson Ridge, Riley Ridge, and Pine Grove Ridge are examples. These geomorphic surfaces are mantled by 4 to 15 feet of very gravelly or very cobbly colluvium and alluvium, primarily overlying clay shales of the Wasatch Formation. The soils in these areas are typically deep and well drained. Granile, Nutras, Rooset, and Jerry soils are examples. These soils have textures ranging from very gravelly or very cobbly sandy loams to clays. Generally, they have dark-colored surface layers under shrub communities and thick, bleached surface layers under coniferous forest. Slopes range from undulating (5 percent) on the flatter bench-like ridge tops to very steep (50 percent and greater) along the sideslopes where these ridges are bounded by deep, narrow valleys. These soils also occur in a cold and moist climate, receiving 15 to 19 inches of annual precipitation; the mean annual air temperature is 32° to 37°F. Site rehabilitation potential varies from fair on the flatter surfaces to poor on the steeper soils. Stoniness and slope are limiting factors.

Side ridges near the Hogsback and Cretaceous Mountain are comprised of undulating to steep convex slopes and crests, underlain by the Wasatch Formation. In these areas, the very gravelly or very cobbly mantle is thin or absent. Soils are moderately deep and reflect the loamy or clayey textural characteristics of interbedded sandstones, siltstones, and shales. These soils, of which Delphill and the Glassner variant are examples, are well drained, cool, and dry. They receive 10 to 14 inches of precipitation annually, with a mean annual air temperature of 37° to 40°F. These soils generally have poor site rehabilitation potential because of slope, depth to rock, and clayey textures. Their potential improves somewhat on the flatter slopes.

Alluvial fans occur over small, nearly level to gently sloping areas scattered throughout the eastern part of the well field. West of Cretaceous Mountain, soils on alluvial fans are deep and well drained. They have dark-colored surface layers and profile textures of very gravelly or very cobbly loams to heavy clay loams. Jerry and Hoodle soils are examples. These soils are well drained and occasionally have stratified sand, gravel, and cobble at depth. These soils have fair potential for use in site rehabilitation; they are limited primarily by rock content. In the vicinity of Cretaceous Mountain and to the south and east towards Calpet, alluvial fans are comprised of finer grained materials derived from the Wasatch

Formation. The soils in these positions have sandy clay loam, loam, and clay loam textures. Typically they are deep and well drained, and have few limitations to use in site rehabilitation efforts. Patent and Kremlin soils are examples.

Streamlain alluvial terraces and floodplains occur throughout the well field. Typically the soils are dark colored, deep, and moderately well to somewhat poorly drained. Textures are sandy loams, loams, and clay loams, with occasional very gravelly or very cobbly textures at depth. Most of these soils occur in areas with level or gentle slopes with riparian vegetation, but large areas along Middle Piney and South Piney Creeks are used agriculturally for hay and pasture. The Silas, Tine, and Foxcreed soils are typical examples. These soils are well suited to site rehabilitation, though care should be taken to avoid disturbance or handling of soil resources during the wettest times of the year. Major limitations to site rehabilitation in these areas relate to sensitive vegetation and wildlife habitat resources.

All soils occurring within the well field and corridor areas have been grouped into rehabilitation units, based on similarities of climate, slope, geomorphic position, and other soil factors (see Methodology Appendix C). About 1,467 acres in the well field have been characterized as sensitive rehabilitation units (Table 2-3 in Chapter 2). Sensitive rehabilitation units are soils exhibiting special constraints with regard to revegetation.

VEGETATION

Vegetation communities in the project region correspond to changes in soils, climate, and topography. Types range from saltbush and mixed desert shrub communities in the dry, southern portion of the region, to widespread big sagebrush communities, to conifer zones at cold, moist elevations in the north and west.

The saltbush and mixed desert shrub communities occur on dry, cool sites in the southern part of the Green River Basin. They occur on basin floors, eroding sideslopes, and scattered sand dunes. The saltbush type is comprised primarily of Gardner saltbush, Indian ricegrass, thickspike wheatgrass, and Sandberg bluegrass. The mixed desert shrub type occurs on isolated sand dunes and is comprised of gray horsebrush, spiny hopsage, rubber rabbitbrush, Wyoming big sagebrush, and Indian ricegrass.

The big sagebrush community occupies extensive land areas throughout the Green River Basin. It occurs primarily on alluvial fans, mesas, and pediment surfaces, generally on loamy, somewhat saline surfaces.

On recent alluvial terraces and drainageways in the Green River Basin, greasewood and saltbush communities occur. Bunchgrass types are present on steep, drouthy ridge crests in this portion of the project area.

At mid-elevations in the foothills of the Overthrust Belt, a sagebrush complex occurs over widespread areas. This complex is comprised of several types that include mountain big sagebrush, alkali sagebrush, and black sagebrush, each dominating intermingled proportions of the community. Douglas-fir and aspen communities occur primarily on cool (north-facing) aspects in association with the mixed sagebrush type.

High elevation ridges within the Overthrust Belt are dominated by coniferous forest communities. Mixed pine (lodgepole pine, subalpine fir, and whitebark pine) and Douglas-fir forest types occupy the lower portion of this zone, while spruce-fir (subalpine fir, Engelmann spruce) dominates the upper portion in association with some mixed pine. Aspen stands occur in scattered areas throughout this zone.

WELL FIELD UNITS

SOILS

Soils and vegetation affected by the Proposed Action and Alternatives are described below. They are discussed in two sections, Well Field and Plant Sites, and Corridors. Soils and vegetation are discussed together under each section and present discussions on the following topics: map units; series descriptions; range sites; soil interpretation; laboratory data; plant communities; threatened, endangered, and rare plants; weeds; and plant community regeneration. Maps 1-3 and 1-4 in the Map Pocket present soils and vegetation for the Riley Ridge well field.

Map Units

Fifty-four map units occur within the boundaries of the Riley Ridge Project well field (see Map 1-3 in the map pocket). Of these 54 units, 42 have been surveyed and described by ERT, 7 of the 42 by the FS, and 12 by Bio/West Inc. Tables 1-1, 1-4, and 1-6 present guides to well field map units. Table 1-1 presents ERT mapping units for the well field. Table 1-4 presents Bio/West mapping units for the well field. Table 1-6 presents mapping units for the FS Survey area which have been supplemented by USGS VIEWIT slop information. ERT interpretive tables are Tables 1-2 and 1-3. The Bio/West interpretive table is Table 1-5. The FS interpretive table is Table 1-7. Map unit descriptions are included in Appendix A.

In order to correlate all the mapping units used in the three soil surveys, ERT prepared a conversion discussion (see Appendix A). This correlation is based on field transects of the FS and Bio/West surveys. Although in some areas there is good correlation between the three surveys, in other areas differences exist in the composition of mapping units occurring on landscapes common to all three survey portions. ERT has attempted to provide a generalized correlation of the different surveys by identifying similarities and differences in order to facilitate interpretation throughout the well field. For purposes of differentiating the three surveys within the well field, Bio/West mapping symbols are numbered 1-47, ERT symbols are numbered 50-99, and FS symbols are numbered greater than 100.

Series Descriptions

Map Units delineated by the ERT survey were correlated to existing series descriptions and typical pedon descriptions developed by the Soil Conservation Service (SCS 1977). A guide to the taxonomic classification of soils is provided in Table 1-1. Typical series descriptions are presented in Appendix B in alphabetical order. Corresponding soil classification legends are also in Appendix B.

TABLE 1-1

GUIDE TO WELL FIELD MAPPING UNITS

(ERT SURVEY AREA)

(MAPPING UNIT DESCRIPTIONS ARE IN APPENDIX A)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
50E	Pishkun, very gravelly loam, 15 to 30 percent slopes	low sagebrush, bluebunch wheatgrass, occ. big sagebrush; Lo. skel., deep, 10YR, colluvial toeslopes, calc.	C2
50F	Pishkun very gravelly loam, 30 to 50 percent slopes	low sagebrush, bluebunch wheatgrass, occ. big sagebrush; Lo. skel., deep, 10YR, colluvial toeslopes, calc.	C2
51E	Pishkun-Starman-Rock Outcrop complex, 15 to 30 percent slopes	mtn. mahogany, limber pine, bluebunch wheat-grass, occ. winterfat ridge crests & sideslopes deep/shallow complex	C2
51F	Pishkun-Starman-Rock Outcrop complex, 30 to 50 percent slopes	shallow loamy range site 15-19" precip. zone	C2
52	Starman-Rock Outcrop complex, 5 to 15 percent slopes	shallow/R.O./deep; on "barren" mtn. slopes; bluebunch, fringed sage, vetch, low buckwheat;	C2
53	Starman-Rock Outcrop-Pishkun complex, 15 to 30 percent slopes	units separated by slope, very shallow range site 15-19" precip. zone	C2
54	Starman-Rock Outcrop-Pishkun complex, 30 to 50 percent slopes		C2
55	Pishkun-Starley-Rock Outcrop complex, 10 to 40 percent slopes	on limestones and dolomites at high elevations	D5
62	Almy loam, 3 to 12 percent slopes	red, in 10-14" precip zone, frigid, big sagebrush, toeslopes and basins	B2

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
64	Pishkun moist - Hobacker complex, 30 to 50 percent slopes	mixed stands of Douglas fir, limber pine, wild currant, snowberry, bluebunch wheatgrass, oregon grape, myrtle	C2
66D	Hub[2] clay loam, 5 to 15 percent slopes	aspen type	C3
66E	Hub[2] clay loam, 15 to 30 percent slopes	aspen type	C4
66F	Mulgon-Hub complex, 30 to 50 percent slopes	aspen type	C4
70	Silas-Cryaquolls complex, 2 to 8 percent slopes	riparian and wet meadows	C1
71	Maxville-Tine complex, 0 to 3 percent slopes	low terraces, irrigated pasture	B1
72	Foxcreek-Turson complex, 0 to 3 percent slopes	wet bottomlands, willows, sedges, dark surface layers	B1
73	Wilsonville var.-McKinney var. complex, 0 to 3 percent slopes	willows, sedges, near streams, stratified, lack dark surface layers	B1
74	Alcova var. fine sandy loam, 2 to 12 percent slopes	mixed alluvium, 10-14" precip, sagebrush, western wheatgrass	B2
75	Heath var.-Jerry[2] - Brownsto[2] complex, 5 to 15 percent slopes	low sagebrush, big sagebrush, black sage-brush on colluvial ridges	C3
77E	Rooset[2] - Jerry[2] - Brownsto[2] complex, 15 to 30 percent slopes	low sagebrush, big sagebrush, black sage-brush on colluvial ridges	C4
77F	Rooset[2] - Southace var. - Brownsto[2] complex, 30 to 50 percent slopes	low sagebrush, big sagebrush, black sage-brush on colluvial ridges	C4

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
81D	Patent gravelly loam, 5 to 15 percent slopes	frigid soil, below about 7,400 feet elevation, big sagebrush and occ. shadscale	B2
81E	Patent gravelly loam, 15 to 30 percent slopes	frigid soil, below about 7,400 feet elevation, big sagebrush and occ. shadscale	B3
81F	Patent gravelly loam, 30 to 50 percent slopes	frigid soil, below about 7,400 feet elevation, big sagebrush and occ. shadscale	B3
82	Cundick var. very gravelly clay loam, 30 to 50 percent slopes	cobbly surface on steeply dipping red Wasatch shales, moderately deep	B3
84	Delphill-Glassner var. complex, 30 to 50 percent slopes	yellow siltstone - red shale complex, units separated on slope	B3
84D	Delphill-Glassner var. complex, 5 to 15 percent slopes	yellow siltstone-red shale complex below about 7,400 feet elevation	B3
85	Unnamed complex, 20 to 50 percent slopes	north and east exposures, some pine and aspen, with big sagebrush, serviceberry, over sandstones and shales	C4
86	Delphill-Glassner var. complex, 15 to 30 percent slopes	yellow siltstone-red shale complex below about 7,400 feet elevation	B3
88	Bead very gravelly sandy clay loam, 2 to 10 percent slopes	west of Deadline Ridge, timbered mtn. benches	D2
90	Bata-Cluff complex, 15 to 30 percent slopes	timbered, on steep slopes W. of Deadline Ridge	D3
91	Hobacker-Hoodle gravelly loams, 20 to 40 percent slopes	shallow loamy range site, 15-19" precip. zone	C4

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
92	Jerry var.-Hoodle[2] complex 2 to 8 percent slopes	big sagebrush and bitterbrush in skeletal alluvial fans and drainages	C3
93E	Granile-Leighcan-Nutras complex, 15 to 30 percent slopes	timbered	D3
93F	Leighcan-Granile-Nutras complex, 30 to 50 percent slopes	timbered	D5
94	Granile-Nutras complex, 5 to 15 percent slopes	timbered	D2
95	Bead-Nutras complex, 5 to 15 percent slopes	timbered	D2
96	Farlow-Starley very gravelly loams, 25 to 50 percent slopes	steep unit on high elevation ridges and sideslopes, open stands of limber and whitebark pines, big sagebrush, wild currant	D5
97	Farlow-Starley very gravelly loams, 10 to 25 percent slopes	bald ridges and knolls with big sagebrush, occ. aspen on edges	D5
98	Hub var.-Irigul-Rock Outcrop complex, 15 to 30 percent slopes	deep soil in conifer w/ shallow soil and rock outcrop, W. of Deadline Ridge	D5
99	Kremlin loam, 2 to 5 percent slopes	frigid soil in drainages and alluvial fans below 7,400 feet, big sagebrush, rabbitbrush	B2
ROS	Rock Outcrop-Starman complex 30 to 50 percent slopes	Steeply dipping rock outcrops with intermingled shallow soils, limber pine, bluebunch wheatgrass	C2

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
RO	Rock Outcrop - steep to extremely steep		

[1]Rehabilitation Units are defined in the glossary and identified in Table 1-18.

[2]Taxadjunct

TABLE 1-2

REHABILITATION INTERPRETATIONS[1]

(ERT SURVEY AREA)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
50E Pishkun	Shallow Loamy 15"-19" precip. zone Alkali sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Moderate	7.4-8.4	.10	3	Low	6	Poor	Droughty, Stones
		10-60	Moderate	Low	7.4-8.4	.05	-	Low	-		
50F Pishkun	Shallow Loamy 15"-19" precip. zone Alkali sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Moderate	7.4-8.4	.10	3	Moderate	6	Poor	Droughty, Stones, Slope
		10-60	Moderate	Low	7.4-8.4	.05	-	Low	-		
51E Pishkun	Shallow Loamy 15"-19" precip. zone Alkali sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Moderate	7.4-8.4	.10	3	Low	6	Poor	Droughty, Stones
		10-60	Moderate	Low	7.4-8.4	.05	-	Low	-		
Starman	Very Shallow 15"-19" precip. zone Fringed sagebrush, Spike fescue	0-10	Moderate	Low	7.4-8.4	.05	1	Low	4L	Poor	Droughty, Depth to rock
51F Pishkun	Shallow Loamy 15"-19" precip. zone Alkali sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Moderate	7.4-8.4	.10	3	Moderate	6	Poor	Droughty, Stones Slope
		10-60	Moderate	Low	7.4-8.4	.05	-	Moderate	-		
Starman	Very Shallow 15"-19" precip. zone Alkali sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Low	7.4-8.4	.05	1	Moderate	4L	Poor	Droughty, Depth to rock
52 Starman	Very Shallow 15"-19" precip. zone Fringed sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Low	7.4-8.4	.05	1	Low	4L	Poor	Droughty, Depth to rock
Rock Outcrop	---	--	---	---	---	--	-	---	--	--	---

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
53											
Starman	Very Shallow 15"-19" precip. zone Fringed sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Low	7.4-8.4	.05	1	Low	4L	Poor	Droughty, Depth to rock
Rock Outcrop	---	--	---	---	---	--	-	---	--	--	---
54											
Starman	Very Shallow 15"-19" precip. zone Fringed sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Low	7.4-8.4	.05	1	Moderate	4L	Poor	Droughty, Depth to rock, slope
Rock Outcrop	---	--	---	---	---	--	-	---	--	--	---
55											
Pishkun	Shallow Loamy 15"-19" precip. zone Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Moderate	7.4-8.4	.10	3	Moderate	6	Poor	Droughty, Small stones, slope
	Very Shallow 15"-19" precip. zone Bluebunch wheatgrass, Phlox, Big sagebrush	0-10	Moderate	Low	7.4-8.4	.05	1	Low	8	Poor	Droughty, Depth to rock, slope
Rock Outcrop	---	--	---	---	---	--	-	---	--	--	---
62											
Almy	Loamy	0-6	Moderate	High	7.4-8.4	.28	5	Moderate	3	Good	Droughty
	10"-14" precip. zone	6-20	Moderate	High	7.9-8.4	.37	-	Moderate	--	Good	
	Bluebunch wheatgrass, Western wheatgrass	20-60	Moderate	High	7.9-8.4	.37	-	Moderate	--	Fair	
64											
Pishkun, moist	Douglas fir, limber Pine, Snowberry Oregon grape	0-10 10-60	Moderate Moderate	Moderate Low	7.4-8.4 7.4-8.4	.10 .05	3 -	Moderate Low	6 --	Poor	Droughty, Stones, Slope
Hobacker	Douglas fir, limber Pine, Snowberry Oregon grape	0-30 30-60	Moderate Moderate	Moderate Low	7.4-8.4 7.4-8.4	.24 .10	3 -	High Moderate	5 --	Poor	Droughty, Stones, Slope
66D											
Hub	Aspen, Snowberry	0-6	Moderate	High	6.1-7.8	.32	5	Moderate	6	Fair	---
	Lupine, Slender	6-14	Moderate	High	6.1-7.8	.32	-	Moderate	--	Fair	---
	Wheatgrass	14-60	Moderate	High	6.1-7.8	.32	-	Moderate	--	Fair	---

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
66D (Con't.) Pagosa	Aspen, Snowberry Lupine, Slender Wheatgrass	0-20 20-60	Moderate Very Slow	High High	6.1-7.3 6.1-7.8	.30 .28	4 -	Moderate Low	8 --	Fair	Clayey
66E Hub	Aspen, Snowberry Lupine, Slender Wheatgrass	0-6 6-14 14-60	Moderate Moderate Moderate	High High High	6.1-7.8 6.1-7.8 6.1-7.8	.32 .32 .32	5 - -	High High High	6 -- --	Poor	Erosion hazard
Pagosa	Aspen, Snowberry Lupine, Slender Wheatgrass	0-20 20-60	Moderate Very Slow	High High	6.1-7.3 6.1-7.8	.30 .28	4 -	High High	8 --	Poor	Clayey, Erosion hazard
66F Mulgon	Aspen, Snowberry Lupine, Slender Wheatgrass	0-15 15-36 36-60	Moderate Moderate Moderately Rapid	Moderate Low Low	6.1-7.4 6.1-7.4 6.1-7.8	.28 .10 .10	5 - -	High Moderate Moderate	8 -- --	Poor	Droughty, Stones, Slope
Hub	Aspen, Snowberry Lupine, Slender Wheatgrass	0-6 6-14 14-60	Moderate Moderate Moderate	High High High	6.1-7.8 6.1-7.8 6.1-7.8	.32 .32 .32	5 - -	High High High	6 -- --	Poor	Slope, Erosion hazard
70 Silas	Overflow 15"-19" precip. zone Big sagebrush Silver sagebrush, Buegrass	0-24 24-60	Moderate Moderate	High High	6.6-8.4 6.6-8.4	.32 .32	5 -	Low Low	6 --	Fair	Wetness
Cryaquolls	Wetland 15"-19" precip. zone Willows, Tufted hairgrass, Sedges, Rushes	0-20 20-60	Moderately Slow Moderately Slow	High High	6.6-8.4 6.6-8.8	.32 .32	5 -	Low Low	6 --	Fair	Wetness
71 Maxville	Irrigated hay and pasture	0-22 22-60	Moderate Rapid	High Low	7.4-8.4 7.4-8.4	.30 .10	3 -	Low Low	4 --	Fair	Wetness, Stones
Tine	Irrigated hay and pasture	0-10 10-60	Rapid Very Rapid	Moderate Low	7.4-8.4 7.4-8.4	.15 .10	3 -	Low Low	-- --	Fair	Wetness, Stones
72 Foxcreek	Wetland Willows, Nebraska sedge, Tufted hairgrass, Red top	0-20 20-60	Moderate Rapid	High Low	7.4-8.4 7.4-8.4	.37 .10	3 -	Low Low	-- --	Fair	Stones, Wetness

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
72 (Con't.) Turson	Subirrigated Willows, Tufted hairgrass, Nebraska sedge, Western wheatgrass	0-24 24-60	Moderate Rapid	High Low	7.4-8.4 7.4-8.4	.32 .10	3 -	Low Low	4 --	Fair	Stones, Wetness
73 Wilsonville Variant	Subirrigated 10"-14" precip. zone Willows, Tufted hairgrass, Sedges, Bluegrass	0-24 24-60	Moderate Rapid	High Low	7.4-8.4 7.4-8.4	.32 .10	3 -	Low Low	4 --	Fair	Stones, Wetness
McKinney Variant	Wetland 10"-14" precip. zone Willows, Sedges, Tufted hairgrass, Red top	0-24 24-60	Moderate Rapid	High Low	7.4-8.4 7.4-8.4	.37 .10	3 -	Low Low	-- --	Fair	Stones, Wetness
74 Alcova Variant	Irrigated hay and pasture, Loamy, 10"-14" precip. zone Big Sagebrush, Western Wheatgrass	0-15 15-60	Moderate Moderate	Moderate Low	7.4-8.4 7.9-9.0	.24 .10	3 -	Low Low	3 --	Good	Droughty, Excess lime, Stones
75 Heath	Dense clay 15"-19" precip. zone Low sagebrush Spike fescue	0-9 9-24 24-60	Moderate Very Slow Moderate	High High Moderate	7.4-8.4 7.4-8.4 7.4-8.4	.32 .32 .15	5 - -	Moderate Moderate Low	4 -- --	Fair	Clayey, Stones
Jerry	Loamy 15"-19" precip. zone Big sagebrush, Spike fescue, Needle grasses, squirreltail	0-13 13-60	Moderate Very Slow	High High	6.6-7.3 7.4-8.4	.30 .32	5 -	Moderate Moderate	6 --	Fair	Clayey, Stones
Brownsto	Gravelly 15"-19" precip. zone Black sagebrush, Bluebunch wheatgrass, Squirreltail	0-10 10-40 10-40	Moderate Moderate Moderate	Low Low Low	7.8-8.4 7.8-8.4 7.8-8.4	.10 .10 .32	3 - -	Low Low Moderate	8 - --	Poor	Droughty, Stones

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
77E Rooset	Loamy 15"-19" precip. zone Big sagebrush, Bitterbrush, Bluebunch wheatgrass, Spike fescue	0-10 10-24 24-60	Moderate Slow Moderate	Moderate Moderate Moderate	7.4-8.4 7.4-8.4 7.4-8.4	.15 .15 .15	5 - -	Moderate Moderate Moderate	8 -- --	Poor	Droughty, Stones, Slope
Jerry	Loamy 15"-19" precip. zone Big sagebrush, Bitterbrush, Bluebunch wheatgrass, Spike fescue	0-13 13-60	Moderate Very Slow	High High	6.6-7.3 7.4-8.4	.30 .32	5 -	Moderate Moderate	6 --	Poor	Erosion hazard
Brownsto	Loamy 15"-19" precip. zone Big sagebrush, Bitterbrush, Bluebunch wheatgrass, Spike fescue	0-10 10-40 40-60	Moderate Moderate Slow	Low Low High	7.8-8.4 7.8-8.4 7.8-8.4	.10 .10 .32	3 - -	Low Low High	8 - --	Poor	Droughty, Stones, Slope
77F Rooset	Loamy 15"-19" precip. zone Big sagebrush, Bitterbrush, Bluebunch wheatgrass, Spike fescue	0-10 10-24 24-60	Moderate Slow Moderate	Moderate Moderate Moderate	7.4-8.4 7.4-8.4 7.4-8.4	.15 .15 .15	5 - -	Moderate Moderate Moderate	8 -- --	Poor	Slope, Droughty, Stones
Southace Variant	Gravelly 15"-19" precip. zone Big sagebrush, Rabbitbrush, Bluebunch wheatgrass	0-10 0-20 20-60	Moderately Slow Moderately Slow Moderately Slow	Moderate Moderate High	7.4-8.4 7.4-8.4 7.8-8.4	.10 .10 .32	5 - -	Moderate Moderate High	4 -- --	Poor	Slope, Droughty, Stones
Brownsto	Loamy 15"-19" precip. zone Big sagebrush, Bitterbrush, Bluebunch wheatgrass, Spike fescue	0-10 10-40 40-60	Moderate Moderate Very Slow	Low Low High	7.8-8.4 7.8-8.4 7.8-8.4	.10 .10 .32	3 - -	Moderate Low High	8 -- --	Poor	Droughty, Stones, Slope
81D Patent	Loamy 10"-14" precip. zone Big sagebrush, Black sagebrush, Bluebunch wheatgrass	0-34 34-60	Moderate Very Slow	High High	7.4-8.4 7.9-8.4	.32 .32	5 -	Low Moderate	4L --	Good	Excess lime

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
81E Patent	Loamy 10"-14" precip. zone Big sagebrush, Black sagebrush, Bluebunch wheatgrass	0-34 34-60	Moderate Very Slow	High High	7.4-8.4 7.9-8.4	.32 .32	5 -	Moderate Moderate	4L --	Poor	Erosion hazard, Excess lime
81F Patent	Loamy 10"-14" precip. zone Big sagebrush, Black sagebrush, Bluebunch wheatgrass	0-34 34-60	Moderate Very Slow	High High	7.4-8.4 7.9-8.4	.32 .32	5 -	High High	4L --	Poor	Erosion hazard, Excess lime
82 Cundick Variant	Shallow Clayey Black sagebrush, Low sagebrush, Bluebunch wheatgrass, Spike fescue	0-4 4-38	Very Slow Very Slow	Moderate Moderate	7.9-8.4 7.9-8.4	.37 .37	3 -	High High	4 --	Poor	Clayey, Slope
84 Delphill	Loamy 10"-14" precip. zone Big sagebrush, Black sagebrush, Bluebunch wheatgrass, Western wheatgrass	0-5 5-12 12-37	Moderate Moderate Moderate	Moderate Moderate Moderate	7.4-8.4 7.9-8.4 7.9-8.4	.37 .37 .37	2 - -	High High High	4 -- --	Poor	Erosion hazard, Slope, Excess Lime
Glassner Variant	Shallow Clayey 10"-14" precip. zone Black sagebrush, Bluebunch wheatgrass, Western wheatgrass	0-38	Very Slow	Moderate	7.9-8.4	.30	2	High	4	Poor	Clayey, Erosion hazard, Slope
84D Delphill	Loamy 10"-14" precip. zone Big sagebrush, Black sagebrush, Bluebunch wheatgrass, Western wheatgrass	0-5 5-12 12-37	Moderate Moderate Moderate	Moderate Moderate Moderate	7.4-8.4 7.9-8.4 7.9-8.4	.37 .37 .37	2 - -	Moderate Moderate Moderate	4 -- --	Good	Excess lime, Erosion hazard

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
84D (Con't.) Glassner Variant	Shallow Clayey 10"-14" precip. zone Black sagebrush, Bluebunch wheatgrass, Western wheatgrass	0-38	Very Slow	Moderate	7.9-8.4	.30	2	High	4	Fair	Clayey, Erosion hazard
85A Unnamed	Loamy 15"-19" precip. zone Big sagebrush, Bluebunch Wheatgrass, Spike fescue, Phlox	0-10	Moderately Rapid	Low	7.4-8.4	.24	5	Moderate	4	Poor	Slope, Droughty
		10-52	Moderately	Low	7.4-8.4	-	-	Moderate	-		
85B Unnamed	Loamy 15"-19" precip. zone Big sagebrush, Bluebunch, Wheatgrass, Spike fescue, Phlox	0-14	Moderately Rapid	Low	7.4-8.4	.24	1	Moderate	4	Poor	Slope, Depth to Rock
85C Unnamed	Loamy 15"-19" precip. zone Big sagebrush, Bluebunch, Wheatgrass, Spike fescue, Phlox	0-16	Moderately Rapid	Low	7.4-8.4	.20	5	Moderate	4	Poor	Slope
		16-29	Moderately Rapid	Low	7.4-8.4	-		Moderate	--		
		29-60	Moderately Slow	High	7.4-8.4	-	-	Low	--		
86 Delphill	Loamy 10"-14" precip. zone Big sagebrush, Black sagebrush, Bluebunch wheatgrass, Western wheatgrass	0-5	Moderate	Mpderate	7.4-8.4	.37	2	High	4	Poor	Erosion hazard, Excess lime
		5-12	Moderate	Moderate	7.9-8.4	.37	-	High	--		
		12-37	Moderate	Moderate	7.9-8.4	.37	-	High	--		
Glassner Variant	Shallow Clayey 10"-14" precip. zone Black sagebrush, Bluebunch wheatgrass, Western wheatgrass	0-38	Very Slow	Moderate	7.9-8.4	.30	2	High	4	Poor	Clayey, Erosion hazard
88 Bead	Lodgepole pine	0-20	Moderate	High	5.5-6.5	.24	4	Moderate	3	Good	Clayey
	Subalpine fir	20-60	Slow	Moderate	6.1-7.3	.17	-	Low	--		

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
90											
Bata	Conifer 20"-25" precip. zone	0-10	Moderate	Moderate	6.2-6.8	.20	5	Moderate	5	Fair	Droughty, stones
	Lodge pole pine, Subalpine fir, Spike trisetum	10-30	Moderate	Moderate	6.2-6.8	--	-	Moderate	--		
		30-60	Moderately Slow	Moderate	6.8-7.4	--	-	Moderate	--		
Cluff	Conifer 20"-25" precip. zone	0-10	Slow	High	6.2-6.8	.20	5	Moderate	5	Fair	Droughty, stones
	Lodgepole pine, Subalpine fir, Spike trisetum	10-28	Very Slow	High	6.7-6.8	--	-	Moderate	--		
		28-50	Very Slow	High	6.8-7.4	--	-	Moderate	--		
91											
Hobacker	Shallow Loamy 10"-14" precip. zone	0-23	Moderate	Moderate	7.4-8.4	.24	3	High	5	Poor	Droughty, Slope Erosion hazard
	Mountain mahogany, Big sagebrush Bluebunch wheatgrass, Spike fescue	23-60	Moderate	Low	7.4-8.4	.10	-	Moderate	--		
Hoodle	Shallow Loamy 10"-14" precip. zone	0-10	Moderate	Moderate	7.4-8.4	.28	2	High	6	Poor	Droughty, Slope Erosion hazard
	Mountain mahogany, Big sagebrush Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Moderate	7.4-8.4	.20	-	Moderate	--		
		20-60	Moderate	Low	7.4-8.4	.15	-	Moderate	--		
92											
Jerry Variant	Loamy 15"-19" precip. zone	0-10	Moderate	High	6.6-7.8	.24	3	Low	6	Fair	Stones, Clayey
	Big sagebrush Bitterbrush, Bluebunch wheatgrass, Spike fescue	10-23	Slow	Moderate	7.4-8.4	.20	-	Low	--		
		23-60	Moderate	Low	7.4-8.4	.10	-	Low	--		
Hoodle	Loamy 15"-19" precip. zone	0-10	Moderate	Moderate	6.6-7.8	.28	2	Low	6	Fair	Droughty, Stones
	Big sagebrush Bitterbrush, Bluebunch wheatgrass, Spike fescue	10-20	Moderate	Moderate	7.4-8.4	.20	-	Low	--		
		20-60	Moderately Rapid	Low	7.4-8.4	.10	-	Low	--		
93E											
Granile	Lodgepole pine Subalpine fir, Arnica	0-15	Moderately Rapid	Low	5.5-6.5	.15	5	Moderate	6	Fair	Droughty, Stones
		15-30	Moderate	Moderate	6.1-7.3	.15	-	Moderate	--		
		30-60	Moderately Rapid to Rapid	Low	7.4-8.4	.10	-	Low	--		

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
Leighcan	Lodgepole pine Subalpine fir, Arnica	0-60	Moderately Rapid	Low	4.5-6.6	.15	5	Moderate	3	Fair	Droughty, Stones
Nutras	Lodgepole pine Subalpine fir, Arnica	0-10 10-20 20-60	Moderate Slow Slow	Moderate Moderate Moderate	5.1-6.5 5.1-6.5 6.1-7.4	.24 .15 .15	4 - -	Moderate Moderate Moderate	8 -- --	Fair	Droughty, Stones
93F Granile	Lodgepole pine Subalpine fir, Arnica	0-15	Moderately Rapid	Low	5.5-6.5	.15	5	High	6	Poor	Slope, Droughty, Stones, Erosion hazard
		15-30 30-60	Moderate Moderately Rapid to Rapid	Moderate Low	6.1-7.3 7.4-8.4	.15 .10	- -	High Moderate	-- --		
Leighcan	Lodgepole pine Subalpine fir, Arnica	0-60	Moderately Rapid	Low	4.5-6.6	.15	5	High	3	Poor	Droughty, Stones Erosion hazard
Nutras	Lodgepole pine Subalpine fir, Arnica	0-10 10-20 20-60	Moderate Slow Slow	Moderate Moderate Moderate	5.1-6.5 5.1-6.5 6.1-7.4	.24 .15 .15	4 - -	High High High	8 -- --	Poor	Droughty, Stones Erosion hazard
94 Granile	Lodgepole pine Subalpine fir, Whitebark pine, Currant, Arnica	0-15	Moderately Rapid	Low	5.5-6.5	.15	5	Low	6	Good	Droughty, Stones
		15-30 30-60	Moderate Moderately Rapid to Rapid	Moderate Low	6.1-7.3 7.4-8.4	.15 .10	- -	Low Low	-- --		
Nutras	Lodgepole pine Subalpine fir, Arnica	0-10 10-20 20-60	Moderate Slow Slow	Moderate Moderate Moderate	5.1-6.5 5.1-6.5 6.1-7.4	.24 .15 .15	4 - -	Low Low Low	8 -- --	Good	Droughty, Stones Clayey
95 Bead	Lodgepole pine Subalpine fir, Whitebark pine, Arnica, Boxleaf myrtle, Elk sedge	0-20 20-60	Moderate Slow	High Moderate	5.5-6.5 6.1-7.3	.24 .17	4 -	Low Low	3 --	Good	Clayey
Nutras	Lodgepole pine Subalpine fir, Whitebark pine, Arnica, Boxleaf myrtle, Elk sedge	0-10 10-20 20-60	Moderate Slow Slow	Moderate Moderate Moderate	5.1-6.5 5.1-6.5 6.1-7.4	.24 .15 .15	4 - -	Low Low Low	8 -- --	Good	Droughty, Stones Clayey

TABLE 1-2 (CONTINUED)

Map Symbol and Soil Name	Range Site and Present Vegetation	Depth (Inches)	Permeability	Available Water Capacity	Soil Reaction (pH)	Erosion Factors K	Erosion Factors T	Water Erosion Hazard	Wind Erodibility Group	Rehabilitation Potential	Rehabilitation Limiting Considerations
96											
Farlow	Loamy 15"-19" precip. zone Big sagebrush, Bluebunch wheatgrass, Needlegrass, Spike fescue, Scattered limber, Whitebark pine,	0-10 10-60	Moderate Moderate	Moderate Low	7.9-8.4 7.9-8.4	.15 .10	3 -	Moderate Moderate	8 --	Poor	Droughty, Stones
Starley	Very Shallow 15"-19" precip. zone Bluebunch wheatgrass, Spike fescue, Phlox	0-10	Moderate	Low	7.4-8.4	.05	1	Low	8	Poor	Droughty, Depth to rock
97											
Farlow	Loamy 15"-19" precip. zone Big sagebrush, Bluebunch wheatgrass, Needlegrass, Spike fescue,	0-10 10-60	Moderate Moderate	Moderate Low	7.9-8.4 7.9-8.4	.15 .10	3 -	Low Low	8 --	Poor	Droughty, Stones
Starley	Very Shallow 15"-19" precip. zone Bluebunch wheatgrass, Spike fescue, Phlox	0-10	Moderate	Low	7.4-8.4	.05	1	Low	8	Poor	Droughty, Depth to rock
98											
Hub Variant	Conifer	0-14 14-60	Moderate Moderately slow	High Moderate	6.1-7.8 6.1-7.8	.32 .32	5 -	Moderate Moderate	6 --	Good	Stones
Irigul	Bluebunch wheatgrass	0-15	Rapid	Low	7.4-8.4	.10	1	Low	6	Poor	Droughty, Depth to rock
99											
Kremlin	Overflow, 10"-14" precip. zone Big sagebrush, Rabbitbrush	0-10 10-20 20-60	Moderate Moderate Moderate	High High High	7.4-8.4 7.4-8.4 7.9-8.4	.37 .37 .37	5 - -	Low Low Low	6 -- --	Good	Excess lime
ROS											
Rock Outcrop	---	--	---	---	---	--	-	---	--	--	---
Starman	Very Shallow 10"-14" precip. zone Fringed sagebrush, Bluebunch wheatgrass, Spike fescue	0-10	Moderate	Low	7.4-8.4	.05	1	Moderate	4L	Poor	Droughty, Depth to rock

[1]Column headings are defined in the Glossary.

TABLE 1-3

SOIL ENGINEERING INTERPRETATIONS[1]

(ERT SURVEY AREA)

Soil Name and Map Symbol	Depth Inches	Engineering Classification Unified	AASHO	Liquid Limit	Plasticity Index	Limitations to: Small Commercial Buildings	Roads	Shallow Excavations	Hydrologic Group
50E									
Pishkun	0-10	GM	A-4	20-30	NP-10	Severe -	Moderate	Moderate	B
	10-60	GP-GC	A-2	25-35	5-15	Slope-stones	Slope-stones	Slope-stones	
50F									
Pishkun	0-10	GM	A-4	20-30	NP-10	Severe	Severe-Slope	Severe	B
	10-60	GP-GC	A-2	25-35	5-15	Slope-stones	Stones	Slope-stones	
51E									
Pishkun	0-10	GM	A-4	20-30	NP-10	Severe	Severe-Slope	Severe	B
	10-60	GP-GC	A-2	25-35	5-15	Slope-stones	Stones	Slope-stones	
Starman	0-10	GM	A-2	30-40	5-10	Severe Slope-Depth to Rock	Severe-Stones Thin Layer	Severe Thin Layer	D
51F									
Pishkun	0-10	GM	A-4	20-30	NP-10	Severe	Severe-Slope	Severe	B
	10-60	GP-GC	A-2	25-35	5-15	Slope-stones	Stones	Slope-stones	
Starman	0-10	GM	A-2	30-40	5-10	Severe Slope-Depth to Rock	Severe-Stones Thin Layer	Severe Thin Layer	D
52									
Starman	0-10	GM	A-2	30-40	5-10	Severe-Slope Depth to Rock	Severe-Slope Thin Layer	Severe Thin Layer	D
Rock Outcrop	--	--	--	--	--	Severe Bedrock	Severe Bedrock	Severe Bedrock	D
53									
Starman	0-10	GM	A-2	30-40	5-10	Severe-Slope Depth to Rock	Severe-Slope Thin Layer	Severe-Slope Thin Layer	D
Rock Outcrop	--	--	--	--	--	Severe Bedrock	Severe Bedrock	Severe Bedrock	D
54									
Starman	0-10	GM	A-2	30-40	5-10	Severe-Slope Depth to Rock	Severe-Slope Thin Layer	Severe-Slope Thin Layer	D
Rock Outcrop	--	--	--	--	--	Severe Bedrock	Severe Bedrock	Severe Bedrock	D
55									
Pishkun	0-10	GM	A-4	20-3-	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	B
	10-60	GP-GC	A-2	25-35	5-10	Stones	Stones	Thin Layer	
Starley	0-10	GM	A-2	30-40	5-10	Severe-Slope Depth to Rock	Severe-Slope Thin Layer	Severe-Slope Thin Layer	D
Rock Outcrop	--	--	--	--	--	Severe Bedrock	Severe Bedrock	Severe Bedrock	D
62									
Almy	0-6	ML	A-4	25-35	5-10	Moderate-	Slight	Slight	B
	6-20	CL	A-6	25-35	10-15	Slope			
	20-60	ML	A-4	25-35	5-10				

TABLE 1-3 (CONTINUED)

Soil Name and Map Symbol	Depth Inches	Engineering Classification Unified	AASHO	Liquid Limit	Plasticity Index	Limitations to: Small Commercial Buildings	Roads	Shallow Excavations	Hydrologic Group
64									
Pishkun	0-10	GM	A-4	20-30	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	B
Moist	10-60	GP-GC	A-2	25-35	5-15	Stones	Stones	Thin Layer	
Hobacker	0-30	GM	A-4	20-30	NP-10	Severe-Slope Stones	Severe-Slope Stones	Severe-Slope Stones	B
66D									
Hub	0-6	ML	A-4	20-30	5-10	Moderate-	Moderate-	Moderate-	B
	6-14	SM	A-2	--	NP	Slope	Slope	Slope	
	14-60	SM-SC	A-2 A-4	25-35	5-10		Low Strength Frost Action		
Pagosa	0-20	ML	A-4	25-40	NP-10	Moderate	Moderate	Moderate	C
	20-60	CL-CH	A-6 A-7	30-60	15-35	Slope-Shrink Swell	Slope-Low Strength	Slope-Clayey	
66E									
Hub	0-6	ML	A-4	20-30	5-10	Severe-Slope	Severe-Slope	Severe Slope	B
	6-14	SM	A-2	--	NP		Low Strength		
	14-60	SM-SC,SM	A-2 A-4	25-35	5-10		Frost Action		
Pagosa	0-20	ML	A-4	25-40	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	C
	20-60	CL-CH	A-6 A-7	30-60	15-35	Shrink-Swell	Shrink-Swell	Too Clayey	
66F									
Mulgon	0-15	CM	A-2	25-30	NP-5	Severe-Slope	Severe-Slope	Severe Slope	B
	15-36	CM-GC	A-2 A-4	25-35	5-10		Low Strength		
	36-60	GM	A-2	25-35	NP-5		Frost Action		
Hub	0-6	ML	A-4	25-30	5-10	Severe-Slope	Severe-Slope	Severe-Slope	B
	6-14	SM	A-2	--	NP		Low-Strength		
	14-60	SM-SC,SM	A-2 A-4	25-35	5-10				
70									
Silas	0-24	ML	A-4	15-25	NP-5	Moderate-	Slight	Moderate-	B
	24-60	ML	A-4	15-25	NP-5	Slope		Wetness	
Cryaquolls	0-20	ML	A-4	25-35	5-15	Severe	Severe	Severe	C
	20-60	CL	A-6	30-40	10-20	Wetness	Wetness-Frost Action	Wetness	
71									
Maxville	0-22	GM	A-4	15-25	5-10	Slight	Slight	Slight	B
	22-60	GP	A-1	--	NP				
Tine	0-60	SM	A-2	15-20	NP-5	Slight	Slight	Slight	A
	10-60	GP-GM	A-1	--	NP				
72									
Foxcreek	0-20	ML	A-4	25-30	NP-5	Severe	Severe	Severe	D
	20-60	GP-GM	A-1	--	--	Wetness	Wetness	Wetness	
Turson	0-24	ML	A-4	25-35	5-10	Severe	Severe	Severe	C
	24-60	GP-GM	A-1	--	NP	Wetness	Wetness	Wetness	
73									
Wilsonville	0-24	ML	A-4	25-35	5-10	Severe	Severe	Severe	C
Variant	24-60	GP-GM	A-1	--	NP	Wetness	Wetness	Wetness	

TABLE 1-3 (CONTINUED)

Soil Name and Map Symbol	Depth Inches	Engineering Classification Unified	AASHO	Liquid Limit	Plasticity Index	Limitations to: Small Commercial Buildings	Roads	Shallow Excavations	Hydrologic Group
McKinney Variant	0-24	ML	A-4	25-30	5-10	Severe Wetness	Severe Wetness	Severe Wetness	C
	24-60	GP-GM	A-1	--	NP				
74									
Alcova	0-15	SM	A-2	--	NP				
	15-60	GM-GC,GM	A-1 A-2	20-30	5-10	Moderate Slope	Moderate Slope	Severe-Small Stones	B
75									
Heath	0-9	ML	A-4	30-40	5-10	Severe-Shrink Swell	Severe-Shrink-Swell	Moderate Too Clayey	C
	9-24	CL,CH	A-6 A-7	45-60	20-40				
	24-60	CL,GC	A-6 A-4	20-35	5-15				
Jerry	0-13	ML	A-4	20-30	NP-10	Moderate Slope Shrink-Swell	Severe Low Strength Too Clayey	Moderate Slope	C
	13-60	CL	A-6	20-45	5-25				
Brownsto	1-10	GM-GC	A-4	25-30	5-10	Moderate Slope Stones	Moderate Slope Frost-Action Stones	Moderate Slope Stones	
	10-40	GC,GM	A-4	25-35	5-15				
	40-60	CL-CH	A-6 A-7	45-60	20-40				
77E									
Rooset	0-10	GM-GC,GC	A-4 A-6	20-30	5-15	Severe-Slope	Severe-Slope	Severe-Slope Stones	B
	10-24	GC	A-6	30-40	10-20				
	24-60	GM,CC	A-2	20-30	5-15				
Jerry	0-13	ML	A-4	20-30	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	C
	13-60	CL	A-6	20-45	5-25				
Brownsto	1-10	GM-GC	A-4	25-30	5-10	Severe-Slope Stones	Severe-Slope	Severe-Slope Stones	B
	10-40	GC-GM	A-4	25-35	5-15				
	40-60	CL-CH	A-6 A-7	40-60	20-40				
77F									
Rooset Southace	0-10	GM-GC,GC	A-2 A-4	20-30	5-10	Severe-Slope Stones	Severe-Slope	Severe-Slope Stones	B
	10-20	GC	A-4	20-30	5-10				
	20-60	GP-GM	A-1 A-2	--	NP				
Brownsto	1-10	GM-GC	A-4	25-30	5-10	Severe-Slope	Severe-Slope	Severe-Slope	B
	10-40	GC-GM	A-4	25-35	5-15				
	40-60	CL-CH	A-6 A-7	40-60	20-40				
81D									
Patent	0-10	ML	A-4	20-35	5-15	Moderate-Slope	Moderate Slope	Moderate Slope	C
	10-60	CL-ML	A-6	20-45	5-25				
81E									
Patent	0-10	ML	A-4	20-35	5-15	Severe Slope	Severe Slope	Severe Slope	C
	10-60	CL-ML	A-6	20-45	5-25				
81F									
Patent	0-10	ML	A-4	20-35	5-15	Severe Slope	Severe Slopes	Severe Slope	C
	10-60	CL-ML	A-6	20-45	5-25				
82									
Cundick Variant	0-4	CM-CC	A-2 A-4	20-30	5-10	Severe-Slope Shrink-Swell	Severe-Slope Shrink-Swell	Severe-Slope Shrink-Swell	D
	4-38	CH	A-7	35-60	15-40				
84D									
Delphill	0-5	ML	A-4	20-35	5-15	Severe-Slope	Severe-Slope Low Strength	Severe-Slope Thin Layer	C
	5-12	ML-CL	A-6	20-45	5-25				
	12-37	ML	A-4	20-35	5-15				
Glassner Variant	0-38	CH	A-7	35-640	15-40	Severe-Slope Shrink-Swell	Severe-Slope Shrink-Swell	Severe Slope-Thin Layer	D

TABLE 1-3 (CONTINUED)

Soil Name and Map Symbol	Depth Inches	Engineering Classification Unified	AASHO	Liquid Limit	Plasticity Index	Limitations to: Small Commercial Buildings	Roads	Shallow Excavations	Hydrologic Group
86									
Delphill	0-5	ML	A-4	20-35	5-15	Severe-Slope	Severe-Slope	Severe-Slope	C
	5-12	ML-CL	A-6	20-45	5-25		Low Strength	Thin Layer	
	12-37	ML	A-4	20-35	5-15				
Glassner Variant	0-38	Ch	A-7	35-60	15-40	Severe-Slope Shrink-Swell	Severe-Slope Shrink-Swell	Severe-Slope Thin Layer	D
84									
Delphill	0-5	ML	A-4	20-35	5-15	Severe-Slope	Severe-Slope	Severe-Slope	C
	5-12	ML-CL	A-6	20-45	5-25		Low Strength	Thin Layer	
	12-37	ML	A-4	20-35	5-15				
Glassner Variant	0-38	CH	A-7	35-60	15-40	Severe-Slope Shrink-Swell	Severe-Slope Shrink-Swell	Severe-Slope Thin Layer	D
85									
Unnamed 1									
Unnamed 2									
Unnamed 3									
88									
Bead	0-20	SM-ML	A-4	20-30	NP-5	Severe-Shrink Swell-Low Strength	Severe-Shrink Swell-Low Strength	Severe-Too Clayey	C
	20-60								
90									
Unnamed 1									
Unnamed 2									
Unnamed 3									
91									
Hobacker	0-23	GM	A-4	20-30	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	B
	23-60	GM-GP	A-2	25-35	5-15			Small Stones	
Hoodle	0-10	GM	A-4	20-30	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	B
	10-20	GC	A-6	25-40	10-20			Small Stones	
	20-60	GM	A-4	20-30	NP-10				
92									
Jerry	0-13	ML	A-4	20-30	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	C
	13-40	CL	A-6	20-45	5-25	Shrink Swell	Low Strength	Too Clayey	
	40-60	GC	A-2	<25	NP-10			Small Stones	
Hoodle	0-10	GM	A-4	20-30	NP-10				
	10-20	GC	A-6	25-40	10-20			Small Stones	
	20-60	GM	A-4	20-30	NP-10				
93E									
Granile	0-5	3M	A-2	--	NP				
	15-30	GC-SC	A-2	25-35	10-15	Severe-	Severe-Slope	Severe	B
	30-60	GP-GM	A-1	--	NP	Slope		Small-Stones Slope	
Leighcan	0-60	GP-GM	A-1	--	NP	Severe-Slope	Severe-Slope	Severe-Slope Small Stones	B
Nutras	0-10	ML	A-4	20-30	NP-5	Severe-Slope	Severe-Slope	Severe-Slope	C
	10-20	CL-ML	A-6	25-40	5-20	Stones	Low Strength	Stones	
	20-60	CH	A-7	40-60	20-40		Stones		
93F									
Leighcan	0-60	GP-GM	A-1	--	NP	Severe-Slope	Severe-Slope	Severe-Slope Small Stones	B
Granile	0-15	SM	A-2	--	NP	Severe Slope	Severe Slope	Severe-Slope	B
	15-30	GC-SC	A-2	25-35	10-15			Small Stones	
	30-60	CP-GM	A-1	--	NP				

TABLE 1-3 (CONTINUED)

Soil Name and Map Symbol	Depth Inches	Engineering Classification Unified	AASHO	Liquid Limit	Plasticity Index	Limitations to: Small Commercial Buildings	Roads	Shallow Excavations	Hydrologic Group
93F (Con't.)									
Nutras	0-10	ML	A-4	20-30	NP-5	Severe Slope	Severe Slope	Severe-Slope	C
	10-20	CL-ML	A-6	25-40	5-20	Stones	Low Strength	Stones	
	20-60	CH	A-7	40-60	20-40		Stones		
94									
Granile	0-15	SM	A-2	--	NP	Severe-Slope	Moderate-	Moderate-Slope	B
	15-30	GC-SC	A-2	25-35	10-15				
	30-60	GP-GM	A-1		NP				
Nutras	0-10	ML	A-4	20-30	NP-5	Severe-Slope	Severe-Slope	Severe-Slope	C
	10-20	CL-ML	A-6	25-40	5-20	Stones	Low Strength	Stones	
	20-60	CH	A-7	40-60	20-40				
95									
Bead	0-20	SM-ML	A-4	20-25	NP-5	Severe-Shrink	Severe-Shrink	Severe	C
						Swell-Low	Swell-Low	Too Clayey	
	20-60	CH-CL	A-7	40-55	20-35	Strength	Strength		
Nutras	0-10	ML	A-4	20-30	NP-5	Severe-Shrink	Severe-Shrink	Severe	C
	10-20	CL-ML	A-6	25-40	5-20	Swell-Low	Swell-Low	Too Clayey	
	20-60	CH	A-7	40-60	20-40	Strength	Strength	Stones	
96									
Farlow	0-10	GM	A-4	20-30	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	B
	10-60	GP-GC	A-2	25-35	5-15	Stones	Stones	Stones	
Starley	0-10	GM	A-2	30-40	5-10	Severe-Slope	Severe-Slope	Severe-Slope	D
						Depth to Rock	Thin Layer	Thin Layer	
97									
Farlow	0-10	GM	A-4	20-30	NP-10	Severe-Slope	Severe-Slope	Severe-Slope	B
	10-60	GP-GC	A-2	25-35	5-15	Stones	Stones	Stones	
Starley	0-10	GM	A-2	30-40	5-10	Severe-Slope	Severe-Slope	Severe-Slope	D
						Depth to Rock	Thin Layer	Thin Layer	
98									
Hub	0-14	ML	A-4	20-30	5-15				
	14-60	SC	A-4	25-35	5-10				
Irigul	0-15	GM	A-2	30-40	5-10	Severe-Slope	Severe-Slope	Severe-Slope	D
						Depth to Rock	Thin Layer	Thin Layer	
Rock Outcrop	--	--	--	--	--	Severe	Severe	Severe	D
						Bedrock	Bedrock	Bedrock	
99									
Kremlin	0-10	ML	A-4	20-30	5-10	Slight	Slight	Slight	C
	10-20	CL-ML	A-6	25-35	10-15				
	20-60	ML	A-4	20-30	5-10				
ROS									
Rock Outcrop	--	--	--	--	--	Severe	Severe	Severe	D
						Bedrock	Bedrock	Bedrock	
Starman	0-10	GM	A-2	30-40	5-10	Severe-Slope	Severe-Slope	Severe	D
						Depth to Rock	Thin Layer	Slope-Thin Layer	

[1]Engineering Classifications, Liquid Limit, Plasticity Index, and Hydrologic Groups are defined in the Glossary.

TABLE 1-4

GUIDE TO WELL FIELD MAPPING UNITS

BIO/WEST SURVEY AREA

(Mapping Unit Descriptions are in Appendix A)

Map Symbol	Field Name	Rehab. Unit[1]
1	Unnamed One - Unnamed Two - Unnamed Three Complex, 15 to 30 percent slopes.	B3
2	Unnamed One - Unnamed Four Complex, 5 to 15 percent slopes.	B2
3	Unnamed Forty Five - Unnamed One Complex, 0 to 5 percent slopes.	B2
4	Unnamed Nine - Unnamed Four Complex, 0 to 5 percent slopes.	C3
5	Unnamed Forty Five - Unnamed Seven - Unnamed One Complex, 3 to 9 percent slopes.	B2
6	Unnamed Four - Unnamed One - Unnamed Twenty Complex, 5 to 15 percent slopes.	B2
7	Unnamed Ten - Unnamed Eleven - Unnamed Four Complex, 5 to 30 percent slopes.	C2
8	Unnamed Twelve - Unnamed Eleven Complex, 5 to 15 percent slopes.	C3
9	Unnamed Eight - Unnamed Twenty Eight Complex, 0 to 5 percent slopes.	B1
10	Unnamed Thirteen - Unnamed Fourteen Complex, 30 to 50 percent slopes.	D5
11	Unnamed Ten - Unnamed Fifteen - Unnamed Four Complex, 5 to 15 percent slopes.	C3
12	Unnamed Sixteen - Unnamed One - Unnamed Twenty Five Complex, 30 to 50 percent slopes.	C4
13	Unnamed Seventeen - Rock Outcrop - Unnamed One Complex, 15 to 50 percent slopes.	C2
14	Unnamed Four - Unnamed One - Unnamed Sixteen Complex, 0 to 9 percent slopes.	B3
15	Unnamed Four - Unnamed Nine Complex, 0 to 5 percent slopes.	C3
16	Unnamed Eighteen - Unnamed Twenty Three Complex, 0 to 5 percent slopes.	C1

TABLE 1-4 (CONTINUED)

Map Symbol	Field Name	Rehab. Unit[1]
17	Unnamed Forty Five - Unnamed Fifteen - Unnamed Three Complex, 5 to 30 percent slopes.	C3
18	Unnamed Twenty Four - Unnamed Ten Complex, 3 to 15 percent slopes.	C3
19	Unnamed Twenty One - Unnamed Twenty Four - Unnamed Twelve Complex, 5 to 15 percent slopes.	C3
20	Unnamed Sixteen - Unnamed One - Unnamed Twenty Five Complex, 50 to 75 percent slopes.	C4
21	Unnamed One - Unnamed Ten - Unnamed Twelve, 15 to 30 percent slopes.	C2
22	Unnamed One - Unnamed Ten Complex, 15 to 30 percent slopes.	C4
23	Unnamed Eighteen - Unnamed Twenty Six Complex, 0 to 5 percent slopes.	B1
30	Unnamed Eighteen - Unnamed Nineteen Complex, 0 to 5 percent slopes.	B2
31	Unnamed Eighteen Complex, 0 to 5 percent slopes.	B2
32	Unnamed One - Unnamed Two Complex, 5 to 15 percent slopes.	B2
34	Unnamed Twenty Two - Unnamed Two Complex, 0 to 15 percent slopes.	B3
35	Badland - Rock Outcrop Complex, 30 to 50 percent slopes.	B3
36	Unnamed One - Unnamed Two - Unnamed Seventeen Complex, 9 to 15 percent slopes.	B3
37	Unnamed Thirty Six silt loam, 0 to 2 percent slopes.	B2
39	Unnamed Twenty Nine loam, 5 to 15 percent slopes.	A3
41	Unnamed Thirty Six - Unnamed Forty One Complex, 3 to 9 percent slopes.	A2
42	Unnamed Thirty Nine - Badland Complex, 2 to 15 percent slopes.	A2
43	Unnamed Thirty Seven - Unnamed Forty One Complex, 3 to 9 percent slopes.	A2
44	Unnamed Forty Two - Unnamed Forty Three Complex, 0 to 5 percent slopes.	A3

TABLE 1-4 (CONTINUED)

Map Symbol	Field Name	Rehab. Unit[1]
45	Unnamed Forty Two silt loam, 0 to 2 percent slopes.	A3
47	Unnamed Ten - Unnamed Eleven - Unnamed Forty Four Complex, 15 to 50 percent slopes.	D5
48	Unnamed Forty Four - Unnamed Twenty Seven Complex, 5 to 30 percent slopes.	D5

[1]Rehabilitation units are defined in the glossary and identified in Table 1-18.

TABLE 1-5

BIO/WEST ENGINEERING AND RANGE SUITABILITY INTERPRETATIONS[1]

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Map Unit 1							
Unnamed One	Shallow Loamy, 10-14" precip. zone, bluebunch wheatgrass, few big sagebrush	Severe	.42/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Unnamed Two	Shallow Loamy, 10-14" precip. zone, bluebunch wheatgrass, few big sagebrush	Severe	.37/1/3	Poor, droughty	D	Severe, slope	Severe, slope
Unnamed Three	Shallow Clayey, 10-14" precip. zone, low sagebrush, bluebunch wheatgrass	Severe	.37/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Map Unit 2							
Unnamed One	Shallow Loamy, 10-14" precip. zone, bluebunch wheatgrass few big sagebrush	Moderate	.42/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Unnamed Four	Loamy, 10-14" precip.zone, big sagebrush, western wheatgrass, Sandberg bluegrass, Nuttall saltbush	Slight	.43/5/4L	0-6", Good; below 6", fair, too clayey	B	Moderate, slope low strength	Moderate, slope <8% Severe, slope >8%
Map Unit 3							
Forty-five	Loamy, 10-14" precip. zone, big sagebrush, western wheatgrass, Idaho fescue, Sandberg bluegrass	Slight	.2/5/3	0-4", Good; below 4", fair, too clayey	B	Slight	Slight
Unnamed One	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Slight	.42/1/4L	Poor, droughty	D	Moderate, depth to bedrock	Moderate, depth to bedrock
Map Unit 4							
Unnamed Nine	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Slight	.24/5/3	0-4", Good; below 4", poor; small stones	B	Slight	Slight, slopes <4% Moderate, slopes >4%

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Unnamed Four	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass, Nuttall Saltbrush	Slight	.43/5/4L	0-6", Good; below 6", fair, too clayey	B	Slight	Slight, slopes <4% Moderate, slopes >4%
Map Unit 5							
Forty-five	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Idaho fescue, Sandberg bluegrass	Slight	.24/5/3	0-4" Good; below 4", fair, too clayey	B	Slight	Slight
Unnamed Seven	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, Sandberg bluegrass, big sagebrush	Slight	.24/3/3	Fair, small stones excess lime	B	Slight, slopes <8%, moderate, slopes >8%	Slight, Slopes <4% Moderate, slopes4-8% Severe, slopes >8%
Unnamed One	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass few big sagebrush	Moderate	.42/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Map Unit 6							
Unnamed Four	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass, Nuttall saltbrush	Slight	.43/5/4L	0-6", Good; below 6", fair, too clayey	B	Moderate, slope low strength	Moderate, slope <8% Severe, slope >8%
Unnamed One	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass few big sage	Moderate	.42/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Unnamed Twenty	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Moderate	.41/2/3	Fair, droughty	C	Slight, slopes <8%, Moderate slopes >8%	Moderate, slopes <8% Severe, slopes >8%
Map Unit 7							
Unnamed Ten	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, prairie junegrass	Moderate	.28/5/3	0-4", Good, below 4" fair, too clayey, small stones	B	Slight, slopes <8%; Moderate, slopes 8-15%; Severe, slopes >15%	Moderate, slopes <8% Severe, slopes >8%

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Unnamed Eleven	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, Sandberg bluegrass	Moderate	.28/5/6	0-8", Fair, small stones; below 8", poor, small stones	B	Slight, slopes <8%; Moderate slopes 8-15%; Severe, sopes >15%	Moderate, slopes <8% Severe, slopes >8%
Unnamed Four	Loamy, 15-19" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass, Nuttall saltbrush	Slight	.43/5/4L	0-6", Good; below 6", fair, too clayey	B	Slight, slopes <8%; Moderate, slopes 8-15%; Severe, slopes >15%	Moderate, slopes <8% Severe, slopes >15%
Map Unit 8							
Unnamed Twelve	No Rangesite, aspen, slender wheat-grass, mountain brome	Slight	.28/5/6	Fair, too clayey	B	Slight, slopes <8%; Moderate, slopes >8%	Moderate, slopes <8% Severe, slopes >8%
Unnamed Eleven	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, Sandberg bluegrass	Slight	.18/5/8	Poor, small stones	B	Slight, slopes <8%; Moderate, slopes >8%	Moderate, slopes <8% Severe, slopes >8%
Map Unit 9							
Unnamed Eight	Wetland, 10-14" precip. zone willow, sedge, baltic rush, tufted hairgrass	Slight	.24/5/8	Good	D	Severe, wetness, ponding	Severe, wetness, ponding
Unnamed Twenty-Eight	Subirrigated, 10-14" precip. zone willow, tufted hairgrass, sedge, baltic rush	Slight	.28/5/4L	Good	C	Moderate, wetness	Moderate, wetness
Map Unit 10							
Unnamed Thirteen	No Rangesite, Douglas-fir, lodgepole pine	Severe	.28/5/6	Fair, erodes easily, too clayey	C	Severe, slope[1]	Severe, slope[1]
Unnamed Fourteen	No Rangesite, Douglas-fir, lodgepole pine	Severe	.24/5/6	Fair, erodes easily, small stones	B	Severe, slope[1]	Severe, slope[1]
Map Unit 11							
Unnamed Ten	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, prairie junegrass	Slight	.28/5/3	0-4" Good; below 4" fair, too clayey, small stones	B	Slight, slopes <8%; Moderate, slopes >8%	Moderate, slopes <8% Severe, slopes >8%

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Unnamed Fifteen	Clayey, 15-19" precip. zone Idaho fescue, bluebunch wheatgrass, low sagebrush	Slight	.18/5/8	0-10", fair; small stones, too clayey; below 10", too clayey	C	Slight, slopes <8%, Moderate, slopes >8%	Moderate, slopes <8% Severe, slopes >8%
Unnamed Four	Loamy, 15-19" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass, Nuttall saltbrush	Slight	.43/5/4L	0-6", Good; below 6", fair, too clayey	B	Slight, slopes <8%; Moderate, slopes >8%	Moderate, slopes <8% Severe, slopes >8%
Map Unit 12							
Unnamed Sixteen	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, fringed sagebrush	Severe	.18/1/8	Poor, small stones, erodes easily	D	Severe, slope	Severe, slope
Unnamed One	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, few big sagebrush	Severe	.41/1/4L	Poor, droughty, erodes easily	D	Severe, slope	Severe, slope
Unnamed Twenty-Five	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, king fescue, balmroot, big sagebrush	Severe	.18/1/8	Poor, droughty, erodes easily	D	Severe, slope	Severe, slope
Map Unit 13							
Unnamed Seventeen	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Moderate	.18/1/8	Poor, droughty	D	Severe, depth to bedrock, slopes >15%	Severe, depth to bedrock, slopes >18%
Rock Outcrop	Barren	Slight	--	--	D	Severe	Severe
Unnamed One	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Severe	.42/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Map Unit 14							
Unnamed Four	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass, Nuttall saltbrush	Slight	.43/5/4L	0-6", Good; below 6", fair, too clayey	B	Slight	Slight, slopes <4% Moderate, slopes <4%

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Unnamed One	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Slight	.42/1/4L	Poor, droughty	D	Moderate, depth to bedrock	Moderate, depth to to bedrock, slopes <8%, Severe, slopes >8%
Unnamed Sixteen	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, fringed sagebrush	Slight	.18/1/8	Poor, droughty	D	Moderate, depth to bedrock	Moderate, depth to bedrock, slopes <8%; Severe, slopes >8%
Map Unit 15							
Unnamed Four	Loamy, 10-14" precip. zone Sandberg bluegrass, Nuttall saltbrush	Slight	.43/5/4L	0-6", Good; below 6", fair, too clayey	B	Slight	Slight, slopes <4% Moderate, slopes >4%
Unnamed Nine	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Slight	.24/5/3	0-4" Good; below 4", poor, small stones	B	Slight	Slight, slopes <4% Moderate, slopes >4%
Map Unit 16							
Unnamed Eighteen	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Slight	.41/5/4L	Fair, too clayey	C	Moderate, low strength	Moderate, low strength
Twenty-three	Wetland, 10-14" precip. zone willows, sedge, baltic rush, tufted hairgrass	Slight	.37/5/4L	0-4" Good; below, 4", fair, too clayey	D	Severe, ponding, wetness	Severe, ponding, wetness
Map Unit 17							
Forty-five	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Idaho fescue, mutton bluegrass	Slight	.24/5/3	0-4" Good; below 4", fair, too clayey	B	Slight	Moderate, slopes <8% Severe, slopes >8%
Unnamed Fifteen	Clayey, 10-14" precip. zone Idaho fescue, blue-bunch wheatgrass, low sagebrush	Moderate	.18/5/8	0-10", Fair, small stones, too clayey; below 10", poor too clayey	C	Severe, slope	Severe, slope

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Unnamed Three	Shallow Clayey, 10-14" precip. zone low sagebrush, blue-bunch wheatgrass	Severe	.37/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Map Unit 18							
Unnamed Twenty-four	Subirrigated, 15-19" precip. zone mutton bluegrass, Sandberg bluegrass, Idaho fescue, sedge	Slight	.24/1/8	0-9", Good; below 9", fair, too clayey	D	Moderate, wetness, depth to bedrock	Moderate, slope 3-8%, depth to bedrock, wetness
Unnamed Ten	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, prairie junegrass	Slight	.28/5/3	0-4" Good; below 4", fair, too clayey small stones	B	Slight, slopes <8%; Moderate, slopes >8%	Slight, slopes <8% Severe, slopes >8%
Map Unit 19							
Unnamed Twenty-one	Loamy, 15-19" precip. zone big sagebrush, mutton bluegrass, needle and thread, king fescue	Slight	.24/2/8	Fair, small stones	C	Slight, slopes <8%; Moderate slopes >8%	Severe, slope
Unnamed Twenty-four	Shallow Loamy, 15-19" precip. zone mutton bluegrass, Sandberg bluegrass, Idaho fescue	Slight	.24/2/8	Poor, droughty	D	Slight, slopes <8%; Moderate, slopes >8%	Moderate, slopes <8% Severe, slopes >8%
Unnamed Twelve	No Rangesite, aspen, slender wheatgrass mountain brome	Slight	.28/5/6	Fair, too clayey	B	Slight, slopes <8%; Moderate, slopes >8%	Moderate, slopes <8% Severe, slopes >8%
Map Unit 20							
Unnamed Sixteen	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, fringed sagebrush	Severe	.18/1/8	Poor, droughty, erodes easily	D	Severe slope	Severe, slope
Unnamed One	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, few big sagebrush	Severe	.42/1/4L	Poor, droughty erodes easily	D	Severe slope	Severe, slope
Unnamed Twenty-five	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, big sagebrush, king fescue	Severe	.18/1/8	Poor, droughty, erodes easily	D	Severe, slope	Severe, slope

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Map Unit 21							
Unnamed One	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, few big sagebrush	Severe	.42/1/4L	Poor, droughty, erodes easily	D	Severe, slope	Severe, slope
Unnamed Ten	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, prairie junegrass	Severe	.28/5/3	Fair, erodes easily	B	Severe, slope	Severe, slope
Unnamed Twelve	No Rangesite, aspen, slender wheatgrass, mountain brome	Severe	.28/5/6	Fair, erodes easily	B	Severe, slope	Severe, slope
Map Unit 22							
Unnamed One	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, few big sagebrush	Severe	.42/1/4L	Poor, droughty	D	Severe, slope	Severe, slope
Unnamed Ten	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, prairie junegrass	Slight	.28/5/3	0-4", Good; below 4", fair, too clayey, small stones	B	Slight, slopes <8%; Moderate, slopes 8-15%; Severe, slopes >15%	Moderate, slopes <8% Severe, slopes >8%
Map Unit 23							
Unnamed Eighteen	Loamy, 15-19" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Slight	.41/5/4L	Fair, too clayey	C	Slight	Slight
Unnamed Twenty-six	Clayey, 15-19" precip. zone western wheatgrass, Sandberg bluegrass, low sagebrush	Slight	.41/5/3	0-4" Good; below 4", poor, too clayey	C	Slight	Slight
Map Unit 30							
Unnamed Eighteen	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Slight	.41/5/4L	Fair, too clayey	C	Slight	Slight

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Unnamed Nineteen	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Slight	.41/5/3	0-4" Good; below 4", fair, too clayey	C	Slight	Slight
Map Unit 31							
Unnamed Eighteen	Loamy, 10-14" precip. zone big sagebrush, western wheatgrass, Sandberg bluegrass	Slight	.41/5/4L	Fair, too clayey	C	Slight	Slight
Unnamed Eighteen (Alkaline)	Saline Upland, 10-14" precip. zone greasewood, western wheatgrass, bottlebrush squirreltail	Slight	.41/5/4L	Fair, excess sodium	C	Slight	Slight, slopes <4% Moderate, slopes >4%
Map Unit 32							
Unnamed One	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, big sagebrush	Moderate	.42/1/4L	Poor, droughty	D	Moderate, depth to bedrock	Moderate, depth to bedrock, slopes <8% Severe, depth to bedrock, slopes >8%
Unnamed Two	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Moderate	.37/1/3	Poor, droughty	D	Severe, depth to bedrock	Severe depth to to bedrock
Map Unit 34							
Unnamed Twenty-two	Very shallow, 10-14" precip. zone bluebunch wheatgrass	Slight	.28/1/3	Poor, droughty	D	Severe, depth to bedrock	Severe, depth to to bedrock
Unnamed Two	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Slight	.37/1/3	Poor, droughty	D	Severe, depth to bedrock	Severe depth to bedrock
Map Unit 35							
Badland	Barren	Severe	--	--	D	Severe, low strength, shrink-swell slope	Severe, low strength, shrink-swell, slope
Rock Outcrop	Barren	Slight	--	--	D	Severe, bedrock, slope	Severe, bedrock, slope

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Map Unit 36							
Unnamed One	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Moderate	.42/1/4L	Poor, droughty	D	Moderate, slope, depth to bedrock	Severe, slopes >8%
Unnamed Two	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Moderate	.37/1/3	Poor, droughty	D	Severe, depth to bedrock	Severe, depth to bedrock, slopes >8%
Unnamed Seventeen	Shallow Loamy, 10-14" precip. zone bluebunch wheatgrass, few big sagebrush	Slight	.18/1/8	Poor, droughty	D	Severe, depth to bedrock	Severe, depth to bedrock, slopes >8%
Map Unit 37							
Unnamed Thirty-six	Saline Upland, 7-9" precip. zone big sagebrush, greasewood, Nuttall saltbrush, thickspike wheatgrass	Slight	.41/5/4L	Poor, excess sodium	C	Slight	Slight
Map Unit 39							
Unnamed Twenty-nine	Loamy, 7-9" precip. zone big sagebrush, thickspike wheatgrass, bottlebrush squirreltail, Sandberg bluegrass	Moderate	.37/5/4L	Good	D	Slight, slopes <8%; Moderate, slopes >8%	Moderate, slopes 4-8% Severe, slopes 8-15%
Map Unit 41							
Unnamed Thirty-six	Saline Upland, 7-9" precip. zone big sagebrush, thickspike wheatgrass, bottlebrush squirreltail, Nuttall saltbrush	Slight	.41/5/4L	poor, excess sodium	C	Slight	Slight
Unnamed Forty-one	Sandy, 7-9" precip. zone needle and thread, alkali sacaton, greasewood, Nuttall saltbrush	Slight	.18/5/2	Poor, too sandy soil blowing	A	Slight, slopes <8%; Moderate, slopes >8%	Slight, slopes <4% Moderate, slopes >4% Severe, slopes >8%

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Map Unit 42							
Unnamed Thirty-nine	Saline Upland, 7-9" percip. zone bud sagewat, Nuttall saltbrush, wild onion	Slight	.28/1/4L	Poor, droughty, excess sodium	D	Moderate, depth to bedrock	Moderate, depth to bedrock, severe, slopes >8%
Badlands	No Interpretations	--	--	--	D	--	--
Map Unit 43							
Unnamed Thirty-seven	Sandy, 7-9" precip. zone needle and thread, spiny hopsage, big sagebrush, thickspike wheatgrass	Slight	.16/5/2	Good	B	Slight, slopes <8%; Moderate, slopes >8%	slight, slopes <4% Moderate, slopes 4-8% Severe, slopes >4%
Unnamed Forty-one	Sandy, 7-9" precip. zone needle and thread, alkali sacaton, greasewood Nuttall saltbrush	Slight	.18/5/2	Poor, too sandy soil blowing	A	Slight, slopes <8%; Moderate, slopes >8%	Slight, slopes <4% Moderate, slopes 4-8% Severe, slopes >8%
Map Unit 44							
Unnamed Forty-two	Loamy, 7-9" precip. zone big sagebrush, bottlebrush squirreltail, thickspike wheatgrass	Slight	.41/5/4L	Good	C	Slight	Slight, slopes <4% Moderate, slopes >4%
Unnamed Forty-three	Shallow Loamy, 7-9" precip. zone winterfat, western wheatgrass	Slight	.41/5/4L	Poor, droughty	D	Moderate, depth to bedrock	Moderate, depth to bedrock slopes >4%
Map Unit 45							
Unnamed Forty-two	Loamy, 7-9" precip. zone big sagebrush, bottlebush squirreltail, thickspike wheatgrass	Slight	.41/5/4L	Good	C	Slight	Slight
Map Unit 47							
Unnamed Ten	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, prairie junegrass	Severe	.28/5/3	Fair, erodes easily, small stones	B	Severe, slope	Severe, slope

TABLE 1-5 (CONTINUED)

Mapping Unit	Tentative Range Site and Dominant Vegetation	Water Erosion Hazard	Erosion Factors K/T/WEG	Revegetation	Hydrologic Groups	Limitations To: Roads	Limitations To: Buildings
Unnamed Eleven	Loamy, 15-19" precip. zone big sagebrush, Idaho fescue, Sandberg bluegrass	Moderate	.18/5/3	Poor, small stones	B	Severe, slope	Severe, slope
Unnamed Forty-four	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, western wheatgrass, multon bluegrass, phlox	Moderate	.18/1/8	Poor, droughty	D	Severe, depth to bedrock, slope	Severe, depth to bedrock slope >8%
Map Unit 48							
Unnamed Forty-four	Shallow Loamy, 15-19" precip. zone bluebunch wheatgrass, western wheatgrass multon wheatgrass, phlox	Moderate	.18/1/8	Poor, droughty	D	Severe, depth to bedrock	Severe, depth to bedrock
Unnamed Twenty-seven	Loamy, 15-19" precip. zone big sagebrush, Idaho Fescue, prairie junegrass	Moderate	.28/5/5	Good	B	Slight, slopes <8%; Moderate, slopes 8-15%; Severe, slopes >15%	Moderate, slopes <8% Severe, slopes >8%

[1]Erosion factors and Hydrologic Groups are defined in the Glossary.

TABLE 1-6

GUIDE TO WELL FIELD MAPPING UNITS

(USFS SURVEY AREA)

(MAPPING UNIT DESCRIPTIONS ARE IN APPENDIX A)

Symbol	Mapping Unit	Phase	Slope Range (%)	Rehabilitation Unit
103	Argic Cryoborolls, loamy-skeletal, mixed - Argic Pachic Cryoborolls, fine-loamy, mixed - Pachic Cryoborolls, fine-loamy, mixed.			
		103 A	0 - 5	D1
		103 B	5 - 15	D1
		103 C	15 - 25	D3
106	Typic Cryaquolls, coarse-loamy, mixed - Typic Cryofluvents, sandy-skeletal, mixed (calcareous).		0 - 5	D1
107	Typic Cryoborolls, loamy-skeletal, mixed - Argic Cryoborolls, fine-loamy, mixed.		0 - 5	D2
120	Argic Cryoborolls, loamy-skeletal, mixed - Typic Cryorthents, coarse-loamy, mixed (calcareous).			
		120 A	0 - 5	D2
		120 B	5 - 15	D2
		120 C	15 - 20	D3
124	Typic Cryoborolls, loamy-skeletal, mixed - Pachic Cryoborolls, loamy-skeletal, mixed.			
		124 A	10 - 15	D2
		124 B	15 - 30	D3
154	Mollic Cryoboralfs, loamy-skeletal, mixed - Mollic Cryoboralfs, fine-loamy, mixed - Mollic Cryoboralfs, fine, montmorillonitic.			
		154 B	10 - 15	D2
		154 C	15 - 30	D3
		154 D	30 - 40	D4
200	Typic Cryoboralfs, loamy-skeletal, mixed - Typic Cryoboralfs, fine-loamy, mixed.			
		200 B	10 - 15	D2
		200 C	15 - 30	D3
		200 D	30 - 45	D4
203	Argic Cryoborolls, fine-loamy, mixed - Argic Cryoborolls, fine, montmorillonitic - Typic Cryorthents, loamy, mixed (calcareous), shallow.			
		203 B	5 - 15	D2
		203 C	15 - 30	D3
		203 D	30 - 50	D5

TABLE 1-6 (CONTINUED)

Symbol	Mapping Unit	Phase	Slope Range (%)	Rehabilitation Unit
220	Mollic Cryoboralfs, fine-loamy, mixed - Typic Cryoboralfs, loamy-skeletal, mixed - Mollic Cryoboralfs, clayey-skeletal, montmorillonitic.			
		220 B	10 - 15	D2
		220 C	15 - 30	D3
		220 D	30 - 45	D4
221	Argic Cryoborolls, loamy-skeletal, mixed - Mollic Cryoboralfs, fine-loamy, mixed - Argic Pachic Cryoborolls, fine-loamy, mixed.			
		221 B	10 - 15	D2
		221 C	15 - 30	D3
		221 D	30 - 45	D4
255	Typic Cryoboralfs, loamy-skeletal, mixed - Mollic Cryoboralfs, loamy-skeletal, mixed.		30 - 50	D4
355	Pachic Cryoborolls, loamy-skeletal, mixed - Lithic Cryorthents, loamy-skeletal, mixed (calcareous) - Lithic Cryoborolls, loamy-skeletal, mixed.		30 - 75	D5
360	Typic Cryoboralfs, loamy-skeletal, mixed - Typic Cryochrepts, loamy-skeletal, mixed.			
		360 B	5 - 15	D2
		360 C	15 - 30	D3
		360 D	30 - 60	D4
391	Typic Cryoboralfs, loamy-skeletal, mixed - Typic Cryorthents, loamy-skeletal, mixed.		30 - 65	D4
492	Typic Cryochrepts, loamy-skeletal, mixed - Pachic Cryoborolls, loamy-skeletal, mixed - Lithic Cryoborolls, loamy-skeletal, mixed.			
		492 B	10 - 15	D3
		492 C	15 - 30	D3
		492 D	30 - 90	D5
502	Typic Cryoborolls, loamy-skeletal, mixed - Lithic Cryoborolls, loamy-skeletal, mixed - Talus - Rock Outcrop.		40 - 100	D5
650	Argic Cryoborolls, fine montmorillonitic - Pachic Cryoborolls, loamy-skeletal, mixed.			
		650 B	10 - 15	D2
		650 C	15 - 30	D3
		650 D	30 - 50	D4

TABLE 1-6 (CONTINUED)

Symbol	Mapping Unit	Phase	Slope Range (%)	Rehabilitation Unit
660	Mollic Cryoboralfs, loamy-skeletal, mixed - Typic Cryoborolls, loamy-skeletal, mixed - Typic Cryochrepts, loamy-skeletal, mixed.			
		660 C	20 - 30	D3
		660 D	30 - 60	D4
675	Argic Cryoborolls, fine, montmorillonitic - Mollic Cryoboralfs, fine, montmorillonitic - Mollic Cryoboralf, loamy skeletal, mixed.			
		675 B	5 - 15	D2
		675 C	15 - 30	D3
		675 D	30 - 60	D4
701	Lithic Cryoborolls, loamy-skeletal, mixed - Argic Cryoborolls, fine-loamy, mixed - Argic Cryoborolls, fine montmorillonitic - Typic Cryoborolls, loamy-skeletal, mixed.			
		701 B	10 - 15	D5
		701 C	15 - 30	D5
		701 D	30 - 40	D5
702	Mollic Cryoboralfs, fine-loamy, mixed - Mollic Cryoboralfs, loamy-skeletal, mixed - Typic Cryochrepts, loamy-skeletal mixed.			
		702 B	5 - 15	D2
		702 C	15 - 30	D3
		702 D	30 - 60	D4
710	Mollic Cryoboralfs, clayey - skeletal, mixed - Argic Pachic Cryoborolls, fine, montmorillonitic - Lithic Cryorthents, loamy - skeletal.		30 - 70	D5
711	Mollic Cryoboralfs, clayey-skeletal, montmorillonitic - Mollic Cryoboralfs, loamy-skeletal, mixed - Typic Cryoboralfs, fine-loamy, mixed.			
		711 C	20 - 30	D3
		711 D	30 - 60	D4
712	Lithic Cryorthents, loamy-skeletal, mixed.			
		712 B	10 - 15	D5
		712 C	15 - 30	D5
		712 D	30 - 50	D5
713	Lithic Cryorthents, loamy-skeletal, mixed - Mollic Cryoboralfs, loamy-skeletal, mixed - Typic Cryoborolls, loamy-skeletal, mixed.		30 - 60	D5

TABLE 1-6 (CONTINUED)

Symbol	Mapping Unit	Phase	Slope Range (%)	Rehabilitation Unit
714	Typic Cryoborolls, loamy-skeletal, mixed - Lithic Cryoborolls, loamy-skeletal, mixed.			
		714 B	10 - 15	D5
		714 C	15 - 30	D5
		714 D	30 - 50	D5
715	Lithic Cryoborolls, loamy-skeletal, mixed - Pachic Cryoborolls, loamy-skeletal, mixed.			
		715 B	5 - 15	D5
		715 C	15 - 30	D5
		715 D	30 - 40	D5

TABLE 1-7

SOILS INTERPRETATIONS[1]

(USFS SURVEY AREA)

Mapping Unit	Soil	Permeability	Available Water Capacity	Hydrologic Group	Factors K	Factors T	Erosion Hazard	Phase Slope Range (%)	Rehabilitation Potential	Rehabilitation Considerations
103	Unnamed 6D6	Moderate	Low	B	.16	5	High			
	Unnamed 6Ee	Moderately slow	High	B	.23	5	High			
	Unnamed 6Ge	Moderate	High	C	.24	5	High			
								0-15	Fair	Wetness, stoniness
								15-25	Fair	Wetness, stoniness
106	Unnamed 6Ae	Moderately rapid	Moderate	C	.11	5	Moderate			
	Unnamed 3Fo	Very Rapid	Low	B	.24	5	Low			
								0-5	Fair	Wetness, stoniness
107	Unnamed 6Bb	Moderate	Moderate	A	.18	5	Moderate			
	Unnamed 6De	Moderate	Moderate	B	.26	5	High			
								0-5	Good	Stoniness
120	Unnamed 6D6	Moderate	Low	B	.16	5	High			
	Unnamed 3Dk	Moderate Rapid	Moderate	B	.44	5	High			
								0-15	Good	Stoniness
								15-20	Fair	Stoniness, slope
124	Unnamed 6Bb	Moderately Rapid	Moderate	B	.18	5	Moderate			
	Unnamed 6Gb	Moderately Rapid	Moderate	B	.14	5	Moderate			
								10-15	Good	Stoniness
								15-30	Fair	Stoniness, slope
154	Unnamed 1Bb	Moderate	Moderate	B	.16	5	Moderate			
	Unnamed 1Be	Moderately slow	High	B	.24	5	High			
	Unnamed 1Bg	Slow	High	C	.32	5	High			
								10-15	Good	Stoniness, clayey Textures
								15-30	Fair	Stoniness, slope
								30-40	Poor	Slope, erosion hazard
200	Unnamed 1Ab	Moderate	Moderate	B	.20	5	High			
	Unnamed 1Ae	Moderately slow	High	B	.24	5	High			
								10-15	Good	Stoniness
								15-30	Fair	Stoniness, slope
								30-45	Poor	Slope, erosion hazard
203	Unnamed 6De	Moderate	Moderate	B	.26	5	High			
	Unnamed 6Dg	Slow	Moderate	C	.34	5	High			
	Unnamed 3Dm	Moderate slow	Low	D	.43	1	High			
								5-15	Good	Clayey textures
								15-30	Fair	Clayey textures, slope
								30-50	Poor	Slope, erosion hazard

TABLE 1-7 (CONTINUED)

Mapping Unit	Soil	Permeability	Available Water Capacity	Hydrologic Group	Factors K	Factors T	Erosion Hazard	Phase Slope Range (%)	Rehabilitation Potential	Rehabilitation Considerations
220	Unnamed 1Be	Moderately slow	High	B	.24	5	High			
	Unnamed 1Ab	Moderate	Moderate	B	.20	5	High			
	Unnamed 1Bc	Moderately slow	Moderate	C	.28	5	Moderate			
								10-15	Good	Growing season, texture
								15-30	Fair	Texture, slope
								30-45	Poor	Slope, erosion hazard
221	Unnamed 6Db	Moderate	Low	B	.16	5	High			
	Unnamed 1Be	Moderately slow	High	B	.24	5	High			
	Unnamed 6Ee	Moderately slow	High	B	.23	5	High			
								10-15	Good	Stoniness
								15-30	Fair	Stoniness, slope
								30-45	Poor	Slope, erosion hazard
255	Unnamed 1Ab	Moderate	Moderate	B	.20	5	High			
	Unnamed 1Bb	Moderate	Moderate	B	.16	5	Moderate	30-50	Poor	Slope stoniness
355	Unnamed 6Gb	Moderately rapid	Moderate	B	.13	5	Moderate			
	Unnamed 3E1	Moderately rapid	Low	D	.21	1	Moderate			
	Unnamed 6Fb	Moderately rapid	Low	D	.12	1	Moderate			
								30-75	Poor	Slope, stoniness, depth to rock
360	Unnamed 1Ab	Moderate	Moderate	B	.20	5	High			
	Unnamed 5Bb	Moderately Rapid	Moderate	B	.18	5	Moderate			
								5-15	Good	Stoniness
								15-30	Fair	Stoniness, slope
								30-60	Poor	Slope, erosion hazard
391	Unnamed 1Ab	Moderate	Moderate	B	.20	5	High			
	Unnamed 3Db	Moderately rapid	Low	B	.23	5	Moderate			
								30-65	Poor	Slope, stoniness, erosion hazard
492	Unnamed 5Bb	Moderately rapid	Moderate	B	.22	5	High			
	Unnamed 6Gb	Moderately rapid	Moderate	B	.14	5	Moderate			
	Unnamed 6Fb	Moderately rapid	Low	D	.09	1	Low			
								5-15	Fair	Stoniness, depth to rock
								15-30	Fair	Slope, stoniness
								30-90	Poor	Slope, stoniness
502	Unnamed 6Bb	Moderately rapid	Moderate	B	.13	5	Moderate			
	Unnamed 6Fb	Moderately rapid	Low	D	.12	1	Moderate			
	Talus-Rock Outcrop	--	--	--	--	--	--			
								40-100	Poor	Slope, depth to rock

TABLE 1-7 (CONTINUED)

Mapping Unit	Soil	Permeability	Available Water Capacity	Hydrologic Group	Factors K	Factors T	Erosion Hazard	Phase Slope Range (%)	Rehabilitation Potential	Rehabilitation Considerations
650	Unnamed 6Dg	Slow	High	C	.23	5	High			
	Unnamed 6Gd	Moderately rapid	Moderate	B	.13	5	Moderate			
								10-15	Good	Clayey textures, stoniness
								15-30	Fair	Texture, slope
								30-50	Poor	Slope, erosion hazard
660	Unnamed 1Bb	Moderate	Moderate	B	.16	5	Moderate			
	Unnamed 6Bb	Moderate	Moderate	B	.18	5	Moderate			
	Unnamed 5Bb	Moderately Rapid	Moderate	B	.22	5	Moderate			
								20-30	Fair	Stoniness, slope
								30-60	Poor	Slope, erosion hazard
675	Unnamed 6Dg	Slow	Moderate	C	.34	5	High			
	Unnamed 1Bg	Slow	High	C	.32	5	High			
	Unnamed 1Bb	Moderate	Moderate	B	.20	5	Moderate			
								5-15	Good	Clayey textures, acidity
								15-30	Fair	Clayey textures, slope
								30-60	Poor	Slope, erosion hazard
701	Unnamed 6Fb	Moderately rapid	Low	D	.12	1	Low			
	Unnamed 6De	Moderate	High	B	.18	5	Moderate			
	Unnamed 6Dg	Slow	High	C	.23	5	Moderate			
	Unnamed 6Bb	Moderate	Moderate	B	.13	5	Moderate			
								10-15	Poor	Stoniness, depth to rock
								15-30	Poor	Stoniness, slope
								30-40	Poor	Slope, depth to rock
702	Unnamed 1Be	Moderately slow	High	B	.24	5	High			
	Unnamed 1Bb	Moderate	Moderate	B	.16	5	Moderate			
	Unnamed 5Bb	Moderately Rapid	Moderate	B	.22	5	Moderate			
								5-15	Good	Stoniness
								15-30	Fair	Stoniness, slope
								30-60	Poor	Slope, erosion hazard
710	Unnamed 1Bc	Moderately slow	Moderate	C	.28	5	High			
	Unnamed 6Eg	Slow	High	C	.25	5	High			
	Unnamed 3Eb	Moderately rapid	Low	D	.11	1	Moderate			
								30-70	Poor	Slope, erosion hazard
711	Unnamed 1Bc	Moderately slow	Moderate	C	.28	High				
	Unnamed 1Bb	Moderate	Moderate	B	.16	Moderate				
	Unnamed 1Ac	Slow	High	B	.24	Moderate				
								20-30	Fair	
								30-60	Poor	Slope, erosion hazard
712	Unnamed	Moderately rapid	Low	D	.11	1	Moderate			
								10-15	Poor	Depth to rock
								15-30	Poor	Depth to rock

TABLE 1-7 (CONTINUED)

Mapping Unit	Soil	Permeability	Available Water Capacity	Hydrologic Group	Factors K	Factors T	Erosion Hazard	Phase Slope Range (%)	Rehabilitation Potential	Rehabilitation Considerations
713	Unnamed 3Eb	Moderately rapid	Low	D	.11	1	Low			
	Unnamed 1Bb	Moderate	Moderate	B	.16	5	Low			
	Unnamed 6Bb	Moderate	Moderate	B	.18	5	Moderate			
								30-60	Poor	Slope, depth to rock
714	Unnamed 6Bb	Moderate	Moderate	B	.18	5	Moderate			
	Unnamed 6Fb	Moderately rapid	Low	D	.09	1	Low			
								10-15	Poor	Stoniness, depth to rock
								15-30	Poor	Stoniness, slope
								30-50	Poor	Slope, depth to rock
715	Unnamed 6Fb	Moderately rapid	Low	D	.12	1	Moderate			
	Unnamed 6Gb	Moderately rapid	Moderate	B	.13	5	Moderate			
								5-15	Poor	Depth to rock
								15-30	Poor	Depth to rock
								30-40	Poor	Slope, depth to rock

[1]Derived from mapping unit interpretations provided by the USFS, supplemented by USGS VIEWIT slope information.
Column headings are defined in the glossary.

Range Sites

Range site descriptions applicable to soil map units occurring in the well field were taken from Soil Conservation Service standard technical guides (SCS 1977). The range sites were used in developing soil-vegetation correlation. The range site descriptions are presented in Appendix C for reference; a correlation between vegetation types and range sites is presented in the discussion of well field and corridor vegetation.

Interpretations

Soils interpretations provide basic baseline data information characterizing the capability and constraints of specific map units for specific uses. These interpretations along with chemical and physical characteristics provide the basis for defining rehabilitation units. Original interpretations for Bio/West map units are presented in Table 1-5. Soil engineering interpretations and rehabilitation interpretations for map units delineated by ERT are presented in Tables 1-2 and 1-3. FS soil interpretations are included in Table 1-7 and are presented in numerical order by mapping unit symbol.

Laboratory Data

Tables reporting results for ERT samples are included in Appendix D.

VEGETATION

Plant Community Descriptions

The vegetation descriptions for the well field area were compiled from three major sources: maps of existing vegetation, forest and non-forest habitat type classification documents, and existing range survey data. The attached vegetation map broadly describes the vegetation as it presently exists on the well field. However, for the purposes of describing impacts to vegetation and land use from well field development it is necessary to describe the current land use and existing vegetation instead of the potential or climax community.

The forest mapping units were derived from Bridger-Teton National Forest timber stand maps and rangeland mapping units were derived from BLM Unit Resource Area (URA) vegetation maps. The forest habitat types that comprise the mapping units were keyed out in the field and described from forest habitat classification documents pertinent to the region (Steele et al. 1979, Steele et al. 1981, Youngblood and Muegler 1981). The sagebrush habitat types that comprise the sagebrush mapping units were described from non-forest classification studies (Hironaka and Fosberg 1981, Bramble-Brodahl 1978). The willow and wet meadoe descriptions were derived from riparian vegetation classification studies (Norton et al. 1980, Mutz and Graham 1982) conducted in the Grey's River-Wyoming Range area.

Productivity and canopy cover estimates were derived from SCS range sites and from ocular range surveys conducted on BLM and Bridger-Teton Forest lands during the early 1960s.

Plant common and scientific names followed Plummer et al. (1977) and Nickerson et al. (1976).

Fifteen land cover map units or vegetation types were defined within the Riley Ridge well field study area (Table 1-8) Forest types (spruce-fir, mixed pine, Douglas-fir, and aspen) occupy 32 percent of the study area. Shrubland types (sagebrush, mountain shrub, greasewood, tall willow) occupy 56 percent of the study area, and the remaining types (meadow, bunchgrass, pasture/ hayland, clearcut, open water, and barren) comprise the remaining 12 percent of the land area. Forest types predominate above 8,000 feet in elevation, and shrublands occupy the ridges and valleys at lower elevations (Table 1-8).

The following discussions of each vegetation map unit includes a summary of its relative extent, topographic position, soil characteristics, dominant species, in the tree, shrub, and herbaceous strata, and forage and cover value.

Spruce-Fir

The Spruce-Fir map unit occupies 10,273 acres or 6 percent of the well field. The unit is characterized by overstory canopy dominance by subalpine fir (Abies lasiocarpa). Secondary overstory species include Engelmann spruce (Picea engelmannii), Douglas-fir (Pseudouga menziesii), lodgepole pine (Pinus contorta), and aspen (Populus tremuloides). Spruce-fir communities range between 8,000 and 10,000 feet, and occupy moderately steep north-facing slopes at lower elevations, and all slope angles at higher elevations. This forest type occupies deep, calcareous soils classified as loamy skeletal, clayey skeletal, or fine of the Cryoboralf and Cryoboroll Great Groups. Parent materials are sedimentary and metamorphic formations that include limestone, dolomites, and quartzites.

The two most abundant habitat types within this unit are the subalpine fir/gooseberry currant (Ribes montigenum) and subalpine fir/heartleaf arnica (Arnica cordifolia) habitat types (Table 1-9).

The subalpine fir/gooseberry currant habitat type is found principally at higher elevations (above 9,000 feet), and on steep north slopes . Engelmann spruce is a comparatively uncommon constituent of most stands, and the principal seral species is lodgepole pine (see Mixed Pine discussion). Tree stem density is frequently very high, and understory cover is very sparse. Ground cover was estimated to be 90 percent, consisting of 25 percent plant cover and 65 percent litter. Buffaloberry (Shepherdia canadensis) and gooseberry currant are frequently observed shrub species. Timber yield capability is low (less than 50 cubic feet/acre/year) (Steele et al. 1979).

The subalpine fir/heartleaf arnica habitat type is found on warmer slope exposures and lower elevations than the previous community. The principal seral species is lodgepole pine. Heartleaf arnica is the indicator species for the type and is often associated with buffaloberry, meadowrue (Thalictrum), geranium (Geranium), yarrow (Archillea millefolium), and fleabane (Erigeron). Timber yield capability is moderate (approximately 60 cubic feet/acre/year), and basal area is approximately 135 feet^2/acre.

TABLE 1-8

VEGETATION TYPES (ACRES) ON THE RILEY RIDGE WELL FIELD

Vegetation Type	Units and Area											
	Tip Top	Hogsback	Riley Ridge	North Riley Ridge	Darby Mtn.	Dry Piney	Lake Ridge	Graphite	Fogarty Creek	Sawmill Area	Total	(Percent)
Mixed Pine	--	--	1,395	3,571	9,624	979	7,933	1,464	1,248	--	26,214	(16.4)
Spruce/Subalpine Fir	19	--	538	2,784	1,210	26	2,874	13	2,707	102	10,273	(6.4)
Douglas-Fir	70	666	1,222	1,254	954	13	1,190	45	858	--	6,272	(3.9)
Aspen	358	26	1,139	2,803	134	672	973	429	1,395	1,203	9,132	(5.7)
Big Sagebrush	8,960	6	3,443	4,712	896	557	5,338	646	6,217	8,874	39,649	(24.8)
Sagebrush Complex	18,758	9,011	5,414	--	90	4,650	186	128	1,555	1,734	41,526	(25.9)
Mountain Shrub	634	538	--	--	538	--	--	--	--	--	1,710	(1.1)
Greasewood	256	--	--	--	--	--	--	--	--	--	256	(0.2)
Bunchgrass	896	806	1,427	2,400	1,370	115	1,274	550	1,408	269	10,515	(6.6)
Willow	525	-	557	1,024	365	45	672	--	262	1,306	4,756	(3.0)
Meadow	154	179	--	--	77	192	224	--	--	26	852	(0.5)
Pasture/Hayfield	1,210	--	435	198	--	26	--	--	166	3,712	5,747	(3.6)
Clearcut	--	--	448	134	1,235	6	326	352	45	--	2,546	(1.6)
Barren	--	--	--	--	397	--	--	13	--	--	410	(0.3)
Lake	--	--	--	--	70	--	--	--	--	--	70	(<.1)
TOTAL	31,840	11,232	16,018	18,880	16,960	7,281	20,990	3,640	15,861	17,226	159,928	(100.0)

Understory productivity is generally low in these forested areas, and consequently livestock grazing is minimal. These areas are good to excellent wildlife habitat because they provide cover in proximity to good forage areas (sagebrush, bunchgrass, and riparian areas). District timber volume data show the spruce-fir map unit averaging approximately 18,000 board-feet/acre.

Mixed Pine

The Mixed Pine map unit occupies 26,214 acres or 16 percent of the well field. The unit is characterized by overstory canopy dominance by pine species, principally lodgepole pine. Secondary overstory species include subalpine fir, Douglas-fir, and aspen. Mixed pine communities range from middle (8,000 feet) to high (10,000 feet) elevations on the study area. The unit occupies deep calcareous soils classified as loamy skeletal, clay skeletal, or fine of the Cryoboralf and Cryoboroll Great Groups. Parent materials are sedimentary and metamorphic formations that include limestone, dolomites, and quartzites.

The two most common habitat types within this unit are the subalpine fir/gooseberry currant and subalpine fir/heartleaf arnica habitat types (Table 1-9). The Mixed Pine communities represent a seral stage of the subalpine fir habitats described previously. Lodgepole stands are frequently even-aged, indicating that lodgepole seedlings established on sites cleared by fire or past logging. Young subalpine fir are common in the understory of these lodgepole pine communities, indicating that the subalpine fir is the climax dominant. On clear-cut sites, both lodgepole and subalpine fir were found to be reestablishing, but lodgepole pine was the most common species. Understory composition and ground cover of these seral stands is similar to that of the spruce-fir communities described previously.

A minor constituent of this unit is the whitebark pine (Pinus albicaulis)/Ross sedge (Carex rossii) habitat type that occurs on the summits and sides of wind-swept ridges. Representative sites for this habitat include Deadline Ridge and the west side of Mount Darby and Fish Creek Mountain. Other species present in this type include limber pine (Pinus flexilis) and lodgepole pine on drier slope aspects. Because of low understory cover, whitebark pine communities are not strongly influenced by fire. As a consequence, whitebark pine individuals are often very old (greater than 600 years), and show high basal areas (as much as 250 $feet^2$/acre) and consequent large biomass. Whitebark pine stands produce virtually no commercial timber, and yield capability is low (between 20 and 50 $feet^3$/year) (Steele 1979). The grass and forb understory is used by grazing animals, but offers little forage value because of low canopy coverage (25 percent). Bighorn sheep range into whitebark pine areas from adjacent grasslands and talus slopes.

Douglas-fir

The Douglas-fir map unit occupies 6,272 acres of 4 percent of the well field. The unit is characterized by overstory canopy dominance by Douglas-fir. The Douglas-fir communities range from approximately 8,000 to 9,000 feet on the study area. They generally occupy a drier and lower

TABLE 1-9

FOREST MAP UNITS, ASSOCIATED HABITAT TYPES, AND COMMUNITY TYPES
PRESENT ON THE RILEY RIDGE WELL FIELD AREA

Map Unit	Associated Habitat and Community Types	Source of Habitat Type Description
Spruce-Fir	Abies lasiocarpa/Ribes montigenum	Steele et al. (1979)
	Abies lasiocarpa/Arnica cordifolia	Steele et al. (1979)
Mixed Pine	Abies lasiocarpa/Ribes montigenum	Steele et al. (1979)
	Abies lasciocarpa/Arnica cordifolia	Steele et al. (1979)
	Pinus albicaulis/Carex rossii	Steele et al. (1979)
Douglas-Fir	Pseudotsuga menziesii/Arnica cordifolia	Steele et al. (1979)
	Pseudotsuga menziesii/Berberis repens	Steele et al. (1979)
Aspen	Populus tremuloides/Ligusticum filicinum	Youngblood and Mueggler (1981)
	Populus tremuloides/Berberis repens	Youngblood and Mueggler (1981)
	Populus tremuloides/Arnica cordifolia	Youngblood and Mueggler (1981)
	Populus tremuloides/Symphoricarpos oreophilus	Youngblood and Mueggler (1981)
	Populus tremuloides/Artemisia tridentata	Youngblood and Mueggler (1981)

elevation zone adjacent to the subalpine fir habitats. The largest stands occur on moderately steep north-facing slopes. Smaller stands are found on moderately steep to steep slopes on all aspects. This forest type occupies deep calcareous soils classified as loamy skeletal, clayey skeletal, or fine of the Cryoborall and Cryoboroll Great Groups. Parent material includes limestones, dolomites, and quartzites.

The most common forest habitat type within this map unit is the Douglas-fir/Oregon grape (Berberis repens) habitat type. In the study area, Douglas fir saplings are most prevalent tree species in the understory, resulting in generally homogeneous stands.

The Douglas-fir/Oregon grape type often adjoins the subalpine fir/heartleaf arnica habitat along a gradient of increasing elevation. The understory frequently consists of Oregon grape, myrtle pachistima (Pachistima myrsinites), and buffaloberry in the shrub stratum; heartleaf arnica, geranium, and elk sedge (Carex geyeri) are common constituents of the herbaceous stratum.

Ground cover was estimated at 95 percent, consisting of 20 percent plant cover and 75 percent litter cover. Vegetative ground cover is very sparse, and steep slopes limit access of livestock. These areas provide excellent wildlife cover. Yield capability is estimated as moderate (approximately 60 $feet^3$/ acre/year); basal area is estimated between 120 and 170 $feet^2$/acre (Steele 1979). District timber volume shows the Douglas-fir map unit averaging approximately 20,000 board feet/acre, the highest volume among the conifer units on the well field.

Aspen

The Aspen map unit occupies 9,132 acres or 6 percent of the well field. The unit is distinguished by overstory canopy dominance by aspen trees. Aspen communities occur throughout most of the altitudinal range of the forests within the well field. The majority of the aspen map unit is associated with moderately steep to steep north and south-facing slopes. The soil and parent material descriptions are consistent with previously described forest communities, except that soils are generally deeper under aspen than conifer stands. A representative soil under aspen stands is a Mollic Cryoboralf, fine loamy.

Five community types within the Aspen map unit are commonly found in the well field area. Aspen occurs as a seral species within the conifer forest, and also grows as large clonal patches with minimal conifer reproduction in the understory. Herbaceous understory cover averages approximately 60 percent, and litter provides 30 percent cover in most stands. The following community types represent reasonably stable units on the study area, and occupy the largest geographical area within the well field.

The most productive community type is the aspen/fern leaf ligusticum (Ligusticum filicinum) type. This type occurs on the most mesic (moist) sites along stream terraces, and in favorable snow accumulation areas at higher elevations. The type is characterized by dense, tall forb undergrowth commonly consisting of fernleaf ligusticum, sweet anise

(Osmorhiza occidentalis), and blue wildrye (Elymus glaucus). Both livestock and big game use this type extensively (Youngblood and Mueggler 1981). Youngblood and Mueggler (1981) estimated that average understory productivity was 1,180 pounds/acre in this community type.

The aspen/heartleaf arnica and aspen/Oregon grape community types commonly occupy steep, relatively dry slopes in the conifer zone. Subalpine fir and lodgepole pine saplings frequently grow in the understory, and eventual climax consists of a subalpine fir forest type. Average undergrowth productivity in aspen/heartleaf arnica and aspen/Oregon grape community types were 755 pounds/acre and 861 pounds/acre (Youngblood and Mueggler 1981).

The aspen/mountain snowberry (Symphoricarpos oreophilus) is the most widespread and important community type within the well field area. The type is characterized by an extensive ground cover of snowberry. A variety of grasses and forbs comprise the understory, including geranium, bedstraw (Galium sp.), mountain brome (Bromus carinatus), oniongrass (Melica bulbosa), blue wildrye (Elymus glaucus), and Kentucky bluegrass (Poa pratensis). This community type often adjoins mountain big sagebrush (Artemisia tridentata vaseyana) communities, and margins of aspen/snowberry communities often grade into an aspen/mountain big sagebrush community type. Average undergrowth productivity within the aspen/snowberry and aspen/big sagebrush types is estimated to be 1,058 pounds/acre and 749 pounds/acre (Youngblood and Mueggler 1981).

The aspen communities in the well field are intensively utilized by livestock during the summer. Understory composition of many stands has been altered by long-term grazing. Frequently these intensively grazed sites contain Kentucky bluegrass, a grazing-tolerant species, and substantial fractions of unpalatable forbs, such as coneflower (Rudbeckia sp.), sunflower (Helianthella), and Wyethia (Wyethia amplexicaulis).

Big Sagebrush

The Big Sagebrush map unit occupies 39,649 acres or 24 percent of the well field. The unit is characterized by the overstory dominance by one of four "big sagebrush" subspecies--Wyoming big sagebrush (Artemisia tridentata wyomingensis), mountain big sagebrush (Artemisia tridentata vaseyana), subalpine big sagebrush (Artemisia tridentata spiciformis), and Basin big sagebrush (Artemisia tridentata tridentata) (Table 1-10). Big sagebrush communities occupy a variety of soils including Typic Cryoborolls at higher elevations, and Argic Cryoborolls or Calciorthids forming on colluvium and alluvium on sideslopes at mid and lower elevations. In general, big sagebrush stands occupy sites where the argillic horizon (claypan) is deeper than that found under black or alkali sagebrush communities. Big sagebrush is generally excluded from sites with extremely shallow soils (e.g., Lithic Cryorthents) except where pockets of deeper soils have formed from wind or water actions.

The four subspecies of big sagebrush are segregated along precipitation and temperature gradients. The majority of the Wyoming big sagebrush and Basin big sagebrush communities lie below an elevation of 7,400 feet. This

TABLE 1-10

SAGEBRUSH MAP UNITS AND ASSOCIATED HABITAT TYPES ON THE RILEY RIDGE WELL FIELD

Map Unit	Associated Habitat Types	Source of Habitat Type Description
Big Sagebrush	Artemisia tridentata wyomingensis/Poa sandbergii	Hironaka and Fosberg (1981)
	Artemisia tridentata wyomingensis/Agropyron spicatum	Hironaka and Fosberg (1981)
	Artemisia tridentata vaseyana/Agropyron spicatum	Hironaka and Fosberg (1981)
	Artemisia tridentata vaseyana/Symphoricarpos oreophilus/Agropyron spicatum	Hironaka and Fosberg (1981)
	Artemisia tridentata spiciformis/Bromus carinatus	Hironaka and Fosberg (1981)
	Artemisia tridentata tridentata/Agropyron spicatum	Bramble-Brodahl (1978)
Sagebrush Complex	Artemisia tridentata vaseyana/Agropyron spicatum	Hironaka and Fosberg (1981)
	Artemisia nova/Agropyron spicatum	Hironaka and Fosberg (1981)
	Artemisia longiloba/Agropyron spicatum	Bramble-Brodahl (1978)

elevation line generally coincides with the boundary between cryic and frigid soils. Mountain big sagebrush occupies the mid to upper elevations on the well field, and commonly adjoins aspen and conifer communities. The subalpine big sagebrush communities are found at the highest elevations, generally above 9,500 feet.

The Wyoming big sagebrush/Sandberg bluegrass (Poa sandbergii) habitat type represents the most xeric (driest) of the big sagebrush habitat types. This well field habitat type occupies the lowland areas in the eastern portion of the well field and characteristically receives 10 inches or less annual precipitation. A common associate of this habitat type is Hoods phlox (Phlox hoodii). At a higher elevation and greater annual precipitation (12 inches), the Wyoming sagebrush/bluebunch wheatgrass (Agropyron spicatum) habitat type predominates. Other important grass species in this type include Sandberg bluegrass, Thurber needlegrass (Stipa thurberiana), and squirreltail (Sitanion hystrix). Needle-and-thread grass (Stipa comata) increases in importance on coarse-textured soils, and thickspike wheatgrass (Agropyron dasystachum) increases in importance on fine-textured soils. Shrub density within the Wyoming big sagebrush communities averages 4,700 plants/acre (Winward no date). These two habitat types occur on the Loamy range site (10 to 14-inch precipitation zone) which is characterized by productivity levels ranging from 700 to 1,500 pounds/acre with an average production of 1,200 pounds/acre. This range site is dominated by grass species (75 percent composition by weight) with cover estimates ranging from 40 to 50 percent (Table 1-11). The Basin big sagebrush/Agropyron spicatum is a minor habitat type that occupies the lower elevations in the northern and eastern portion of the well field. Basin big sagebrush commonly occurs on deep, fine textured soils associated with swales, valley bottoms, and roadsides. A common associate of this habitat type is rabbitbrush (Chrysothamnus spp.). Common grass and forb species include western wheatgrass (Agropyron smithii), bluebunch wheatgrass, thickspike wheatgrass, and sulfur flower buckwheat (Eriogonum umbellatum). The overflow (10 to 14-inch) range site correlates with this habitat type. Production estimates range from 1,200 to 2,200 pounds/acre. Current production is generally much lower than these estimates due to heavy grazing pressure. Based on SCS range site data, ground cover averages 60 to 75 percent (Table 1-11).

The Mountain big sagebrush/bluebunch wheatgrass habitat occupies the lower elevations (7,500-8,500 feet) of the well field, and generally occurs below the elevation of most of the conifer zone. The habitat type is characterized by the presence of bluebunch wheatgrass. In the well field, other important grass species including Letterman needlegrass (Stipa lettermanii), Sandberg bluegrass, and Great Basin wildrye (Elymus cinereus), and spike fescue (Hesperochloa kingii). Bitterbrush (Purshia tridentata) is frequently an important constituent of communities within this type, especially along south-facing slopes. Range sites that correlate with the mountain big sagebrush/bluebunch wheatgrass habitat type include Shallow Loamy (15 to 19-inch), Gravelly (15 to 19-inch), and Loamy (15 to 19-inches). Average production for these range sites range from 750 to 2,000 pounds/acre. Grass species (65 to 75 percent composition by weight) dominate these range sites and ground cover estimates range from 30 to 65 percent (Table 1-11). The mountain big sagebrush/mountain snowberry (Symphoricarpos oreophilus) habitat type predominates in the middle to upper (8,000-9,000 feet) elevations of the well field and frequently adjoin aspen

TABLE 1-11

WELL FIELD VEGETATION TYPE/HABITAT TYPE/RANGE SITE[1] CORRELATION SUMMARY

Vegetation Type	Habitat Type	Range Site (Precipitation Zone)	Annual Production Estimates (pounds/acre)	% Composition by Weight			% Ground Cover
				Grass	Forb	Shrub	
Big Sagebrush	Artemisia tridentata vaseyana/ Agropyron spicatum	Shallow Loamy (15-19")	800-1,700 (1,400)[2]	65	10	25	30-65
		Gravelly (15-19")	650-1,250 (750)	65	15	20	35-40
		Loamy (15-19")	1,400-2,400 (2,000)	75	15	10	55-60
	Artemisia tridentata vaseyana/ Symphoricarpos oreophilus/ Agropyron spicatum	Loamy (15-19")	1,400-2,400 (2,000)	75	15	10	55-60
	Artemisia tridentata spiciformis/ Bromus carinatus	Loamy (15-19")	1,400-2,400 (2,000)	75	15	10	55-60
	Artemisia tridentata tridentata Agropyron spicatum	Overflow (10-14")	1,200-2,200 (1,800)	65	15	20	60-75
	Artemisia tridentata wyomingensis/ Poa sandbergii	Loamy (10-14")	700-1,500 (1,200)	75	10	15	40-50
	Artemisia tridentata wyomingensis/ Agropyron spicatum	Loamy (10-14")	700-1,500 (1,200)	75	10	15	40-50
Sagebrush Complex	Artemisia tridentata vaseyana/ Agropyron spicatum	Shallow Loamy (15-19")	800-1,700 (1,400)	65	10	25	30-65
		Gravelly (15-19")	650-1,250 (750)	65	15	20	35-40
		Loamy (15-19")	1,400-2,400 (2,000)	75	15	10	55-60
	Artemisia nova/ Agropyron spicatum	Shallow Loamy (15-19")	800-1,700 (1,400)	65	10	25	30-65
		Very Shallow (15-19")	450-750 (600)	65	10	25	30-35
		Loamy (15-19")	1,400-2,400 (2,000)	75	15	10	55-60
		Dense Clay (15-19")	800-1,500 (1,200)	75	15	10	60-65
		Shallow Clayey (10-14")	500-1,000 (750)	75	5	20	40-50

TABLE 1-11 (CONTINUED)

Vegetation Type	Habitat Type	Range Site (Precipitation Zone)	Annual Production Estimates (pounds/acre)	% Composition by Weight Grass	Forb	Shrub	% Ground Cover
Greasewood		Saline Upland (7-9")	300-600 (450)	55	5	45	20-40
Pasture/Hayfield		Loamy (10-14")	700-1,500 (1,200)	75	10	15	40-50
		Subirrigated (15-19")	3,500-5,500 (4,500)	65	20	15	85-100
		Subirrigated (10-14")	3,000-4,500 (3,800)	65	20	15	85-100
Aspen and Conifer[3]							

[1]SCS Range Site Description Data (November 1977)

[2]Average Annual Production

[3]No Range Site Descriptions Available

communities that contain a snowberry understory. This habitat type contains a diverse mixture of grasses and forbs. Typical species include sulfur flower buckwheat, lupines (Lupinus), arrowleaf balsamroot (Balsamorhiza sagittata), junegrass (Koeleria cristata), spike fescue, and Kentucky bluegrass. Shrub density in mountain big sagebrush communities averages 17,000 plants/acre (Winward no date). The loamy (15 to 19-inch) range site correlates with this habitat type. Production estimates range from 1,400 to 2,400 pounds/acre, with an average of 2,000 pounds/acre. Ground cover estimates range from 55 to 60 percent with grass species approximately 75 percent composition by weight (Table 1-11).

The subalpine big sagebrush/mountain brome (Bromus carinatus) habitat type occurs at high elevations in the western portion of the well field. Important constituents of this type include mountain brome, mountain snowberry, and spike fescue. These communities commonly adjoin bunchgrass and whitebark pine communities on high, windswept ridges. Estimated density is 8,500 plants/acre. Production and cover estimates of the Loamy range site (described in previous habitat type) are applicable to the subalpine big sagebrush/mountain brome habitat type.

The big sagebrush communities on the well field represent important summer grazing areas for cattle and sheep. Letterman needlegrass, Sandberg bluegrass, and Kentucky bluegrass are species that increase in importance with sustained grazing. These three species are abundant throughout the sagebrush communities in the well field.

Sagebrush Complex

The Sagebrush Complex map unit occupies 44,168 acres or 27 percent of the well field. The unit is characterized by the dominance of "low" sagebrush species, black sagebrush (Artemisia nova) and alkali sagebrush (Artemisia longiloba) (Table 1-10). Mountain big sagebrush is also an important constituent of this type. The "low" sagebrush species generally grow to a height of 8 to 12 inches. Associated big sagebrush commonly grow to a height of 18 to 36 inches. This unit consists of a mosaic of the three species. Each species commonly forms discrete patches of 5 acres or less.

The mountain big sagebrush/bluebunch wheatgrass habitat, the most important big sagebrush component within this map unit, was described previously. This habitat type occurs primarily along drainage bottoms and on small areas of deeper soils on slopes.

The black sagebrush/bluebunch wheatgrass habitat type is most strongly associated with limestone and limestone-derived soils on the well field. Soils under this habitat type range from extremely shallow Lithic Cryorthents to deeper soils with abundant coarse fragments (Typic Cryorthent, loamy skeletal; Ustic Torriorthent, fine loamy mixed). Good examples of black sagebrush-dominated sites occupy the slopes of Cretaceous Mountain and the Hogsback. Black sagebrush also mixes with alkali sagebrush on many sites. Black sagebrush is generally less prevalent than alkali sagebrush on soils derived from shale and sandstone parent materials (e.g., Wasatch Formation). Other important understory constituents in this type include bottlebrush squirreltail, Sandberg bluegrass, Hood's phlox, and wild buckwheat (Eriogonum). Five range sites can be correlated with the

black sagebrush/bluebunch wheatgrass habitat type (Table 1-10). Production estimates range from 450 to 2,400 pounds/acre with average annual production at 600 to 2,000 pounds/acre. Ground cover estimates range from 30 to 65 percent with grass species accounting for 75 percent composition by weight.

Alkali sagebrush (Artemisia longiloba) is most commonly associated with needlegrasses and wheatgrasses on the well field. An alkali sagebrush/ bluebunch wheatgrass habitat type recognized by Bramble-Brodahl (1978) describes the alkali sagebrush-dominated sites in the well field. Alkali sagebrush communities commonly occupy fine-textured soils with a shallow (12 inches or less) claypan layer (e.g., Argic Cryoborolls). Commonly encountered understory species include bluebunch wheatgrass, Sandberg bluegrass, Indian ricegrass, Letterman needlegrass, and needle-and-thread grass. Three range sites [Gravelly (15 to 19-inch), Loamy (10 to 14-inch) and Shallow Clayey (10 to 14-inch)] can be correlated with this habitat type. Average annual production estimates range from 750 to 1,200 pounds/ acre. Ground cover averages over 40 percent with grasses dominating the percent composition by weight (Table 1-11).

The Sagebrush Complex map unit is extensively grazed or browsed by sheep, cattle, antelope, and mule deer.

Mountain Shrub

The Mountain Shrub map unit occupies 1,710 acres or 1 percent of the well field. The unit is characterized by an overstory dominance by mountain shrub species: true mountain mahogany (Cercocarpus montanus), serviceberry (Amelanchier alnifolia), and mountain snowberry. Mountain big sagebrush is also a common associate. The unit generally occurs as small linear bands along the slopes of major ridges at lower elevations (7,500-8,500 feet). A representative location for this type is the east slope of the Hogsback in the Tip Top Unit. The unit occupies very shallow soils (e.g., Lithic Cryorthents) and colluvial soils on slopes (Argic and Pachic Cryoborolls, loamy skeletal).

The understory of this unit consists of a mixture of grasses and forbs, most typically bluebunch wheatgrass, spike fescue, slender wheatgrass, Indian ricegrass, sulfur buckwheat, and lupine. Ground cover ranges from 20 to 30 percent for small isolated areas associated with rock outcrops, to 50 to 60 percent cover for the largest extent of this type along the east side of Hogsback. Shallow Loamy (10 to 14-inch) and Shallow Loamy (15 to 19-inch) range sites correlate with this vegetation type. Annual production estimates range from 900 to 1,400 pounds/acre (see Table 1-11).

Greasewood

The Greasewood map unit occupies 256 acres or 0.2 percent of the well field. This unit is characterized by an overstory dominance by greasewood (Sarcobatus vermiculatus). This type occurs along drainage bottoms and basin floors in the extreme eastern portions of the well field at low (7,000 feet) elevations. Soils underlying greasewood stands are typically deep, fine-textured Natrargids with high sodium content and high pH. Common understory associates with greasewood include several annual forbs such as

goosefoot (Chenopodium), tansymustard (Descurainia), and perennial grasses such as thickspike wheatgrass (Agropyron dasystachyum) and inland saltgrass (Distichlis stricta). The Saline Upland (7 to 9-inch) range site correlates with this vegetation type. Shrub species account for approximately 45 percent composition by weight. Estimated shrub canopy cover is 20 percent; herbaceous ground cover ranges from 20 to 40 percent. Estimated herbaceous annual production ranges from 300 to 600 pounds/acre. This unit is grazed by both sheep and cattle in the well field area.

Bunchgrass

The Bunchgrass map unit occupies 10,515 acres or 6.5 percent of the well field. The unit is characterized by a low-growing, single stratum community dominated by grasses and forbs. Sagebrush patches consisting of mountain big sagebrush, alkali sagebrush, and black sagebrush occur as inclusions within this type.

The grassland communities commonly occur through the 8,000 to 10,000 foot elevation range with the majority of the grassland areas concentrated at the 8,000 to 8,500 foot elevations. At the highest elevations, this map unit includes a subalpine to alpine plant community. The most exposed windy sites along the axis of the mountain ridges are occupied by a cushion plant community characteristic of the alpine zone. In the lee of the ridges where windspeeds are less and snow accumulation is greater, a bunchgrass and sedge community predominates. Grass and sedge heights may attain 6 to 12 inches. At lower elevations this type generally occurs on the summits and also moderately steep to steep south-facing slopes of the major ridges (Cretaceous Mountain, The Hogsback) and mesas. The bunchgrass communities occupy shallow (with inclusions of moderately deep) calcareous soils classified as loamy skeletal Cryorthents. Parent materials consist of limestone (Madison Formation) and sandstone/shale (Green River Formation). The majority of the soils of the bunchgrass type within the study area are derived from limestones.

Common species include bluebunch wheatgrass (Agropyron spicatum), fringed sagebrush (Artemisia frigida), spike fescue (Hesperochloa kingii), Hood's phlox (Phlox hoodii), penstemon (Penstemon sp.), fernleaf fleabane (Erigeron compositus), and sandwort (Arenaria sp.).

Ground cover was estimated at 80 percent with rocks (cobbles, gravels) accounting for approximately 40 percent. Five range sites correlate with the bunchgrass type. Ground cover estimates range from 30 to 65 percent (Table 1-10). The bunchgrass communities do not provide significant cover but do provide valuable forage for wildlife and livestock, especially at higher elevations. Estimated average annual production ranges from 600 to 2,000 pounds/acre based on SCS range site potential production levels.

Willow

The Willow (Salix) type occupies 4,756 acres or 2.9 percent of the well field. The type is distinguished by shrub willow thickets that provide 50 percent or more of the vegetative canopy cover on a site. The type occurs most extensively on the floodplains of major streams (South Piney, Middle Piney, LaBarge Creek, Fontenelle Creek) and as small patches on

smaller streams and intermittent drainages. Along stream drainages on the east side of the Wyoming Range, willow communities commonly occur on soils classified as Typic, Aquic, or Cumulic subgroups of Cryoborolls (Mutz and Graham 1982).

The Wolf willow (Salix wolfii), Booth willow (Salix boothii), and Coyote willow (Salix exigua) dominance types (Mutz and Graham 1982) are recognized from the riparian zones of streams along the east side of the Wyoming Range. Wolf willow forms low (0.5 meter to 1.5 meter) thickets at elevations generally above 8,000 feet. Booth willow and Coyote willow form taller stands (2 meters and taller) at elevations below 8,000 feet. Other shrubs commonly associated with the dominant willows include silver sagebrush (Artemisia cana), shrubby cinquefoil (Potentilla fruticosa), and birch (Betula glandulosa). Important herbaceous species in the understory of willow communities include beaked sedge (Carex rostrata), Kentucky bluegrass (Poa pratensis), miterwort (Mitella pentandra, and alpinebog swertia (Swertia perennis). Two range sites (Wetland 10 to 14-inch, Wetland 15 to 19-inch) correlate with SCS potential production levels. Ground cover ranges from 85 to 100 percent. Estimated average herbacous production ranges from 5,000 to 6,000 pounds/acre.

The willow shrubs represent important browse for moose. The herbaceous understory is extensively grazed by livestock. The importance of Kentucky bluegrass in many areas suggests that the herbaceous composition has been altered by long-term grazing. Kentucky bluegrass is able to invade and thrive on mesic sites under intensive grazing where native species are eliminated (Daubenmire 1970). Beaver are an important influence on the distribution of willows in the well field area. Beaver dams widen the riparian zone, offering additional sites favorable for willow growth.

Meadow

The Meadow map unit occupies 852 acres or 0.5 percent of the well field. This unit is characterized by dominance of the riparian zones by herbaceous species (sedges, rushes), and low shrubs [silver sagebrush (Artemisia cana)]. Tall willows provide less than 50 percent of the canopy cover on the site. The Meadow unit is further distinguished from the pasture/hayland unit by being free from any evidence of human manipulation (irrigation ditches, hay stacks). The map unit occupies small areas along the major streams in the well field area. The Overflow (15 to 19-inch) and Wetland (10 to 14-inch) range sites are applicable to the meadow vegetation type (Table 1-11).

The three principal herbaceous cover types are recognized from streams in the well field area. Two sedge types include a beaked sedge-water sedge (Carex aquatilis) component and an analogne sedge (Carex simulata) component on very wet sites. Soils under these sites include Histosols, Cryaquents, and histic Cumulic and Aquic Cryoborolls. Canopy cover averages 90 percent; herbaceous production is estimated to range from 700 to 2,150 pounds/acre (Mutz and Graham 1982). A Baltic rush (Juncus balticus) component is recognized as a very minor cover type along several stream drainages. Baltic rush occupies both very wet sites and sites that become seasonally dry.

Two units that contain low shrubs are included in the Meadow map unit. A bush cinquefoil (Potentilla fruticosa)/hairgrass (Deschampsia caespitosa) cover type is recognized from several drainages in the study area. The component represents a transition between the wetter willow sites to the drier silver sagebrush sites on terraces. Bush cinquefoil provides approximately 30 percent canopy cover, and herbaceous species approximately 60 percent; annual herbaceous production is estimated to range from 770 to 1,700 pounds/acre (Mutz and Graham 1982). Terraces along streams are frequently dominated by a silver sagebrush/Idaho fescue cover type. Silver sagebrush averages 30 percent cover, and the herbaceous stratum provides up to 80 percent cover. Orange sneezeweed (Helenium hoopsei) and western yarrow (Achillea millefolium) are two unpalatable forbs that have increased under sustained grazing in this cover type. Estimated annual herbaceous production ranges from 750 to 1,850 pounds/acre (Mutz and Graham 1982).

As discussed above, livestock intensively use the riparian zone of most streams. Based on soil moisture regimes, Mutz and Graham (1982) suggest that road building be avoided on the perennially moist sedge, rush, and bush cinquefoil community types. Road building would be more acceptable in the silver sagebrush/hairgrass community type.

Pasture/Hayfield

The Pasture/Hayland map unit occupies 5,747 acres or 3.5 percent of the well field. The unit lies in the riparian zone of the major streams, and consists of an herbaceous community containing tame grasses (smooth brome, timothy) as well as native wetland species (rushes, sedges). The unit is distinguished from the Meadow unit by evidence of diversion ditches, hay mowing, and haystacks. Three range sites based on potential natural vegetation are described in Table 1-11.

Clearcut

The Clearcut map unit occupies 2,546 acres or 1.6 percent of the well field area. Clearcuts represent logged areas in the Spruce-Fir and Mixed Pine map units in the western portion of the well field. Clearcuts characteristically contain conifer saplings (lodgepole pine, subalpine fir), gooseberry currant, and various grasses and forbs [spike trisetum (Trisetum spicatum)], Ross sedge, Kentucky bluegrass, avens (Geum triflorum), and fleabane (Erigeron). Most mapped clearcuts represent very early stages of regeneration. Most saplings are less than 10 feet tall, and conifer reproduction is scattered and generally sparse (1 to 5 saplings/ 100 meter^2). Most clearcuts are grazed by cattle during the summer. Production yields in these areas are estimated to be comparable to those obtained in the most favorable bunchgrass sites.

Barren

The Barren map unit occupies 410 acres or 0.3 percent of the well field area. This category is applied to very steep rocky talus slopes in the Darby Mountain and Graphite Units.

Lake

The Lake map unit occupies 70 acres and is applied to the surface area of Middle Big Piney Lake.

Weeds

One noxious weed (Wyoming Department of Environmental Quality 1981) observed in many locations on the well field was Canadian thistle (Cirsium arvense). This rhizomatous species was especially common in the conifer zone, especially in clear cuts. Other economically important weed species present on the well field included musk thistle (Carduus nutans) seen invading reseeded rights-of-way, and halogeton (Halogeton glomeratus), which was found growing in disturbed areas along roadsides at lower (below 7,500 feet) elevations. Halogeton was observed to be quite abundant on disturbed sites in the vicinity of Opal, and eastward from Opal along roads to Rock Springs.

Threatened, Endangered, and Rare Plant Species

A summary of the rare plant populations potentially affected by the Riley Ridge Project is presented in Table 1-11. The information sources used in compiling this data include:

- U.S. Fish and Wildlife Service published list of candidate threatened and endangered plant species for the United States [Federal Register - FR 45 (242): 8240-82569].

- Wyoming Natural Heritage Program working rare plant list.

The federal and state status designations for the eight plant species of concern are explained below:

- Federal Category 2 species include those that may be threatened or endangered, but for which insufficient information is available.

- Federal Category 3C species include those that are no longer being considered for listing as Endangered or Threatened since they have proven to be more abundant or widespread than previously believed and/or are not subject to any identifiable threat.

- Federally Unique species have no federal status, but due to limited distribution are considered unique by the Wyoming Natural Heritage Program.

- State Threatened plants, as defined by the Wyoming Natural Heritage Program, include those species which are likely to be endangered in the foreseeable future through all or a significant portion of its range.

- State Rare plants, as defined by the Wyoming Natural Heritage Program, include those species or subspecies which are uncommon in Wyoming but may be common elsewhere or may be locally abundant in Wyoming but rare or absent elsewhere.

The eight rare plant species listed in Table 1-12 are known to occur in the vicinity of the project facilities (Sweetwater, Lincoln, and Sublette counties). Documented populations of three rare plant species, (Astragalus paysonii, Penstemon paysoniorum, and Oxytheca dendroidea), potentially could be affected by the proposed and/or alternative project facilities. No documented populations of the five remaining species considered would be affected by the proposed and/or alternative project facilities.

TABLE 1-12

RARE PLANT POPULATION SUMMARY FOR WELL FIELD AND CORRIDOR AREAS

Species	Status	Habitat	Documented Population Locations in Relation to Project Facilities[1]	Notes
Astragalus paysonii	Federal Category 3C (USFW)[2] State Threatened (WNHP)[1]	Common on burned slash areas associated with clearcuts less than 2 to 3 years old.	Four populations near Mount Darby within Darby Mountain Unit.	-Southernmost population near access road (two-lane gravel) -Three populations not impacted by project facilities
Physaria condensata	Federal Candidate (Category 2) (USFW) State Threatened (WNHP)	Occurs on calcareous to shaley hills, exposed knolls.	No populations occur within the well field and proposed or alternative route corridors.	Documented populations occur in Lincoln and Sublette counties.
Physaria dornii	Not federally listed (USFW) Federally Unique/ State Unique (WNHP)	Calcareous to shaly hills.	No populations occur within the well field and proposed or alternative route corridors.	Documented populations in Lincoln County
Penstemon paysoniorum	Federal Candidate (Category 3C) (USFW) State Rare (WNHP)	Endemic to Wyoming, mostly found on calcareous, clay slopes usually barren of most other vegetation.	Within 1-mile wide corridors of: -Transmission line to sulfur loadout. -Transmission line from NPP to Craven Creek Site. -CO_2 pipeline from Craven Creek Site to MAPCO. -Railroad spur to Craven Creek Site.	Documented populations in Sweetwater and Uinta counties
Oxytheca dendroidea	Not federally listed (USFW) Federally Unique/ State Rare (WNHP)	Sandy soils of the valley of the Upper Green River and dry roadsides.	Within 1-mile wide corridor of Railroad from West Dry Basin to Stauffer Chemical Spur.	Documented populations in Sublette County

TABLE 1-12 (CONTINUED)

Species	Status	Habitat	Documented Population Locations in Relation to Project Facilities[1]	Notes
Eriogonum acaule	Not federally listed (USFW) Federally Unique/ State Rare (WNHP)	Endemic to Wyoming, generally occurs on sagebrush flats to rocky knolls.	No populations occur within the well field and proposed or alternative route corridors.	Documented populations in Sweetwater and Lincoln counties.
Trifolium wormskjoldii	Not federally listed (USFW) Federally Unique/ State Rare (WNHP)	Alkaline meadows.	No populations occur within the well field and proposed or alternative route corridors.	Documented population in in Sublette County (6 miles NE of Big Piney)
Eriogonum divaricatum	Not federally listed (USFW) Federally Unique/ State Rare (WNHP)	Clay soils of flat to sloping saltbush and sagebrush communities.	No populations occur within the well field and proposed or alternative route corridors.	Documented populations in Uinta and Sweetwater counties
Cryptantha scoparia	Not federally listed (USFW) Federally Unique/ State Rare (WNHP)	Dry slopes and flats often in sagebrush communities.	No populations occur within the well field and proposed or alternative route corridors.	Documented populations in Sweetwater County

[1]Wyoming Natural Heritage Program data.

[2]USFS Federal Register (December 15, 1980).

Plant Community Regeneration

An important consideration in evaluating the short and long-term effects of disturbance is the time required for components of the pre-existing vegetation strata (herbaceous, shrub, tree) to re-establish at previous levels of canopy cover and height. Note that restoration of vegetative strata to pre-existing levels differs from vegetative site stabilization by requiring a longer period of time.

Rate of regeneration by vegetation is affected by a variety of factors. Among the most important are climate, soils, availability of seed sources, interspecific competition, and herbivores. The following is a brief description of how these major factors influence the rate of establishment and vigor of plants on disturbed sites.

Annual precipitation in the Riley Ridge Project area is highly variable from year to year, which affects the number of new seedlings that can establish in a given year. One favorable year may be followed by several unfavorable years. The risk of insufficient precipitation for establishment is especially high in zones receiving less than 10 inches of annual precipitation. Such areas will require intensive rehabilitation efforts and follow-up maintenance until plant re-establishment is successful.

Soil chemistry, depth, slope angle, and slope aspect influence the probability of seedling establishment, and the long-term vigor of the plant community. The BLM (1979) states that successful revegetation is nearly impossible on slopes in excess of 30 percent. These soil chemistry and topographic factors are considered in detail in the rehabilitation potential evaluations.

Seed sources of adapted species must have the opportunity to grow on disturbed sites. Under natural conditions, seed from surrounding communities must be disseminated into the disturbed areas by wind, water, and rodents.

Interspecific competition influences the species that can establish over a given period of time, and the rate at which other species can successfully invade areas dominated by species characteristic of an earlier stage of secondary succession. Highly competitive weeds such as halogeton, cheatgrass (Bromus tectorum), and Canadian thistle can impede the re-establishment of more desirable grasses and forbs.

Herbivores have a profound effect on the rate of vegetation establishment. Livestock (cattle and sheep) as well as smaller mammals (rabbits, mice) may retard the rate of growth, as well as reproductive potential of plants.

The following is a summary of plant community recovery times developed from a review of the forestry and range literature for vegetation types similar to those on the Riley Ridge study area. Age-growth curves for conifers after harvesting, and measurements on shrub canopy cover and density after fires or spraying provide indices of regeneration time.

Alexander (1974) estimates that both Engelmann spruce and lodgepole pine can attain a height of 70 feet in 100 years on an average site in the subalpine zone in the central Rocky Mountains. Schier (1975) states that aspen attains maturity (30 to 50 feet) in 80 to 100 years. Giese (1982) observed that initial natural reestablishment of lodgepole pine was good on disturbed drill pads in the Bridger-Teton National Forest, but that growth rates were very slow, and mortality among saplings was high.

Recovery of sagebrush after fire and herbicide spraying is highly variable. Johnson (1969) found that big sagebrush reached pre-spraying density after 14 to 17 years on a big sagebrush/wheatgrass site at 6,800 feet in the 9-inch precipitation zone near Lander, Wyoming. In the same study, live crown area in the sprayed area was approximately 50 percent of the crown area of unsprayed plots after 14 years. Thilenius and Brown (1974) found that big sagebrush attained from 8 to 40 percent of pre-spraying canopy cover after 10 years in the Big Horn Mountains, Wyoming. Harniss and Mueggler (1973) estimated that sagebrush had regained pretreatment cover after 30 years on a site near Dubois, Idaho. Cook (1974) studied secondary succession on low elevation (6,000 feet) sagebrush sites that had been disturbed by construction in the Piceance Basin, Colorado. He found that a perennial grass community became established after about 8 years, and that a shrub/grass community dominated by sagebrush and rabbitbrush became important by 15 to 17 years after disturbance. In the same study, Cook observed a shrub/grass community developing on disturbed high elevation (8,000 feet) after 8 years, and a taller shrub component consisting of serviceberry, snowberry, and Gambel oak developing after 15 years.

Wright et al. (1979) evaluated the capacity of a variety of native shrubs to resprout or reseed after fire. They estimate that weak-sprouters such as sagebrush require 30 years to regenerate, bitterbrush 30 to 40 years, rabbitbrush 20 to 25 years, and serviceberry 30 to 50 years. Strong post-fire sprouters such as snowberry require only 10 years to reach former size and cover.

Regeneration of the herbaceous stratum is highly variable, depending upon the availability of nearby seed sources and the amount of viable seed already present in disturbed soils. Based on observations along the Northwest Pipeline between Big Piney and Opal, native species of grasses (thickspike wheatgrass, Indian ricegrass, squirreltail, and Sandberg bluegrass) were important constituents of pipeline right-of-ways approximately 14 years after construction.

Applicable and effective revegetation practices greatly accelerate the opportunities for plant establishment, usually resulting in faster rates of recovery than could be expected from natural reseeding. For the southwestern Wyoming region, the BLM (1979) estimates that successful understory revegetation (equivalent ground cover to pre-disturbance conditions) can be realized from 3 to 5 years in zones receiving greater than 9 inches of precipitation; and from 5 to 8 years in zones receiving less than 9 inches annually, assuming that effective seedbed preparation, planting, and soil protection measures were applied. For the Uinta Basin in Utah, which contains a number of vegetation types present in the Riley Ridge

study area, the estimated understory vegetation recovery time is 3 to 10 years (BLM 1982). Understory recovery under proper revegetation and management in the Bridger-Teton National Forest was estimated to be 4 to 5 years (Giese 1982). On a site dominated by Mountain big sagebrush in northwestern Colorado, it was found that canopy cover of a crested wheatgrass seeding ranged from 30 to 38 percent after six years, as compared to a combined canopy cover (grass, forb, shrub) of 38 to 47 percent on native range (Laycock and Conrad 1981).

In summary, it is estimated that under natural re-invasion conditions, the forest communities on the Riley Ridge project area require 50 to 100 years to reach maturity; tall shrub communities such as Willow, Mountain Shrub require 20 to 50 years; and sagebrush communities require 10 to 30 years. Natural reinvasion by perennial herbaceous communities usually requires 5 to 10 years.

Reestablishment of the herbaceous cover after effective revegetation measures have been applied on suitable sites generally requires 5 years or less in precipitation zones above 9 inches. Reestablishment of shrub and tree components will follow rates described above. A greater risk of longer revegetation times can be expected in areas receiving less than 9 inches. The mixed desert shrub, saltbush, greasewood, and big sagebrush vegetation types in the transportation corridors in the southern portion of the study area represent communities where revegetation times may exceed 5 years.

CORRIDORS AND PLANT SITES

SOILS

Soils and vegetation affected by corridors and plant sites related to the proposed action and alternatives are described below. Soils and vegetation are discussed together and present discussions on the following topics; map units, series descriptions, range sites, soil interpretations, laboratory data, and plant communities. Map 1-5, in the Map Pocket, presents soils and vegetation for the corridors and plant sites.

Map Units

Corridors and plant sites were evaluated using a reconnaissance level (Order 3) survey. Corridor soils were mapped in conjunction with landform characteristics or "geomorphic units". Table 1-13 presents a guide to soils map units, for the corridors. Table 1-14 presents a guide to geomorphic units and follows the soil description section. The units were correlated to a corresponding soil association, and vegetation types were delineated based on photointerpretation and ground checks. Table 1-15 presents a correlation guide for geomorphic units, soils and vegetation; and Table 1-16 presents soils interpretations for the ERT corridor survey area. Corridor mapping within the well field reflects general geomorphic characteristics only. For appropriate soil, vegetation, and climatic descriptions, refer to the well field soil survey and vegetation maps (Maps 1-3 and 1-4).

TABLE 1-13

GUIDE TO CORRIDOR AND PLANT SITE SOIL MAPPING UNITS

(AS SURVEYED BY ERT)

Symbol	Mapping Unit	Rehab. Unit[1]
101	Typic Fluvaquents, loamy over sandy skeletal--Typic Torrifluvents loamy over sandy-skeletal. Level and nearly level	A1
102	Typic Torrifluvents, loamy,--Typic Natrargids, loamy and fine. Level and nearly level	A2
103	Typic Calciorthids, loamy--Typic Torriorthents, loamy. Nearly level to gently sloping	A3
104	Typic Torrifluvents, loamy--Typic Natrargids, loamy and fine--Typic Torripsamments. Gently sloping to rolling	A2
105	Typic Torrifluvents, loamy over sandy skeletal--Typic Natragids loamy and clayey over sandy-skeletal. Nearly level to gently sloping	A2
107	Typic Torrifluvents, loamy--Typic Natrargids, loamy and fine. Gently sloping to rolling	A2
109	Ustic Torriorthents, loamy--Ustertic Torriorthents, fine. Gently sloping to rolling	B2
203	Typic Camborthids, loamy--Typic Calciorthids, loamy. Gently sloping to rolling	A3
204	Typic Torriorthents, loamy,--Typic Calciorthids, loamy. Rolling to steep	A4
206	Typic Torriorthents, loamy--Typic Calciorthids, loamy. Gently sloping to rolling	A3
207	Badlands--Typic Torriorthents, loamy, shallow. Gently sloping to rolling	A4
224	Typic Torriorthents, loamy, shallow--Lithic Torriorthents, loamy--Shale Outcrop Escarpments. Steep and very steep	A4
309	Lithic Ustic Torriorthents, loamy-skeletal,--Ustic Torriorthents, clayey, shallow. Gently sloping to rolling	B3
310	Lithic Ustic Torriorthents, loamy skeletal--Ustic Torriorthents clayey, shallow. Rolling to steep	B3

[1]Rehabilitation units are identified in Table 1-18.

TABLE 1-14

GUIDE TO CORRIDOR GEOMORPHIC UNITS

Symbol	Landform
Group 1 - Floodplains, Terraces, and Alluvial Fans	
11	Well and Moderately Well Drained Streamlain Alluvium
12	Poorly and Somewhat Poorly Drained Streamlain Alluvium
13	Alluvial Fans
Group 2 - Uplands	
20	Mesa Caps and Plateaus
21	Pediments, gently rolling
22	Pediments and Terraces, moderately dissected
23	Dendritic Basins, strongly dissected
24	Mesa Sideslopes, strongly dissected
Group 3 - Folded and Faulted Lands	

TABLE 1-15

CORRELATION GUIDE TO GEOMORPHIC, SOIL, AND VEGETATION TYPES:
CORRIDORS AS SURVEYED BY ERT

Geomorphic Unit	Corresponding Soil Association	Corresponding Vegetation Types (In general order of dominance)
11 - Well and Moderately Well Drained Streamlain Alluvium	102 - Typic Torrifluvents, loamy -Typic Natrargids, loamy and fine. Level and nearly level.	Greasewood Saltbush
	104 - Typic Torrifluvents, loamy -Typic Natrargids loamy and fine - Typic Torripsamments. Gently sloping to rolling	Saltbush Greaswood Mixed Desert Shrub
	105 - Typic Torrifluvents, loamy over sandy-skeletal -Typic Natrargids, loamy and clayey over sandy-skeletal. Nearly level to gently sloping.	Saltbush Greasewood
12 - Poorly and Somewhat Poorly Drained Streamlain Alluvium	101 - Typic Fluvaquents, loamy over sandy-skeletal -Typic Torrifluvents, loamy over sandy-skeletal. Level and nearly level.	Pasture/Hayfield Riparian Big sagebrush
13 - Alluvial Fans	103 - Typic Calciorthids, loamy, -Typic Torriorthents, loamy, nearly level to gently sloping	Big sagebrush
	107 - Typic Torrifluvents, loamy -Typic Natrargids, loamy and fine. Gently sloping to rolling.	Greasewood
	109 - Ustic Torriorthents, loamy -Ustertic Torriorthents, fine. Gently sloping to rolling.	Big sagebrush Sagebrush complex Bunchgrass

TABLE 1-15 (CONTINUED)

Geomorphic Unit	Corresponding Soil Association	Corresponding Vegetation Types (In general order of dominance)
20 - Mesa Caps and Plateaus and 21 - Pediments, gently rolling	203 - Typic Camborthids, loamy -Typic Calciorthids, loamy. Gently sloping to rolling.	Big sagebrush Bunchgrass
	206 - Typic Torriorthents, loamy -Typic Calciorthids, loamy. Gently sloping to rolling.	Big sagebrush
22 - Pediments and Terraces, moderately dissected, and	204 - Typic Torriorthents, loamy -Typic Calciorthids, loamy. Rolling to steep.	Big sagebrush Bunchgrass
23 - Dendritic Basins, strongly dissected	207 - Badland - Typic Torriorthents, loamy, shallow. Gently sloping to steep.	Saltbush
24 - Mesa Side-slopes, strongly dissected	224 - Typic Torriorthents, loamy, shallow -Lithic Torriorthents, loamy - Shale Escarpments. Steep and very steep.	Big sagebrush
3 - Folded and Faulted Lands	309 - Lithic Ustic Torriorthents, loamy-skeletal -Ustic Torriorthents, clayey shallow. Gently sloping to rolling.	Big Sagebrush Bunchgrass
	310 - Lithic Ustic Torriorthents, loamy-skeletal -Ustic Torriorthents, clayey, shallow. Rolling to steep.	Big sagebrush Bunchgrass Mountain shrub

TABLE 1-16

SOIL INTERPRETATIONS[1]

(ERT CORRIDOR SURVEY AREA)

Map Symbol and Component	Permeability	Available Water Capacity	Reaction (pH)	Factors K	Factors T	Erosion Hazard	Erodibility Group	Rehabilitation Potential	Rehabilitation Considerations
101									
Typic Fluvaquents, loamy over sandy-skeletal	Moderately slow	High	7.9-8.4	.24	5	Low	3	Fair	Wetness, stoniness at depth
Typic Torrifluvents, loamy over sandy-skeletal	Moderate	High	7.4-9.0	.24	5	Low	3	Fair	Stoniness at depth
102									
Typic Torrifluvents, loamy	Moderately slow	Moderate	8.0-9.5	.32	5	Low	4L	Fair	Some salinity
Typic Natrargids, loamy and fine	Moderately slow	Low	8.0-9.5	.32	5	Low	3	Poor	Salts, drouthiness
103									
Typic Calciorthids, loamy	Moderately rapid	Low	7.4-8.4	.24	5	Low	3	Good	Drouthiness, some salinity
Typic Torriorthents, loamy	Moderate	High	6.6-8.4	.24	5	Low	3	Good	Some salinity
104									
Typic Torrifluvents, loamy	Moderately slow	Moderate	8.0-9.5	.32	5	Moderate	4L	Fair	Some salinity
Typic Natrargids, loamy and fine	Moderately slow	Moderate	8.0-9.5	.32	5	Moderate	3	Poor	Salts, drouthiness
Typic Torripsamments	Rapid	Low	7.2-8.4	.15	3	Low	1	Poor	Drouthiness
105									
Typic Torrifluvents, loamy over sandy-skeletal	Moderate	Low	8.0-9.5	.32	5	Low	4L	Poor	Some salinity, stoniness at depth
Typic Natrargids, loamy and clayey over sandy-skeletal	Moderate to slow	Low	8.0-9.5	.32	3	Low	3	Poor	Salts, stoniness at depth
107									
Typic Torrifluvents, loamy	Moderately slow	Low	8.4-9.5	.37	5	Moderate	6	Poor	Salts, drouthiness
Typic Natrargids, loamy and fine	Moderately slow	Moderate	8.4-9.5	.32	5	Moderate	3	Poor	Salts, drouthiness
109									
Ustic Torriorthents, loamy	Moderate	Low	7.9-9.0	.32	3	Moderate	5	Good	Drouthiness, some salinity
Ustertic Torrithents, fine	Very slow	Moderate	7.4-8.6	.37	3	High		Fair	Clayey textures

TABLE 1-16 (CONTINUED)

Map Symbol and Component	Permeability	Available Water Capacity	Reaction (pH)	Factors K	Factors T	Erosion Hazard	Erodibility Group	Rehabilitation Potential	Rehabilitation Considerations
203 Typic Camborthids, loamy	Moderate	High	7.9-9.0	.28	5	Moderate	4L	Good	Some salinity, drouthiness
Typic Calciorthids, loamy	Moderately rapid	Low	7.4-9.0	.28	2	Moderate	3	Good	Drouthiness, some salinity
204 Typic Torriorthents, loamy	Moderate	Low	6.6-8.4	.24	3	High	4L	Poor	Drouthiness, slope
Typic Calciorthids, loamy	Moderately Rapid	Low	7.4-9.0	.28	3	High	5	Poor	Drouthiness, slope
206 Typic Torriothents, loamy	Moderate	Low	6.6-8.4	.24	3	Moderate	4L	Good	Drouthiness
Typic Calciorthids, loamy	Moderate	Low	7.4-9.0	.28	3	Moderate	5	Good	Drouthiness
207 Badlands	--	--	--	--	--	--	--	Poor	Depth to rock, salinity
Typic Torriorthents, loamy, shallow	Moderate	Low	7.4-9.0	.15	1	Moderate	4L	Poor	Depth to rock, drouthiness
224 Typic Torriothents, loamy shallow	Moderate	Low	7.4-9.0	.37	1	High	4L	Poor	Depth to rock, slope
Lithic Torriorthents, loamy	Moderate	Low	7.4-9.0	.24	1	High	3	Poor	Depth to rock, slope
Shale Outcrop Escarpments	--	--	--	--	--	--	--	Poor	Depth to rock, slope
309 Lithic Ustic Torriorthents, loamy-skeletal	Moderately slow	Low	7.9-9.0	.32	1	Moderate	4L	Poor	Depth to rock
Ustic Torriorthents, clayey, shallow	Slow	Low	7.9-9.0	.32	1	High	4L	Poor	Depth to rock, clayey textures
310 Lithic Ustic Torriorthents, loamy-skeletal	Moderately rapid	Low	6.6-8.4	.10	1	Moderate	5	Poor	Depth to rock, slope, stoniness
Ustic Torriorthents, clayey, shallow	Slow	Low	7.9-9.0	.32	1	High	4L	Poor	Depth to rock, clayey textures, slope

[1]Interpretations based on ERT Corridor mapping units and SCS Form 5's for representative soil series from the ERT Corridor reconnaissance survey. Column headings are defined in the glossary.

101 - Typic Fluvaquents, loamy over sandy skeletal--Typic Torrifluvents loamy over sandy-skeletal. Level and nearly level.

The soils in this unit occupy nearly level and gently sloping stream and riverbottom floodplains and low stream terraces. The soils formed in loamy and gravelly alluvium. Elevations are 6,500 to 7,200 feet. Slopes are 0 to 3 percent.

Typic Fluvaquents make up about 55 percent of this map unit, and Typic Torrifluvents about 35 percent. The remaining 10 percent is composed of deep, loamy, strongly alkaline soils.

Typic Fluvaquents: These deep, light-colored, somewhat poorly and poorly drained soils have loamy to gravelly loamy textures and are 30 to 40 inches over sand and gravel mixtures. They have slopes of 0 to 5 percent. Depth to bedrock is over 60 inches and flooding is common for brief periods. Depth to a seasonal high water table is 0 to 3 feet. Permeability is moderate, frost action potential is high. Typically these soils are moderately or strongly alkaline. A typical soil series is Hagga.

Typic Torrifluvents: These deep, light-colored, well and somewhat poorly drained soils have loamy textures and are 20 to 40 inches over sand and gravel. These soils are on nearly level floodplains and have slopes of 0 to 5 percent. Depth to bedrock is greater than 60 inches. Permeability is moderate, and frost action potential is high. Seasonal high water table is at 3 to 4 feet. These soils are typically moderately or mildly alkaline and are calcareous throughout. Typical soil series are Glenderson and Quealman.

These soils are used as rangeland and for irrigated hay and pasture. Native vegetation includes big sagebrush, fourwing saltbush and shadscale and wheatgrasses on well drained areas, and rushes, sedges, willows on poorly drained areas. A mixture of grasses, rushes and sedges is grown on the irrigated land.

Corresponding Geomorphic Unit: Wet alluvium (12)

Range Sites: Subirrigated, 7-9" precipitation zone.
Lowland, 7-9" precipitation zone.

102 - Typic Torrifluvents, loamy,--Typic Natrargids, loamy and fine. Level and nearly level.

The soils in this unit occupy level and nearly level floodplains and low stream terraces. The soils formed in calcareous, alkaline, loamy and fine textured alluvium from shales and sandstones. Elevations are from 6,500 to 7,400 feet.

Typic Torrifluvents make up about 50 percent of the unit and Typic Natrargids about 40 percent. The remaining 10 percent includes Typic Torriorthents, loamy, and Typic Torripsamments.

Typic Torrifluvents: These deep, light-colored, well drained soils have loamy to clayey textures. These soils are on nearly level to gently sloping floodplains and alluvial valley bottoms. Depth to bedrock is greater than

60 inches. Permeability is moderately slow to slow. Frost action potential is moderate to high. Seasonal water tables are deeper than 60 inches. These soils are typically calcareous throughout and are strongly to very strongly alkaline. Typical soil series are Laney, Dines (alkaline) and Chrisman.

Typic Natrargids: These deep, light-colored, well drained, very alkaline soils have loamy and clayey subsoils. These soils are on nearly level to gently sloping floodplains and alluvial fans. Depth to bedrock is more than 60 inches and depth to a seasonal high water table is more than 5 feet. Permeability is very slow, and shrink-swell potential is high. Frost action potential is low. Corrosion potential is high. These soils are typically strongly or very strongly alkaline throughout and exchangeable sodium ranges from 15 to 60 percent in a major portion of the soil. Typical soil series are Westvaco, Sandbranch, and Debone.

These soils are used mainly as rangeland. Native vegetation includes greasewood, rabbitbrush, shadscale, Gardners saltbush, and wheatgrasses and bud sagebrush. Excess alkali severely limits its cropland potential. Corrosivity and high shrink-swell potential are limitations to non-agricultural uses.

Corresponding Geomorphic Unit: Dry alluvium (11)

Range sites: Saline Upland and/or Saline Lowland, 7-9" precipitation zone.

<u>103 - Typic Calciorthids, loamy--Typic Torrorthents, loamy. Nearly level to gently sloping</u>.

The soils in this unit occupy gently sloping terraces and fans. The soils formed in calcareous alluvium from shale and sandstones. Elevations are 6,500 to 7,400 feet. Slopes are 0 to 5 percent.

Typic Calciorthids make up about 50 percent of this unit and Typic Torriorthents about 40 percent. The remaining 10 percent are inclusions of Typic Torrifluvents.

Typic Calciorthids: These deep and moderately deep, well drained light-colored soils have loamy and gravelly loam textures. They are on terraces and fans with slopes from 0 to 5 percent. Depth to bedrock ranges from 30 inches to more than 60 inches. Permeability is moderate and shrink swell potential and frost action are low. These soils have a calcic (high lime) horizon, and are typically moderately alkaline and calcareous throughout. Typical soil series are Cambarge and Pepal.

Typic Torriorthents: These moderately deep and deep, light-colored, well drained soils have loamy textures and usually contain less than 35 percent rock fragments. These soils are on terraces and fans with slopes of 0 to 5 percent. Depth to bedrock ranges from 30 to more than 60 inches. Permeability is moderate and shrink-swell potential and frost action are low. Typically these soils are mildly to moderately alkaline and calcareous throughout. A typical soil series is Monte.

These soils are used mainly as rangeland. Native vegetation includes: big sagebrush, rabbitbrush, woody buckwheat, shadscale, wheatgrasses, Indian ricegrass and squirreltail.

Corresponding Geomorphic Unit: Dry alluvium (11)

Range Sites: Sandy, 7-9" precipitation zone.
Loamy, 7-9' precipitation zone.

104 - Typic Torrifluvents, loamy--Typic Natrargids, loamy and fine--Typic Torripsamments. Gently sloping to rolling.

The soils in this unit occupy gently sloping to rolling floodplains and alluvial fans. The soils formed loamy, calcareous, very alkaline alluvium from shales and sandstones. The Torripsamments are formed from local wind-deposited sands. Elevations are from 6,500 to 7,400 feet. Slopes are 2 to 10 percent.

Typic Torrifluvents make up about 50 percent of the unit and Typic Natrargids about 30 percent. The remaining 20 percent consists of Typic Torripsamments occurring as small dunes.

Typic Torrifluvents: These deep, light-colored, well drained soils have loamy and clayey textures. These soils are on nearly level to gently sloping floodplains and fans. Depth to bedrock is greater than 60 inches. Permeability is moderately slow to slow. Frost action potential is moderate to high. Seasonal water tables are deeper than 60 inches. These soils are typically calcareous throughout and are strongly to very strongly alkaline. Typical soil series are Laney, Dines alkaline, and Chrisman.

Typic Natrargids: These deep, light-colored, well drained, very alkaline soils have loamy and clayey subsoils. These soils are on nearly level to gently sloping floodplains and fans. Depth to bedrock is more than 60 inches and depth to seasonal high water table is more than 5 feet. Permeability is moderately slow and shrink-swell potential is high. Corrosion potential is high. These soils are typically strongly or very strongly alkaline throughout and exchangeable sodium ranges from 15 to 60 percent in a major portion of the soil. Typical soil series are Westvaco, Sandbranch and Debone.

Typic Torripsamments: These deep, well to excessively well drained, light-colored soils have sand or loamy fine sand textures. These soils occur as gently sloping to rolling dunes on floodplains and alluvial fans. Depth to bedrock is more than 60 inches. Depth to a seasonal high water table is more than 5 feet. Permeability is rapid to very rapid and shrink-swell potential is low. Frost action and corrosion potential is low. Wind erosion potential is very high. These soils are typically moderately alkaline and calcareous throughout. A typical soil series is Kandaly.

These soils are used mainly as rangeland. Native vegetation includes greasewood, rabbitbrush, shadscale, Gardner's saltbush and wheatgrasses. Hopsage and rabbitbrush dominate the sandy Kandaly soils. Excess alkali severely limits cropland potential. Moderate erosion potential, corrosivity and high shrink-swell potential are limitations to non-agricultural uses.

Corresponding Geomorphic Unit - Dry alluvium (11)

Range Sites: Saline Upland and Saline Lowland, 7-9" precipitation zone.
Sands, 7-9" precipitation zone.

105 - Typic Torrifluvents, loamy over sandy skeletal--Typic Natragids, loamy and clayey over sandy-skeletal. Nearly level to gently sloping

This map unit is of minor extent. The soils in this unit occupy nearly level floodplains and low stream terraces. The soils formed in relatively thin deposits of calcareous, alkaline alluvium over gravel and sand materials. Elevations are from 6,500 to 7,400 feet. Slopes are 0 to 5 percent.

Typic Torrifluvents. These deep, light-colored, well drained soils have loamy to clayey textures to depths of 20 to 30 inches. Below this depth is a sand and gravel mixture. These soils are on nearly level to gently sloping floodplains and fans. Depth to bedrock is more than 60 inches and depth to a seasonal high water table is more than 5 feet. Permeability of the upper 20 to 30 inches of the soil is moderately slow and permeability in the sand and gravel layers is very rapid. Shrink-swell potential and corrosion potential are high the upper 20 to 30 inches and is low in the sand and gravel layers. These soils are typically calcareous and alkaline throughout. Typical soil series are not established but sandy skeletal substratum variants of Laney and Chrisman series will fit for interpretations.

Typic Natrargids: Clayey over sandy skeletal; these deep, light-colored, well drained soils have loamy and clayey subsoils to depths of 20 to 30 inches; below this depth is a sand and gravel mixture. These soils are on nearly level to gently sloping floodplains and fans. Depth to bedrock is more than 60 inches and depth to a seasonal high water table is more than 5 feet. Permeability is very slow and shrink-swell potential is high in the upper 20 to 30 inches. Permeability is very rapid in the sand and gravel layers. Corrosion potential is high in the upper 20 to 30 inches. These soils are typically strongly alkaline and calcareous in the upper layers and moderately alkaline in the lower substratum layers. Exchangeable sodium ranges from 15 to 60 percent in the upper 20 to 30 inches. Typical soil series are not established but sandy-skeletal substratum variants of Westvaco, Sandbranch and Debone series will fit for interpretations.

These soils are used mainly as rangeland. Native vegetation includes greasewood, rabbitbrush, shadscale, Gardner's saltbush and wheatgrasses. Excess alkali severely limits cropland potential. Corrosivity, high shrink-swell potential and high erosion hazard are limitations to non-agricultural uses. The gravel and sand substratum materials are good road base materials and are less corrosive for pipelines.

Corresponding Geomorphic Unit - Dry alluvium (11)

Range Site: Saline Lowland, 7-9" precipitation zone.

107 - Typic Torrifluvents, loamy--Typic Natrargids, loamy and fine. Gently sloping to rolling.

The soils in this unit occupy gently sloping to rolling floodplains, terraces and fans. The soils formed in calcareous, alkaline, loamy and fine textured alluvium from shales and sandstones. Elevations are from 6,500 to 7,400 feet. Slopes are 2 to 10 percent.

Typic Torrifluvents make up about 50 percent of the unit and Typic Natrargids about 40 percent. The remaining 10 percent includes Typic Torriorthents, loamy, and Typic Torripsamments.

Typic Torrifluvents: These deep, light-colored, well drained soils have loamy to clayey textures. These soils are on gently sloping to rolling floodplains, terraces and fans. Depth to bedrock is greater than 60 inches and a seasonal high water table is more than 5 feet. Permeability is moderately slow to slow. Frost action potential and shrink-swell potential are high. These soils are typically calcareous throughout and are strongly to very strongly alkaline. Typical soil series are Laney, Dines (alkaline) and Chrisman.

Typic Natrargids: These deep, light-colored, well drained, very alkaline soils have loamy and clayey subsoils. These soils are on gently sloping to rolling, floodplains, terraces and fans. Depth to bedrock is greater than 60 inches and a seasonal high water table is more than 5 feet. Permeability is slow. Shrink-swell potential is high. These soils are typically calcareous throughout and strongly to very strongly alkaline. Exchangeable sodium ranges from 15 to 60 percent in a major portion of the soil. Typical soil series are Westvaco, Sandbranch and Debone.

These soils are used mainly as rangeland. Native vegetation includes greasewood, rabbitbrush, shadscale, Gardner's saltbush, wheatgrasses and bud sagebrush.

Excess alkali and moderate slopes limit cropland potential. Moderate erosion potential, high corrosivity and high shrink-swell potential are limitations to non-agricultural uses.

Corresponding Geomorphic Unit: Dry alluvium (11)

Range Sites: Loamy, 7-9" precipitation zone.
Clayey, 7-9" precipitation zone.
Saline Upland and/or Saline Lowland, 7-9" precipitation zone.

109 - Ustic Torriorthents, loamy--Ustertic Torriorthents, fine. Gently sloping to rolling.

The soils in this unit occupy gently sloping to rolling terraces and fans. The soils formed in and from calcareous alluvium from shales and sandstones. Elevations are from 6,900 to 7,400 feet. Precipitation is 10 to 14 inches. Slopes are 2 to 10 percent.

Ustic Torriorthents, loamy, make up about 50 percent of the unit and Ustertic Torriorthents, fine, make up about 30 percent. The remaining 20 percent consists of Borollic Calciorthids, loamy, and Borollic Haplargids, loamy.

Ustic Torriorthents: These deep, well drained, light-colored soils have loamy textures. These soils are on gently sloping to rolling terraces and fans. Depth to bedrock is greater than 60 inches and a seasonal high water table is more than 5 feet. Permeability is moderate. Frost action and shrink-swell potential are low. These soils are typically calcareous at or near the surface and are moderately alkaline throughout. Typical soil series are Patent and Delphill.

Ustertic Torriorthents: These deep and moderately deep, well drained, light-colored soils have clayey textures. These soils are on gently sloping to rolling terraces and fans. The soils formed in clayey, calcareous alluvium from shales. Elevations are from 6,900 to 7,400 feet. Precipitation is 10 to 14 inches.

These soils are used mainly as rangeland. Native vegetation includes big sagebrush, rabbitbrush, woody buckwheat, black sagebrush, wheat grasses, pholox, shadscale, and Gardner's saltbush.

Moderate slopes, slow permeability and high erosion hazard limit cropland potential. High erosion potential, high corrosivity and high shrink-swell potential are limitations to non-agricultural uses.

Corresponding Geomorphic Unit: Dry alluvium (11)

Range Sites: Loamy, 10-14" precipitation zone.
Clayey, 10-14" precipitation zone.

203 - Typic Camborthids, loamy--Typic Calciorthids, loamy. Gently sloping to rolling.

The soils in this unit occupy gently sloping to rolling upland slopes, broad terraces and fans. The soils formed from residuum and alluvium from calcareous sandstones and shales. Elevations are 6,500 to 7,200 feet. Precipitation is 7 to 10 inches. Slopes are 2 to 10 percent.

Typic Camborthids, loamy, make up about 40 percent of this map unit and Typic Calciorthids about 40 percent, the remaining 20 percent is composed of shallow loamy soils developing from sandy shales, and deep alkaline alluvial soils in narrow drainways.

Typic Camborthids: These deep and moderately deep well drained, light-colored soils have loamy textures. These soils are on gently sloping to rolling uplands, fans and terraces. Depth to bedrock ranges from 30 to more than 60 inches. Permeability is moderate, frost action potential and shrink-swell potential are low. Depth to a seasonal high water table is more than 5 feet. Water erosion potential is moderate to high. These soils are calcareous at or near the surface and are moderately alkalines. Typical soil series are Sagecreek and McCullen.

Typic Calciorthids: These deep and moderately deep, well drained, light-colored soils have loamy textures. These soils are on gently sloping to rolling uplands, fans and terraces. Depth to bedrock ranges from 30 to

more than 60 inches. A seasonal high water table is more than 5 feet. Permeability is moderately rapid. Shrink-swell and frost action potentials are low. Water erosion potential is moderate to high. These soils are calcareous throughout and a calcic (high lime) horizon below the surface layer. They are moderately alkaline throughout. Typical soil series are Bitter Creek, Sage Creek, and Teagulf.

These soils are used mainly as rangeland. Native vegetation includes big sagebrush, rabbitbrush, woody buckwheat, shadscale, hopsage, wheatgrasses, squirreltail and Indian ricegrass.

Moderate slopes, and erodibility limit cropland potential. Moderate erosion potential, and low strength are non-agricultural limitations.

Corresponding Geomorphic Unit: Upland Pediments and Mesas (20, 21)

Range Sites: Loamy, 7-9" precipitation zone.
Sandy, 7-9" precipitation zone.

204 - Typic Torriorthents, loamy-- Typic Calciorthids, loamy. Rolling to steep.

The soils in this unit occupy rolling to steep strongly dissected upland slopes, terraces, and fans. These soils formed in residuum and alluvium from sandstones and sandy and silty shales. Elevations are 6,500 to 7,200 feet. Precipitation is 7 to 10 inches. Slopes are 10 to 30 percent.

Typic Torriorthents, loamy, make up about 60 percent of this map unit and Typic Calciorthids, loamy, about 30 percent. The remaining 10 percent is composed of similar shallow soils developing from sandstones and sandy shales. Inclusions of deep alluvial soils occur in narrow drainways.

Typic Torriorthents: These moderately deep, well drained, light-colored soils have loamy textures. These soils are on rolling to steep, strongly dissected upland slopes, terraces and fans. Depth to bedrock ranges from 20 to 40 inches. Depth to a seasonal high water table is more than 5 feet. Permeability is moderate. Shrink-swell and frost action potential are low. Water erosion potential is high. These soils are typically calcareous throughout and are moderately alkaline. Typical soil series are McCullen and Monte. Included series are Tasselman and Haterton.

Typic Calciorthids: These deep, well drained, light-colored soils have loamy textures. These soils are on rolling to steep, strongly dissected upland slopes, terraces and fans. Depth to bedrock is more than 40 inches. Depth to a seasonal high water table is more than 5 feet.

Frost action and shrink-swell potential are low. Water erosion hazard is high. These soils are typically calcareous throughout and have a calcic (high lime) horizon below the surface layer. They are moderately alkaline throughout. Typical soil series are Zirkel, Sage Creek and Teagulf.

These soils are used mainly as rangeland. Native vegetation includes big sagebrush, rabbitbrush, woody buckwheat, shadscale, hopsage, wheatgrasses, squirreltail and Indian ricegrass.

Steep slopes, high erodibility, restricted rooting depths and water holding capacity limit cropland potential. High erosion potential and low strength are non-agricultural limitations.

Corresponding Geomorphic Unit: Dissected Pediments (23)

Range Sites: Loamy and/or Sandy, 7-9" precipitation zone.
Shallow Loamy and/or Shallow Sandy, 7-9" precipitation zone.

206 - Typic Torriorthents, loamy--Typic Calciorthids, loamy. Gently sloping to rolling.

The soils in this unit occupy gently sloping to rolling uplands, high terraces and fans. These soils formed in residuum and alluvium from sandstones and sandy and silty shales. Elevations are 6,500 to 7,200 feet. Precipitation is 7 to 10 inches. Slopes are 2 to 10 percent.

Typic Torriorthents, loamy, make up about 40 percent of this map unit and Typic Calciorthids, loamy, about 40 percent. The remaining 20 percent is composed of similar, shallow, loamy soils developing from sandstone and sandy shales. Inclusions of deep alluvial soils also occur in narrow drainways.

Typic Torriorthents: These moderately deep, well drained, light-colored soils have loamy textures. These soils are on gently sloping to rolling uplands, broad terraces and fans. Depth to bedrock ranges from 20 to 40 inches. Depth to a seasonal high water table is more than 5 feet. Permeability is moderate, shrink-swell and frost action potentials are low. Water erosion potential is moderate. These soils are typically calcareous throughout and are moderately alkaline. Typical soil series are McCullen and Monte. Included series are Tasselman and Haterton.

Typic Calciorthids: These deep, well drained, light-colored soils have loamy textures. Thse soils are in gently sloping to rolling uplands, broad terraces, and fans. Depth to bedrock is more than 40 inches. Depth to a seasonal high water table is more than 5 feet. Frost action potential and shrink-swell potential are low. Water erosion potential is moderate. These soils are calcareous throughout and have a calcic (high lime) horizon below the surface layer. They are moderately alkaline throughout. Typical soil series are Zirkel, Sage Creek and Teagulf.

These soils are used mainly as rangeland. Native vegetation includes big sagebrush, rabbitbrush, woody buckwheat, shadscale, hopsage, wheatgrasses, squirreltail and Indian ricegrass.

Moderate slopes, high erodibility, restricted rooting depths and water holding capacity limit cropland potential. High erosion potential and low strength are non-agricultural limitations.

Corresponding Geomorphic Unit: Upland Pediments (23)

Range Sites: Loamy and/or Sandy, 7-9" precipitation zone.
Shallow Loamy and/or Shallow Sandy, 7-9" precipitation zone.

207 - Badlands--Typic Torriorthents, loamy, shallow. Gently sloping to rolling.

This land type and associated shallow soils occupy gently sloping to rolling uplands. The soils formed in shales. Elevations are 6,500 to 7,200 feet. Precipitation is 7 to 10 inches.

Badlands make up about 70 percent of this map unit and Typic Torriorthents, loamy, shallow, about 30 percent. Slopes are 3 to 12 percent.

Badlands: Consists mainly of raw shale outcrops with little or no soil development. Depth to shale bedrock is 0 to 3 inches. Permeability is very slow. Erosion hazard is very high, shrink-swell potential is high. These areas are calcareous and strongly alkaline.

Typic Torriorthents: These shallow, light-colored, well drained soils have loamy to clayey textures and are 7 to 10 inches over shale bedrock. These soils are on gently sloping to rolling uplands and have slopes of 0 to 10 percent. Permeability is moderate to slow to shale, shrink-swell potential is moderate to high. These soils are typically calcareous and moderately to strongly alkaline throughout. A typical soil series is Horsley.

These soils are used as rangeland. Native vegetation is a very sparse cover of bud sagebrush, Gardner's saltbush and annual weeds. They are unsuitable for agricultural or for construction uses and should be avoided where possible.

Corresponding Geomorphic Unit: Mesa Sideslopes, strongly dissected (24)

Range Site: Shale, 7-9" precipitation zone.

224 - Typic Torriorthents, loamy, shallow--Lithic Torriorthents, loamy--Shale Outcrop Escarpments. Steep and very steep.

The soils in this unit occupy steep and very steep upland escarpments and terrace breaks. The soils and land types formed in residuum and alluvium from shales and sandstones. Elevations are 6,500 to 7,200 feet. Precipitation is 7 to 10 inches. Slopes are 30 to 70 percent.

Typic Torriorthents loamy, shallow, make up about 25 percent of this map unit and Lithic Torriorthents, loamy about 30 percent. About 30 percent of the unit consists of shale outcrops and associated very shallow soils. The remaining 15 percent consists of loamy and clayey, moderately deep soils over sandstones and shales.

Typic Torriorthents: These shallow, well drained, light-colored soils have loamy textures. These soils are on steep and very steep upland escarpments and terrace breaks. Depth to soft bedrock ranges from 10 to 20 inches.

Depth to a seasonal high water table is more than 5 feet. Permeability is moderate to bedrock. Shrink-swell potential and frost action potential are low. Water erosion potential is high. These soils are typically calcareous and moderately to strongly alkaline. Typical soil series are Horsley and Haterton.

Lithic Torriorthents: These shallow, well drained, light-colored soils have loamy textures. These soils are on steep and very steep upland escarpments and terrace breaks. Depth to hard bedrock is 10 to 20 inches. Depth to a seasonal high water table is more than 5 feet. Pemeability is moderate to bedrock. Shrink-swell potential and frost action potential are low. Water erosion potential are low. Water erosion potential is high. These soils are typically calcareous and moderately alkaline throughout. Typical soil series are Tasselman and Winton.

These soils are used mainly as rangeland. Native vegetation includes big sagebrush, rabbitbrush, Gardner's saltbush, shadscale, bluebunch wheatgrass, western wheatgrass, Indian ricegrass and squirreltail.

Steep slopes, shallow depths, and high erosion potential limit both agricultural and non-agricultural uses.

Corresponding Geomorphic Unit: Mesa Sideslopes, strongly dissected (24)

Range Sites: Shallow Loamy, 7-9" precipitation zone.
Shallow Sandy, 7-9" precipitation zone.
Shale, 7-9" precipitation zone.

309 - Lithic Ustic Torriorthents, loamy-skeletal,--Ustic Torriorthents, clayey, shallow. Gently sloping to rolling.

The soils in this unit occupy gently sloping to rolling, folded and faulted uplands mainly in the Overthrust Belt. They formed in sandstones, limestones and shales. Elevations are 6,500 to 7,400 feet. Precipitation is 10 to 14 inches. Slopes are 3 to 10 percent.

Lithic Ustic Torriorthents, loamy skeletal, make up about 40 percent of this map unit and Ustic Torriorthents, clayey, shallow, about 40 percent. The remaining 20 percent is composed of similar soils which are loamy or clayey and moderately deep to shale or sandstone. The soil occurrence is intermingled on the landscape.

Lithic Ustic Torriorthents: These shallow, well drained, light-colored soils have gravelly loamy textures and are 10 to 20 inches over sandstone or limestone bedrock. Depth to a seasonal high water table is more than 5 feet. Permeability is moderately slow to bedrock. Shrink-swell potential and frost action potential are low. Typically these soils are calcareous and moderately alkaline throughout. A typical soil series is Rentsac. Included series are Blazon and Quealey.

Ustic Torriorthents: These shallow, well drained, light-colored soils have clayey textures and are 10 to 20 inches over shale bedrock. Depth to a

seasonal high water table is more than 5 feet. Permeability is slow to bedrock. Shrink-swell potential is high. Frost action potential is low. Water erosion hazard is high. These soils are typically calcareous throughout and are moderately alkaline. A typical soil series is Moyerson. Included series are Kemmerer and Dempsey.

These soils are used as rangeland. Native vegetation includes big sagebrush, rabbitbrush, woody buckwheat, antelope bitterbrush, bluebunch wheatgrass, western wheatgrass, squirreltail, bluegrasses, and a few scattered junipers. On east and north exposures some mountain mahogany and serviceberry may occur.

Steep slopes, high erosion potential, shallow depths to bedrock, and low water holding capacity severely limit these soils for both non-agricultural and agricultural uses.

Corresponding Geomorphic Unit: Folded and Faulted Lands (3)

Range Sites: Shallow Loamy and/or Loamy, 10-14" precipitation zone.
Shallow Clayey and/or Clayey, 10-14" precipitation zone.

<u>310 - Lithic Ustic Torriorthents, loamy skeletal--Ustic Torriorthents, clayey, shallow. Rolling to steep</u>.

The soils in this unit occupy rolling to steep, strongly folded and faulted uplands mainly in the Overthrust Belt. They formed in sandstones, limestones, and shales. Elevations are 6,500 to 7,400 feet. Precipitation is 10 to 14 inches. Slopes are 10 to 30 percent.

Lithic Ustic Torriorthents, loamy skeletal, make up about 40 percent of this map unit, and Ustic Torriorthents, clayey, shallow, about 40 percent. The remaining 20 percent is composed of similar soils which are loamy or clayey and moderately deep to shale or sandstone. The soil occurrence is intermingled on the landscape.

Lithic Ustic Torriorthents: These shallow, light-colored, well drained soils have gravelly, loamy textures and are 10 to 20 inches over sandstone or limestone bedrock. Depth to a seasonal high water table is more than 5 feet. Permeability is moderately rapid to bedrock. Shrink-swell potential and frost action potential are low. Typically these soils are calcareous and moderately alkaline throughout. A typical soil series is Rentsac. Included series are Blazon and Quealey.

Ustic Torriorthents: These shallow, well drained light-colored soils have clayey textures and are 10 to 20 inches over shale bedrock. Depth to a seasonal high water table is more than 5 feet. Permeability is slow to bedrock, and shrink-swell potential is high. Frost action potential is low. Water erosion hazard is high. Thse soils are typically calcareous throughout and are moderately alkaline. A typical soil series is Moyerson. Included series are Kemmerer and Dempsey.

These soils are used as rangeland. Native vegetation includes big sagebrush, rabbitbrush, woody buckwheat, bluebunch wheatgrass, western

wheatgrass, squirreltail, bluegrasses, and a few trees (mainly juniper on east and north exposures). Some mountain mahogany and serviceberry may occur.

Steep slopes, high erosion hazard, shallow depths to bedrock, and low water holding capacity severely limit these soils for both non-agricultural and agricultural uses.

Corresponding Geomorphic Unit: Folded and Faulted Lands (3)

Range Sites: Loamy, 10-14" precipitation zone.
Clayey, 10-14" precipitation zone.

Series Descriptions

Corridor map units were correlated to standard series descriptions compiled by the Soil Conservation Service for Wyoming and Colorado. Typical pedon descriptions may be obtained at Bureau of Land Management offices in Rock Springs or Soil Conservation Service offices in Evanston or Rock Springs, Wyoming.

Range Sites

Range site correlations with vegetation types are discussed in the Plant Community Descriptions section that follows.

Soil Interpretations

Soil engineering and rehabilitation capabilities are shown in Table 1-16.

Soils Laboratory Data

No samples were collected or analyzed for corridor soils.

Geomorphic Unit Descriptions

Group 1 - Floodplains and Terraces

11 - Well and Moderately Well Drained Streamlain Alluvium (0 to 10 percent slopes)

This unit consists of dry alluvial terraces and drainageways along ephemeral streams, older remnant floodplains, valley fill terraces, and playas. It is widely distributed on level to gently rolling surfaces throughout the project region. This landform typically consists of medium to fine-textured alluvium which is salt-affected. Sand and gravel deposits occupy relict and ephemeral drainage channels. Small, somewhat stabilized sand dunes are included with this unit in the south and east part of the project region, as well as in the vicinity of LaBarge. Slopes on these dunes range from 5 to 10 percent.

12 - Poorly and Somewhat Poorly Streamlain Alluvium (0 to 3 percent slopes)

This unit consists of low alluvial terraces and floodplains along oxbows and present courses of rivers and perennial streams. Generally, the unit occurs as a level or nearly level subirrigated terrace system one-half to 2 miles wide. It is located along the Green River and perennial streams flowing eastward from the Overthrust Belt into the Green. Typically, the alluvium consists of deposits of finer-textured sediments overlying sandy gravel.

13 - Alluvial Fans (0 to 10 percent slopes)

These coarse to medium-textured deposits form at the toeslopes of mesas, foothills, and mouths of ephemeral streams draining from the uplands onto terraces. They typically occur as level to gently rolling, somewhat conical aprons of sediment or as broad, evenly contoured deposits such as those in the vicinity of Rock Springs.

Group 2 - Uplands

20 - Mesa Caps and Plateaus (0 to 10 percent slopes)

This unit consists of higher, nearly level to rolling surfaces on the tops of mesas and plateaus. It has formed on erosion-resistant shales of the Green River Formation and sandstone members of the Wasatch Formation. Generally bedrock occurs at relatively shallow depth below the ground surface. Big Mesa and Names Hill, near LaBarge, are examples.

21 - Pediments, gently rolling (0 to 10 percent slopes)

These surfaces formed by a combination of braided stream action and in-place weathering on relatively flat-lying rock strata, primarily of the Wasatch Formation. They typically occur in the eastern and southern portions of the project region. Rippable bedrock underlies the ground surface at variable depths.

22 - Pediments and Terraces, moderately dissected (10 to 30 percent slopes)

This geomorphic unit consist of both pediments and dry alluvial terraces which have undergone shallow channel dissection at approximate intervals of one-fourth to 1 mile. It typically occurs as rolling to steep land surfaces bordering dry streamlain alluvium, and as gentler sideslopes grading from a higher upland surface to a lower.

23 - Dendritic Basins, strongly dissected (3 to 30 percent slopes)

This unit formed in isolated areas of eroding Bridger or Wasatch shales and mudstones. It occurs as a strongly degrading bedrock upland, deeply dissected by dentritic channels which funnel onto an alluvial

fan or ephemeral stream. The unit also occurs as a series of convex, rolling shale ridges bordering streamlain alluvium. Typically, dissections occur at one-eighth to one-fourth mile intervals. Slopes are gently sloping to steep.

24 - Mesa Sideslopes, strongly dissected (30 to 70 percent slopes)

These are steep and very steep bedrock-controlled surfaces eroded primarily into the Wasatch and the Bridger formations. They take the form of badlands or shale escarpments which are somewhat stabilized by vegetation. Typically sandstone or sandy shale formation members outcrop on the sideslope. This unit commonly occurs in association with Unit 20, Mesa Caps and Plateaus, although in scattered areas the resistant surface has ultimately been eroded away to leave steep, nearly barren hills and badlands. The sideslopes of Big Mesa, northwest of LaBarge, and Ross Butte, east of Big Piney, are typical of this unit.

Groups 3 - Folded and Faulted Lands (3 to 30 percent)

This geomorphic unit occurs in the Overthrust Belt. It consists of steeply dipping, up-thrust ridges of limestone, shale, and quartzite. Both accelerated surface erosion and mass wasting are potential geologic hazards on this unit, particularly on moist slopes. Slopes are gently sloping to steep.

VEGETATION

Plant Community Descriptions

The following vegetation type descriptions were developed from field reconnaissance of the corridors and plant sites, and from BLM URA maps and legend descriptions. Uses of plant communities in the corridors and plant sites are wildlife habitat (antelope, mule deer), and livestock grazing (cattle and sheep). The most productive communities are the subirrigated stream and river bottoms. These areas have frequently been developed for pasture or cut for hay. The least productive sites are shallow, clayey soils on steep slopes that support a very limited cover of saltbush and grass species. Sagebrush communities predominate over the majority of the corridor segments. Annual production on sagebrush sites ranges from an average of 500 pounds/acre on the driest portion (7 to 9-inch precipitation zone) of the study region to 1,200 pounds acre in a slightly higher precipitation zone (10 to 14-inch).

Big Sagebrush

This map unit consists of areas principally dominated by the Wyoming big sagebrush/Sandberg bluegrass habitat type. The unit occurs throughout the study region on gently sloping upland sites on moderately deep soils. The unit corresponds to the soil association Units 101, 103, 109, 203, 204, 206, 224, 309, and 310 (Table 1-13). SCS range sites corresponding to this vegetation type include Lowland (7 to 9-inch), Sandy (7 to 9-inch), Loamy

(7 to 9-inch), Clayey (7 to 9-inch), Loamy (10 to 14-inch), and Clayey (10 to 14-inch) (Table 1-17). Other important constituents of this map unit include winterfat (Ceratoides lanata) on highly calcareous soils on basin floors (Dowr 1977), and Nuttall saltbush (Atriplex gordonii) and shadscale (Atriplex confertifolia) in areas of transition between sagebrush-dominated uplands and saltbush-dominated basin floors and sideslopes. Thickspike wheatgrass (Agropyron dasystachum) is a common associate with sagebrush on clayey, deeper soils. Squirreltail (Sitanion hystrix) dominates disturbed and intensively grazed areas. Needlegrasses (Stipa) represent a minor component on most sites. Vegetation canopy cover ranges from 20 to 70 percent with shrub species contributing the majority of the cover. Average annual production ranges from 500 to 2,000 pounds/acre.

Sagebrush Complex

This map unit was previously described under the well field discussion. This map unit corresponds to the soil association Unit 109 (Table 1-13) on the corridors and plant sites. Four range sites are described for this vegetation type (Table 1-17). Cover ranges from 10 to 60 percent; annual production estimates range from 200 to 1,400 pounds/acre.

Mixed Desert Shrub

This map unit consists of scattered low dunes overlying alkaline clay soils on basin floors and on wide, gently sloping drainages. The unit corresponds to the soil association Unit 104 (Table 1-13). The dunes are dominated by gray horsebrush (Tetradymia canescens), spiny hopsage (Grayia spinosa), rubber rabbitbrush (Chrysothamnus nauseosus), Wyoming big sagebrush, and Indian ricegrass (Oryzopsis hymenoides). The basin floors are dominated by Nuttall saltbush (Atriplex gordonii), and thickspike wheatgrass.

The Sands (7 to 9-inch) range site occurs within this vegetation type. Average cover in this type ranges from 15 percent in the saltbush component to 25 percent on the shrub-dominated dunes. Estimated annual production is 350 to 700 pounds/acre. The greatest extent of this type is north-east of Opal and west of the Green River.

Saltbush

This map unit occupies basin floors and erosive sideslopes throughout the study region. The unit corresponds to the soil association Units 102, 104, 105, 107, 207, and 224 (Table 1-13). The unit is dominated by Nuttall saltbush (Atriplex gordonii). Minor constituents include thickspike wheatgrass, Sandberg bluegrass, bud sagebrush (Artemisia spinescens), Indian ricegrass, and squirreltail. Five range sites are described for the saltbush vegetation type (Table 1-17). Average cover in this type ranges from 5 to 70 percent, and average annual production is estimated to be 200 to 1,200 pounds/ acre. Gardner saltbush and galleta show intensive utilization by livestock within this vegetation type (Turner 1971).

Greasewood

This map unit was previously described under the well field discussion. This vegetation type corresponds to soil association Units 102, 104, 105, and 107 (Table 1-13) on the corridors and plant sites. Range sites include

Saline Upland (7 to 9-inch) and Saline Lowland (7 to 9-inch). Ground cover ranges from 20 to 70 percent and annual production ranges from 300 to 2,000 pounds/acre.

Bunchgrass

Higher elevation components of this map unit were described under the well field discussion. At lower elevations (6,000 feet to 7,000 feet) the type occurs on windy ridgelines where Sandberg bluegrass, squirreltail, and needlegrasses predominate. The vegetation type was also mapped on sandy soils in basins where Indian ricegrass was the most important species. This map unit corresponds to the soil association Units 109, 203, 204, 206, 224, 309, and 310 (Table 1-13). Ground cover ranges from 10 to 70 percent, and annual production ranges from 200 to 2,000 pounds/acre based on the six SCS range sites described for this vegetation type (Table 1-17).

Mountain Shrub

This map unit was previously described under the well field discussion. This unit corresponds to the soil association Unit 310 (Table 1-13) and Shallow Loamy (10 to 14-inch) range site (Table 1-17).

Pasture/Hayfield

This map unit was previously described under the well field discussion. This unit corresponds to the soil association Unit 106 (Table 1-13) and Subirrigated (7 to 9-inch) and Subirrigated (10 to 14-inch) range sites (Table 1-17).

Riparian

This map unit predominantly consists of streamside vegetation along the major streams and rivers on the study area. The Green River, which accounts for the majority of the riparian type within the study area, contains scattered cottonwood trees (Populus angustifolia) with dominant understory species including willows, rose, sedges (Carex spp.), rushes (Juncus spp.), and inland saltgrass (Distichlis stricta). Included in this map unit are the narrow, isolated meadows associated with the Green River, Hams Fork, and Big Sandy. These meadows are dominated by sedges and rushes. This map unit corresponds to the soil association Unit 101 (Table 1-13). Three range sites are described for the riparian type (Table 1-17). Average ground cover ranges from 65 to 100 percent and annual production ranges from 1,400 to 4,500 pounds/acre based on SCS estimates.

Threatened, Endangered, and Rare Plant Species

These species were covered in the well field discussion.

Weeds

Weeds were discussed under the well field area.

Plant Community Regeneration

Plant community regeneration was covered under the well field discussion.

TABLE 1-17

CORRIDOR VEGETATION TYPE/RANGE SITE[1] CORRELATION SUMMARY

Vegetation Type	Range Site (Precipitation Zone)	Annual Production Estimates (pounds/acre)	% Composition by Weight Grass	Forb	Shrub	% Ground Cover
Big Sagebrush	Lowland (7-9")	1,400-2,700 (2,000)[2]	45	15	40	65-70
	Sandy (7-9")	300-700 (500)	70	10	20	20-30
	Loamy (7-9")	300-700 (500)	75	10	15	20-35
	Clayey (7-9")	300-700 (500)	70	15	15	40-50
	Loamy (10-14")	700-1,500 (1,200)	75	10	15	40-50
	Clayey (10-14")	600-1,400 (1,100)	75	15	10	55-60
Sagebrush Complex	Clayey (7-9")	300-700 (500)	70	15	15	40-50
	Shallow Loamy (7-9")	200-450 (350)	70	10	20	10-30
	Clayey (10-14")	600-1,400 (1,100)	75	15	10	55-60
Sagebrush Complex	Shallow Clayey (10-14")	500-1,000 (750)	75	5	20	40-50
Mountain Shrub	Shallow Loamy (10-14")	700-1,200 (900)	75	10	15	15-30

TABLE 1-17 (CONTINUED)

Vegetation Type	Range Site (Precipitation Zone)	Annual Production Estimates (pounds/acre)	% Composition by Weight			% Ground Cover
			Grass	Forb	Shrub	
Mixed Desert Shrub	Sands (7-9")	350-700 (500)	60	15	25	15-25
Greasewood	Saline Upland (7-9")	300-600 (450)	55	5	45	20-40
	Saline Lowland (7-9")	800-2,000 (1,200)	60	10	30	55-70
Saltbush	Saline Upland (7-9")	300-600 (450)	50	5	45	20-40
	Saline Lowland (7-9")	800-2,000 (1,200)	60	10	30	55-70
	Clayey (7-9")	300-700 (500)	70	15	15	40-50
	Shale (7-9")	150-300 (200)	55	10	35	5-15
	Shallow Loamy (7-9")	200-450 (350)	70	10	20	10-30
Bunchgrass	Saline Upland (7-9")	300-600 (450)	50	5	45	20-40
	Saline Lowland (7-9")	800-2,000 (1,200)	60	10	30	55-70
	Shallow Sandy (7-9")	200-450 (350)	70	10	20	10-20
	Shallow Loamy (10-14")	700-1,200 (900)	75	10	15	15-30
	Shallow Clayey (10-14")	500-1,000 (750)[2]	75	5	20	40-50

TABLE 1-17 (CONTINUED)

Vegetation Type	Range Site (Precipitation Zone)	Annual Production Estimates (pounds/acre)	% Composition by Weight			% Ground Cover
			Grass	Forb	Shrub	
Pasture/Hayfield	Subirrigated (7-9")	2,300-3,500 (3,000)	65	20	15	85-100
	Subirrigated (10-14")	3,000-4,500 (3,800)	65	20	15	85-100
Riparian	Subirrigated (7-9")	2,300-3,500 (3,000)	65	20	15	85-100
	Subirrigated (10-14")	3,000-4,500 (3,800)	65	20	15	85-100
	Lowland (7-9")	1,400-2,700 (2,000)	45	15	40	65-70

[1]SCS Range Site Description data (November 1977)

[2]Average Annual Production

Rehabilitation Units

In order to provide a framework for identifying sensitive lands within the project area, and in order to develop reclamation recommendations for these areas, data from the soils and vegetation inventories were used to devise a set of "rehabilitation units". Rehabilitation units (defined in the glossary) were identified on the basis of soils, slope, climate, and geomorphic position. By grouping similar areas under these factors, and incorporating vegetation data, rehabilitation recommendations can be made. The rehabilitation unit should be viewed as a land management tool developed from a compilation of resource inventories and interpretations. It provides general guidance to site conditions and erosion control and revegetation techniques and materials pertaining to the Riley Ridge project area.

Table 1-18 identifies rehabilitation units developed for the project area; units that are sensitive to disturbance are so noted on the table. Good, fair, and poor rehabilitation potentials are defined in the glossary.

REHABILITATION UNITS DEVELOPED FOR THE RILEY RIDGE STUDY AREA

CLIMATIC ZONE A: COOL, DRY SOUTHERN BASINS.
7-9" PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 38-43°F, GROWING SEASON 85-100 DAYS

Rehab. Unit[1]	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
A1	Deep, wet soils formed in stream-lain alluvium on perennial stream drainageways and river bottoms. Corridor Soil Association 101	Loamy over sand and gravel	0-5	60"+	Slight	Moderate: some channel scouring, cutbanks cave.	Pasture/ Hayfield	Fair	Wetness[3], stoniness at depth, restoration of intensive land uses, potential for stream crossings, flooding.	Control cutbank erosion via mechanical techniques (rip-rap,etc.) where necessary. Late fall seeding with fertilization. Transplant shrub seedlings. Drill or broadcast adapted species, depending on wetness.
*A2	Deep and moderately deep, saline-alkaline soils formed in alluvium on dry drainageways and stream terraces. Includes small areas of geographically associated sand dunes. Corridor Soil Associations 102, 104, 105, 107. Bio/West Units 41, 42, 43.	Loamy to clayey, minor sandy	5-15	20-60"	Severe	Slight, some run-on, severe wind erosion hazard over limited areas	Greasewood, Saltbush, Mixed Desert Shrub	Poor	High salts, compaction, drouthiness SENSITIVE REHABILITATION UNIT	Spring-tooth harrow. Add organic seedbed amendments. Use of salt-tolerant plant species, warm and cool season. Broadcast seeding in late fall. Clean hay mulch crimped in @ 2-4 T/a. Fertilize 2-3 years after seedling establishment.
A3	Deep and moderately deep soils forming on upland alluvial fans, pediments, and plateaus. Corridor Soil Associations 103, 203, 206. Bio/West Units 39, 44, 45.	Loamy	5-15	20-60"	Moderate	Slight	Big sagebrush, bunchgrass, few irrigated fields near Big Piney	Good	Drouthiness, some salinity	Drill seeding. Use of drought-tolerant plant species, warm and cool season. Clean straw/hay mulch crimped in @ 2-4 T/a. Fertilize 2-3 years after seedling establishment.
*A4	Shallow to deep, eroding soils on pediments, truncated uplands, badlands, and escarpments. Corridor Soil Associations 204, 207, 224.	Loamy to clayey	15-50	10-40"	Moderate	Severe	Big sagebrush, Saltbush, Bunchgrass	Poor	Steep slopes, drouthiness, depth to bedrock SENSITIVE REHABILITATION UNIT	Add organic seedbed amendments. Contour furrowing. Closely-spaced water bars. Plant adapted warm and cool-season species via broadcast or drill, depending on access. Clean straw/hay mulch applied @ 2-4 T/a. Mulch tackifiers, erosion control netting.

TABLE 1-18 (CONTINUED)

CLIMATIC ZONE B: COOL, DRY BASINS NORTH AND WEST.
10-14" PRECIPITATION ZONE, MEAN ANNUAL AIR
TEMPERATURE 37-40°F, GROWING SEASON 75-90 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
B1	Deep, wet soils formed in stream-lain alluvium on bottomlands. Generally colder than normal for this zone, due to wetness and topo-graphy trapping cold air. Well Field Soil Units 71, 72, 73. Bio/West Units 9, 23.	Loamy over sand and gravel	0-5	60"+	Slight	Moderate: cutbanks cave, some channel scouring	Pasture/ Hayfield Willow Meadow	Fair	Wetness, stoniness at depth, restora-rion of intensive land uses, poten-tion for stream crossings, flooding	See Rehabilitation Unit A1
B2	Deep and moderate-ly deep soils on alluvial fans, high terraces, and pediments. Corridor Soil Association 109. Well Field Soil Units 62, 74, 81D, 84D, 99. Bio/West Units 2, 3, 5, 6, 30, 31, 32, 37.	Loamy to clayey	5-15	30-60"	Moderate	Slight	Big sagebrush, Sagebrush complex, Bunchgrass	Good	Drouthiness, some salinity	See Rehabilitation Unit A3
*B3	Shallow to moder-ately deep soils on ridgeslopes, hillsides, folded and faulted lands. Corridor Soil Associations 309, 310. Well Field Soil Units 84, 86. Includes minor areas of deep soils in Well Field Soil Units 81E, 81F. Bio/West Units 1, 14, 34, 35, 36.	Loamy to clayey	15-30+	10-40"	Moderate	Severe	Big sagebrush, Bunchgrass, some mountain shrub	Poor	Drouthiness, depth to bedrock, high probability of exten-sive cuts and fills, avoid moist slopes to minimize erosion and slumping SENSITIVE REHABILITATION UNIT	See Rehabilitation Unit A4

TABLE 1-18 (CONTINUED)

CLIMATIC ZONE C: COOL, MOIST FOOTHILLS, 15-19" PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 34-37°F, GROWING SEASON 70-85 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
C1	Deep, wet soils formed in stream-lain alluvium in drainageways. Well Field Soil Unit 70. Bio/West Unit 16.	Loamy	2-8	60"	Slight	Moderate: cutbanks cave, some channel scouring	Pasture Willow.	Fair	Wetness, channel crossings, possible disturbance of associated springs and seeps.	See Rehabilitation Unit A1
*C2	Drouthy, shallow and deep, gravelly soils on ridge crests and side-slopes. Well Field Soil Units 50E, 50F, 51E, 51F, 52, 53, 54, 64. ROS Bio/West Units 7, 13, 21.	Loamy, with high rock content	15-30+	10-60"	Moderate	Slight	Bunchgrass, Mountain shrub Douglas fir	Poor	Depth to hard bed-rock, stoniness, slope, drouthiness SENSITIVE REHABILITATION UNIT	Seed drought-tolerant species adapted to shallow stony sites. Restore gravelly surface. Broadcast seed, fertilize 2-3 years after seedling establishment.
C3	Deep, gravelly soils on rolling ridgeslopes and fans. Well Field Soil Units 66D, 75, 92. Bio/West Units 4, 8, 11, 15, 17, 18, 19.	Loamy to clayey, with high rock content	5-15	60"	Moderate	Slight to moderate	Sage Complex, Mountain brush, Aspen	Fair	Stoniness, some salinity, some clayey textures	Drill seed cool-season species, transplant containerized shrub seedlings. Clean straw/hay mulch crimped in @ 2 T/a. Fertilize 1-2 years after seedling establishment.
*C4	Deep, gravelly soils on steep ridgeslopes. Well Field Soil Units 66E, 66F, 77E, 77F, 82, 85, 91. Bio/West Units 12, 20, 22.	Loamy to clayey, with high rock content	15-30+	60"	Moderate	Severe, gullying	Big Sagebrush, Mountain shrub, Aspen	Poor	Slope, stoniness, moist slopes surface erode or slump, need for extensive cuts and fills. SENSITIVE REHABILITATION UNIT	Avoid slump-prone areas. Closely-spaced water bars, other drainage diversions. Mulches, erosion control nets. Broadcast or drill seed according to access. Fertilize 1-2 years after seedling establishment. Transplant containerized shrub seedlings. Use mechanical stabilization techniques such as gabions where necessary.

TABLE 1-18 (CONTINUED)

CLIMATIC ZONE D: COOL, MOIST FOOTHILLS, 20"+ PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 32-35°F, GROWING SEASON 60-75 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
D1	Deep, well drained to poorly drained soils intermixed on alluvial fans and stream terraces. USFS Units 103A, 103B, 106.	Loamy to sandy, occ. high rock content	0-15	60"	Slight	Slight to Moderate	Willow, Mountain Shrub	Fair	Wetness, some stoniness, potential for stream crossings, flooding, shortness of growing season.	Control cutback erosion via mechanical techniques (rip-rap, etc.) where necessary. Spring or fall seeding with fertilization. Transplant shrub seedlings. Drill or broadcast adapted species, depending on wetness.
D2	Deep, gravelly soils on mountain benches. ERT Well Field Soil Units 88, 94, 95. USFS Units 107, 120A, 120B, 124A, 154B, 200B, 203B, 220B, 221B, 360B, 650B, 675B, 702B.	Loamy to clayey, with high rock content	5-15	60"	None	Slight	Mixed Pine Spruce/Subalpine fir, Douglas fir, Clearcut	Good	Shortness of growing season, stoniness, some soil acidity, areas of heavy clay.	Transplant containerized seedlings for trees, shrubs. Spring-tooth harrow. Broadcast adapted cool-season grass species.
03	Deep, gravelly soils on mountain sideslopes. ERT Well Field Soil Units 90, 93E. USFS Units 103C, 120C, 124B, 154C, 200C, 203C, 220C, 221C, 255B, 255C, 360B, 360C, 492B, 492C, 650C, 660C, 675C, 702C, 711C.	Loamy to clayey, with high rock content	15-30	60"	None	Moderate	Mixed Pine Spruce/Subalpine fir, Douglas fir, Clearcut, Mountain Shrub.	Fair	Shortness of growing season, stoniness, some soil acidity, areas of heavy clay	Transplant containerized seedlings. Closely spaced water bars, other drainage diversions. Broadcast adapted cool-season grass species. Mulch w/tackifier or erosion control net.
*04	Deep, well drained gravelly and non-gravelly soils on steep to extremely steep ridges and mountain sideslopes. USFS Units 154D, 220D, 221D, 255D, 360D, 391, 650D, 660D, 675D, 702D, 711D	Loamy to clayey with occ. high rock content	30+	60"	None to slight	Severe	Mixed Pine, Spruce/Subalpine fir, Clearcut, Mountain Shrub.	Poor	Steep to extremely steep slopes, shortness of growing season, need for extensive cuts and fills. SENSITIVE REHABILITATION UNIT	Transplant containerized seedlings for trees, shrubs. Broadcast adapted grass species. Use mechanical stabilization and control structures where necessary. Avoid slump-prone areas.

TABLE 1-18 (CONTINUED)

CLIMATIC ZONE D: COOL, MOIST FOOTHILLS, 20"+ PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 32-35°F, GROWING SEASON 60-75 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
*D5	Deep and shallow, gravelly soils with rock outcrop on steep mountain sideslopes. Well Field Units 55, 93F, 96, 97, 98. Bio/West Unit 10. USFS Units 203D, 355, 492D, 502, 701, 710, 712, 713, 714, 715.	Loamy with high rock content	15-50+	10-60"	Moderate to slight	Severe	Mixed Pine, Spruce/Subalpine fir, Douglas fir, Mountain shrub, Clearcut	Poor	Slope, shortness of growing season, erosion hazard, stoniness, depth to hard bed-rock, need for extensive cuts and fills. SENSITIVE REHABILITATION UNIT	Transplant containerized seedlings for trees, shrubs. See Rehabilitation Unit D4.

Note: See Soils, Vegetation, and Reclamation Technical Report.

[1]Asterisk (*) indicates a sensitive rehabilitation unit.

[2]Slope ranges shown are the dominant slopes; inclusions of flatter or steeper slopes occur within the units. Inclusions of 30 to 50+ percent slopes will require very intensive rehabilitation procedures if disturbed.

[3]Major features defining rehabilitation considerations are underlined.

CHAPTER 2

ENVIRONMENTAL CONSEQUENCES

ASSUMPTIONS

In order to evaluate the impacts to soils and vegetation resulting from the proposed and alternative actions, it was necessary to develop some assumptions for future reclamation practices. This will allow evaluation of short-term and long-term impacts.

- Assumptions for permanent disturbance were developed in order to calculate and evaluate impacts by development phase, construction, operation, and abandonment. Assumptions were made for all major types of facilities (plant sites, roads, pipelines, well pads, and power transmission lines).

- In the analysis it is assumed that the general Erosion Control, Revegetation, and Restoration Guidelines will become part of the right-of-way stipulations and applicants will comply with these measures. These general measures are included in Chapter 3 of this report.

- Additional specific program assumptions are shown as footnotes to Table 2-5.

SIGNIFICANCE CRITERIA

- Impacts to soils were considered significant if increased erosion rates or reduction of soil productivity and stability resulting from project activities would prevent successful rehabilitation and eventual recovery to near preconstruction conditions.

- Evaluations of successful rehabilitation were based on whether soils having severe reclamation constraints would stabilize to near preconstruction conditions within five years of reclamation given the applicant's revegetation plans and compliance with federal stipulations for erosion control and revegetation (see Appendix B).

- Impacts to vegetative productivity and wildlife habitat were considered significant if rehabilitated areas would not 1) have adequate vegetative ground cover to control soil erosion at preconstruction levels and, 2) have adequate vegetative ground cover consisting of plant species which have a utility in the post-disturbance land use within five years following initial revegetation.

- Impacts were considered significant if any federally listed threatened or endangered plant species were affected, since loss of these species would contribute to a decline of an irretrievable resource.

- Impacts to vegetation resulting from operational emissions were considered significant if emissions exceed known injury thresholds for sensitive vegetation (such as Douglas-fir) from chronic exposure to SO_2 and NO_x. Chronic exposure and NO_x could reduce vigor in sensitive species making them more susceptible to injury from disease.

- Impacts were considered significant if construction of roads, well pads and plant sites disturbed poorly drained soils occupied by riparian vegetation. Long-term productivity would be reduced in these areas because the composition and addition of fill would alter soils-water relations in this zone permanently, preventing reestablishment of riparian communities. Riparian areas are scarce in western environments, provide valuable wildlife habitat, and contribute to watershed maintanance.

GENERAL IMPACTS

The principal impacts to soils and vegetation resulting from construction of the Proposed Action or alternatives include the removal of vegetation and the disturbance of soil. The degree of potential impacts from the project would depend on the types of disturbance necessary to construct facilities. Five major types of land disturbance would be associated with the project: gathering system pipelines, well pads, railroads and transmission towers. Construction of these project components would result in direct removal of vegetation, reduced vegetative productivity from sidecasting of earth materials, soil compaction, losses of soil and rock in areas of steep sidehill cuts, and alteration or removal of topsoil resources. Such disturbances would increase surface water runoff and accelerate erosion losses.

The potential impacts to vegetation include foliar damage to plants from exposure to air pollutants released by project facilities; increased off-road traffic that may damage or kill plants and accelerate erosion; increased risk of fire, especially in conifer communities because of a larger human population in the well field area; and increased risk of weed invasion because weeds increase rapidly on disturbed sites and are easily transported to favorable germination sites by wind and livestock. Indirect effects to vegetation include loss of forage for livestock and wildlife for varying lengths of time, and additional browsing or grazing pressure on vegetation resulting from wildlife and lifestock displacement from disturbed areas. Losses are considered short-term if impacts can be mitigated within five years; impacts are long-term if mitigation requires more than five years.

Gathering pipelines would be constructed throughout the life of the well field as needed to serve producing wells. The gathering system would account for 53 percent of the disturbance in the well field. Excavation of pipeline trenches would alter soil profiles; however, construction would not require extensive cuts-and-fills since the system would generally follow gentle slopes or traverse steep inclines. Installation of the gathering system would incorporate erosion control and revegetation measures immediately after disturbance. Accelerated erosion and vegetative

productivity losses would be short-term impacts until pipeline rights-of-way are stabilized (2-5 years).

Construction of well pads, which accounts for 27 percent of the well field disturbance, would potentially have more intensive impacts. Well pads would generally be located on more gently sloping surfaces where erosion potential is less. However, on steeper slopes where cuts-and-fills are necessary to construct the pad, impcats to soil and vegetation would be increased. Sidehill cuts-and-fills on slopes exceeding 30 percent would creat extensive sidewall cuts that may cause slope instability, and would also involve side-casting of large volumes of earth materials onto otherwise undisturbed areas. Such impacts would limit the effectiveness of re-grading in cut areas, and would create difficult conditions for site rehabilitation.

New road construction would have the greatese potential for impacts to soil and vegetation resources. Continued erosion losses would occur along roads. This impact would be most serious where sidehill cuts are constructed, as previously described for well pads. In addition, access roads could be used for off-road land disturbance. The use of unsurfaced roads during wet weather would subject them to rutting. This would increase the hazard of concentrated runoff and resultant gully erosion.

Construction of transmission lines would involve less intensive disturbance to soils and vegetation than construction of other project components. Impacts would generally be limited to compaction from access trails and tower sites. Potential impacts to vegetation are similar to those described earlier, but would be less extensive.

Railroad construction would pose significant impacts to both soils and vegetation, due to the long-term nature of such a project component. Maintaining railroad grades would require cuts-and-fills, the creation of borrow areas and drainage structures, and the use of large volumes of crushed rock as ballast for the track base. These types of disturbance would cause an essentially permanent loss of soil and vegetation resources on areas affected by railroad rights-of-way. The acres of vegetation and sensitive soils affected by Proposed Action or alternative railroads are shown in subsequent tables.

Overall, the risk of significant soil and vegetation impacts would be higher in areas of limited rehabilitation potential. Soils occurring within the project area have been grouped into rehabilitation units according to climatic regime, slope, and other factors (Table 3-3 and the glossary). Sensitive rehabilitation units, as identified in the table, would be more susceptible to impacts should the proposed activities be located on such areas. These sensitive rehabilition areas would require more intensive construction engineering, mechanical erosion controls, and revegetation practices in order to minimize impacts to soils and vegetation.

In order to quantify the potential magnitude of increased erosion losses, the Universal Soil Loss Equation (USLE) was applied to four representative soils within the well field (see Table 2-1). Based on these evaluations, it is expected that; 1) with the use of effective erosion control, reclamation, and revegetation procedures and 2) appropriate engineering design for

TABLE 2-1

WATER EROSION RATES ASSOCIATED WITH SEVERAL SOIL EROSION TREATMENT SCENARIOS[1]

Soil Series and Vegetation Condition	Condition, Erosion Treatment, and Revegetation Scenario	Erosion Rates[2] (Tons/Acre/Year)
Heath Variant Soil - Deep soils with loamy surface textures and clayey subsoils, 25 percent rock fragments on the surface. Annual precipitation - 15 to 19 inches. Slope -10 percent, 300 feet long. Vegetation Cover - 35 percent, in alkali sagebrush.	Current Condition	2.3
	Exposed Compacted Soil[3]	25.0
	Erosion Control Measures	
	- 100-foot interval water bars	14.6
	- 2-ton/acre mulch	1.1
	- 1 ton/acre mulch	3.4
	- 100-foot interval water bars plus 2 ton/acre mulch	0.7
	- 100-foot interval water bars plus 1 ton/acre mulch	2.0
Part of ERT Map Unit 75, Heath Variant - Jerry - Brownsto complex, 5 to 15 percent slopes.	Reseeding (seedling establishment to 10 percent cover, grass)	
	- No erosion control measures	6.1
	- 100-foot interval water bars	3.6
	- 100-foot interval water bars plus contouring[4]	2.15
Farlow Soil - Deep, loamy, very gravelly soils, 35 percent rock fragments on surface. Annual precipitation - over 20 inches. Slope - 35 percent, 200 feet long. Vegetative Cover 50 percent, in mountain shrub.	Current Condition	6.9
	Exposed Compacted Soil[3]	149.0
	Erosion Control Measures	
	- 100-foot interval water bars	98.2
	- 2 ton/acre mulch plus plastic netting	4.6
	- 1 ton/acre mulch plus plastic netting	11.4
	- 100-foot interval water bars plus 2 ton/acre mulch plus netting	3.0
Part of ERT Map Unit 96, Farlow - Starley very gravelly loams, 25 to 50 percent slopes, in Sensitive Rehabilitation Unit D5.	- 100-foot interval water bars plus 1 ton/acre mulch plus netting	7.5
	Reseeding (seedling establishment to 10 percent cover, grass)	
	- No erosion control measures	36.7
	- 100-foot interval water bars	24.2
	- 100-foot interval water bars plus contouring[4]	24.2
	Reseeding (grass plus containerized shrub seedlings, establishment to 50 percent cover with 25 percent low canopy)	
	- 100-foot interval water bars plus contouring[4]	4.5
Unnamed 1Be Soil - Deep, loamy, non-gravelly soil under coniferous forest on USFS lands. Annual precipitation - over 20 inches. Slope -20 percent, 200 feet long. Vegetation Cover - 75 percent canopy with 100 percent litter cover, in mixed pine.	Current Condition	0.1
	Exposed Compacted Soil	51.1
	Erosion Control Measures	
	- 100-foot interval water bars	33.7
	- 2 ton/acre mulch plus plastic netting	1.6
	- 1 ton/acre mulch plus plastic netting	3.9
	- 100-foot interval water bars plus 2 ton/acre mulch plus plastic netting	1.0
Part of USFS Map Unit 154, Phase C, 15 to 30 percent slopes.	- 100-foot interval water bars plus 1 ton/acre mulch plus plastic netting	2.6
	Reseeding (seedling establishment to 20 percent cover, grass)[5]	
	- No erosion control measures	7.9
	- 100-foot interval water bars plus contouring	4.7
Moyerson Soil - Shallow, clayey soil 10 to 20 inches deep over shale bedrock. Annual precipitation - 12 inches. Slope - 20 percent, 100 feet long. Vegetation Cover - bunchgrass, saltbush.	Current Condition	4.5
	Exposed Compacted Soil	18.2
	Erosion control Measures	
	- 50-feet interval water bars	12.0
	- 2 ton/acre mulch plus jute or plastic netting	0.6
	- 1 ton/acre mulch plus jute or plastic netting	1.4
	- 50-foot interval water bars plus 2 ton/acre mulch plus jute or plastic netting	0.4
Representative part of ERT Soil Unit 310, in Sensitive Rehabilitation Unit B3.	- 50-foot interval water bars plus 1 ton/acre mulch plus jute or plastic netting	0.9
	Reseeding (seedling establishment to 10 percent cover, grass)	
	- No erosion control measures	4.5
	- 50-foot interval water bars plus contouring	2.7

TABLE 2-1 (CONTINUED)

Footnotes

[1]Based on laboratory data and other information contained in the Soils, Vegetation, and Reclamation Technical Report.

[2]Based on Universal Soil Loss Equation factors and concepts (SCS 1977b, Clyde et al. 1978, Patric 1982, SCS and EPA 1977). Soil loss estimates are speculative above slopes of 24 percent, as these values are projected beyond available research data.

[3]Based on barren topsoil compacted by a bulldozer up and down the slope.

[4]Topsoil spreading and seedbed preparation done on the contour.

[5]Long-term re-establishment of forest canopy not accounted for.

Conclusions

These estimated erosion rates demonstrate the effectiveness of the various erosion control and revegetation measures. For example, the use of mulches on well pad cuts and fills and on sidehill road cuts is effective for temporary stabilization of disturbed sites. This practice becomes still more effective when applied in conjunction with water bars or other mechanical erosion control practices as outlined in the Soils, Vegetation, and Reclamation Technical Report.

Soil loss tolerances (the loss allowable with productivity level maintained) for the Heath variant, Farlow, and Unnamed 1Be soils are about 5 tons/acre/year each. The Moyerson soil has a soil loss tolerance of 1 ton/acre/year. It should be noted that successful revegetation and mechanical treatments are both needed to reach or even approximate these limits in a re-established land use system.

structures and well pads erosion losses would be held to within tolerance limits established for the Bridger-Teton National Forest and BLM lands.

Some small, unquantifiable soil losses would occur prior to rehabilitation efforts during the construction phase. In addition, a few small sensitive areas would require follow-up rehabilitation efforts until stabilized. Impacts to soils would generally be insignificant because the implementation of applicable erosion control and revegetation practices (see Chapter 3) will minimize erosion and productivity losses. However, impacts to soils would be significant if applicable rehabilitation measures were not properly implemented due to lack of compliance with approved erosion control plans and stipulations.

Well pads would not be constructed in riparian areas, and pipeline rights-of-way in riparian areas would rehabilitate quickly. However, addition of fill for road construction would permanently alter soils-water relations in the riparian zone, reducing the potential for reestablishment of similar vegetation.

The following sections describe the impacts to soils and vegetation associated with implementing the Proposed Action and the three alternatives (Buckhorn, Shute Creek, and Northern Alternative). Impacts to vegetation are expressed as area of disturbance by sensitive rehabilitation unit. This quantification provides a measure of impact magnitude (area), and quality (productivity of a vegetation type or degree of difficulty for revegetation). Impact duration (time required for revegetation and natural regeneration) was discussed in general terms in the baseline section, and revegetation times are estimated in the rehabilitation section in Chapter 3.

PROPOSED ACTION

CONSTRUCTION

Implementation of the Proposed Action would result in the potential land disturbance of 12,852 acres (Table 2-2). Of this land disturbance total, approximately 70 percent would occur in sagebrush-dominated vegetation types. The next most disturbed type (8 percent) would be conifer forests (mixed pine, Douglas-fir, spruce-fir).

Construction of the proposed well field would affect approximately 1,467 acres of soils in sensitive rehabilitation units (see Table 2-3). This represents 11 percent of the proposed disturbed acreage on the well field. Major environmental consequences on these areas would be soil compaction, erosion losses during and after construction, and difficulties in restoring a suitable plant growth medium from gravelly or clayey soil materials.

A minor proportion (10 acres) of the sensitive areas of the well field are characterized by adverse salinity and/or alkalinity.

Approximately 75 percent (1,105 acres) of the sensitive areas on the well field are composed of steep, gravelly and/or clayey soils, some of which have bedrock at shallow depths. Soils that are shallow over limestones, dolomites, and quartzites have non-rippable bedrock contacts; excavation will necessitate blasting. Soils over shales and sandstones, particularly

TABLE 2-2

POTENTIAL CONSTRUCTION DISTURBANCE BY VEGETATION TYPE

PROPOSED ACTION

(ACRES)

	Vegetation Types[1]															
	BS	SC	MS	MDS	Sa	G	MP	SF	D	A	C	R	P/H	Gr	Di	Total
Well Field																
Roads	208	196	4	0	0	70	124	29	18	34	9	29	36	0	0	757
Wells	294	284	7	0	0	90	245	48	18	49	18	0	49	0	0	1,102
Gathering System	549	403	10	0	0	207	452	106	32	107	38	106	89	10	0	2,109
Total	1,051	883	21	0	0	367	821	183	68	190	65	135	174	10	0	3,968
Plant Sites																
East Dry Basin	483	0	0	0	157	0	0	0	0	0	0	0	0	0	0	640
West Dry Basin	605	30	0	0	0	5	0	0	0	0	0	0	0	0	0	640
Big Mesa	506	0	26	0	0	108	0	0	0	0	0	0	0	0	0	640
Craven Creek	496	0	0	144	0	0	0	0	0	0	0	0	0	0	0	640
Sulfur Loadout	22	0	0	0	125	0	0	0	0	0	0	34	0	0	59	240
Total	2,112	30	26	144	282	113	0	0	0	0	0	34	0	0	59	2,800
Linear Facilities																
Railroads	22	0	0	31	18	0	0	0	0	0	0	2	0	8	4	85
Transmission Lines	916	0	0	31	117	56	0	0	0	0	0	10	37	15	0	1,182
Pipelines	3,738	131	0	31	121	42	0	0	0	0	0	63	13	123	0	4,262
Sulfur Pipeline	372	46	0	8	49	12	0	0	0	0	0	5	27	9	0	528
Access Roads	20	4	0	0	3	0	0	0	0	0	0	0	0	0	0	27
Total	5,068	181	0	101	308	110	0	0	0	0	0	80	77	155	4	6,084
Grand Total	8,231	1,094	47	245	590	590	821	183	68	190	65	249	251	165	63	12,852

[1]BS = Big Sagebrush
SC = Sagebrush Complex
MS = Mountain Shrub
MDS = Mixed Desert Shrub
Sa = Saltbush
G = Grassland
MP = Mixed Pine
SF = Spruce Fir
D = Douglas-fir
A = Aspen
C = Clearcut
R = Riparian
P/H = Pasture/Hayfield
Gr = Greasewood
Di = Disturbed (Disturbed Land)

TABLE 2-3

SENSITIVE SOIL REHABILITATION UNITS (ACRES)
IN THE WELL FIELD

Unit	Soils	Units and Area										Total	Rehabilitation Considerations
		Hogsback	Dry Piney	Graphite	Fogarty Creek	Lake Ridge	Tip Top	Riley Ridge	North Riley Ridge	Sawmill	Darby Mtn		
A2	Deep and moderately deep, saline-alkaline soils formed in alluvium on dry drainage-ways and stream terraces. Includes small areas of geographically associated sand dunes. Corridor Soil Associations 102, 104, 105, 107						10					10	High salts, compaction, drouthiness
B3	Shallow to moderately deep soils on ridgeslopes, hillsides, folded and faulted lands. Corridor Soil Associations 309, 301. ERT Well Field Soil Units 82,84, 86. Includes minor areas of deep soils in ERT Well Field Units 81E, 81F. Bio/West Units 1, 14, 34, 35, 36.	37	23		2		234	19	7	30		352	Drouthiness, depth to bedrock, high probability of extensive cuts and fills, avoid moist slopes to minimize surface erosion and slumping.
C2	Drouthy, shallow and deep, gravelly soils on ridge crests and sideslopes. ERT Well Field Soil Units 50E, 50F, 51E, 51F, 52, 53, 54, 64, 97. Bio/West Units 7, 13, 21	124					31	7	5	2		169	Depth to hard bedrock, stoniness, slope, drouthiness
C4	Deep, gravelly soils on steep ridgeslopes. Well Field Soil Units 66E, 66F, 77E, 77F, 82, 85, 91. Bio/West Units 12, 20, 22.		39		50	6	6	27	21	73		222	Slope, stoniness, moist slopes surface erode or slump, need for extensive cuts and fills.

TABLE 2-3 (CONTINUED)

Unit	Soils	Units and Area										Rehabilitation Considerations
		Hogsback	Dry Piney	Graphite	Fogarty Creek	Lake Ridge	Tip Top	Riley Ridge	North Riley Ridge	Sawmill	Darby Mtn	Total	
D4	Deep, nongravelly and gravelly soils on steep to extremely steep ridges and mountain sideslopes. USFS Units 154C, 200C, 220C, 221C, 255C, 360C, 391, 650C, 660C, 675B, 702C, 711B.					127		9	2		5	143	Slope, shortness of growing season, erosion hazard, need for extensive cuts and fills.
D5	Deep and shallow, gravelly soils with rock outcrop on steep mountain sideslopes. ERT Well Field Units 55, 93F, 96, 98. USFS Units 203C, 355, 492C, 502, 701, 701, 710, 712, 713, 714, 715. Bio/West Unit 10, 47, 48.		26	19	61	339		7	25		26	571	Slope, shortness of growing season, erosion hazard, stoniness, depth to hard bedrock, need for extensive cuts and fills.
TOTAL ACRES		161	88	19	113	472	281	137	60	105	31	1,467	

of the Wasatch formation, have rippable bedrock contacts. Site stabilization of well pads, roads, and pipelines would involve intensive rehabilitation techniques. Construction on areas of shallow bedrock would probably involve blasting, which would make future rehabilitation difficult.

Construction of the proposed corridors and plant sites would affect sensitive rehabilitation units on approximately 1,533 acres of linear facilities and 969 acres of proposed plant sites (see Table 2-4). About half of these sensitive areas on the proposed linear facilities and 80 percent of the sensitive areas within proposed plant sites, occur on strongly saline-alkaline soils (see Table 2-4). Site stabilization and restoration would be difficult on these areas. The proposed East Dry Basin (Quasar), Craven Creek, and sulfur loadout sites are located within such areas. The sulfur loadout facility would also occupy approximately 34 acres of poorly drained alluvial soils. Soil compaction and potential pipe corrosion would be environmental consequences at this location. Additional sensitive units occur at the proposed West Dry Basin, Big Mesa, and sulfur loadout facilities where shallow, steep soils are present in rehabilitation unit A4 (see Table 2-4). Site stabilization and revegetation would be major rehabilitation concerns in these areas.

A total of 3,968 acres of vegetation would be removed from the well field during construction. Of this total, the majority (49 percent or 1,934 acres) consists of sagebrush-dominated areas, followed by conifer forest (27 percent or 1,072 acres) (Table 2-2). Significant impacts are expected to result from construction in the riparian types, an indicator of poorly drained soils within the riparian zone. A total of 155 acres of riparian vegetation would be potentially disturbed. Significant impacts would occur on 29 acres, where road building would result in a long-term productivity loss. No listed threatened or endangered plant species would be affected by construction on the well field (Table 1-11). One federal candidate species (Astragalus paysonii) is known from clearcut areas within the Darby Mountain Unit. No listed threatened or endangered species would be affected by construction (Table 1-11).

A total of 2,800 acres would be disturbed by construction of the plant sites and sulfur loadout facilities. Of this disturbance total, 74 percent or 2,112 acres would occur in sagebrush-dominated types (Table 2-2). Potentially significant impacts on 34 acres are expected from construction in the riparian zone, where somewhat poorly to poorly drained soils predominate.

A total of 6,084 acres would be potentially disturbed by corridor construction; nearly 80 percent or 4,790 acres of the disturbance would be associated with pipelines (Table 2-2). Of the total disturbance, 83 percent or 5,068 acres would occur in sagebrush-dominated types. Potentially significant impacts on 80 acres in the riparian zone are anticipated.

One rare plant species (Penstemon paysoniorum) is known from the vicinity of several corridors in the southern portion of the Riley Ridge study area. However, no federally listed threatened or endangered species would be affected.

TABLE 2-4

AREAS (ACRES) OF POTENTIAL CONSTRUCTION DISTURBANCE ON SENSITIVE REHABILITATION UNITS[1]
PROPOSED ACTION

	A2	A4	B3	C2	C4	D4	D5	Total
Well Field								
Roads	0	0	113	50	66	32	125	386
Wells	0	0	84	64	63	38	145	394
Gathering System	10	0	155	55	93	73	301	687
Subtotal	10	0	352	169	222	143	571	1,467
Plant Sites								
East Dry Basin (Quasar)	600	0	0	0	0	0	0	600
West Dry Basin (Exxon)	0	40	0	0	0	0	0	40
Big Mesa (Exxon)	0	120	0	0	0	0	0	120
Craven Creek (Northwest)	144	0	0	0	0	0	0	144
Sulfur Loadout (Exxon)	40	25	0	0	0	0	0	65
Subtotal	784	185	0	0	0	0	0	969
Linear Facilities								
Railroads	58	0	0	0	0	0	0	58
Transmission Line	189	157	113	0	0	0	0	459
Pipeline	405	448	0	0	0	0	0	853
Sulfur Pipeline	138	20	0	0	0	0	0	158
Access Roads	1	4	0	0	0	0	0	5
Subtotal	791	699	113	0	0	0	0	1,533
Total	1,585	814	465	169	222	143	571	3,969

[1]Sensitive Rehabilitation Units are identified in Table 3-3.

OPERATION

Based on applicants' plans to reclaim rights-of-way and well pads after construction, a total of 4,154 acres (Table 2-5) would remain in use (unreclaimed) after long-term operation is initiated. Operation of the proposed well field would have no significant impacts on the soil resource.

Two principal gaseous pollutants, sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) commonly responsible for tissue damage in plants, would be emitted by well field diesel generators and gas treatment plants. The following discussion reviews the effects of these pollutants on vegetation as a means of providing an index of vegetation susceptibility for the Riley Ridge project area. The sensitivity of plants to damage from pollutants depends upon the species, the soil moisture status, plant phenology, time of day, and synergy with other pollutants. Most studies of plant susceptibility to pollutant damage are conducted under controlled laboratory and field conditions. These dose-response studies provide general guidelines for comparison with expected emissions. Table 2-5 provides a summary of the maximum expected concentrations of SO_2 and NO_x pollutants over different time intervals for the Proposed Action and alternatives.

The toxicity of SO_2 can be summarized as follows:

> "Sulfur dioxide enters leaves mainly through the stomata. The toxicity of this gas to the mesophyll cells of the leaves is primarily due to its reducing properties. Injury to the leaves has been classified into two types, acute or chronic. Acute injury is caused by absorption of high concentrations of sulfur dioxide in a relatively short time. This results in a rapid accumulation of sulphite which is toxic to the metabolic processes taking place in the mesophyll cells. Chronic injury is caused by a long-term absorption of sulfur dioxide at sub-lethal concentrations. The sulfite formed is oxidized to sulphate at about the same rate the gas is absorbed. When sulphate accumulates beyond a threshold value that the plant cells can tolerate, chronic injury results. It is estimated that sulphate is about 30 times less toxic than sulphite" (Linzon 1969).

Limited research has been conducted on the susceptibility of plants characteristic of arid environments. Hill et al. (1974) exposed several of the species found on the Riley Ridge Project area to SO_2. He used concentrations of 0.5, 1.0, 2.0, 4.0, 6.0, and 10.0 parts/million SO_2 for two hours in the study. Species included serviceberry, sagebrush, cheatgrass, mountain mahogany, rabbitbrush, sweetvetch, Utah juniper, prickly pear cactus, Indian ricegrass, pinyon pine, squirreltail, and snowberry. Of these species, Indian ricegrass appeared to be most sensitive and was injured at 0.5 parts/million SO_2. The remaining species, with the exception of serviceberry and snowberry, were unaffected by exposure to 1.0 part/million SO_2. After conducting their study with 87 species of native vegetation, the authors concluded that most of the plants required exposure to more than 2 parts/million SO_2 for 2 hours to produce injury. Tingey et al. (1976) exposed western wheatgrass, Idaho fescue (Festuca idahoensis),

TABLE 2-5

NUMBER OF ACRES DISTURBED BY COMPONENT FOR THE PROPOSED ACTION

	Construction	Reclaimed	Operation	Reclaimed	Abandonment[1]
Well Field					
Well Sites	1,102	658	444	444	0
Gathering System	2,109	2,109	0	0	0
Access Roads[2]	757	0	757	151	606
Subtotal	3,968	2,767	1,201	595	606
Plant Sites	2,800	0	2,800	2,800	0
Corridors					
Railroad[3]	85	64	21	8	13
Pipelines[4]	4,790	4,685	105	105	0
Transmission Line	1,182	1,182	0	0	0
Access Roads	27	0	27	5	22
Subtotal	6,084	5,931	153	118	35
TOTAL	12,852	8,698	4,154	3,513	641

[1]Represents the number of acres of disturbance that would not be reclaimed after the project is abandoned. Included here are facilities that would continue in use after project abandonment, or are infeasible to reclaim.

[2]Many existing roads would only require upgrading; thus, new disturbance would be less than total land requirement. It is assumed that 80 percent of the project road system would remain in use after project abandonment.

[3]It is assumed that the operational right-of-way would be 25 feet wide and that a 15-foot wide portion of the right-of-way would be infeasible to reclaim upon project abandonment.

[4]It is assumed that the sulfur pipeline would require a 15-foot wide strip for an access trail during project operation.

prairie junegrass (Koeleria cristata), needle-and-thread grass (Stipa comata), and fringed sagewort (Artemisia frigida) to 0.5 to 2.0 parts/million SO_2 for 4 hours. None of the plant species were injured at concentrations below 1.0 part/million for 4 hours.

An evaluation of 3-hour maximum air pollutant concentration data (Table 2-5) indicates that plant species would not be significantly affected by these short-term SO_2 exposures from the well field diesel generators or treatment plants. Exposures of western wheatgrass (Agropyron smithii) at Colstrip, Montana, to SO_2 concentrations averaging 0.073 part/million for the entire growing season did not produce foliar SO_2 injury, but did induce accelerated leaf senescence (Heitschmidt et al. 1978; Rice et al. 1979).

In a report assessing up to three years of SO_2 fumigations at Colstrip, Montana, Dodd et al. (1979) stated that no differences in above-ground biomass were found between the plants receiving the SO_2 exposures and the controls. The lowest concentation of SO_2 used in the study was approximately 0.025 part/million and the highest approximately 0.073. Exposures were conducted throughout the growing season (Preston 1979). The lowest concentration used in the study is greater than the maximum annual average concentration of .005 part/million SO_2. Thus, it is anticipated that annual SO_2 emissions from the Riley Ridge Project would not have any significant impact on biomass production.

LeBlanc and Rao (1973) established SO_2 levels which they believe represent thresholds for injury to foliose lichens which are highly sensitive to SO_2. They proposed long-term average concentrations of 0.03 part/million as an acute injury threshold and concentrations between 0.006 and 0.03 part/million as a chronic injury threshold. The maximum short-term (24-hour) concentration of SO_2 expected for the Proposed Action is 0.04 part/million (124 micrograms/meter^3). Thus it would appear that there is a slight potential for acute injury to foliose lichens at the maximum expected SO_2 levels. However, many of the lichens present on the Riley Ridge sites are crustose, saxicolous types (forming shallow layers on rocks). Le Blanc and Rao (1975) state that crustose lichen growth forms are generally more resistent to SO_2 injury than foliose and fruticose lichen types. Therefore, impacts are not expected to be significant.

Acute symptoms of nitrogen dioxide injury closely resemble injury by SO_2. Taylor (1969) states that acute injury to sensitive vegetation requires 6 parts/million over 7 hours, and chronic injury results from exposure to 0.5 part/million for many hours. It is further stated that "such periods of sustained elevated concentrations probably do not occur because NO_2 is consumed in the photochemical reaction which produces ozone and PAN. It is doubtful if NO_2 is presently causing an appreciable amount of plant injury but it is quite possible that dangerous concentrations may be common some time in the future". Maximum NO_2 concentrations emitted from well field generators would be 0.08 part/million, far below the threshold for both acute or chronic injury. No significant impacts to vegetation are expected from this pollutant.

ABANDONMENT

Abandonment of the proposed well field would generally not involve significant environmental impacts to soil resources. Applicable reclamation techniques would be utilized to ensure site stability and revegetation.

At the completion of the project, a total of 641 acres (Table 2-5) would remain in use (unreclaimed), including 13 acres for the railroad spur which is assumed would be abandoned and unreclaimed. This is because major regrading of the roadbed to facilitate revegetation is assumed to be infeasible. This unreclaimed acreage represents a long-term impact.

In summary, given the general erosion control and revegetation stipulations for federal lands and special mitigation measures recommended in Chapter 3, no significant impacts to soil productivity or stability would result from construction, operation, and abandonment of temporary facilities for the proposed action.

A significant reduction in long-term productivity on 156 acres of riparian vegetation is anticipated as a result of construction of roads, well pads, and plant sites. In addition, 13 acres of the railroad route would be unreclaimed and would be permanently lost.

COMPONENT ALTERNATIVES TO THE PROPOSED ACTION

Sulfur Transport

Construction of the proposed railroad would affect approximately 19.4 miles (235 acres) of sensitive rehabilitation units, of which 17.8 miles (216 acres) are comprised of strongly saline-alkaline soils. About 1.6 miles (19 acres) cross steep, shaly areas (see Table 2-7).

The Exxon railroad option from West Dry Basin to the Stauffer Chemical spur would disturb a total of 1,109 acres, of which 80 percent consists of sagebrush-dominated communities (Table 2-6). Potentially significant impacts on 22 acres in the riparian zone are anticipated from this option. A total of 166 acres of unreclaimed railroad right-of-way would remain after abandonment, a long-term impact (Table 2-8).

Employee Housing

The three construction camp sites (West Dry Basin, East Dry Basin, and Big Mesa) would each disturb 320 acres of sagebrush communities. The proposed employee housing option would affect approximately 30 acres of highly saline-alkaline soils at the proposed West Dry Basin construction camp. In all three cases, the sagebrush vegetation type would be primarily disturbed. No significant impacts to vegetation are anticipated for implementation of any or all of these options, since disturbance to sagebrush communities is not considered significant, given the Significance Criteria and adherence to erosion control and revegetation stipulations.

Power Supply

The UP&L power transmission line system would affect 1,152 acres of vegetation if substituted fof the proposed power supply system to the Proposed Action. It would affect 1,182 acres if substituted for the Buckhorn Alternative system, and 970 acres of vegetation if substituted for the Northern Alternative system. Sagebrush communities would be the vegetation types most affected (over 85 percent of each alternative). Between 13 and 15 acres of riparian vegetation would also be affected at perennial stream crossings for all alternatives. About 680 acres of

TABLE 2-6

POTENTIAL CONSTRUCTION DISTURBANCE BY VEGETATION TYPE
COMPONENT ALTERNATIVES
(ACRES)

	Vegetation Types[1]															
	BS	SC	MS	MDS	Sa	G	MP	SF	D	A	C	R	P/H	Gr	Di	Total
Sulfur Transport																
Railroad to West Dry Basin	885	0	0	14	124	22	0	0	0	0	0	22	21	21	0	1,109
Railroad to Shute Creek	39	0	0	8	50	0	0	0	0	0	0	0	0	6	0	103
Power Supply																
UP&L - Proposed Action	1,028	0	20	0	29	26	0	0	0	0	0	13	28	8	0	1,152
Buckhorn	1,042	0	16	0	40	26	0	0	0	0	0	15	33	10	0	1,182
Shute Creek	1,105	0	16	0	54	26	0	0	0	0	0	15	33	12	0	1,261
Northern	846	0	20	0	34	21	0	0	0	0	0	13	28	8	0	970
BLM - Proposed Action	991	0	28	25	53	59	0	0	0	0	0	12	24	14	0	1,206
Buckhorn	1,004	0	24	25	64	59	0	0	0	0	0	15	29	16	0	1,236
Shute Creek	957	0	24	34	113	59	0	0	0	0	0	15	29	17	0	1,248
Northern	846	0	21	0	39	42	0	0	0	0	0	10	29	7	0	994
Employee Housing																
East Dry Basin Camp	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320
West Dry Basin Camp	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320
Big Mesa Camp	220	100	0	0	0	0	0	0	0	0	0	0	0	0	0	320
Buckhorn Camp	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320
Shute Creek Camp	0	0	0	320	0	0	0	0	0	0	0	0	0	0	0	320

[1]BS = Big Sagebrush
SC = Sagebrush Complex
MS = Mountain Shrub
MDS = Mixed Desert Shrub
Sa = Saltbush
G = Grassland
MP = Mixed Pine
SF = Spruce fir
D = Douglas-fir
A = Aspen
C = Clearcut
R = Riparian
P/H = Pasture/Hayfield
Gr = Greasewood
Di = Disturbed

TABLE 2-7

AREAS (ACRES) OF POTENTIAL CONSTRUCTION DISTURBANCE ON SENSITIVE REHABILITATION UNITS[1]
COMPONENT ALTERNATIVES

	A2	A4	B3	C2	C4	D4	D5	Total
Sulfur Transport								
Railroad to West Dry Basin	216	19	0	0	0	0	0	235
Railroad to Shute Creek	69	0	0	0	0	0	0	69
Power Supply								
UP&L - Proposed Action	254	426	0	0	0	0	0	680
UP&L - Buckhorn	274	406	0	0	0	0	0	680
UP&L - Shute Creek	243	397	0	0	0	0	0	640
UP&L - Northern	283	470	0	0	0	0	0	753
BLM - Proposed Action	287	414	0	0	0	0	0	701
BLM - Buckhorn	308	395	0	0	0	0	0	703
BLM - Shute Creek	347	386	0	0	0	0	0	733
BLM - Northern	253	296	0	0	0	0	0	549
Employee Housing								
East Dry Basin Camp	0	0	0	0	0	0	0	0
West Dry Basin Camp	30	0	0	0	0	0	0	30
Big Mesa Camp	0	0	0	0	0	0	0	0
Buckhorn Camp	0	0	0	0	0	0	0	0
Shute Creek Camp	60	0	0	0	0	0	0	60

[1]Sensitive Rehabilitation Units are identified in Table 3-3.

TABLE 2-8

NUMBER OF ACRES AFFECTED BY EACH COMPONENT ALTERNATIVE

	Construction	Reclaimed	Operation	Reclaimed	Abandonment[1]
Sulfur Transport[2]					
Railroad to West Dry Basin	1,109	832	277	111	166
Railroad to Shute Creek	103	77	26	11	15
Power Supply UP&L System					
Proposed Action	1,152	1,152	0	0	0
Buckhorn Alternative	1,182	1,182	0	0	0
Shute Creek Alternative	1,261	1,261	0	0	0
Northern Alternative	970	970	0	0	0
Power Supply BLM System					
Proposed Action	1,206	1,206	0	0	0
Buckhorn Alternative	1,236	1,236	0	0	0
Shute Creek	1,248	1,248	0	0	0
Northern Alternative	994	994	0	0	0
Employee Housing					
East Dry Basin Camp	320	320	0	0	0
West Dry Basin Camp	320	320	0	0	0
Big Mesa Camp	320	320	0	0	0
Buckhorn Camp	320	320	0	0	0
Shute Creek Camp	320	320	0	0	0

[1]Represents the number of acres of disturbance that would not be reclaimed after the project is abandoned. Included here are facilities that would continue in use after project abandonment, or are infeasible to reclaim.

[2]It is assumed that the operational right-of-way would be 25 feet wide and that a 15-foot wide portion of the right-of-way would be infeasible to reclaim upon project abandonment.

sensitive rehabilitation units would be affected by substitution to the Proposed Action. Similarly, 680 acres of sensitive rehabilitation units would be affected by UP&L substitution to the Buckhorn Alternative. About 640 and 753 acres of sensitive areas would be affected for the Shute Creek and Northern Alternatives, respectively. The sensitive rehabilitation units affected are dominantly steep, shaly areas (60 to 70 percent for each alternative) with the remainder comprised of strongly saline/alkaline soils.

The BLM power transmission line system would affect 1,206 acres of vegetation if substituted for the proposed power supply system to the Proposed Action. It would affect 1,236 acres of vegetation if substituted to the Buckhorn Alternative, 1,248 acres if substituted to the Shute Creek Alternative, and 994 acres if substituted for the proposed system to the Northern Alternative. Between 10 and 15 acres of riparian vegetation would be affected at perennial stream crossings for all alternatives. Of remaining vegetation communities, the sagebrush type would be most affected (75 to 85 percent of each alternative). About 701 acres of sensitive rehabilitation units would be affected under the BLM substitution for the Proposed Action. About 703 acres of sensitive rehabilitation units would be affected for the Buckhorn Alternative. About 733 acres and 549 acres of sensitive areas would be affected for the Shute Creek and Northern Alternatives, respectively. Generally, 40 to 45 percent of the sensitive acreage is comprised of strongly saline/alkaline soils, while the remainder is comprised of steep, shaly areas.

BUCKHORN ALTERNATIVE

CONSTRUCTION

Implementation of the Buckhorn Alternative would result in the disturbance of 12,983 acres (Table 2-9). Of this disturbance total, 75 percent (9,676 acres) would occur in sagebrush-dominated communities. Anticipated impacts in the well field are the same as those described under the Proposed Action.

Construction of the proposed plant sites would affect approximately 95 acres total of steep, shaly areas at West Dry Basin, East Dry Basin (Exxon), Buckhorn, and the sulfur loadout facility. In addition, 254 acres of strongly saline-alkaline soils would be affected (see Table 2-10). Approximately 1,676 acres of linear facilities would occur on similar sensitive units. Approximately 30 acres of highly saline-alkaline soils would be affected by component options at the West Dry Basin construction camp.

A total of 2,800 acres would be disturbed by construction of the plant sites and sulfur loadout facilities. Of this disturbance, 81 percent (2,276 acres) would occur in sagebrush-dominated types (Table 2-9). Significant impacts on 34 acres are expected from construction in the riparian zone.

A total of 6,215 acres would be potentially disturbed by corridor construction; 78 percent of the disturbance would be associated with pipelines (Table 2-9). Potentially significant impacts on 83 acres in the riparian zone are anticipated. No impacts on listed threatened or endangered plant species or anticipated.

TABLE 2-9

POTENTIAL CONSTRUCTION DISTURBANCE BY VEGETATION TYPE
BUCKHORN ALTERNATIVE
(ACRES)

	Vegetation Types[1]															
	BS	SC	MS	MDS	Sa	G	MP	SF	D	A	C	R	P/H	Gr	Di	Total
Well Field																
Roads	208	196	4	0	0	70	124	29	18	34	9	29	36	0	0	757
Wells	294	284	7	0	0	90	245	48	18	49	18	0	49	0	0	1,102
Gathering System	549	403	10	0	0	207	452	106	32	107	38	106	89	10	0	2,109
Total	1,051	883	21	0	0	367	821	183	68	190	65	135	174	10	0	3,968
Corridors																
Railroads	22	0	0	31	18	0	0	0	0	0	0	2	0	8	4	85
Transmission Lines	967	0	0	31	110	46	0	0	0	0	0	14	41	19	0	1,228
Pipelines	3,803	62	0	31	145	35	0	0	0	0	0	61	31	89	0	4,257
Sulfur Pipeline	459	46	0	8	53	12	0	0	0	0	0	6	31	13	0	628
Access Roads	14	0	0	0	3	0	0	0	0	0	0	0	0	0	0	17
Total	5,265	108	0	101	329	93	0	0	0	0	0	83	103	129	4	6,215
Plant Sites																
Buckhorn	640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	640
West Dry Basin	605	30	0	0	0	5	0	0	0	0	0	0	0	0	0	640
East Dry Basin	483	0	0	0	157	0	0	0	0	0	0	0	0	0	0	640
Craven Creek	496	0	0	144	0	0	0	0	0	0	0	0	0	0	0	640
Sulfur Loadout	22	0	0	0	125	0	0	0	0	0	0	34	0	0	59	240
Total	2,246	30	0	144	282	5	0	0	0	0	0	34	0	0	59	2,800
Grand Total	8,562	1,021	21	245	611	465	821	183	68	190	65	252	277	139	63	12,983

[1]BS = Big Sagebrush
SC = Sagebrush Complex
MS = Mountain Shrub
MDS = Mixed Desert Shrub
Sa = Saltbush
G = Grassland
MP = Mixed Pine
SF = Spruce/Fir
D = Douglas-fir
A = Aspen
C = Clearcut
R = Riparian
P/H = Pasture/Hayfield
Gr = Greasewood
Di = Disturbed

TABLE 2-10

AREAS (ACRES) OF POTENTIAL CONSTRUCTION DISTURBANCE ON SENSITIVE REHABILITATION UNITS[1]
BUCKHORN ALTERNATIVE

	A2	A4	B3	C2	C4	D4	D5	Total
Well Field								
Roads	0	0	113	50	66	32	125	386
Wells	0	0	84	64	63	38	145	394
Gathering System	10	0	155	55	93	73	301	687
Subtotal	10	0	352	169	222	143	571	1,467
Plant Sites								
Buckhorn (Quasar)	0	0	0	0	0	0	0	0
West Dry Basin (Exxon)	0	40	0	0	0	0	0	40
East Dry Basin (Exxon)	70	30	0	0	0	0	0	100
Craven Creek (Northwest)	144	0	0	0	0	0	0	144
Sulfur Loadout (Exxon)	40	25	0	0	0	0	0	65
Subtotal	254	95	0	0	0	0	0	349
Linear Facilities								
Railroads	58	0	0	0	0	0	0	58
Transmission Line	200	132	113	0	0	0	0	445
Pipeline	481	505	0	0	0	0	0	986
Sulfur Pipeline	139	47	0	0	0	0	0	186
Access Roads	1	0	0	0	0	0	0	1
Subtotal	879	684	113	0	0	0	0	1,676
Total	1,143	779	465	169	222	143	571	3,492

[1]Sensitive Rehabilitation Units are identified in Appendix C.

OPERATION

Based on applicants' plans to reclaim right-of-ways and well pads after construction, a total of 4,164 acres (Table 2-11) would remain in use (unreclaimed) after long-term operations are initiated. Operation of the Buckhorn Alternative would not affect sensitive rehabilitation units.

Based on anticipated emissions from the proposed treatment plants and well field operations, there would not be significant acute or chronic effects on plant growth resulting from exposure to SO_2 or nitrous oxides. See discussion under the Proposed Action.

ABANDONMENT

Abandonment of the Buckhorn Alternative would affect the sensitive rehabilitation units discussed with the Proposed Action. Although difficult, site stabilization and revegetation would ultimately mitigate the consequences of disturbing the sensitive areas; however, at completion of the project, a total of 633 acres (Table 2-11) would remain in use (unreclaimed); 13 acres of railroad corridor are assumed to be abandoned and unreclaimed. The residual unreclaimed acreage is the same as that discussed for the Proposed Action.

In summary, given the general erosion control and revegetation stipulations for federal lands and mitigation measures recommended in Chapter 3, no significant impacts to soil productivity or stability would result from construction, operation, and abandonment of temporary facilities for the Buckhorn Alternative.

Significant impacts to vegetation associated with implementation of the Buckhorn Alternative consists of the potential construction disturbance on 252 acres of riparian vegetation. In addition, 13 acres of land would be unreclaimed after abandonment of the project. These impacts are essentially equivalent to the impacts described under the Proposed Action.

COMPONENT ALTERNATIVES ASSOCIATED WITH THE BUCKHORN ALTERNATIVE

Construction Camp Sites

The West Dry Basin camp site was described under Proposed Action. The Buckhorn camp site consists of 320 acres consisting entirely of a sagebrush-dominated community. No significant impacts are anticipated for either camp option.

SHUTE CREEK ALTERNATIVE

CONSTRUCTION

Implementation of the Shute Creek Alternative would result in the potential disturbance of 12,115 acres (Table 2-12). Of this disturbance, 64 percent (7,763 acres) would occur in sagebrush-dominated communities. Anticipated impacts in the well field are the same as those described under the Proposed Action.

Construction of the Shute Creek Alternative would affect approximately 849 acres of sensitive lands for plant site components, 1,814 acres of

TABLE 2-11

NUMBER OF ACRES DISTURBED BY COMPONENT FOR THE BUCKHORN ALTERNATIVE

	Construction	Reclaimed	Operation	Reclaimed	Abandonment[1]
Well Field					
Well Sites	1,102	658	444	444	0
Gathering System	2,109	2,109	0	0	0
Access Roads[2]	757	0	757	151	606
Subtotal	3,968	2,767	1,201	595	606
Plant Sites	2,800	0	2,800	2,800	0
Corridors					
Railroad[3]	85	64	21	8	13
Pipelines[4]	4,885	4,760	125	125	0
Transmission Line	1,228	1,228	0	0	0
Access Roads	17	0	17	3	14
Subtotal	6,215	6,052	163	136	27
TOTAL	12,983	8,819	4,164	3,531	633

[1]Represents the number of acres of disturbance that would not be reclaimed after the project is abandoned. Included here are facilities that would continue in use after project abandonment, or are infeasible to reclaim.

[2]Many existing roads would only require upgrading; thus, new disturbance would be less than total land requirement. It is assumed that 80 percent of the project road system would remain in use after project abandonment.

[3]It is assumed that the operational right-of-way would be 25 feet wide and that a 15-foot wide portion of the right-of-way would be infeasible to reclaim upon project abandonment.

[4]It is assumed that the sulfur pipeline would require a 15-foot wide strip for an access trail during project operation.

TABLE 2-12

POTENTIAL CONSTRUCTION DISTURBANCE BY VEGETATION TYPE
SHUTE CREEK ALTERNATIVE
(ACRES)

	Vegetation Types[1]															
	BS	SC	MS	MDS	Sa	G	MP	SF	D	A	C	R	P/H	Gr	Di	Total
Well Field																
Roads	208	196	4	0	0	70	124	29	18	34	9	29	36	0	0	757
Wells	294	284	7	0	0	90	245	48	18	49	18	0	49	0	0	1,102
Gathering System	549	403	10	0	0	207	452	106	32	107	38	106	89	10	0	2,109
Total	1,051	883	21	0	0	367	821	183	68	190	65	135	174	10	0	3,968
Linear Facilities																
Railroads	22	0	0	31	18	0	0	0	0	0	0	2	0	8	4	85
Transmission Lines	926	0	0	69	136	50	0	0	0	0	0	14	41	25	0	1,261
Pipelines	3,069	164	0	114	317	55	0	0	0	0	0	45	36	75	0	3,875
Sulfur Pipeline	422	0	0	43	119	16	0	0	0	0	0	6	41	13	0	660
Access Roads	68	0	0	5	24	5	0	0	0	0	0	0	0	4	0	106
Total	4,507	164	0	262	614	126	0	0	0	0	0	67	118	125	4	5,987
Plant Sites																
Buckhorn	640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	640
Shute Creek	0	0	0	177	0	463	0	0	0	0	0	0	0	0	0	640
Craven Creek	496	0	0	144	0	0	0	0	0	0	0	0	0	0	0	640
Sulfur Loadout	22	0	0	0	125	0	0	0	0	0	0	34	0	0	59	240
Total	1,158	0	0	321	125	463	0	0	0	0	0	34	0	0	59	2,160
Grand Total	6,716	1,047	21	583	739	956	821	183	68	190	65	236	292	135	63	12,115

[1]BS = Big Sagebrush
SC = Sagebrush Complex
MS = Mountain Shrub
MDS = Mixed Desert Shrub
Sa = Saltbush
G = Grassland
MP = Mixed Pine
SF = Spruce/Fir
D = Douglas-fir
A = Aspen
C = Clearcut
R = Riparian
P/H = Pasture/Hayfield
Gr = Greasewood
Di = Disturbed

sensitive lands for linear facilities, and 69 acres of linear component options (Table 2-13). About 60 acres of strongly saline-alkaline soils would be affected at the proposed Shute Creek construction camp (see Table 2-7). Of the sensitive units within plant site locations, 640 acres of saline-alkaline soils would be affected by the Shute Creek site. About 144 acres of saline-alkaline soils would be affected at Craven Creek. At the sulfur loadout facility, 65 acres of saline-alkaline lands and shale lands would be affected.

A total of 2,160 acres would be disturbed by construction of the plant sites. Of this disturbance, 52 percent (1,158 acres) would occur on sagebrush-dominated communities. Other types primarily affected would be bunchgrass (21 percent) and mixed desert shrub (14 percent) (Table 2-12). Potential significant impacts on 34 acres are expected from construction in the riparian zone.

A total of 5,987 acres would be potentially disturbed by corridor construction; 75 percent of the disturbance would be associated with pipelines (Table 2-12). Potentially significant impacts on 67 acres in the riparian zone area are anticipated. No effects to listed threatened or endangered plants are anticipated.

OPERATION

Based on applicants' plans to reclaim rights-of-way and well pads after construction, a total of 3,620 acres (Table 2-14) would remain in use (unreclaimed) after long-term operation is initiated.

Air pollution impacts to vegetation are projected to be insignificant. See discussion under the Proposed Action.

ABANDONMENT

At completion of the project, a total of 704 acres (Table 2-14) would remain in use (unreclaimed). Thirteen acres are assumed to be abandoned and unreclaimed. The residual unreclaimed acreage is the same as that discussed for the Proposed Action.

In summary, given the general erosion control and revegetation stipulations for federal lands and special mitigation measures recommended in Chapter 3, no significant impacts to soil productivity or stability would result from construction, operation, and abandonment of temporary facilities for the Proposed Action.

Significant impacts to vegetation associated with implementation of the Shute Creek Alternative consist of the potential reduction in productivity of 236 acres of riparian vegetation on somewhat poorly and poorly drained soils. In addition, 13 acres of unreclaimed, abandoned land would remain at the conclusion of the project. These impacts are essentially equivalent to the Proposed Action.

TABLE 2-13

AREAS (ACRES) OF POTENTIAL CONSTRUCTION DISTURBANCE ON SENSITIVE REHABILITATION UNITS[1] SHUTE CREEK ALTERNATIVE

	A2	A4	B3	C2	C4	D4	D5	Total
Well Field								
Roads	0	0	113	50	66	32	125	386
Wells	0	0	84	64	63	38	145	394
Gathering System	10	0	155	55	93	73	301	687
Subtotal	10	0	352	169	222	143	571	1,467
Plant Sites								
Buckhorn (Quasar)	0	0	0	0	0	0	0	0
Shute Creek (Exxon)	640	0	0	0	0	0	0	640
Craven Creek (Northwest)	144	0	0	0	0	0	0	144
Sulfur Loadout (Exxon)	40	25	0	0	0	0	0	65
Subtotal	824	25	0	0	0	0	0	849
Linear Facilities								
Railroads	58	0	0	0	0	0	0	58
Transmission Line	170	132	113	0	0	0	0	415
Pipeline	663	348	0	0	0	0	0	1,011
Sulfur Pipeline	218	47	0	0	0	0	0	265
Access Roads	61	4	0	0	0	0	0	65
Subtotal	1,170	531	113	0	0	0	0	1,814
Total	2,004	556	465	169	222	143	571	4,130

[1]Sensitive Rehabilitation Units are identified in Appendix C.

TABLE 2-14

NUMBER OF ACRES DISTURBED BY COMPONENT FOR THE SHUTE CREEK ALTERNATIVE

	Construction	Reclaimed	Operation	Reclaimed	Abandonment[1]
Well Field					
Well Sites	1,102	658	444	444	0
Gathering System	2,109	2,109	0	0	0
Access Roads[2]	757	0	757	151	606
Subtotal	3,968	2,767	1,201	595	606
Plant Sites	2,160	0	2,160	2,160	0
Corridors					
Railroad[3]	85	64	21	8	13
Pipelines[4]	4,535	4,403	132	132	0
Transmission Line	1,261	1,261	0	0	0
Access Roads	106	0	106	21	85
Subtotal	5,987	5,728	259	161	98
TOTAL	12,115	8,495	3,620	2,916	704

[1]Represents the number of acres of disturbance that would not be reclaimed after the project is abandoned. Included here are facilities that would continue in use after project abandonment, or are infeasible to reclaim.

[2]Many existing roads would only require upgrading; thus, new disturbance would be less than total land requirement. It is assumed that 80 percent of the project road system would remain in use after project abandonment.

[3]It is assumed that the operational right-of-way would be 25 feet wide and that a 15-foot wide portion of the right-of-way would be infeasible to reclaim upon project abandonment.

[4]It is assumed that the sulfur pipeline would require a 15-foot wide strip for an access trail during project operation.

COMPONENT ALTERNATIVES ASSOCIATED WITH THE SHUTE CREEK ALTERNATIVE

Railroad Spur

The Craven Creek to Shute Creek railroad spur would disturb 103 acres. The route would primarily disturb the saltbush and sagebrush vegetation types. Significant impacts to vegetation would consist of 13 acres of that would be abandoned and reclaimed at the end of the project. About 69 acres of strongly saline-alkaline soils would be affected.

Construction Camp Sites

The Buckhorn camp site was discussed previously. The Shute Creek site of 320 acres consists entirely of the mixed desert shrub vegetation type. No significant impacts to soils or vegetation are anticipated for construction, operation and abandonment of this option.

NORTHERN ALTERNATIVE

CONSTRUCTION

Implementation of the Northern Alternative would result in the potential disturbance of 13,050 acres (Table 2-15). Of this disturbance, 75 percent (9,804 acres) would occur in sagebrush-dominated communities. Anticipated impacts in the well field are the same as those discussed under the Proposed Action. No impacts to federally listed threatened and endangered species are expected.

Construction of the Northern Alternative would affect about 825 acres of sensitive soils on plant sites, and approximately 1,398 acres of sensitive soils along linear facilities (see Table 2-16). In addition, component options would affect about 30 acres of saline-alkaline lands at the West Dry Basin construction camp.

Of sensitive rehabilitation units on the plant sites, 600 acres of saline-alkaline lands would be affected at East Dry Basin (NWP), and 40 acres at the sulfur loadout. About 40 acres, 120 acres, and 25 acres of steep, shaly lands would occur within the West Dry Basin, Big Mesa, and sulfur loadout sites, respectively. Rehabilitation considerations for these sensitive units are shown in Table 3-3.

A total of 2,800 acres of vegetation would be disturbed by construction of the plant sites and sulfur loadout facility (Table 2-15). Of this disturbance, 81 percent would occur in sagebrush-dominated communities. Long-term productivity losses on 34 acres are expected from construction in the riparian zone.

A total of 6,282 acres would be potentially disturbed by corridor construction; 83 percent of the disturbance would be associated with pipelines (Table 2-15).

OPERATION

Based on applicants' plans to reclaim right-of-ways and well pads after construction, a total of 4,028 acres (Table 2-17) would remain in use after long-term operation is initiated.

TABLE 2-15

POTENTIAL CONSTRUCTION DISTURBANCE BY VEGETATION TYPE

NORTHERN ALTERNATIVE

(ACRES)

	Vegetation Types[1]															
	BS	SC	MS	MDS	Sa	G	MP	SF	D	A	C	R	P/H	Gr	Di	Total
Well Field																
Roads	208	196	4	0	0	70	124	29	18	34	9	29	36	0	0	757
Wells	294	284	7	0	0	90	245	48	18	49	18	0	49	0	0	1,102
Gathering System	549	403	10	0	0	207	452	106	32	107	38	106	89	10	0	2,109
Total	1,051	883	21	0	0	367	821	183	68	190	65	135	174	10	0	3,968
Linear Facilities																
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transmission Lines	837	0	0	0	80	44	0	0	0	0	0	10	33	14	0	1,018
Pipelines	4,106	93	0	28	102	40	0	0	0	0	0	72	7	138	0	4,586
Sulfur Pipeline	472	49	0	8	56	13	0	0	0	0	0	6	33	14	0	651
Access Roads	22	5	0	0	0	0	0	0	0	0	0	0	0	0	0	27
Total	5,437	147	0	36	238	97	0	0	0	0	0	88	73	166	0	6,282
Plant Sites																
Buckhorn	640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	640
West Dry Basin	605	30	0	0	0	5	0	0	0	0	0	0	0	0	0	640
Big Mesa	506	0	26	0	0	108	0	0	0	0	0	0	0	0	0	640
East Dry Basin	483	0	0	0	157	0	0	0	0	0	0	0	0	0	0	640
Sulfur Loadout	22	0	0	0	125	0	0	0	0	0	0	34	0	0	59	240
Total	2,256	30	26	0	282	113	0	0	0	0	0	34	0	0	59	2,800
Grand Total	8,744	1,060	47	36	520	577	821	183	68	190	65	257	247	176	59	13,050

[1]BS = Big Sagebrush
SC = Sagebrush Complex
MS = Mountain Shrub
MDS = Mixed Desert Shrub
Sa = Saltbush
G = Grassland
MP = Mixed Pine
SF = Spruce/Fir
D = Douglas-fir
A = Aspen
C = Clearcut
R = Riparian
P/H = Pasture/Hayfield
Gr = Greasewood
Di = Disturbed

TABLE 2-16

AREAS (ACRES) OF POTENTIAL CONSTRUCTION DISTURBANCE ON SENSITIVE REHABILITATION UNITS[1]
NORTHERN ALTERNATIVE

	A2	A4	B3	C2	C4	D4	D5	Total
Well Field								
Roads	0	0	113	50	66	32	125	386
Wells	0	0	84	64	63	38	145	394
Gathering System	10	0	155	55	93	73	301	687
Subtotal	10	0	352	169	222	143	571	1,467
Plant Sites								
Buckhorn (Quasar)	0	0	0	0	0	0	0	0
West Dry Basin (Exxon)	0	40	0	0	0	0	0	40
Big Mesa (Exxon)	0	120	0	0	0	0	0	120
East Dry Basin (Northwest)	600	0	0	0	0	0	0	600
Sulfur Loadout (Exxon)	40	25	0	0	0	0	0	65
Subtotal	640	145	0	0	0	0	0	825
Linear Facilities								
Railroads	0	0	0	0	0	0	0	0
Transmission Line	120	147	59	0	0	0	0	326
Pipeline	424	450	0	0	0	0	0	874
Sulfur Pipeline	149	49	0	0	0	0	0	198
Access Roads	0	0	0	0	0	0	0	0
Subtotal	693	646	59	0	0	0	0	1,398
Total	1,343	791	411	169	222	143	571	3,690

[1]Sensitive Rehabilitation Units are identified in Appendix C.

TABLE 2-17

NUMBER OF ACRES DISTURBED BY COMPONENT FOR THE NORTHERN ALTERNATIVE

	Construction	Reclaimed	Operation	Reclaimed	Abandonment[1]
Well Field					
Well Sites	1,102	658	444	444	0
Gathering System	2,109	2,109	0	0	0
Access Roads[2]	757	0	757	151	606
Subtotal	3,968	2,767	1,201	595	606
Plant Sites	2,800	0	2,800	2,800	0
Corridors					
Pipelines[3]	5,237	5,237	0	0	0
Transmission Line	1,018	1,018	0	0	0
Access Roads	27	0	27	5	22
Subtotal	6,282	6,255	27	5	22
TOTAL	13,050	9,022	4,028	3,400	628

[1]Represents the number of acres of disturbance that would not be reclaimed after the project is abandoned. Included here are facilities that would continue in use after project abandonment, or are infeasible to reclaim.

[2]Many existing roads would only require upgrading; thus, new disturbances would be less than total land requirement. It is assumed that 80 percent of the project road system would remain in use after project abandonment.

[3]It is assumed that the operational right-of-way would be 25 feet wide and that a 15-foot wide portion of the right-of-way would be infeasible to reclaim upon project abandonment.

Air pollution impacts to vegetation are projected to be insignificant. See discussion under the Proposed Action.

ABANDONMENT

Significant impacts to vegetation associated with implementation of the Northern Alternative consist of long-term productivity losses on 190 acres of riparian vegetation. Although acreage significantly affected by this alternative is less than the Proposed Action, the two alternatives differ by less than 5 percent. At completion of the project, a total of 628 acres (Table 2-17) would remain in use (unreclaimed).

CHAPTER 3

RECLAMATION

INTRODUCTION

Achieving successful reclamation and erosion control on lands disturbed by project development and operation in the Riley Ridge Project area would require an intensive reclamation program. As part of the overall impact evaluation for the project, site-specific environmental constraints have been compared to the reclamation plans proposed by each of the applicants and agency land use objectives. Environmental constraints were determined from site-specific soil surveys, vegetation mapping, on-site inspections, literature reviews, and interviews with various agency specialists. Land use objectives were determined based on existing practices and plans expressed by agency personnel and in various documents [BLM Unit Resource Area (URA) - Management Framework Plans, FS, Forest Planning Units].

Important inherent environmental variables that influence reclamation success in the region include climate, soil properties such as shallow depths, thin surface layers, low inherent fertility, moderate to strong salinity and alkalinity, large volumes of rock fragments, and steeply sloping terrain; weed competition; consumption by wild herbivores. Other variables dependent on land use and management which would influence reclamation success include grazing control on seeded areas, adequate erosion control and revegetation, and control of off-road vehicles.

The lack of successful reclamation in the past has been due, in part, to inadequate reclamation practices and/or a lack of compliance to applicable reclamation practices and continuing follow-up measures. Reclamation efforts have been improving in recent years due to: (1) stronger emphasis on achieving successful reclamation to meet regulatory requirements and a more dedicated stewardship commitment; (2) improved methods, procedures, and plant varieties; (3) improved kinds of machinery to implement practices; and (4) stronger emphasis on compliance and monitoring programs.

ASSUMPTIONS

Different kinds of land disturbance caused by project activities would require tailored reclamation programs. These include: (1) reclamation and revegetation of land disturbed by surface facilities (well sites and plant sites), and (2) reclamation and revegetation of right-of-way facilities, such as pipelines, roads, and electric transmission lines. Table 3-1 identifies the types of land disturbance related to each applicant's project.

The determinations made concerning erosion control and reclamation success on lands disturbed by project construction and operation activities are based on the following assumptions:

(1) Applicants operating on Wyoming state land would prepare and follow appropriate plans, including applicable measures and procedures to accomplish and ensure successful reclamation of state land affected by project action, as required by the Commission of Public Lands for Wyoming.

TABLE 3-1

SITE SIZES AND RIGHT-OF-WAY WIDTHS USED FOR DISTURBANCE CALCULATIONS[1]

	Quasar	Williams	Exxon	Northwest	Mobil
	In Acres				
Well Sites	3.7	3.7	6.7	NA	3.7
Plant Sites	640	NA	1,280	640	NA
	In Feet				
Gathering[1] System	50	50	100	50	NA
Plant Access Roads	30	NA	50	50	NA
Well Field Access Roads	30	35	50	NA	50
Sour Gas Trunk Lines	75	75	100	75	NA
Transmission Line[2]	100	NA	100	100	NA
Sales Gas Pipeline	50	NA	100	50	NA
CO_2 Pipeline	50	NA	100	75	NA
Sulfur Pipeline	with Exxon	NA	75	NA	NA
Railroad Spur[2]	NA	NA	100	100	NA
Raw Water Pipeline	NA	NA	NA	60	NA

Source: Companies' Right-of-Way Applications.

NA = Not Applicable

[1]The size of permanent legal right-of-way would vary according to component and agency stipulations.

[2]ERT assumption.

(2) Applicants would comply with the proposed erosion control and reclamation programs they have developed and/or would follow through on their commitment to "comply with appropriate regulations and required plans and stipulations to protect and restore the land disturbed by project construction and operation to a stable, productive and aesthetically acceptable condition." We interpret this to mean compliance with Erosion Control, Revegetation, and Restoration Guidelines for use on government lands (see following section).

The applicants' proposed erosion control and reclamation programs have been reviewed, evaluated, and a determination made as to their adequacy and effectiveness. Additional mitigation measures have been identified and recommended. (refer to Specific Project Applicants Reclamation Program Evaluations in this chapter).

(3) Applicants would comply with soil protection and land use goals stated by the landowner on private lands.

(4) Results of the soils surveys have accurately assessed local conditions and potential for reclamation success. The entire 160,000-acre well field has been mapped at the Order 3 level. This report provides detailed information on the reclamation potential and constraints of soils in the well field and provides recommendations for reclamation procedures.

(5) Soils occurring along Proposed Action and alternative corridor routes were surveyed at a reconnaissance level via photo-interpretation and extensive field transects. Information on the reclamation constraints and potentials of these soils are also incorporated into this report. This information assumes accurate resource assessments to the level of detail for which recommendations may properly be made from the surveys.

EROSION CONTROL, REVEGETATION, AND RESTORATION GUIDELINES FOR USE ON FEDERAL LANDS

The following guidelines would be included as stipulations in the right-of-way grants issued to the applicants.

Standard procedures for the applicants would include implementation of erosion control and revegetation measures to assure that lands disturbed by construction and operation activities would be restored to a stable, productive, and aesthetically acceptable condition.

A detailed, site-specific reclamation plan would be developed and become part of the Construction and Use (CU) Plan submitted by each company under the requirements of the rights-of-way grants. Because the proposed rights-of-way are composed of many types of terrain, soils, vegetation, land uses, and climatic conditions, the detailed plan would include sets of techniques and measures tailored to each condition encountered. Preparation of the plans will use existing soils and geologic data and where determined necessary by the Authorizing Officer, additional data will be collected. Local expertise and locally effective reclamation methods would be followed when the site-specific procedures for the detailed reclamation plan are

developed. The Erosion Control, Revegetation, and Restoration Guidelines and CU Plan would be implemented under the direction of the appropriate agency official.

Detailed information regarding applicable techniques and technical assistance to private landowners concerning erosion control measures and reclamation procedures would be obtained from the Soil Conservation Service through local Soil Conservation Districts. Technical assistance and approval of written plans for federal lands would be obtained from the BLM and FS prior to any construction.
During construction, operation, and abandonment of the project, the applicants would provide an experienced reclamation specialist for: (1) liaison with private landowners, federal agencies, and local government; (2) direction for timely restoration requirements, and (3) favorable public relations.

General erosion control and restoration measures have been developed for the following areas and would be included as part of the Operating Plan:

- Right-of-way and Site Clearing
- Site Preparation, Trenching and Preservation of Topsoil
- Backfilling and Grading
- Land Preparation and Cultivation
- Revegetation
- Maintenance and Monitoring
- Use of Biochemicals
- Stream Protection

RIGHT-OF-WAY AND SITE CLEARING

Emphasis would be placed on protecting existing vegetation and minimizing disturbance of the existing environment.

- Land grading would be done only on the minimum area required for construction.

- Existing roads would be used for vehicle traffic where possible; vehicles and equipment would not be allowed in streambeds unless specified by the authorizing agency.

- Sidehill cuts would be kept to a minimum to ensure resource protection and a safe and stable plane for efficient equipment use. The authorizing agency would provide assistance and would approve sidehill cuts prior to construction.

- Existing ground cover such as grasses, leaves, roots, brush, and tree trimmings would be cleared and piled only to the extent necessary. Slash would be piled and later shredded and chipped for use in restoration operations or disposed of at the discretion of the authorized agency official.

- Trees and shrubs on the right-of-way that are not cleared would be protected from damage during construction.

- Where the right-of-way crosses streams and other water bodies, the banks would be stabilized to prevent erosion. Construction techniques would minimize damage to shorelines, recreational areas, and fish and wildlife habitat. A channel stability evaluation will be completed before stream crossing locations are finalized. Channel stability ratings of 1 or 2 shall be avoided (Forest Service 1978).

- Care will be taken to avoid oil spills and other types of pollution in all areas, including streams and other water bodies and in their immediate drainages. All oil spills would be immediately cleaned up, following notification of applicable state and federal agencies.

- Design and construction of all temporary and permanent roads would be based on an approved transportation plan and would ensure proper drainage, minimize soil erosion, and preserve topsoil. After abandonment, these roads would be closed and restored without delay or maintained at the discretion of the landowners. Restoration, including redistribution of topsoil and establishment of natural surface drainage patterns, would be to the satisfaction of the landowner and/or authorizing official.

- During adverse weather conditions, as determined by the on-site reclamation specialist and federal agency officials, the authorizing agency would issue stop and start orders to prevent rutting or excessive tracking of soil and deterioration of vegetation in the right-of-way area.

- During construction activities in or near streams or lakes, sedimentation (detention) basins and/or straw bale filters would be constructed to prevent suspended sediments from reaching downstream water courses or lakes as required by the Authorizing Officer.

- If construction through extensive wetland areas is deemed necessary, construction would occur during the driest period of the year and/or erosion contol mats would be used to minimize damage to wetland sites, as required by the Authorizing Officer.

- Actual construction activities and implementation of erosion control measures would immediately follow clearing operations, especially in areas with soils that are highly susceptible to wind or water erosion and other special areas.

SITE PREPARATION, TRENCHING, AND PRESERVATION OF TOPSOIL

Site Preparation and Trenching methods and techniques would ensure that:

- Topsoil is removed from the trench area by double-ditching (i.e., windrowed separately, protected, and replaced last during backfilling). This procedure and the depth of such topsoil removal would be followed as specified by the Authorizing Officer.

- Topsoil would be removed from facility site areas (e.g., drill pads and roads) and stored for replacement on disturbed surface areas after final backfilling and grading.

- Remaining unearthed materials are removed and stored in a manner that facilitates backfilling procedures, uses a minimum amount of right-of-way area, and protects the excavated material from vehicular and equipment traffic.

- A specific trenching and excavated material stockpiling procedure would be used on steep-sloping and rough, broken terrain to ensure minimum disturbance as outlined in the CU Plan. This procedure would be developed by both the Authorizing Officer and applicant.

BACKFILLING AND GRADING

The following backfilling and grading techniques would be used:

- Backfill would be replaced in a sequence and density similar to the preconstruction soil condition.

- Backfilling operations would be conducted in a manner that would minimize further disturbance of vegetation.

- The contour of the ground would be restored to permit normal surface drainage.

- In strongly sloping and steep terrain, erosion control structures such as water bars, diversion channels, and terraces would be constructed to divert water away from the pipeline trench and reduce soil erosion along the right-of-way and other adjoining areas disturbed during construction.

- All structures such as terraces, levees, underground drainage systems, irrigation pipelines and canals would be restored to preconstruction conditions so that they would function as originally intended.

- The surface would be graded to conform to the existing surface of the adjoining areas except for a slight crown over the trench to compensate for natural subsidence. In cropland areas, especially border and furrow irrigated cropland, the soils would be compacted and the crown would be smoothed to match the bordering area to allow surface irrigation.

- Topsoil would be uniformly replaced over the trench fill and other disturbed areas to restore productivity to its preconstruction condition.

- Materials unsuitable for backfilling or excess backfill material would be disposed of as arranged by the authorizing officials.

- Temporary work space areas used at stream and highway crossings and other special sites would be restored to approximate preconstruction conditions and to the satisfaction of the authorizing officials.

- The right-of-way at stream crossings would be restored to preconstruction conditions. The upland areas and banks would be revegetated to preconstruction conditions. Where this is not possible, they would be mulched with rock. The size of the rock mulch would be larger in diameter than materials excavated from the trench. The streambed would be returned to its original width and depth with sediments like those that were excavated.

- Well sites would be restored without undue delay and maintained at the discretion of the landowners. Restoration including grading and redistribution of topsoil, would be to the satisfaction of the landowner and/or Authorizing Officer.

LAND PREPARATION FOR SEEDING AND CULTIVATION

Construction, backfilling, and grading activities commonly cause compaction and alter soil conditions that affect soil productivity and/or seeding success in the right-of-way area. The following practices and techniques would be used to improve these soil conditions, protect soil from erosion, and provide a favorable seedbed:

- In cropland areas, as required by the authorizing agency or landowner, subsoiling or chiseling would be used to ensure that soil compaction is reduced and preconstruction soil permeability is restored.

- Chiseling would be used, unless objected to by the landowner or authorizing agency, in rangeland areas to reduce compaction and improve soil permeability. Pitting and contour furrowing as directed by the authorizing agency or landowner would be done on steep slopes of disturbed areas to increase infiltration and to reduce runoff and erosion.

- Suitable mulches and other soil stabilizing practices would be used on all regraded and topsoiled areas to protect unvegetated soil from wind and water erosion and to improve water absorption.

- Special mulching practices or matting would be used, as necessary, in critical areas where wind and water are serious erosion hazards to protect seeding, seedlings after germination, and plantings.

- Commercial fertilizers would be applied to soil areas with low inherent fertility to maintain crop yields and establish grass seedings. Application rates would be commensurate with annual precipitation and available irrigation water.

- Seedbeds for areas seeded to grass would be prepared to provide a firm and friable condition suitable for the establishment of vegetation.

- Rock mulches would be used in steep-sloping rock outcrop areas and low precipitation areas to reduce erosion and promote vegetal growth.

- Cultivation and land preparation operations on steeply sloping areas would be done on the contour to minimize erosion.

- Soil area with rock fragments, such as very coarse gravel, cobble, or stone scattered on the surface, would be restored to the original preconstruction surface condition to blend with the adjoining area, to avoid a smooth surface right-of-way area, and to control accelerated erosion.

REVEGETATION (RESEEDING AND PLANTING)

The loss of vegetation from lands disturbed by pipeline construction can be mitigated only by satisfactory revegetation. To ensure a successful revegetation program, methods and procedures would be consistent with local climate and soil conditions and would follow recommendations and directions of local experts. Revegetation efforts would be continued until a satisfactory vegetative cover is established. The following practices and techniques would be used in areas where reseeding is suitable as determined by the authorizing agency:

- A firm seedbed would be prepared prior to seeding. This would include a mulch of plant residues or other suitable materials. A cover crop would be used as necessary in larger disturbed areas.

- Seed would be planted by drilling, broadcasting, or hydroseeding. Drilling is the preferred method because it is usually most successful. Drill seeding with a grass drill equipped with depth bands would be used where topography and soil conditions allow operation of equipment to meet the seeding requirements of the species being planted. Broadcast seeding would be used for inaccessible or small areas. Seed would be covered by raking or harrowing. Hydroseeding would be done in critical areas determined by the reclamation specialist or authorizing officer.

- Only species adaptable to local soil and climatic conditions would be used. Generally, these would be native species. However, introduced species may be considered for specific conditions when approved by the landowner and regulatory authority. Seeding rates in critical area plantings and generally throughout the right-of-way would be increased 100 percent over regular seeding rates to allow for seed mortality due to adverse growing conditions.

- Seed testing would be conducted to meet state, federal, and agency seed requirements.

- Seeding would be done when seasonal or weather conditions are most favorable, as determined by the landowner or authorizing officer.

- Grazing or mowing may be delayed at least one season after seeding to provide time for vegetation to become established, especially in highly erodible areas, unless objected to by the landowner or lessee. Protective fencing may be necessary in special areas and would be constructed, maintained, and removed according to authorizing agency specifications.

- In areas of low annual precipitation (generally less than 8 to 10 inches), where reseeding is not suitable or as successful, erosion control structures and measures would be applied on sloping areas to reduce accelerated erosion, to allow re-establishment of preconstruction surface soil conditions, and to allow natural revegetation.

- Trees and shrubs would be reestablished in areas as specified in the revegetation plan. Temporary and/or permanent barriers to off-road vehicles would be installed by the company at specific locations along the right-of-way and other disturbed sites to prevent off-road vehicle access as specified by the authorizing agency.

MAINTENANCE AND MONITORING

Joint inspection of the right-of-way by the applicant and authorizing agency would be conducted to monitor the success and maintenance of erosion control measures and revegetation programs on disturbed land for two growing seasons, or for a period determined by the landowner on private land, or the authorized agency official on state or federal land. The monitoring program would identify problem areas and corrective measures to ensure vegetation cover and erosion control. Certification of successful revegetation and erosion control would be determined by the landowner or authorized agency official.

USE OF BIOCHEMICALS

The use of biochemicals such as herbicides, fungicides, and fertilizers would comply with state and federal laws, regulations, and policies regarding the use of poisonous, hazardous, or persistent substances. State and federal wildlife agencies would be contacted if application of any of these substances would be on or near sensitive wildlife areas. Application of these substances would be by ground methods or by helicopter as approved by landowner and authorizing officer. Prior to the use of such substances on or near the permit or grant area, the applicant would obtain approval of a written plan for such use from the authorizing officer, landowner, and appropriate wildlife agency. The plan would outline the kind of chemical, method of application, purpose of application, and other information as required, and would be considered as the authorized procedure for all applications until revoked by the authorizing officer, landowner, or appropriate wildlife agency. This plan would become part of the CU Plan.

CONSTRUCTION TIMING

Pipeline construction activities on irrigated cropland would be timed, as possible, to avoid disruption of irrigation delivery systems during the

major irrigation season to reduce effects on crop production in areas of construction as well as adjoining irrigated cropland areas served by the systems.

Pipeline construction activities in narrow floodplain areas subject to high erosion hazards would be timed to avoid high water flows as much as possible, this would reduce the effects of construction on erosion and sedimentation.

STREAM PROTECTION

To maintain stream bank stability, preserve stream channel and flood plain effectiveness, and minimize adverse changes in stream water chemistry, physical properties, or associated aquatic organisms, the following would be incorporated into construction and rehabilitation programs:

- The natural drainage channels of any stream will be maintained during construction activities wherever possible.

- Clear water diversion methods will be employed whenever construction activities such as pipeline trenching must pass through a stream channel.

- Tree or shrub vegetation, which give greater stability due to rooting structure, will be replaced during the revegetation of channel banks following construction.

- Construction staging and equipment service areas will be located outside of riparian areas.

- Following construction activities the stream channel will be returned to as nearly the original width, depth, gradient, and curvature as possible.

REVIEW AND EVALUATION OF APPLICANTS' PROPOSED RECLAMATION PROGRAMS

The applicants' erosion control, reclamation, and revegetation procedures were reviewed using information collected for the vegetation, soils, agriculture, and climate studies done for the project. The reclamation procedures were evaluated in separate phases according to the type of land disturbance based on the potential problem areas and conditions identified in the vegetation, soils, and climatic inventories. The measures and procedures outlined by the applicants were then evaluated to determine whether they were applicable and effective for the range of soils, vegetation types, terrain, land use, and climatic conditions encountered in the project area.

Table 3-2 is the checklist that was used as a guideline for the review and evaluation of erosion control, reclamation, and revegetation programs. The checklist is a summarized list of effective and reliable measures and procedures essential for successful erosion control and reclamation. (The sources for these measures and procedures are identified on the table.) A summary of review comments for each applicant's proposed erosion control and reclamation program is presented in the following individual project discussions.

TABLE 3-2

EROSION CONTROL, RECLAMATION AND REVEGETATION PROGRAM CHECKLIST FOR RILEY RIDGE PROJECT REVIEW AND ASSESSMENT[1]

Reclamation Methods and Procedures	Northwest Pipeline	Exxon	American Quasar	Williams
GENERAL MEASURES				
A. Avoidance of Critical Areas and Minimize Disturbance by Using Common Corridors	X	X	X	X
B. Time Construction to Minimize Impacts (e.g., Cropland Areas, Sensitive Wildlife Areas).	0	X	X	X
C. Salvage Merchantable Timber (where practical)	X	X	X	X
D. Construction Precautions During Adverse Weather Conditions (e.g., Prevent Tracking and Compaction During Wet Soil Conditions).	0	X	X	X
E. Minimize Off-Road Vehicle Travel to Reduce Land Surface Disturbance.	0	X	0	0
F. Prepare and Implement an Erosion Control, Reclamation and Revegetation Plan Tailored to Conditions, Within Project Area.	0	X	X	X
G. Reclamation Accomplished in all Disturbed Areas as soon as Practical.	0	X	X	X
H. Use of Native Shrubs and Trees (where applicable)	0	0	X	X
I. On-site Reclamation Specialist for Project	0	X	X	X
J. Compliance with Regulations (Local, State, and Federal) and Implementation of Applicable Measures and Procedure.	0	X	X	X
LAND SURFACE AREA DISTURBANCE, EROSION CONTROL, AND REVEGETATION				
A. Right-of-Way and Site Clearing and Preparation.				
1. Minimize area of disturbance	0	X	X	X
2. Appropriate clearing, storage, and disposal of vegetation	X	X	X	X
3. Protection of existing vegetation	0	X	X	X
4. Protection of natural drainages	0	X	X	X
5. Land grading techniques for steep slopes	0	X	X	X
6. Specific techniques used for stream crossings and streams	0	X	X	X
7. Erosion control (wind and water) measures	X	X	X	X
8. Sedimentation (retention) basins, dikes, and diversions	X	X	X	X
9. Design and construction for restoration of temporary roads and construction sites	0	X	X	X
B. Site Grading, Trenching, Preservation of Topsoil, and Excavated Material Handling				
1. Topsoil (or suitable plant growth material) removal, storage, and protection	X	X	X	X
2. Excavated material stockpiling procedures	X	X	X	X
3. Trenching techniques (steep sloping areas)	0	X	0	0
4. Grading techniques for surface facilities and out areas	0	X	X	X
5. Compaction and erosion control (fill areas)	0	0	0	0
6. Stream crossing techniques	0	X	X	X

TABLE 3-2 (CONTINUED)

Reclamation Methods and Procedures	Northwest Pipeline	Exxon	American Quasar	Williams
C. Backfilling, Shaping, and Cleanup				
1. Backfilling procedures (compaction and shaping)	0	0	X	X
2. Restoring contour of land surface to permit drainage	0	X	X	X
3. Topsoil replacement	0	X	X	X
4. Restoring structures (roads, irrigation systems, etc.)	0	X	X	X
5. Matching surrounding landscape (rock outcroppings, coarse fragments on surface, etc.)	X	X	X	X
6. Erosion control measures (contouring, terraces, diversions)	0	X	X	X
7. Disposal of excess or unsuitable excavated material	0	X	X	X
D. Land Preparation for Seeding and Cultivation				
1. Measures to improve soil physical conditions (ripping, discing, chiseling)	X	X	X	X
2. Seed bed preparation (scarring, narrowing)	0	X	X	X
3. Fertilizers and other soil amendments (if applicable)	0	X	X	X
4. Suitable mulches and mulching practices	X	X	X	X
5. Special land preparation methods on "critical areas"	0	X	0	0
E. Revegetation (Reseeding and Planting)				
1. Selection of adapted species	X	X	X	X
2. Seeding and planting methods and techniques	X	X	X	X
3. Protection of seedlings from livestock & wildlife (fencing)	0	X	X	X
4. Continuing revegetation efforts to ensure satisfactory cover (when necessary)	0	0	0	0
F. Maintenance and Monitoring				
1. Identify maintenance, monitoring and corrective measures to ensure erosion control and successful revegetation	0	X	X	X
G. Use of Biochemicals				
1. Identify procedures regarding use of herbicides, pesticides and fertilizers (when needed)	0	X	X	X

Notes:

This checklist was developed by the BLM Division of EIS Services (EISS) to provide a guideline to review and evaluate the adequacy and effectiveness of applicants' proposed erosion control, reclamation and revegetation programs. The checklist is a summarized list of measures, practices, and procedures essential to ensure successful reclamation, revegetation, and erosion control for land disturbance. ERT conducted the evaluation of these programs using this checklist as a guide.

The measures and procedures listed have been used in meeting objectives associated with soil and water conservation, water management, pollution abatement, waste disposal, protecting fish and wildlife habitat, and the quality of the environment. The effectiveness and reliability of these measures and procedures are based on past research and experiences of many years. All practices and procedures identified are well documented and have been demonstrated to be reliable in making assumptions regarding effectiveness when properly implemented. (References available upon request from Bureau of Land Management, EISS, 555 Zang Street, Third Floor East, Denver, Colorado 80228).

Review comments reflect the adequacy of the applicants' proposed program by: (1) identifying the essential measures and procedures recognized; (2) identifying essential measures omitted; (3) making note of overall intent and compliance to ensure successful reclamation, revegetation and erosion control; and (4) identifying whether program is tailored to the needs and conditions (soils, vegetation and climate) of the project area. Additional mitigation measures needed by applicants are discussed in the text.

[1]X = Measure(s) contained in applicant's plan.
O = Measure(s) not contained in applicant's plan.

NORTHWEST PIPELINE CORPORATION

Northwest Pipeline Corporation (NWP) would construct the necessary roads and pipelines to service wells drilled in Mobil Corporation's Tip Top, Hogsback, and Dry Piney Units. Mobil and/or Mobil's on-site operators would construct the well pads; therefore, it would be important that NWP and Mobil coordinate reclamation efforts to ensure compliance with the general guidelines and stipulations specified in the right-of-way grant. An on-site reclamation specialist would help ensure coordination. It should be noted that the Wyoming State Office of BLM has published an Oil and Gas Technical Bulletin (No. 1) which addresses the Tip Top Rehabilitation study area.

Since NWP and Mobil's proposed sour gas development would occur in an area where sweet gas development is currently underway, much of the necessary road network, well pads, and power lines are currently in place. This would help minimize new surface disturbance.

General Measures

NWP's reclamation plan does not adequately address the general measures outlined in Table 3-2. However, since most of these measures are included in the agencies' erosion control reclamation and revegetation programs, it is assumed that NWP and Mobil would comply with these provisions and include these measures in their site-specific plans.

Surface Disturbance, Erosion Control, and Revegetation

Page 37 of NWP's plans specifies that topsoil would be salvaged "where sufficient topsoil exists" and "8 to 12 inches of soil would be salvaged." In areas with shallow topsoil where double trenching techniques are not feasible, blading should be considered. Topsoil should be separated to the greatest depth possible, depending on site conditions, to ensure maximum redistribution of soils on the disturbed rights-of-way. Topsoil stored on the right-of-way should be protected from vehicles and wind and water erosion.

Backfilling procedures should include replacing backfill material in the same order as it was removed, compacting soil, and leaving additional soil above pipelines (crown) to allow for future subsidence.

Depending on the season of disturbance and the extent of the disturbance, seeding of temporary cover crops should be considered. Page 38 specifies a basic seed mixture. Seed mixtures and seeding rates should be included in development of the site-specific plans, not in the general program specifications. Appropriate seed mixtures and seeding rates should be developed and recommended based on the rehabilitation units specified for the study area (see Rehabilitation Units discussion) and interviews with the authorizing agency and local experts.

The variety of mulching techniques specified on page 39 meet agency recommendations; however, additional discussion on land preparation for seeding and cultivation are needed. For example, ripping, chiseling, compacting, harrowing, and use of fertilizers should be considered depending on site-specific conditions.

Table E1.2, which describes water bar intervals, should be developed for site-specific conditions and included in the reclamation plan. Additional erosion control techniques such as contouring, terracing, sedimentation basins, check dams, diversions, and culverts should be considered along with the water bar and mulch techniques specified.

The NWP program should include a general provision for returning structures to original use, meeting specifications developed by the authorizing agency and identifying maintenance, monitoring, and corrective measures as necessary to ensure erosion control and successful revegetation.

EXXON

General Measures

Exxon's LaBarge Project reclamation plans are discussed extensively in the right-of-way application. Exxon's proposed program includes all of the agencies proposed general measures with the exception of using native shrubs and trees.

Surface Disturbance, Erosion Control, and Revegetation

Exxon's proposed program includes all measures specified in the checklist with the exception of addressing compacting and erosion control at fill areas, restoring soil physical conditions, and protecting seedlings from livestock and wildlife with fences. However, most of these measures can be addressed in the site-specific reclamation plans.

The development of site-specific plans should include an expanded discussion of techniques to minimize impacts on the floodplain and stream crossings. This is especially critical for Exxon since much of Exxon's proposed development could affect sensitive streams (see Fisheries section of Wildlife and Fisheries Technical Report). Also, pages 15 and 19 appear to contradict each other relative to construction in the floodplain. Page 15 states no construction would be done in the floodplain (probably referring to well pads), and page 9 states surface facilities (possible pipelines and roads) would be provided with protection from 100-year floods by location ..... or protected by suitable means. Additional clarification is needed. Generally, construction in the floodplain, especially in areas with saturated soils, is not recommended. Any filling of wetlands would result in difficult reclamation and potentially interfere with water movement in wetlands affecting surrounding areas. Recommendations for minimizing impacts to aquatic resources are discussed in the Wildlife and Fisheries Technical Report which should be consulted when finalizing reclamation plans. Page 24 of Exxon's plan lists seeding rates; seed mixtures and rates should be addressed in the final reclamation plan. Exxon's general provisions meet the objectives and intent of ensuring successful reclamation.

AMERICAN QUASAR

General Measures

The reclamation and erosion control program presented in American Quasar's right-of-way application is thorough and complete. American Quasar's plan

addresses all general procedures in the checklist except minimizing off-road vehicle use to reduce surface disturbance. However, the intention to minimize surface disturbance is evident in the use of existing rights-of-way and minimizing road improvements and right-of-way widths.

Surface Disturbance, Erosion Control, and Revegetation

The program addresses all items specified in the checklist with the exception of 1) using special trenching techniques on steep slopes, 2) specifying erosion control measures for fill areas, and 3) using special land preparation methods in critical areas. With these three exceptions, American Quasar's general provisions meet the objectives and intent of ensuring successful reclamation.

Page 159 illustrates an integrated erosion control system proposed for American Quasar's development. The concept of an integrated control system is a good one, successful erosion control management calls for preplanning as well as a number of different integrated techniques to manage surface runoff. However, Figure VII-7 implies that water bars and sediment ponds would routinely be used for roads. Given the need for reliable roads and their extensive use, a system of properly installed culverts would be preferred. Sediment ponds would be more appropriate below large disturbed areas on very steep slopes. A rock spillway below culverts would probably be satisfactory to decrease water velocity and filter sediment. Constructing an extensive system of sediment ponds could result in unnecessary increased surface area disturbance. Likewise, Figure VII-18 illustrates a method of installing water bars on access roads and disturbed slopes which could increase rill and gully erosion instead of collecting and dissipating water.

SUMMARY

It is predicted that successful erosion control, reclamation, and revegetation generally would be achieved throughout the project area provided the applicants implement effective measures and procedures tailored to the kind of land disturbance and to the conditions encountered. It is emphasized, however, that to ensure reclamation success, a strong compliance program accompanied by an effective monitoring and maintenance program is necessary to ensure that applicable measures are applied effectively, and that follow-up measures are carried out. The compliance program would be conducted by the authorizing agencies and landowners for their lands and the on-site reclamation specialists.

RECOMMENDATIONS

General Siting Recommendations

Construction, operation, and abandonment of the Riley Ridge Project would create disturbance to soil and vegetation resources that would necessitate intensive rehabilitation efforts. In order to enhance the probability of successful erosion control and revegetation, the following general siting recommendations should be considered during all construction phases.

- Avoid or minimize disturbance to slopes over 20 percent gradient. This is the practical limit of safe, efficient operation for

commonly available reclamation equipment. Steep slope grading and rehabilitation techniques are ultimately more intensive and costly.

- Avoid or minimize disturbance to poorly or somewhat poorly drained soils. Project activities on these areas would lead to heavily compacted, difficult to treat, wet seedbeds with immediate sediment delivery to channels. Flooding and the intensive effort necessary to replace wildlife habitat are additional concerns.

- Avoid or minimize disturbance to highly saline-alkaline sites. An example of this type of site is the "white alkali" Soapholes area north and east of Big Piney. Chemical and physical soil characteristics on these sites will severely impede rehabilitation.

- Avoid or minimize disturbance to sand dunes. Most of the dunes in the area are somewhat stabilized by mixed desert shrub vegetation. Disturbance to these dunes will generate an extreme wind erosion hazard that may eventually affect a much wider area than the original disturbance.

Rehabilitation Units

In order to provide a framework for identifying sensitive lands within the project area, and in order to develop reclamation recommendations for these areas, data from the soils and vegetation inventories were used to devise a set of "rehabilitation units". Rehabilitation units (defined in the glossary) were identified on the basis of soils, slope, climate, and geomorphic position. By grouping similar areas under these factors, and incorporating vegetation data, rehabilitation recommendations can be made. The rehabilitation unit should be viewed as a land management tool developed from a compilation of resource inventories and interpretations. It provides general guidance to site conditions and erosion control and revegetation techniques and materials pertaining to the Riley Ridge project area.

Table 3-3 identifies rehabilitation units developed for the project area; units that are sensitive to disturbance are so noted on the table. Good, fair, and poor rehabilitation potentials are defined in the glossary.

Mechanical Erosion Control Measures

The following mechanical erosion control recommendations generally apply to all the rehabilitation units for construction of roads, well pads, pipelines and transmission lines. Specific mechanical erosion control practices for a management group or disturbance type are presented in separate paragraphs.

Initial Diversions

Initial diversion methods consist of non-graded techniques such as filter fences, straw bale barriers, brush barriers, and wattling. These practices may be applied alone or in combination, or one may be substituted for another depending on site-specific applicability and availability of materials. These are temporary techniques which should be employed with

TABLE 3-3

REHABILITATION UNITS DEVELOPED FOR THE RILEY RIDGE STUDY AREA

CLIMATIC ZONE A: COOL, DRY SOUTHERN BASINS.
7-9" PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 38-43°F, GROWING SEASON 85-100 DAYS

Rehab. Unit[1]	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
A1	Deep, wet soils formed in stream-lain alluvium on perennial stream drainageways and river bottoms. Corridor Soil Association 101	Loamy over sand and gravel	0-5	60"+	Slight	Moderate: some channel scouring, cutbanks cave.	Pasture/ Hayfield	Fair	Wetness[3], stoniness at depth, restoration of intensive land uses, potential for stream crossings, flooding.	Control cutbank erosion via mechanical techniques (rip-rap,etc.) where necessary. Late fall seeding with fertilization. Transplant shrub seedlings. Drill or broadcast adapted species, depending on wetness.
*A2	Deep and moderately deep, saline-alkaline soils formed in alluvium on dry drainageways and stream terraces. Includes small areas of geographically associated sand dunes. Corridor Soil Associations 102, 104, 105, 107. Bio/West Units 41, 42, 43.	Loamy to clayey, minor sandy	5-15	20-60"	Severe	Slight, some run-on, severe wind erosion hazard over limited areas	Greasewood, Saltbush, Mixed Desert Shrub	Poor	High salts, compaction, drouthiness SENSITIVE REHABILITATION UNIT	Spring-tooth harrow. Add organic seedbed amendments. Use of salt-tolerant plant species, warm and cool season. Broadcast seeding in late fall. Clean hay mulch crimped in @ 2-4 T/a. Fertilize 2-3 years after seedling establishment.
A3	Deep and moderately deep soils forming on upland alluvial fans, pediments, and plateaus. Corridor Soil Associations 103, 203, 206. Bio/West Units 39, 44, 45.	Loamy	5-15	20-60"	Moderate	Slight	Big sagebrush, bunchgrass, few irrigated fields near Big Piney	Good	Drouthiness, some salinity	Drill seeding. Use of drought-tolerant plant species, warm and cool season. Clean straw/hay mulch crimped in @ 2-4 T/a. Fertilize 2-3 years after seedling establishment.
*A4	Shallow to deep, eroding soils on pediments, truncated uplands, badlands, and escarpments. Corridor Soil Associations 204, 207, 224.	Loamy to clayey	15-50	10-40"	Moderate	Severe	Big sagebrush, Saltbush, Bunchgrass	Poor	Steep slopes, drouthiness, depth to bedrock SENSITIVE REHABILITATION UNIT	Add organic seedbed amendments. Contour furrowing. Closely-spaced water bars. Plant adapted warm and cool-season species via broadcast or drill, depending on access. Clean straw/hay mulch applied @ 2-4 T/a. Mulch tackifiers, erosion control netting.

TABLE 3-3 (CONTINUED)

CLIMATIC ZONE B: COOL, DRY BASINS NORTH AND WEST.
10-14" PRECIPITATION ZONE, MEAN ANNUAL AIR
TEMPERATURE 37-40°F, GROWING SEASON 75-90 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
B1	Deep, wet soils formed in stream-lain alluvium on bottomlands. Generally colder than normal for this zone, due to wetness and topo-graphy trapping cold air. Well Field Soil Units 71, 72, 73. Bio/West Units 9, 23.	Loamy over sand and gravel	0-5	60"+	Slight	Moderate: cutbanks cave, some channel scouring	Pasture/ Hayfield Willow Meadow	Fair	Wetness, stoniness at depth, restora-rion of intensive land uses, poten-tion for stream crossings, flooding	See Rehabilitation Unit A1
B2	Deep and moderate-ly deep soils on alluvial fans, high terraces, and pediments. Corridor Soil Association 109. Well Field Soil Units 62, 74, 81D, 84D, 99. Bio/West Units 2, 3, 5, 6, 30, 31, 32, 37.	Loamy to clayey	5-15	30-60"	Moderate	Slight	Big sagebrush, Sagebrush complex, Bunchgrass	Good	Drouthiness, some salinity	See Rehabilitation Unit A3
*B3	Shallow to moder-ately deep soils on ridgeslopes, hillsides, folded and faulted lands. Corridor Soil Associations 309, 310. Well Field Soil Units 84, 86. Includes minor areas of deep soils in Well Field Soil Units 81E, 81F. Bio/West Units 1, 14, 34, 35, 36	Loamy to clayey	15-30+	10-40"	Moderate	Severe	Big sagebrush, Bunchgrass, some mountain shrub	Poor	Drouthiness, depth to bedrock, high probability of exten-sive cuts and fills, avoid moist slopes to minimize erosion and slumping SENSITIVE REHABILITATION UNIT	See Rehabilitation Unit A4

CLIMATIC ZONE C: COOL, MOIST FOOTHILLS, 15-19" PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 34-37°F, GROWING SEASON 70-85 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation[3] Rating	Considerations	Suggested Techniques
C1	Deep, wet soils formed in stream-lain alluvium in drainageways. Well Field Soil Unit 70. Bio/West Unit 16.	Loamy	2-8	60"	Slight	Moderate: cutbanks cave, some channel scouring	Pasture Willow	Fair	Wetness, channel crossings, possible disturbance of associated springs and seeps.	See Rehabilitation Unit A1
*C2	Drouthy, shallow and deep, gravelly soils on ridge crests and side-slopes. Well Field Soil Units 50E, 50F, 51E, 51F, 52, 53, 54, 64. ROS Bio/West Units 7, 13, 21.	Loamy, with high rock content	15-30+	10-60"	Moderate	Slight	Bunchgrass, Mountain shrub Douglas fir	Poor	Depth to hard bed-rock, stoniness, slope, drouthiness SENSITIVE REHABILITATION UNIT	Seed drought-tolerant species adapted to shallow stony sites. Restore gravelly surface. Broadcast seed, fertilize 2-3 years after seedling establishment.
C3	Deep, gravelly soils on rolling ridgeslopes and fans. Well Field Soil Units 66D, 75, 92. Bio/West Units 4, 8, 11, 15, 17, 18, 19.	Loamy to clayey, with high rock content	5-15	60"	Moderate	Slight to moderate	Sage Complex, Mountain brush, Aspen	Fair	Stoniness, some salinity, some clayey textures	Drill seed cool-season species, transplant containerized shrub seedlings. Clean straw/hay mulch crimped in @ 2 T/a. Fertilize 1-2 years after seedling establishment.
*C4	Deep, gravelly soils on steep ridgeslopes. Well Field Soil Units 66E, 66F, 77E, 77F, 82, 85, 91. Bio/West Units 12, 20, 22.	Loamy to clayey, with high rock content	15-30+	60"	Moderate	Severe, gullying	Big Sagebrush, Mountain shrub, Aspen	Poor	Slope, stoniness, moist slopes surface erode or slump, need for extensive cuts and fills. SENSITIVE REHABILITATION UNIT	Avoid slump-prone areas. Closely-spaced water bars, other drainage diversions. Mulches, erosion control nets. Broadcast or drill seed according to access. Fertilize 1-2 years after seedling establishment. Transplant containerized shrub seedlings. Use mechanical stabilization techniques such as gabions where necessary.

TABLE 3-3 (CONTINUED)

CLIMATIC ZONE D: COOL, MOIST FOOTHILLS, 20"+ PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 32-35°F, GROWING SEASON 60-75 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
D1	Deep, well drained to poorly drained soils intermixed on alluvial fans and stream terraces. USFS Units 103A, 103B, 106.	Loamy to sandy, occ. high rock content	0-15	60"	Slight	Slight to Moderate	Willow, Mountain Shrub	Fair	Wetness, some stoniness, potential for stream crossings, flooding, shortness of growing season.	Control cutback erosion via mechanical techniques (rip-rap, etc.) where necessary. Spring or fall seeding with fertilization. Transplant shrub seedlings. Drill or broadcast adapted species, depending on wetness.
D2	Deep, gravelly soils on mountain benches. ERT Well Field Soil Units 88, 94, 95. USFS Units 107, 120A, 120B, 124A, 154B, 200B, 203B, 220B, 221B, 360B, 650B, 675B, 702B.	Loamy to clayey, with high rock content	5-15	60"	None	Slight	Mixed Pine Spruce/Subalpine fir, Douglas fir, Clearcut	Good	Shortness of growing season, stoniness, some soil acidity, areas of heavy clay.	Transplant containerized seedlings for trees, shrubs. Spring-tooth harrow. Broadcast adapted cool-season grass species.
D3	Deep, gravelly soils on mountain sideslopes. ERT Well Field Soil Units 90, 93E. USFS Units 103C, 120C, 124B, 154C, 200C, 203C, 220C, 221C, 255B, 255C, 360B, 360C, 492B, 492C, 650C, 660C, 675C, 702C, 711C.	Loamy to clayey, with high rock content	15-30	60"	None	Moderate	Mixed Pine Spruce/Subalpine fir, Douglas fir, Clearcut, Mountain Shrub.	Fair	Shortness of growing season, stoniness, some soil acidity, areas of heavy clay	Transplant containerized seedlings. Closely spaced water bars, other drainage diversions. Broadcast adapted cool-season grass species. Mulch w/tackifier or erosion control net.
*D4	Deep, well drained gravelly and non-gravelly soils on steep to extremely steep ridges and mountain sideslopes. USFS Units 154D, 220D, 221D, 255D, 360D, 391, 650D, 660D, 675D, 702D, 711D	Loamy to clayey with occ. high rock content	30+	60"	None to slight	Severe	Mixed Pine, Spruce/Subalpine fir, Clearcut, Mountain Shrub.	Poor	Steep to extremely steep slopes, shortness of growing season, need for extensive cuts and fills. SENSITIVE REHABILITATION UNIT	Transplant containerized seedlings for trees, shrubs. Broadcast adapted grass species. Use mechanical stabilization and control structures where necessary. Avoid slump-prone areas.

TABLE 3-3 (CONTINUED)

CLIMATIC ZONE D: COOL, MOIST FOOTHILLS, 20"+ PRECIPITATION ZONE, MEAN ANNUAL AIR TEMPERATURE 32-35°F, GROWING SEASON 60-75 DAYS

Rehab.[1] Unit	Soils	Textural Type	Dominant Slope Range[2] (%)	Rooting Depth	Salinity/ Alkalinity	Erosion Hazard	Present Vegetation Type	Rehabilitation Rating	Rehabilitation Considerations	Rehabilitation Suggested Techniques
*D5	Deep and shallow, gravelly soils with rock outcrop on steep mountain sideslopes. Well Field Units 55, 93F, 96, 97, 98. Bio/West Unit 10. USFS Units 203D, 355, 492D, 502, 701, 710, 712, 713, 714, 715.	Loamy with high rock content	15-50+	10-60"	Moderate to slight	Severe	Mixed Pine, Spruce/Subalpine fir, Douglas fir, Mountain shrub, Clearcut	Poor	Slope, shortness of growing season, erosion hazard, stoniness, depth to hard bed-rock, need for extensive cuts and fills. SENSITIVE REHABILITATION UNIT	Transplant containerized seedlings for trees, shrubs. See Rehabilitation Unit D4.

Note: See Soils, Vegetation, and Reclamation Technical Report.

[1]Asterisk (*) indicates a sensitive rehabilitation unit.

[2]Slope ranges shown are the dominant slopes; inclusions of flatter or steeper slopes occur within the units. Inclusions of 30 to 50+ percent slopes will require very intensive rehabilitation procedures if disturbed.

[3]Major features defining rehabilitation considerations are underlined.

shoulder dikes to reduce erosion during the construction phase and until permanent erosion control structures and vegetation are established.

- Filter fences should be constructed as needed along the contour, at the toes of steep cuts and fills, along streams, and at natural drainage areas. They should be employed over short distances only where erosion hazards are excessive and where wildlife movement will not be adversely restricted. Fences should be placed on the uphill side of the posts. Resistant commercial filter fabrics (not burlap) should be placed on the uphill side of the fence and entrenched at the base. Filter fences should be removed and used as needed elsewhere, once permanent control structures and revegetation techniques are employed. The fabric should be cut at ground level, the wire and posts removed; all collected sediment and be spread and seeded.

- Straw bales should be utilized along the contour of natural slopes or cuts and fills to act as a temporary barrier to sediment movement. They may also be placed as temporary check dams in channels and at culvert outlets. Bales should be embedded to a depth of 4 to 5 inches and anchored by wooden stakes. In areas of relatively long-term emplacement and high precipitation, runoff, or wildlife pressure, bales should be protected by plastic coverings anchored at the base by earth or rock.

- Brush barriers may be employed in drainage channels and along the shoulders of short, low gradient slopes. Brush barriers should be used only as a last resort or short-term, interim measure. In practice, erosion must be controlled above the drainage channels. Brush barriers consist of long low piles of well mingled brush, poles, and trimmings. They are held in place by stakes on the downhill side. In areas of longer use or higher erosion hazard, the uphill face of the piles should be covered with filter cloth. Along natural and constructed drainages, log and brush check dams may be employed in place of secured brush piles as a somewhat more permanent control structure utilizing similar materials.

Graded Structures

Graded structural diversions consist of soil or rock dikes, berms, contour ditches, and terraces or benches as applicable to the steepness of the site, and length of slope.

- Dikes, berms, and ditches will be installed and maintained on slopes up to 20 percent. A shoulder diversion of compacted soil should be constructed and maintained along the crowns of all cuts and fills. Diversion practices such as contour furrows or water bars should be constructed parallel to the contour in steeper areas. Contour furrows can and should be used on longer cut and fill slopes for erosion control on slopes of up to 20 percent. Generally, furrows should be spaced 100 feet apart. Water bars should be employed where a right-of-way crosses slopes perpendicular to the contour; these should be shielded with rock where necessary. Spacing of water bars will be dependent on site-

specific slope characteristics. Drainage collected from contour furrows, ditches, and water bars should be channeled into culverts or sediment traps, or dissipated onto less steep slopes and vegetated areas by means of level spreaders. All well pads should be encircled by a compacted, maintained containment dike utilizing a buried plastic liner and capable of containing incidental spills.

- Spaced terraces and benches should be installed where the construction of drill pads and rights-of-ways create long, steep cuts or fills. Terraces or benches should be employed on slope grades over 20 percent. Spacing should be less than every 100 feet of slope, or at the midpoint for slopes less than 100 feet in length.

Disposal Structures and Dissipators

Disposal structures and energy dissipators consist of culverts and sediment traps. Sediment traps consist of rock-filled trenches, designed such that periodic removal and cleaning of the backfill may be accomplished. Culverts should be constructed to minimize the vertical drop at the outlet. All culvert outlets should be protected by rock-lined channels, rock piles, or covered straw bales to provide a discharge apron. Level spreaders should be used with diversions to disperse drainage onto undisturbed, vegetated areas having low slope grades.

Retaining Walls (For Rehabilitation Units A4, B3, C4, D3, D4, D5,)

Retaining walls should be constructed of gabions. Gabions are constructed of heavily galvanized steel mesh containers, filled with hard, durable, angular rocks. Retaining walls are particularly applicable, when used with surface and subsurface drainage diversions, to road and pipeline cuts.

Techniques for Stream Crossing Stabilization (For Rehabilitation Units A1, B1, and C1)

Mechanical techniques for stabilizing and protecting streambanks and channels consist of gabions, rip-rap, jetties, and filter fences. Streambanks should be sloped as necessary to allow for construction of rip-rap or for vegetative re-establishment. Rip-rap consists of hard, durable, angular stones which serve as a bank liner. All rip-rap should be underlain with resistant filter cloth or a sandy filter layer. Jetties consist of posts, rock piles, or fences anchored in the streambed and at the bank. Gabions may be used as jetties where necessary. Sediment from ephemeral side-drainages should be controlled by check dams near the mouth and by brush piles and plastic covered straw bales at the drainage head. Overland flow should be controlled by filter fences or other stabilization techniques (including vegetation). Existing herbaceous cover and trees should be left in place as much as possible, as should natural channel morphology. Vegetated buffer strips should be left along irrigated fields. Coffer dams should be employed when constructing pilings at wide channel crossings such as the Green River.

Pipeline Trench Stabilization
(For Rehabilitation Units A4, B3, C2, C4, D3, D4, D5)

On steep pipeline gradients, drainage within the pipe trench should be reduced to a minimum in order to reduce piping and to stabilize the backfill against downslope movement. This should be accomplished by means of subdrains and impervious plugs (or bulkheads).

- Plugs should be constructed of bentonite, cement, or local source material identified as suitable by permeability and compaction testing in the field. Pervious materials such as sand, gravel, or unsuitable soil sources should be avoided in the construction of plugs, because of their permeability characteristics at the backfill interface and the lack of shear strength. Plugs should be constructed with adequate footings into the base and walls of the pipeline trench. Drainage diverted to the slope surface should be dispersed by ditches, berms, and level spreaders.

Maintenance and Abandonment

Mechanical erosion control applications should be periodically inspected to insure effectiveness and to identify areas requiring maintenance. Sediment traps and discharge aprons should be checked and cleaned as necessary. Level spreaders, contour furrows, and water bars should be checked for gullying and re-graded if needed. Filter fences, straw bales, and brush piles should be periodically inspected for deterioration and replaced if necessary or removed when vegetation and permanent structures are in place. Streambanks should be inspected for effectiveness and placement of erosion control structures.

At abandonment, cuts and fills should be re-graded to approximate original contour, and mechanical and vegetative stabilization techniques should be employed and maintained periodically to insure site rehabilitation.

Site Preparation

Site preparation techniques consist primarily of surface manipulation practices such as clearing, grading, and topsoil handling. Two recommendations apply to site clearing on any area. One, clearing should precede just in advance of actual construction, in order to minimize erosion losses prior to implementing stabilization techniques. Two, slash, other vegetative materials, and residues from incidental spills during construction should not be mixed with fill materials or topsoil sources. These materials, including trash, should be hauled to specified sites and burned or otherwise disposed of. Some slash materials may be set aside for use in temporary brush barriers or check dams.

Grading techniques and their application were discussed previously under "Mechanical Erosion Control Measures."

Topsoil Handling

Whenever possible, topsoil should be handled when moderately dry. This will alleviate some of the compaction tendency during wet handling, as well as decreasing wind erosion and dust that normally occur when dry soils are

salvaged. The use of topsoil gives best rehabilitation results when immediately re-spread over the site, as would be applicable in pipeline and transmission line construction. Salvage and replacement operations should take place parallel to the contour on sloping areas or perpendicular to the prevailing wind direction on more level, wind erosion prone sites.

The construction of roads, well pads, and facility sites will necessitate long-term stockpiling of topsoil resources. These stockpiles must be properly located to minimize erosion losses; they should be placed outside of drainage pathways on relatively flat-lying ground. Stockpiles should be oriented to the leeward side of natural or man-made obstructions (including snow-fences). All soil materials salvaged from cut-and-fill operations (particularly roads and well pads) should be stockpiled up-gradient from the site. Erosion losses can be partially alleviated by the design and location of stockpiles. From a water erosion standpoint, low-profile stockpiles with gentle sideslopes and roughened surfaces are preferable to steep, high-profile stockpiles. For road and drill pad stockpiles, it will be beneficial to create a smaller number of larger stockpiles located strategically in relation to haul-distance, rather than creating many scattered stockpiles. Fewer, larger stockpiles will permit more efficient application of stockpile stabilization techniques, while at the same time reducing the overall percentage of exposed surface area.

Rehabilitation Units A1, B1, C1. The soils of these rehabilitation units are characterized by wetness. Whenever possible, they should be handled when relatively dry. The number of equipment passes used to handle these materials should be minimized. Stockpiles from drill pads or roads should be located outside the floodplain. Such stockpiles should be immediately seeded with a dense cover crop to combat weed infestation on these moist materials. Stockpile sideslopes should be covered with jute or synthetic erosion control netting.

Rehabilitation Unit A2. Soils in this rehabilitation unit are characterized by high salinity and/or alkalinity, with some areas of sand dunes included. Disturbance of these areas should be avoided whenever possible. These materials should not be mixed with other sources during any phase of construction. Stockpiles should be heavily seeded with a cover crop. If sand dunes are partially excavated during construction, the remaining face of the dune should be broadcast seeded with perennial grases and shrubs, and covered with jute or synthetic netting. A slow-curing, cellulose soil tackifier may be used in place of netting; application rates should not preclude moisture penetration into the seedbed. During rehabilitation activities, use of a spring-tooth harrow will alleviate some of the compaction caused by handling strongly saline-alkaline soils.

Remaining Rehabilitation Units. Topsoil from these units should be handled in accordance with recommendations presented in introductory paragraphs to this section. Stockpiles should be stabilized by cover crops and clean straw or hay mulch crimped in at 2-3 tons/acre, both as an erosion control and weed control measure.

Recommended Procedures Matrices

The following matrices (Tables 3-4 through 3-7) show recommended procedures for revegetating different disturbance types, such as wellpads or roads,

TABLE 3-4

REVEGETATION TECHNIQUES FOR WELL PADS

	Rehabilitation Units					
	A1, B1, C1	A2	A3, B2	A4, B3	C3, D1, D2	C2, C4, D3, D4, D5
Seedbed Preparation	No Pads Proposed					
Discing						
Dozer Tracking[2]						X
Harrowing						X
Chiseling						
Seedbed Amendments						
Fertilizer Broadcasting						X
Fertilizer Drilling					X	
Broadcasting Organic Amendments						
Seeding and Planting						
Broadcast Seeding						X
Drill Seeding					X	
Hand-Planted Seedlings						X
Mechanical Seedling						X
Mulching						
Straw Mulch Blown on @ 2T/a[3]						X
Crimped Straw/ Hay Mulch @ 2T/a					X	
Crimped Straw/ Hay Mulch @ 2-4T/a						
Jute Netting						
Synthetic Netting						X
Soil Tackifiers						

[1]This matrix is for well pads at abandonment; during the life of the pad, a cover crop and synthetic netting should be used on cut-and-fill slopes in combination with contour furrowing or terracing as needed.

[2]Dozer (or scraper) tracking is assumed to be done as an earthmoving technique in re-grading and topsoil replacement operations; where indicated as a technique, it signifies that additional seedbed preparation techniques are inapplicable, primarily due to slope.

[3]Tons/acre. Recommendations for mulching may vary, dependent on site-specific conditions.

TABLE 3-5

REVEGETATION TECHNIQUES FOR ROADS

	Rehabilitation Units					
	A1, B1, C1	A2	A3, B2	A4, B3	C3, D1, D2	C2, C4, D3, D4, D5
Seedbed Preparation						
Discing			X			
Dozer Tracking[1]				X		X
Harrowing		X			X	
Chiseling	X	X	X		X	
Seedbed Amendments						
Fertilizer Broadcasting	X	X		X		X
Fertilizer Drilling			X		X	
Broadcasting Organic Amendments		X		X		
Seeding and Planting						
Broadcast Seeding	X	X		X		X
Drill Seeding			X		X	
Hand-Planted Seedlings	X					X
Mechanical Seedling Planters					X	
Mulching						
Straw Mulch Blown on @ 2T/a[2]				X		X
Crimped Straw/ Hay Mulch @ 2T/a	X				X	
Crimped Straw/ Hay Mulch @ 2-4T/a		X	X			
Jute Netting		X		X		
Synthetic Netting						X
Soil Tackifiers		X				

[1]Dozer (or scraper) tracking is assumed to be done as an earthmoving technique in re-grading and topsoil replacement operations; where indicated as a technique, it signifies that additional seedbed preparation techniques are inapplicable, primarily due to slope.

[2]Tons/acre. Recommendations for mulching may vary, dependent on site-specific conditions.

TABLE 3-6

REVEGETATION TECHNIQUES FOR PIPELINES AND TRANSMISSION LINES

	Rehabilitation Units					
	A1, B1, C1	A2	A3, B2	A4, B3	C3, D1, D2	C2, C4, D3, D4, D5
Seedbed Preparation						
Discing		X	X		X	
Dozer Tracking[1]						X
Harrowing						
Chiseling		X				
Seedbed Amendments						
Fertilizer Broadcasting	X	X		X		X
Fertilizer Drilling			X		X	
Broadcasting Organic Amendments		X		X		
Seeding and Planting						
Broadcast Seeding	X	X		X		X
Drill Seeding			X		X	
Hand-Planted Seedlings	X					X
Mechanical Seedling Planters					X	
Mulching						
Straw Mulch Blown on @ 2T/a[2]				X		X
Crimped Straw/Hay Mulch @ 2T/a	X				X	
Crimped Straw/Hay Mulch @ 2-4T/a		X	X			
Jute Netting		X		X		
Synthetic Netting						X
Soil Tackifiers		X				

[1]Dozer (or scraper) tracking is assumed to be done as an earthmoving technique in re-grading and topsoil replacement operations; where indicated as a technique, it signifies that additional seedbed preparation techniques are inapplicable, primarily due to slope.

[2]Tons/acre. Recommendations for mulching may vary, dependent on site-specific conditions.

TABLE 3-7

REVEGETATION TECHNIQUES FOR FACILITY SITES

	Rehabilitation Units					
	A1, B1, C1	A2	A3, B2	A4, B3	C3, D1, D2	C2, C4, D3, D4, D5
Seedbed Preparation						
Discing			X		No Sites Proposed	
Dozer Tracking[1]				X		
Harrowing		X				
Chiseling		X	X			
Seedbed Amendments						
Fertilizer Broadcasting	X	X		X		
Fertilizer Drilling			X			
Broadcasting Organic Amendments		X		X		
Seeding and Planting						
Broadcast Seeding	X	X		X		
Drill Seeding			X			
Hand-Planted Seedlings	X					
Mechanical Seedling Planters						
Mulching						
Straw Mulch Blown on @ 2T/a[2]				X		
Crimped Straw/Hay Mulch @ 2T/a	X					
Crimped Straw/Hay Mulch @ 2-4T/a		X	X			
Jute Netting		X		X		
Synthetic Netting						
Soil Tackifiers		X				

[1]Dozer (or scraper) tracking is assumed to be done as an earthmoving technique in re-grading and topsoil replacement operations; where indicated as a technique, it signifies that additional seedbed preparation techniques are inapplicable, primarily due to slope.

[2]Tons/acre. Recommendations for mulching may vary, dependent on site-specific conditions.

pipelines and transmission lines, or facility sites. For each disturbance type, recommendations are made for seedbed preparation, seedbed amendments, seeding and planting, and mulching. These recommendations are separated by groups of rehabilitation units that react similarly to erosion control and revegetation practices.

In using these matrices, it should be noted that fertilizing and mulching in the first four columns of rehabilitation units management groups 1 to 4 generally differ in application from that of the last two. Nitrogen fertilization should generally be delayed two to three years after seedling establishment in the Green River Basin, to discourage weed growth. The use of extra-heavy mulch applications will also serve in this regard. Crimping will cover broadcast seed and still allow moisture penetration. In the last two columns of rehabilitation units, nitrogen fertilizer may be applied one to two years after seedling establishment. Separate phosphorus fertilizers, which may contain low amounts of nitrogen, should be applied during initial treatment and incorporated into the seedbed.

Species Selection Recommendations

Revegetation species selection is dependent on the expected land use for the reclaimed area, adaptability of species to site conditions, commercial availability, and ease of establishment. Table 3-8 presents a list of species that are appropriate for the major vegetation types present on the Riley Ridge well field, plant sites, and transportation corridors. These species were selected based on dominance within the existing species composition of the region, and on review of the revegetation literature (Long 1981, Plummer et al. 1968, Wyoming Game and Fish Department 1981, Monsen and Christensen 1975). Table 3-8 also estimates commercial availability of different species and the type of plant material (seed, transplant, cutting) most likely to establish under local conditions. The commercial availability estimate was based upon a review of seed supplier lists, especially companies that carry seeds and transplants of native species. It is recommended that local sources of shrub seed and cuttings be used to maximize the benefits of local climatic adaptation and preference by livestock and big game.

A careful evaluation of reclamation objectives and site conditions should be made prior to including shrub and tree seeds in mixtures, or planting shrub and tree transplants. The most important area for transplants would be in riparian and forested areas, where good establishment because of adequate soil moisture can be expected. Adequate physical protection (fencing) for transplants should be considered during planning. Natural reinvasion can be expected in many areas where undisturbed rangeland is located adjacent to the disturbance.

Unified Reclamation Program

The Riley Ridge project will require intensive and successful erosion control and revegetation measures. For this reason, the applicants should consider implementing a unified, cooperative reclamation program. Such a program would improve economic and working efficiency by avoiding duplication of staff and of reclamation planning. A unified program, with an on-site reclamation supervisor, would provide a single liaison between the applicants and private landowners, federal agency officials, and local

TABLE 3-8

RECOMMENDED REVEGETATION SPECIES FOR VEGETATION TYPES ON THE RILEY RIDGE WELL FIELD, CORRIDORS, AND PLANT SITES

	Availability	S	SC	MS	G	M	W	Gr	SB	MDS	R	A	SFMB	D
NATIVE GRASSES														
Thickspike wheatgrass (Agropyron dasystachum)	F	S	S					S	S	S	S			
Western wheatgrass (Agropyron smithii)	G	S	S			S		S			S			
Bluebunch wheatgrass (Agropyron spicatum)	P	S	S	S	S									
Slender wheatgrass (Agropyron trachycaulum)	F	S	S	S	S							S		S
Basin wildrye (Elymus cinereus)	F	S	S	S	S									
Tufted hairgrass (Deschampsia caespitosa)	P					S	S					S		
Inland saltgrass (Distichlis stricta)	P							S,T	S,T		S,T			
Mountain brome (Bromus marginatus)	F											S	S	S
Galleta (Hilaria jamesii)	P								S	S				
Sheep fescue (Festuca ovina)	P			S	S							S	S	S
Indian ricegrass (Oryzopsis hymenoides)	G	S	S	S	S				S	S				
Reed canarygrass (Phalaris arundinacea)	F					S	S				S			
Big bluegrass (Poa ampla)	P	S	S	S								S	S	S
Alkali grass (Puccinelia airoides)	P					S					S			
Alkali sacaton (Sporobolus airoides)	F													
Needle-and-thread (Stipa comata)	F	S	S	S	S					S				
Green needlegrass (Stipa viridula)	F					S					S			
Spike trisetum (Trisetum spicatum)	P			S	S							S	S	S
Bottlebrush squirrel tail (Sitanion hystrix)	P	S	S	S	S			S	S	S				
NATIVE FORBS														
Arrowleaf balsam root (Balsamoriza sagittata)	F	S	S	S	S							S	S	S
Western sweetvetch (Hedysarum boreale)	F	S	S	S	S									
Lewis flax (Linum lewisii)	F	S	S	S	S									
Sweetanise (Osmorhiza occidentalis)	P											S	S	S

TABLE 3-8 (CONTINUED)

	Availability	S	SC	MS	G	M	W	Gr	SB	MDS	R	A	SFMB	D
INTRODUCED FORBS														
Cicer milkvetch (Astgealus cicer)	F	S	S	S	S									
Prostrate summer cypress (Kochia proshata)	F							S	S	S				
Birds foot trefoil (Lotus corniculatus)	G											S	S	S
Yellow sweetclover (Melilotus officnalis)	G	S	S	S	S	S	S				S	S	S	S
Alfalfa (Medicago sativa)	G			S	S	S	S				S	S	S	S
Alsike clover (Trifolium hydridum)	G					S	S				S	S	S	S
Whitedutch clover (Trifolium repens)	G					S	S				S	S	S	S
NATIVE SHRUBS AND TREES														
Fringed sagewort (Artemisia frigida)	C	S	S	S	S									
Alkali sagebrush (Artemisia longiloba)	C	S	S											
Black sagebrush (Artemisia nova)	C	S	S	S	S									
Big sagebrush (Artemisia tridentata ssp.)	C	S	S	S	S					S				
Fourwing saltbush (Atriplex canescens)	C	S	S					S	S	S				
Gardner saltbush (Atriplex gardneri)	C							S	S	S				
Nuttall saltbush (Atriplex gardenii)	C	S	S					S	S	S				
Winterfat (Ceratoides lanata)	C	S	S		S				S	S				
Mountain mahogany (Cercocarpas montanus)	C	S	S	S	S									
Rubber rabbitbrush (Chrysothamnus nauseosus)	C					S		S	S	S	S			
Spiny hopsage (Grayia spinosa)	C								S	S				
Lodgepole pine (Pinus contorta)	G											S,T	S,T	
Narrowleaf cottonwood (Populus angustifolia)	F					C,T	C,T				C,T			
Fremont cottonwood (Populus fremontii)	G					C,T	C,T				C,T			
Aspen (Populus tremuloides)	G											T	T	
Chokecherry (Prunus virginiana)	G			S,T								S,T		
Douglas fir (Pseudotsuga menziesii)	G													T
Bitterbrush (Purshia tridentatata)	F	S,T		S,T								S,T	S,T	S,T
Golden currant (Ribes aureum)	F			S,T		S,T	S,T				S,T			
Woodsrose (Rosa woodsii)	F			S,T		S,T	S,T				S,T	S,T	S,T	S,T
Willow (Salix sp.)	C					C,T	C,T				C,T			
Greasewood (Sarcobatus vermiculatus)	C							S						
Mountain snowberry (Symphoricarpos oreophilus)	C			S,C,T								S,C, T	S,C, T	S,C, T

TABLE 3-8 (CONTINUED)

	Availability	S	SC	MS	G	M	W	Gr	SB	MDS	R	A	SFMB	D
Red osier dogwood (Swida sericea)	C					C,T	C,T				C,T			

Commercial Availability
G = Widely available, many sources
F = Somewhat limited availability
P = Very limited availability
C = Use locally collected seed and cuttings.

Planting Material
S = Seed
T = Transplant
C = Cutting

Vegetation Types
BS = Big Sagebrush
SC = Sagebrush Complex
MS = Mountain Shrub
G = Grassland
M = Meadow
W = Willow
SFMP = Spruce Fir, Mixed Pine
Gr= Greasewood
SB = Saltbush
MDS = Mixed Desert Shrub
R = Riparian (Corridors)
A = Aspen
D = Douglas Fir

governments. It would also help to ensure a cooperative approach between various project engineering concerns and rehabilitation requirements. Together, these factors would assist in maintaining favorable public relations and in achieving proper implementation and compliance with applicable, effective erosion control and revegetation measures.

The cooperative reclamation program should be supervised by an experienced, senior reclamation specialist having the following qualifications:

- A degree in soils, range, agronomy, or other natural resource management field.
- Five years or more of practical, applied resource management experience involving soils, range, and wildlife biology.
- Familiarity with applicable environmental regulations and permitting processes.
- Working experience with federal, state, and local government agencies.
- Familiarity with oil field construction engineering and environmental engineering concepts and practices.
- Ability to accept responsibility for ensuring a successful rehabilitation program in cooperation with engineers, heavy equipment foremen, landsmen, and other environmental staff.

The unified reclamation program should involve detailed, site-specific planning of erosion control measures, re-grading and topsoil handling, and revegetation techniques, and materials. Planning and permitting must be completed in advance of construction. A unified reclamation program, with a qualified senior reclamation specialist, will provide on-site expertise during construction so that applicable procedures are implemented when special conditions are encountered, while avoiding construction and operation delays.

CHAPTER 4

METHODOLOGY

SOILS

ERT conducted Order 3 (reconnaissance) level surveys on lands specified by the Forest Service (FS) and Bureau of Land Management (BLM) in the Riley Ridge Statement of Work. The survey areas included 3,945 acres of FS lands in the Lake Ridge and Fogarty Creek Units, and 44,985 acres of BLM lands in the North Riley Ridge, Sawmill, Dry Piney, Graphite, and Hogsback Units. Previously collected data were used as background to new surveys as well as for matching purposes. Reconnaissance surveys (Order 3-4) were also conducted on approximately 522 miles of corridors to the south and east of the main project area.

REVIEW OF EXISTING SOILS INFORMATION

ERT collected and used soils information generated by the FS, BLM, Soil Conservation Service (SCS), and the applicants. This information served both as background data for new baseline surveys and for predicting impacts and recommending mitigation. Included with the previous data was a privately contracted survey on 69,180 acres adjacent to new survey areas. This inventory was available prior to initiating field work. In addition, FS Land Inventory soils data were made available for approximately 41,820 acres of the well field. ERT used this previously collected information as a base for new survey data. General soils information for Sublette, Sweetwater, and Lincoln counties was collected from the agency sources previously mentioned.

Complementary climatic and geologic information was collected and reviewed for use during the soils and reclamation program. Climatic data originated both from the SCS and National Oceanic and Atmospheric Administration (NOAA) climatic histories of the area. Geologic information originated primarily from U.S. Geological Survey (USGS) sources and the Wyoming State Geological Society, with input from FS and BLM specialists.

Primary resource contacts for soils, reclamation, and geology were:

- Alan Amen - BLM
- John Nordin - FS
- Maurine White - Minerals Management Service (MMS)
- Don Lewis - SCS

REVIEW OF RECLAMATION GUIDELINES AND PLANS

ERT reviewed general reclamation and erosion control guidelines and manuals used by the FS, BLM, and SCS. During this study phase, reclamation programs generated by the applicants were collected and compared to a general reclamation procedures and techniques checklist (see Chapter 3).

BASELINE SOIL INVENTORIES

Mapping

ERT conducted Order 3 (reconnaissance) level surveys on lands specified by the FS and BLM. The survey areas included 3,200 acres of FS lands in the Lake Ridge and Fogarty Creek Units, and 44,000 acres of BLM lands in the North Riley Ridge, Sawmill, Dry Piney, Graphite, and Hogsback Units. Previously collected data were used as background information wherever possible.

Mapping units were designed on the basis of concepts generated during initial traverses over the survey area. Units consisted primarily of consociations of series phases based on:

- Slope
- Present erosion
- Surface texture
- Stoniness
- Salinity/Alkalinity
- Internal drainage
- Special differentiating characteristics, such as aspect or climatic regime

Complexes and associations of these were employed where dictated by the mapping scale or soil survey objectives and interpretations.

The mapping units were delineated on 1:24,000 scale aerial photography provided by the U.S. Department of Agriculture.

In keeping with the standards of a reconnaissance survey, ERT examined soil profiles in about 80 percent of the mapping unit delineations. Soil boundaries were identified on the basis of profile examination by tile spade and hand auger, and by field interpretation of vegetative communities, geology, relief, and elevation.

Sampling and Description

ERT generated profile descriptions for each component of the major mapping units. These data provided documentation relative to the composition of units for use in progress and final reviews, as well as technical reports. Minor units were documented as needed to allow description and interpretation.

Pedons described for major mapping unit components were characterized by laboratory analyses. These type location samples were identified via field note documentation and map delineations maintained by the soil survey party.

The pedon samples were retrieved by pit excavation by hand or by backhoe. Samples and descriptions were taken to a depth of 60 inches below the mineral surface, or to a lithic or paralithic contact, whichever was shallower. The samples were contained in clean, polyethylene plastic bags and sealed and tagged in accordance with ERT standard operating procedures. Sample bags and tags recorded the stop number, horizon designation, and depth or thickness represented by each sample. Logs were recorded on the description form and sent to the laboratory.

The samples were analyzed by Intermountain Laboratories in Sheridan, Wyoming.

ERT analyzed six key soils from FS lands and ten key soils from BLM lands. The samples were analyzed for the following parameters:

- Particle size distribution (with coarse fragments as necessary)
- Soil reaction
- Soluble Ca, Mg, Na in meq/l
- Sodium adsorption ratio
- Electrical conductivity
- Percent organic matter
- Calcium carbonate percentage
- Percent base saturation
- Saturation moisture percentage

Profile descriptions were recorded on standard SCS or FS data forms.

Field Notes and Reviews

Field notes were maintained by each party member throughout the course of the survey. These were recorded in notebook form with entries for the date, location, personnel, and soil factors.

A progress review was held approximately halfway through the mapping effort. At this time, ERT and agency personnel met both in the field and office to review the following:

- Composition and documentation of mapping units and profile descriptions, and other draft handbook contents such as legends, preliminary interpretations, and map quality.
- On-site review of representative profiles as part of profile description, sampling, and tentative correlation efforts.
- Range site correlation. Range sites were determined by interaction between ERT and agency vegetation specialists. A range specialist attended the field reviews and periodically accompanied the soil survey party in order to correlate range sites and productivity to soil units.

A similar final review was held in Fort Collins at the end of the field program. Throughout the course of the field program, letters of confirmation were exchanged between the personnel involved to document objectives and changes as necessary. During and after these reviews, the field soil correlations were revised as needed to fit tentative correlations to the family and series levels. Soils were tentatively correlated to an existing series or family, or to taxadjuncts and variants.

Corridor Assessments

ERT gathered soils data for approximately 522 miles of corridors during the initial data collections described earlier. Where information was lacking, ERT conducted Order 4 soil surveys on the corridor areas by the use of aerial photo interpretation and by extending existing data through extensive ground-truthing. Criteria utilized in this study phase included, among others:

- Slope and aspect
- Soil textures (including coarse fragments)
- Soil depth
- Erodibility
- Surficial geology and bedrock hardness
- Potential site stability and flooding frequency

CORRELATION OF THE SOIL SURVEYS

ERT has prepared a tentative correlation of the three soil surveys conducted within the well field. ERT's survey area was mapped during the fall of 1982, and covered approximately 48,930 acres. Bio/West's survey area was investigated during 1981, and covered approximately 69,180 acres. Soil surveys on Forest Service lands were conducted primarily from 1975 through 1979, on approximately 41,820 acres within the well field.

The soils on ERT's survey area have been tentatively correlated to established series, or to variants or taxadjuncts of established series. This was done primarily for ease of reference within the report, to assist in mapping efforts and associated communication between field personnel, and as a starting point for future correlations by government agencies operating in the area. ERT's correlation is by no means official.

The Bio/West survey and the Forest Service land inventory have soils and mapping units listed in numerical fashion. The Forest Service inventory was supplemented by slope mapping generated by the USGS VIEWIT computer program, which provided a printout of slope classes ranging from 0 to 5 percent, 5 to 15 percent, 15 to 30 percent, and 30+ percent. Since the total area of the 0 to 5 percent slope range on FS lands is small, it is not identified on the 1:48,000 scale well field soils map. Almost all the 0 to 5 percent slope range occurs in the Snider Basin area.

Soil survey interpretations for Bio/West and Forest Service survey areas were made from information and/or original interpretations provided by the two organizations. Forest Service interpretations were refined by ERT according to supplemental slope information. Both Bio/West and Forest Service mapping units (and slope phases) were assigned rehabilitation units by ERT. Interpretations for ERT well field and corridor survey areas, and all rehabilitation units, were made by ERT.

GEOMORPHOLOGICAL TERRAIN ANALYSIS

ERT performed analyses on the project corridors utilizing terrain and geomorphic criteria. Much of this analysis was conducted via aerial photo interpretation and geologic data from USGS, FS, and BLM. This effort was complemented by field surveys to verify the nature and occurrence of:

- Past and recent geologic processes
- Structural, erosional, depositional, and residual features
- Drainage patterns

Geomorphic delineations included: talus slopes, fluvial landforms, escarpments, folded and faulted landforms, pediments, and mesas and plateaus. Geomorphic units were delineated on USGS 7.5-minute quadrangles.

IMPACT ANALYSIS

The soils maps generated for the well field and corridors, and the rehabilitation units formed the basis for impact analysis. Areas of the most sensitive rehabilitation units (units having severe limitations for reclamation) were calculated. Areas of disturbance in each of these rehabilitation units resulting from roads, pipelines, transmissions lines, well sites, and gas treatment plants were computed by overlaying the project facilities onto the soils map.

REPORT MAPS

Final maps were prepared at a scale of 1:48,000 for well field soils and present a composite of all mapping surveys done for the project. The final corridor maps were prepared at a scale of 1:126,720 or 0.5 inch to the mile in order to be consistent with other resource information. All original data interpretation was done at 1:24,000 scale (USGS 7.5-minute topographic quadrangles). This data will be transmitted to BLM with other working file information.

VEGETATION

The following sections describe the sources of data and the techniques used to prepare vegetation maps, impact analyses, and soil/vegetation correlations.

VEGETATION MAPPING

The vegetation classification system developed for the vegetation map was based on four criteria:

1) Existing mapped data were used for all available areas,

2) Map units could be interpreted from 1:24,000 aerial photography,

3) Mapping detail was compatible with a final map scale of 1:24,000, and

4) Mapping was based on existing, rather than potential climax vegetation.

Two vegetative cover map sources met the above criteria: BLM Unit Resource Analysis (URA) vegetation overlays and the FS Bridger-Teton timber stand maps. These maps were used as the basis for the map legend and preliminary mapping. Existing map unit delineation criteria were used when available (FS, no date), or if criteria were not available, new criteria were developed. Table 4-1 summarizes the vegetation types present on the study area, the photo-interpretation criteria used to identify map units, and the composition criteria used to delineate boundaries between units.

After classification criteria were established, orthophotography of the study area was taken to the field, and mapping was initiated. Ground truth points were taken at intervals along major roads at all elevations in the study area to confirm or correct existing mapping. At each ground truth point, a listing of the dominant plant species by stratum (tree, shrub, herbaceous) was prepared.

IMPACT ANALYSIS

The basis for impact analysis was the vegetation maps described above. The area of each vegetation type within each well field unit or transportation alternative was calculated using a TRS-80 digitizer. Areas of disturbance in each vegetation type resulting from roads, pipelines, transmission lines, well sites, and gas treatment plants were computed by overlaying the project facilities onto the vegetation map.

SOILS/VEGETATION CORRELATION

The basis for the soils/vegetation correlation was the soils and vegetation maps and field inspection. The soil survey described soils map units for the Riley Ridge study area. For each soils map unit, a vegetation description was prepared. The vegetation description was based on the dominant vegetation species listed on the Form 232 soils description sheet, vegetation map ground truth data, interpretation of aerial photography, and correlation with forest and range habitat types described in habitat and community type publications pertinent to the region (Youngblood 1981, Steele et al. 1979, Bramble-Brodahl 1978, Mutz and Graham 1982).

The first step in correlating soils and vegetation was to list all the soils map units and array the vegetation descriptions pertinent to each soils unit. The next step was to determine whether the soil map unit contained one or more vegetation map units. If the soil unit contained a single vegetation map unit, then a single comprehensive description was prepared. If the soil unit contained more than one vegetation map unit, or consisted of a mosaic of discrete vegetation communities (e.g., sagebrush complex), then a percentage of each type present in the soils unit was estimated. The vegetation description attached to each soils map unit description consisted of the dominant species, any variation within the unit, and any pertinent observations on use of the vegetation (e.g, browsing, grazing).

TABLE 4-1

VEGETATION MAP UNITS & MAPPING CRITERIA FOR WELL FIELD AND CORRIDORS,
RILEY RIDGE EIS STUDY AREA

Vegetation Types	Source of Vegetation Type Name	Photointerpretation Criteria (true color aerial photography @1:15,000)	Composition Criteria	Comments
Mixed Pine	Bridger-Teton NF Timber Stand map legend	Lodgepole-small diameter crown, round top, commonly occurs in dense, even-aged stands on steep, north aspects. Whitebark pine-wide, irregular crown shape, found primarily in open stands on ridges. Limber pine-minor constituent no criteria	>50% of total canopy cover consists of lodgepole, timber or whitebark pine. Criteria source: USFS Bridger-Teton Timber Stratification Guideline	Lodgepole contributes the majority (75%) of the pine cover in this type on well field. Many stands contain juvenile and mature subalpine fir.
Spruce-fir	Bridger-Teton NF Timber Stand map legend	Subalpine fir - small diameter crown, spire top, commonly in stands of mixed ages on steep, north aspects at higher elevations. Englemann spruce - minor constituent, no criteria.	>50% of total canopy cover consists of Subalpine fir or Engelmann spruce. Criteria source: see Mixed Pine	Subalpine fir is the most important species within this type in the project area; intergrades extensively with Mixed Pine type at higher elevations on well field.
Douglas-fir	Bridger-Teton NF Timber Stand map legend, BLM URA map legend	Large diameter crown, commonly in open to fairly dense stands at lower elevations (7500'-8500') on north facing slopes	>50% of total canopy cover consists of Douglas fir. Criteria Source: see Mixed Pine	Intergrades with Mixed Pine type at lower elevations on north and south aspects on well field.
Aspen	Bridger-Teton NF Timber Stand map legend BLM URA map legend	Deciduous crown, clonal growth pattern (patchy), commonly as even-aged stands on deeper soils on all aspects, slopes at middle elevations (8500-9000')	>50% of total canopy cover consists of aspen. Criteria source: see Mixed Pine	Stands frequently contain conifer saplings (subalpine fir, Englemann spruce) on well field.
Cottonwood	ERT	Large trees, broad crowns, low density. Located on floodplains of major streams and rivers	Cottonwood trees present	Occurs primarily along Green River and low elevations of S. Piney Creek.
Bunchgrass-forb	BLM URA-(Grassland)	Smooth, often gray texture. Occupies windswept ridges with very shallow soils. Contains some inclusions of big, low, and black sagebrush.	>75% of total canopy cover consists of grasses and forbs. Dominants include bluebunch wheatgrass, king's fescue, Hood phlox, hymenoxys, fringed sagewort. Criteria Source: ERT	Composition ranges from cushion-forb communities on ridgeline to bunch grass dominated communities on wind-protected slopes on well field. Grass component more important at higher elevations (e.g., Darby Mt.).
Big Sagebrush	BLM URA map legend	Dark gray texture, high density. Occupies drainage bottoms, deeper soils on ridgetops, basins, and side slopes. At higher elevations (8500'-9500') green color of other shrub species associated with big sagebrush can be seen.	>50% of total canopy cover consists of big sagebrush. Inclusions include low sagebrush and black sagebrush, bunch grass. Criteria Source: ERT	At higher elevations (>7500') principally Artemisia tridentata ssp. vaseyana; at lower elevations (>7500') principally Artemisia tridentata ssp. wyomingensis. Occurs on well field and transportation corridors.

TABLE 4-1 (CONTINUED)

Vegetation Types	Source of Vegetation Type Name	Photointerpretation Criteria (true color aerial photography @1:15,000)	Composition Criteria	Comments
Sagebrush Complex	ERT	Mosaic consisting of small patches of big sagebrush (dark gray, heterogeneous in height) and low and black sagebrush (light gray, uniform height, low density).	>50% of total canopy cover consists of low or black sagebrush; big sagebrush present. Criteria Source: ERT	Unit predominates on shallow soils. Black sagebrush usually intermingled with low sagebrush; big sagebrush forming small, discrete patches. Occurs primarily on well field.
Mountain Shrub	BLM URA legend	Greenish to brownish, variable canopy height	Mountain mahogany; snowberry, serviceberry and ceanothus potentially present; big, low or black sagebrush <50% of total canopy cover. Criteria Source: ERT	Occurs on steep slopes, usually on the lee side of ridges on well field.
Willow	ERT	Dark green, globular shrubs in riparian zone; forming patches, often associated with beaver activity	>50% of total canopy cover consists of willow shrubs. Herbaceous species (grasses, rushes, sedges) important constituents. Criteria Source: ERT	Located on floodplains of principal streams on well field.
Greasewood	BLM URA map legend	Light green, discernible crown, scattered; often mixed with sagebrush species	>50% of total canopy cover consists of greasewood. Criteria source: ERT	Located in wide drainageways and basins at lower (7000'-7500') elevations on well field.
Low Saltbush	ERT	Gray green, very low density, usually on basin floors, often on alkaline (whitish) soils	>50% of total canopy cover consists of low saltbush species (Nuttall saltbush, mat saltbush) Criteria Source: ERT	Occurs primarily on transportation corridors.
Shadscale	BLM URA map legend	Gray green, very low density, usually on side slopes on alkaline (whitish or reddish) soils.	>50% of total canopy cover consists of shadscale saltbush. Criteria Source: ERT	Occurs primarily on transportation corridors along margins of basins and major drainages.
Riparian Meadow	ERT	Green, herbaceous species with few or no shrubs; restricted to riparian zone; no evidence of human manipulation (e.g., diversion ditches, haystacks).	<50% of total canopy cover consists of willow shrubs; herbaceous species (grass, rushes, sedges) primary constituents. Criteria Source: ERT	Located on floodplain of major and minor streams on well field and at major stream crossings on transportation corridors.
Pasture/Hayfield	ERT	Green, herbaceous species with few or no shrubs; primarily located in riparian zone; evidence of human manipulation (e.g., diversion ditches, haystacks, farm machinery)	<50% of total canopy cover consists of willow shrubs; herbaceous species (grasses, rushes, sedges) primary constituents. Criteria Source: ERT	--
Forest clearcut	ERT	Open area surrounded by closed forest; slash piles evident, access roads to sites.	No mature trees present	Understory consists of a variety of herbaceous species, scattered shrubs, conifer saplings.

REPORT MAPS

Final maps for report presentation were prepared at 1:48,000 scale (to overlay the soils map) for the well field. Final graphics for the corridors are presented at 1:126,720 scale with 0.5 inch to the mile and combine both soils and vegetation information on one map.

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GLOSSARY OF SELECTED SOILS AND VEGETATION TERMS

AASHO CLASSIFICATION - An engineering property classification. Grouping soils of about the same general load-carrying capacity and service together resulted in seven basic groups that were designated A-1 through A-7. The best soils for road subgrades are classified as A-1, the next best A-2, etc., with the poorest soils classified as A-7.

ALLUVIUM - 1) Locally derived--unconsolidated mineral material deposited on sideslopes and valley floors by local unconcentrated downslope runoff, accompanied somewhat by gravitational forces. 2) Stratified--mineral material that has been subjected to appreciable transport in suspension with concentrated water flow, and deposited in highly variable layers.

AVAILABLE WATER CAPACITY - The relative amount of water that a soil, from 0 to 60 inches or to a paralithic or lithic contact, holds available for use by plants. Affected by such characteristics as soil texture, depth, structure, salts, and organic matter. [Based on inches of water held in the soil profile: <6 = low, 6-9 = moderate, >9 = high.]

COARSE FRAGMENTS - Mineral particles or rocks having diameter greater than 2 millimeters, such as gravels, cobbles, channers, and stones.

COARSE LOAMY - Generally, a soil textural class having less than 18 percent clay by weight in the fine-earth fraction, and 15 percent or more of the soil particles are fine sand or coarser. Textures are not sandy (see).

COLLUVIUM - Unconsolidated earth material which has been deposited on or at the base of slopes primarily by gravitational forces.

DEEP SOIL - The soil is greater than 40 inches deep over bedrock.

EOCENE - On the geologic time-scale, an epoch of the Tertiary Period. The Eocene epoch occurred over a length of approximately 38 to 53 million years ago.

EFFECTIVE ROOTING DEPTHS - Depth to which plant roots may freely penetrate without limitation by bedrock, hardpans, or other impenetrable layers.

EPHEMERAL DRAINAGE - A drainage through which water flows intermittently, chiefly in direct response to precipitation.

FINE - A soil textural class having 35 to 59 percent clay in the fine-earth fraction, by weight.

FINE-EARTH FRACTION - That portion of the soil particles which has diameter of less than 2 millimeters.

FINE LOAMY - By weight, a textural class in which the fine earth fraction has 18 to 34 percent clay and greater than 15 percent fine or coarser sand.

FRIGID - A soil temperature regime with mean annual soil temperature between (and not including) 0°C to 8°C (3247°F). Mean summer temperatures are generally greater than 15°C (59°F).

HABITAT TYPE - A habitat type is "all the land capable of producing similar plant communities at climax. The climax plant community, since it is the end result of plant succession, reflects the most meaningful integration of the environmental factors affecting vegetation. Each habitat type represents a relatively narrow segment or environmental variation that is delineated by ascertaining potential for vegetative development. Although one habitat type may support a variety of disturbance-induced or seral plant communities, the ultimate product of vegetative succession anywhere within one habitat type will be similar climax communities. The habitat type system is a method of site classification that uses the plant community as an integrated indicator of environmental factors. These factors affect species reproduction, competition, and plant community development" (Steele et al. 1979).

HORIZON - A soil layer.

HYDROLOGIC SOIL GROUPS - Groupings used in watershed planning to estimate runoff from rainfall. Groups range from A to D, in increasing runoff potential. [The A group has low runoff potential, B signifies moderately low potential, the C group has moderately high potential, and the D group has high runoff potential.]

INTERNAL DRAINAGE - Refers to aeration or saturation characteristics within the soil profile. Well drained soils allow water to move through the profile readily but not rapidly, and soil aeration is typically not a problem. Somewhat excessively drained soils allow water to move rapidly through the profile, and are typically droughty, sandy, and poorly developed. Poorly drained soils have a water table at shallow depth. [Riparian vegetation generally occurs on somewhat poorly to poorly drained soils.]

K FACTOR - This value indicates the relative susceptibility of a surface soil to water erosion. Values may range from .00 to about .70. Higher K values indicate higher erosion susceptibility. Soils with K factors over about 0.40 are generally considered to be highly susceptible to water erosion. It should be noted that the K factor is primarily derived from physical characteristics of the soil, and does not reflect other soil erosion factors such as management practices, precipitation, or length and steepness of slope.

LIQUID LIMIT - The moisture content at which a soil passes from a plastic to a liquid state.

MESOZOIC - A major geologic era believed to have extended from about 64 million to 225 million years ago. Sometimes referred to as the Age of Reptiles.

MODERATELY DEEP - The soil is 20 to 40 inches deep over bedrock.

PALEOZOIC - A major geologic era, believed to have extended from about 225 million to 570 million years ago.

PEDON - A conceptual unit area of soil which represents the nature and variabilities of its horizons and other properties. Comparable to the unit cell of a crystal.

PERMEABILITY - Permeability is a characteristic of soil which relates to the movement of water through the profile. Permeability criteria are based on the rate at which water moves through the most slowly permeable layer in a saturated soil profile.

Class	Rate (in/hr)
Very Slow	Less than 0.06
Slow	0.06 - 0.2
Moderately Slow	0.2 - 0.6
Moderate	0.6 - 6.0
Moderately Rapid	2.0 - 6.0
Rapid	6.0 - 20
Very Rapid	More than 20

PHASE - A subdivision of a soil series based on such factors as slope, surface texture, stoniness, salinity, internal drainage, etc.

PLASTICITY INDEX - The numerical difference between liquid limit and plastic limit. The plastic limit of soils is the moisture content at which a soil changes from a semisolid to a plastic state.

PROFILE - The sequence of horizons present in a soil.

REGENERATION - The natural regrowth of indiginous plant communities through the process of reinvasion and competition with reseed species on disturbed sites. Regeneration is used as a synonym to reestablishment and recovery in this report.

REHABILITATION - The process of applying mechanical erosion control and revegetation techniques to disturbed sites in order to limit soil loss and maintain soil productivity and capacity in the short term, such that is will support similar land uses in the future. Rehabilitation is used as a synonym to stabilization, revegetation, reclamation, and restoration in this report.

REHABILITATION UNIT - Rehabilitation units and rating criteria are defined separately at the end of the glossary.

RESIDUUM - Unconsolidated material which accumulates by weathering of parent material in place.

SANDY - Texture of the fine earths is sand or loamy sand but not loamy very fine sand or very fine sand; rock fragments make up less than 35 percent by volume.

SERIES - A level of classification in the soil taxonomic system; somewhat similar to the species category in the Linnaean taxonomic system.

SHALLOW SOIL - The soil is less than 20 inches deep over bedrock.

SKELETAL - The soil contains 35 percent or more coarse fragments, by volume. Fine-earth modifiers of sandy, loamy, or clayey precede the term skeletal in soil classification.

SOIL REACTION - The pH range of a soil, indicating acidity or alkalinity. Ranges are as follows:

Extremely acid	Below 4.5	Neutral	6.6 - 7.3 Very
strongly acid	4.5 - 5.0	Mildly alkaline	7.4 - 7.8
Strongly acid	5.1 - 5.5	Moderately alkaline	7.9 - 8.4
Medium acid	5.6 - 6.0	Strongly alkaline	8.5 - 9.0
Slightly acid	6.1 - 6.5	Very strongly alkaline	9.1 and higher

T FACTOR - The theoretical amount of erosion loss (in tons/acre/year) that a soil can sustain without a decrease in productivity. Values usually range from 1 to 5.

UNIFIED CLASSIFICATION - An engineering property classification. Soils are divided as (1) coarse-grained soils, (2) fine-grained soils, and (3) highly organic soils. The coarse-grained soils are subdivided into gravels (G) and sands (S). The four secondary divisions of each group--GW, GP, GM, and GC (gravel); SW, SP, SM and SC (sand)--depend on the amount and type of fines. Fine-grained soils are subdivided into silts (M) and clays (C), depending on their liquid limit and plasticity index. The silt and clay groups have secondary divisions based on whether the soils have a relatively low (L) or high (H) liquid limit. The highly organic soils, usually very compressible and with undesirable construction characteristics, are designated by OH, OL, or the symbol "Pt."

WEG (WIND ERODIBILITY GROUP) - This is an arbitrary grouping of soils based on texture and aggregation. Values range from 1 to 8, with lower numbers indicating increased susceptibility to wind erosion.

REHABILITATION UNITS AND RATINGS

REHABILITATION UNIT - A group of soils that are similar in suitability for plant growth and respond to the same kind of soil management. (Similar to the land capability unit as used in the Land Capability Classification System developed by the Soil Conservation Service.)

REHABILITATION UNIT RATING - A ranking of Rehabilitation Units into 3 categories (Good, Fair, and Poor) based on their response to be reclaimed utilizing applicable and effective erosion control, reclamation, and revegetation measures. Ranking for this project is based on the following soil properties and limitation parameters:

Soil Property	Rating		
	Good	Fair	Poor
Dominant Slope (%)	0 - 10	10 - 30	30+
Depth to Bedrock (in.)		21 to 40+ if rippable	<21
Salinity (mmhos/cm)	0 - 4	4 - 8	>8
Soil Reaction	5.6 - 7.9	4.5 - 5.5 8.0 - 8.5	<4.5 <8.5
Soil Texture	Other than Fair, Poor	Heavy clay loams and silty clay loams; light sandy loams, light silt loams	Clays, sands, loamy sands
Coarse Fragments (% Vol.)			
2mm - 3" diameter	0 - 35	35 - 60	60+
3" - 10+ diameter	0 - 5	5- 15	15+
Total, all sizes	0 - 35	35 - 60	60+

Note that a degree of judgment is necessary in rating rehabilitation units. Other criteria enter into a rating, such as dominance of soil components within a mapping unit, the occurrence of pan spots, the availability and adaptation of plant species, or the expense and duration of reclamation effort anticipated for successful rehabilitation.

APPENDIX A

MAPPING UNIT DESCRIPTIONS FOR THE WELL FIELD

Appendix A1 - ERT Survey Area
Appendix A2 - Bio/West Survey Area
Appendix A3 - FS Survey Area
Appendix A4 - Correlation of Soil Map Units for the Three Well Field Soil Surveys

APPENDIX A1

MAPPING UNIT DESCRIPTIONS - ERT SURVEY AREA

(In Numerical Order by Map Symbol)

TABLE 1-1

GUIDE TO WELL FIELD MAPPING UNITS

(ERT SURVEY AREA)

(MAPPING UNIT DESCRIPTIONS ARE IN APPENDIX A)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
50E	Pishkun, very gravelly loam, 15 to 30 percent slopes	low sagebrush, bluebunch wheatgrass, occ. big sagebrush; Lo. skel., deep, 10YR, colluvial toeslopes, calc.	C2
50F	Pishkun very gravelly loam, 30 to 50 percent slopes	low sagebrush, bluebunch wheatgrass, occ. big sagebrush; Lo. skel., deep, 10YR, colluvial toeslopes, calc.	C2
51E	Pishkun-Starman-Rock Outcrop complex, 15 to 30 percent slopes	mtn. mahogany, limber pine, bluebunch wheat-grass, occ. winterfat ridge crests & sideslopes deep/shallow complex	C2
51F	Pishkun-Starman-Rock Outcrop complex, 30 to 50 percent slopes	shallow loamy range site 15-19" precip. zone	C2
52	Starman-Rock Outcrop complex, 5 to 15 percent slopes	shallow/R.O./deep; on "barren" mtn. slopes; bluebunch, fringed sage, vetch, low buckwheat;	C2
53	Starman-Rock Outcrop-Pishkun complex, 15 to 30 percent slopes	units separated by slope, very shallow range site 15-19" precip. zone	C2
54	Starman-Rock Outcrop-Pishkun complex, 30 to 50 percent slopes		C2
55	Pishkun-Starley-Rock Outcrop complex, 10 to 40 percent slopes	on limestones and dolomites at high elevations	D5
62	Almy loam, 3 to 12 percent slopes	red, in 10-14" precip zone, frigid, big sagebrush, toeslopes and basins	B2

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
64	Pishkun moist - Hobacker complex, 30 to 50 percent slopes	mixed stands of Douglas fir, limber pine, wild currant, snowberry, bluebunch wheatgrass, oregon grape, myrtle	C2
66D	Hub[2] clay loam, 5 to 15 percent slopes	aspen type	C3
66E	Hub[2] clay loam, 15 to 30 percent slopes	aspen type	C4
66F	Mulgon-Hub complex, 30 to 50 percent slopes	aspen type	C4
70	Silas-Cryaquolls complex, 2 to 8 percent slopes	riparian and wet meadows	C1
71	Maxville-Tine complex, 0 to 3 percent slopes	low terraces, irrigated pasture	B1
72	Foxcreek-Turson complex, 0 to 3 percent slopes	wet bottomlands, willows, sedges, dark surface layers	B1
73	Wilsonville var.-McKinney var. complex, 0 to 3 percent slopes	willows, sedges, near streams, stratified, lack dark surface layers	B1
74	Alcova var. fine sandy loam, 2 to 12 percent slopes	mixed alluvium, 10-14" precip, sagebrush, western wheatgrass	B2
75	Heath var.-Jerry[2] - Brownsto[2] complex, 5 to 15 percent slopes	low sagebrush, big sagebrush, black sage-brush on colluvial ridges	C3
77E	Rooset[2] - Jerry[2] - Brownsto[2] complex, 15 to 30 percent slopes	low sagebrush, big sagebrush, black sage-brush on colluvial ridges	C4
77F	Rooset[2] - Southace var. - Brownsto[2] complex, 30 to 50 percent slopes	low sagebrush, big sagebrush, black sage-brush on colluvial ridges	C4

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
81D	Patent gravelly loam, 5 to 15 percent slopes	frigid soil, below about 7,400 feet elevation, big sagebrush and occ. shadscale	B2
81E	Patent gravelly loam, 15 to 30 percent slopes	frigid soil, below about 7,400 feet elevation, big sagebrush and occ. shadscale	B3
81F	Patent gravelly loam, 30 to 50 percent slopes	frigid soil, below about 7,400 feet elevation, big sagebrush and occ. shadscale	B3
82	Cundick var. very gravelly clay loam, 30 to 50 percent slopes	cobbly surface on steeply dipping red Wasatch shales, moderately deep	B3
84	Delphill-Glassner var. complex, 30 to 50 percent slopes	yellow siltstone - red shale complex, units separated on slope	B3
84D	Delphill-Glassner var. complex, 5 to 15 percent slopes	yellow siltstone-red shale complex below about 7,400 feet elevation	B3
85	Unnamed complex, 20 to 50 percent slopes	north and east exposures, some pine and aspen, with big sagebrush, serviceberry, over sandstones and shales	C4
86	Delphill-Glassner var. complex, 15 to 30 percent slopes	yellow siltstone-red shale complex below about 7,400 feet elevation	B3
88	Bead very gravelly sandy clay loam, 2 to 10 percent slopes	west of Deadline Ridge, timbered mtn. benches	D2
90	Bata-Cluff complex, 15 to 30 percent slopes	timbered, on steep slopes W. of Deadline Ridge	D3
91	Hobacker-Hoodle gravelly loams, 20 to 40 percent slopes	shallow loamy range site, 15-19" precip. zone	C4

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
92	Jerry var.-Hoodle[2] complex 2 to 8 percent slopes	big sagebrush and bitterbrush in skeletal alluvial fans and drainages	C3
93E	Granile-Leighcan-Nutras complex, 15 to 30 percent slopes	timbered	D3
93F	Leighcan-Granile-Nutras complex, 30 to 50 percent slopes	timbered	D5
94	Granile-Nutras complex, 5 to 15 percent slopes	timbered	D2
95	Bead-Nutras complex, 5 to 15 percent slopes	timbered	D2
96	Farlow-Starley very gravelly loams, 25 to 50 percent slopes	steep unit on high elevation ridges and sideslopes, open stands of limber and whitebark pines, big sagebrush, wild currant	D5
97	Farlow-Starley very gravelly loams, 10 to 25 percent slopes	bald ridges and knolls with big sagebrush, occ. aspen on edges	D5
98	Hub var.-Irigul-Rock Outcrop complex, 15 to 30 percent slopes	deep soil in conifer w/ shallow soil and rock outcrop, W. of Deadline Ridge	D5
99	Kremlin loam, 2 to 5 percent slopes	frigid soil in drainages and alluvial fans below 7,400 feet, big sagebrush, rabbitbrush	B2
ROS	Rock Outcrop-Starman complex 30 to 50 percent slopes	Steeply dipping rock outcrops with intermingled shallow soils, limber pine, bluebunch wheatgrass	C2

TABLE 1-1 (CONTINUED)

Symbol	Mapping Unit	Identifying Factors	Rehabilitation Unit[1]
RO	Rock Outcrop - steep to extremely steep		

[1]Rehabilitation Units are defined in the glossary and identified in Table 1-18.

[2]Taxadjunct

50E - Pishkun very gravelly loam 15 to 30 percent slopes

This deep, well drained soil is on slopewash fans and mountain slopes. It formed in very gravelly and cobbly alluvium derived dominantly from limestone and dolomite. The native vegetation is mainly low sagebrush, low rabbitbrush, forbs, and grasses. Elevation is 7,400 to 8,400 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

Typically the surface layer about 4 inches thick is pale brown very gravelly loam, the upper 7 inches of the underlying layer is a very pale brown very gravelly loam, and the lower part is a very pale brown extremely cobbly loam to a depth of 60 inches or more.

Included in this unit are small areas of Starman very gravelly loam on similar slopes and small areas of rock outcrop. Included areas make up about 10 percent of the total acreage.

Permeability of this somewhat excessively drained soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is slight.

The potential plant community on this unit is mainly low sagebrush, low rabbitbrush, bluebunch wheatgrass, spike fescue, and forbs. As the ecological condition deteriorates, annual weeds and forbs increase. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 700 pounds in unfavorable years.

Shallow Loamy range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to development of drilling pads, pipelines and roads because of slopes requiring excessive cuts and fills and very gravelly soils. Revegetation of areas is difficult because of droughty very gravelly soil materials. Erosion hazard is slight. For recoverable soil resources, the upper 12 inches may be salvaged and used as needed.

50F - Pishkun very gravelly loam 30 to 50 percent slopes

This deep, somewhat excessively drained soil is on slopewash fans and mountain slopes. It formed in very gravelly and cobbly alluvium and colluvium derived dominantly from limestone and dolomite. The native vegetation is mainly low sagebrush, low rabbitbrush, forbs, and grasses. Elevation is 7,400 to 8,400 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

Typically the surface layer is a pale brown very gravelly loam about 4 inches thick. The upper 7 inches of the underlying layer is a very pale brown very gravelly loam, and the lower part is a very pale brown extremely cobbly loam to a depth of 60 inches or more.

Included in this unit are small areas of Starman very gravelly loam on similar slopes and small areas of rock outcrop on ridge crests. Included areas make up about 10 percent of the total acreage.

Permeability of this somewhat excessively drained soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is slight.

The potential plant community on this unit is mainly low sagebrush, low rabbitbrush, bluebunch wheatgrass, spike fescue, and forbs. As the ecological condition deteriorates, annual weeds and forbs increase. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 700 pounds in unfavorable years.

Shallow Loamy range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to development of drill pads, pipelines, and roads because of steep slopes requiring excessive cuts and fills and very gravelly soils. Revegetation of disturbed areas is difficult because of droughty very gravelly soil materials. Erosion hazard is slight. For recoverable soil resources, up to 12 inches may be salvaged as needed.

51E - Pishkun-Starman-Rock Outcrop complex, 15 to 30 percent slopes

This map unit is on toeslopes and mountain sideslopes. The native vegetation is mainly low sagebrush, rabbitbrush, forbs, and grasses. Elevation is 7,500 to 8,100 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 70 percent Pishkun, 20 percent Starman. Also in this unit is about 10 percent rock outcrop. The Pishkun soil is on fans and toeslopes, and the Starman soil is on knobs, points, and ridge crests. Rock outcrop is on ridge crests on outcrop knobs. All soils are on similar slopes.

The Pishkun soil is deep, gravelly and cobbly, calcareous and somewhat excessively well drained. It formed in gravelly and cobbly colluvial and alluvial materials derived dominantly from limestone and dolomite.

Typically the surface layer is a pale brown very gravelly loam about 4 inches thick. The upper 7 inches of the underlying layer is very pale brown very gravelly loam, and the lower part is a very pale brown extremely cobbly loam to a depth of 60 inches or more.

Permeability of the Pishkun soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is slight.

The Starman soil is shallow, gravelly, calcareous and well drained. It formed in residuum derived dominantly from limestone and dolomite.

Typically the surface layer is as light brownish gray very gravelly loam about 3 inches thick. The underlying layer about 7 inches thick is pale brown very cobbly loam. Hard limestone or dolomite is at 10 to 15 inches.

Permeability of the Starman soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 15 inches. Runoff is moderate, and the hazard of water erosion is slight.

The potential plant community on the Pishkun soil is mainly low sagebrush, low rabbitbrush, bluebunch wheatgrass, spike fescue, needle grasses, and forbs. As the ecological condition deteriorates, annual weeds and forbs increase. The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 700 pounds in unfavorable years.

The potential plant community on the Starman soil is mainly fringed sage, bluebunch wheatgrass, spike fescue, and forbs. As the ecological condition deteriorates, forbs, sagebrush, and annual weeds increase. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Pishkun: Shallow Loamy range site, 15 to 19-inch precipitation zone.

Starman: Very Shallow range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to development of drilling pads, pipelines, and roads because of slopes requiring excessive cuts and fills and very gravelly soils. The Starman portion of the unit is shallow over hard non-rippable limestone. Revegetation is poor because of very gravelly soil materials and low water-holding capacity. Erosion hazard is slight. For recoverable soil resources, the Pishkun soil may be salvaged to a depth of 12 inches and the Starman soil to a depth of 10 inches as needed.

51F - Pishkun-Starman-Rock Outcrop complex, 30 to 50 percent slopes

This map unit is on slopewash fans and mountain slopes. The native vegetation is mainly low sagebrush, low rabbitbrush, forbs, and grasses. Elevation is 7,500 to 8,100 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average frost-free season is 70 to 85 days.

This unit is 70 percent Pishkun, 20 percent Starman. Also in this unit is about 10 percent Rock Outcrop. The Pishkun soil is on fans and toeslopes, and the Starman soil is on knolls, points, and ridge crests. All soils are on similar slopes.

The Pishkun soil is deep, gravelly and cobbly, calcareous, and somewhat excessively well drained. It formed in gravelly and cobbly colluvial and alluvial materials derived dominantly from limestone and dolomite.

Typically the surface layer is a pale brown very gravelly loam about 4 inches thick. The upper 7 inches of the underlying layer is very pale brown very gravelly loam and the lower part is a very pale brown extremely cobbly loam to a depth of 60 inches or more.

Permeability of the Pishkun soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is moderate because of steep slopes.

The Starman soil is shallow, gravelly, calcareous, and somewhat excessively drained. It formed in residuum derived dominantly from limestone and dolomite.

Permeability of the Starman soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 15 inches. Runoff is moderate, and the hazard of water erosion is moderate.

The potential plant community on the Pishkun soil is mainly low sagebrush, low rabbitbrush, bluebunch wheatgrass, spike fescue. As the ecological condition deteriorates, annual weeds and forbs increase.

The potential plant community produces about 900 pounds of air-dry vegetation per acre in normal years. Production varies from 1,200 pounds in favorable years to 700 pounds in unfavorable years.

The potential plant community on the Starman soil is mainly fringed sage, bluebunch wheatgrass, spike fescue, and forbs. As the ecological condition deteriorates, forbs, sagebrush, and annual weeds increase. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Pishkun: Shallow Loamy range site, 15 to 19-inch precipitation zone.

Starman: Very Shallow range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to development of drilling pads, pipeline, and roads because of slopes and excessive cuts and fills needed. Both soils are very gravelly and cobbly. The Starman portion of the unit is shallow to non-rippable limestone. Revegetation potential is poor because of very gravelly soil materials and low water-holding capacity. Erosion hazard is moderate. For recoverable soil resources, the Pishkun soil may be salvaged to a depth of 12 inches and the Starman soil to a depth of 10 inches as needed.

52 - Starman-Rock Outcrop complex, 5 to 15 percent slopes

This map unit is on upland limestone ridges and mountain side slopes. The native vegetation is mainly low sagebrush, forbs, and grasses. Elevation is 7,700 to 8,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 65 percent Starman and 20 percent Rock Outcrop. Also in this unit is about 10 percent Pishkun very gravelly loam on similar slopes. Starman soils and Rock Outcrops are on ridge crests and sideslopes. The Pishkun soil in on toe slopes and in concave drainways.

The Starman soil is shallow, gravelly, calcareous and well drained. It formed in residuum derived dominantly from limestone or dolomite.

Typically the surface layer is a light brownish gray very gravelly loam about 3 inches thick. The underlying layer about 7 inches thick is pale brown very cobbly loam. Hard limestone or dolomite is at 10 to 15 inches.

Permeability of the Starman soil is moderate. Available water capacity is low. Effective rooting depth is 7 to 15 inches. Runoff is moderate, and the hazard of water erosion is slight.

The rock outcrop portion of this unit consists of barren ridge caps and outcrops of limestone.

The potential plant community on the Starman soil is mainly fringed sage, bluebunch wheatgrass, spike fescue, and forbs. As the ecological condition deteriorates, forbs, sagebrush, and annual weeds increase. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Very Shallow range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to development of well pads, pipelines, and roads because of shallow depth to hard non-rippable bedrock. Revegetation of disturbed areas is difficult because of very shallow, gravelly, and droughty soil conditions. Erosion is a slight hazard.

53 - Starman-Rock Outcrop complex, 15 to 30 percent slopes

This map unit is on upland ridges and mountain sideslopes. The native vegetation is mainly low sagebrush, forbs, and grasses. Elevation is 7,700 to 8,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 60 percent Starman and 20 percent Rock Outcrop. Included in this unit is about 15 percent Pishkun very gravelly loam on similar slopes. Starman soils and rock outcrops are on ridges and sideslopes. The Pishkun soil is on lower toeslopes and in concave drainways.

The Starman soil is shallow, gravelly, calcareous, and well drained. It formed in residuum derived dominantly from limestone or dolomite.

Typically the surface layer is a light brownish gray very gravelly loam about 3 inches thick. The underlying layer about 7 inches thick is pale brown very cobbly loam. Hard limestone or dolomite is at 10 to 15 inches.

Permeability of the Starman soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 15 inches. Runoff is moderate, and the hazard of water erosion is slight.

The rock outcrop portion of this unit consist of barren ridge caps and outcrops of limestone and dolomite.

The potential plant community on the Starman soil is mainly fringed sage, bluebunch wheatgrass, spike fescue, and forbs. As the ecological condition deteriorates, forbs, sagebrush, and annual weeds increase. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Very Shallow range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to development of oil well pads, pipeline, and roads because of steep slopes and shallow depths to hard non-rippable bedrock. Revegetation is difficult because of very shallow, gravelly, and droughty soils.

54 - Starman-Rock Outcrop complex 30 to 50 percent slopes

This map unit is on upland ridges and mountain sideslopes. The native vegetation is mainly low sagebrush, forbs, and grasses. Elevation is 7,700 to 8,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 60 percent Starman, and 20 percent Rock Outcrop. Also in this unit is about 15 percent Pishkun very gravelly loam on similar slopes. Starman soils and rock outcrop are on ridges and sideslopes. The Pishkun soil is on lower toeslopes and in concave drainways.

The Starman soil is shallow, gravelly, calcareous and well drained. It formed in residuum derived dominantly from limestone and dolomite.

Typically the surface layer is a light brownish gray very gravelly loam about 3 inches thick. The underlying layer about 7 inches thick is pale brown very cobbly loam. Hard limestone or dolomite is at 10 to 15 inches.

Permeability of the Starman soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 15 inches. Runoff is moderate, and the hazard of water erosion is moderate.

The rock outcrop portion of this unit consists of barren ridge caps and outcrops of limestone and dolomite.

The potential plant community on the Starman soil is mainly fringed sage, bluebunch wheatgrass, spike fescue, and forbs. As the ecological condition deteriorates, forbs, fringed sage, and annual weeds increase. The potential plant community produces about 600 pounds or air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Very Shallow range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to development of drill pads, pipelines, and roads because of steep slopes and shallow depth to hard non-rippable bedrock. Revegetation is difficult because of very shallow, gravelly, and droughty soils. Erosion is a moderate hazard because of steep slopes.

55 - Pishkun-Starley-Rock Outcrop Complex, 10 to 40 Percent Slopes

This map unit is on forested mountain sideslopes generally west of Deadline Ridge. The native vegetation is mainly subalpine species of mustard, buckwheat, milkvetch, fleabane, and dwarfed bluebunch wheatgrass. Elevation is 9,500 to 10,000 feet.

The average annual precipitation is about 19 to 24 inches, the average annual air temperature is 32 to 34 degrees F., and the average growing season is 60 to 75 days.

This unit is 50 percent Pishkun soils, 25 percent Starley soils, and 15 percent Rock Outcrop.

The Pishkun soil is on steep sideslopes below ridge crests, the Starley soil is on gentler ridge shoulders and crests, and Rock Outcrop is on ridge crests.

The Pishkun soils is deep, extremely gravelly, and well to somewhat excessively drained. It formed in residuum and colluvium derived dominantly from limestones and dolomites.

Typically the surface layer is a brown extremely gravelly loam 2 inches thick. The next layer is a brown to yellowish brown very gravelly loam 6 inches thick. The underlying material is a very pale brown extremely gravelly loam to a depth of 40 inches or more. The Pishkun soil is calcareous throughout its depth.

Permeability of the Pishkun soil is moderate to moderately rapid. Available water capacity is moderate. Effective rooting depth is 40 inches or more. Runoff is slow and the hazard of water erosion is moderate.

The Starley soil is shallow to very shallow, extremely gravelly and somewhat excessively drained. It formed in residuum derived dominantly from limestone and dolomites.

Typically the surface layer is a brown extremely gravelly loam 4 inches thick, underlain by hard un-rippable limestones and dolomites.

Permeability of the Starley soil is moderate to moderately rapid. Available water capacity is low. Effective depth is 4 to 10 inches. Runoff is moderate, and the hazard of water erosion is low.

Included in this unit is about 10 percent Farlow and Starman soils on steep sideslopes and convex ridge crests, respectively.

The potential plant community on the Pishkun and Starley soils is mainly bluebunch wheatgrass, buckwheat, milkvetch, fleabane, and mustards. As the ecological condition deteriorates, mustards, annual grases, and annual weeds increase. The potential plant community produces about 400 pounds or air-dry vegetation per acre in normal years. Production varies from 600 pounds in favorable years to 200 pounds in unfavorabe years.

Shallow Loamy range site, 20+ inch precipitation zone.

62 - Almy loam, 3 to 12 percent slopes

This deep, well drained soil occurs on upland benches and on gently sloping fans. It formed in alluvium derived dominantly from sandstones and shales. The native vegetation is mainly big sagebrush, rabbitbrush, phlox, bluebunch wheatgrass, western wheatgrass, squirreltail and other forbs. Elevation is 7,300 to 7,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

Typically the surface layer is a reddish brown loam about 8 inches thick. The upper subsoil is reddish brown clay loam about 11 inches thick. The lower subsoil, 5 inches thick, is brown calcareous clay loam. The substratum is pink sandy clay loam to a depth of 60 inches.

Included in this unit are small areas of similar soils on similar slopes which are medium textured throughout and lack developed subsoil layers. Also included are small areas of similar soils with fine textured subsoil layers. Included areas make up about 15 percent of the total acreage.

Permeability of this well drained soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is moderate.

The potential plant community on this unit is mainly big sagebrush, rabbitbrush, bluebunch wheatgrass, western wheatgrass, and forbs. As the ecological condition deteriorates, big sagebrush, rabbitbrush, forbs, and annual weeds increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

Loamy range site, 10 to 14-inch precipitation zone.

64 - Pishkun Moist-Hobacker complex, 30 to 50 percent slopes

This map unit is on steep, protected sideslopes. The native vegetation is mainly Douglas-fir and limber pine with an understory of snowberry, wild currant, and grape. Elevation is 7,600 to 8,600 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F., and the average growing season is 70 to 85 days.

This unit is 60 percent Pishkun moist, and 25 percent Hobacker. The Pishkun soil is on convex and steeply sloping portions of hillsides, and the Hobacker soil occurs in concave areas along small ephemeral drainages and swales.

The Pishkun moist soil is deep, gravelly and cobbly, calcareous, and somewhat excessively drained. It formed in gravelly and cobbly colluvium and slopewash materials derived from limestones and dolomites.

Typically the soil has a 2-inch thick mat of organic material on the surface. The mineral surface layer is a brown gravelly loam about 8 inches thick. The upper 7 inches of the underlying layer is a brown, very gravelly loam or light clay loam, and the lower part is a pale brown very cobbly loam to a depth of 60 inches or more.

Permeability of the Pishkun moist soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate due to slope.

The Hobacker soil is deep, gravelly, calcareous, and somewhat excessively drained. It formed in colluvium and slopewash from limestones and dolomites.

Typically the soil has a 1-inch thick mat of organic material on the surface. The upper part of the mineral surface layer is a brown loam about 3 inches thick. The lower part of the surface layer is a brown gravelly loam 7 inches thick. The subsoil is a brown very gravelly light clay loam about 13 inches thick. The substratum is a pale brown very gravelly loam to a depth of 50 inches or more.

Permeability of the Hobacker soil is moderate to moderately slow. Available water capacity is low. Effective rooting depth is 50 inches or more. Runoff is medium and the hazard of water erosion is moderate because of the steep slopes.

Included in this unit is about 15 percent soils similar to Pishkun, but having strong subsoil development.

The potential plant community on the Pishkun moist soil is mainly Douglas-fir, limber pine, snowberry, wild currant, grape, and occasional mountain mahogany. The potential plant community on the Hobacker soil is mainly Douglas fir, snowberry, wild currant, and grape. Pishkun moist is in a conifer site, 15 to 19-inch precipitation zone.

Hobacker is in a similar conifer site, 15 to 19-inch precipitation zone.

66D - Hub-Pagosa complex, 5 to 15 percent slopes

This map unit is on upland hillslopes that often receive extra moisture in the form of snowdrifts. Land slides occur in some areas. The native vegetation is mainly aspen, snowberry, Oregon grape, buffaloberry, serviceberry, lupine, yarrow, geranium, slender wheatgrass, and pinegrass. Subalpine fir is invading in some areas. Elevation is 7,800 to 9,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 50 percent Hub and 35 percent Pagosa soils. These soils are intermingled on the landscape.

The Hub soil is deep and well drained. It formed in alluvium and residuum derived dominantly from shale and sandstone.

Typically the Hub soil has an organic mat 2 inches thick on the soil surface. The surface mineral layer is reddish brown, neutral, clay loam about 6 inches thick; the subsoil is reddish brown, neutral, clay loam or gravelly clay loam about 35 inches thick; and the substratum is reddish brown and yellow, calcareous, moderately alkaline, clay loam to 60 inches or more.

Permeability of the Hub soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pagosa soil is deep and well drained. It formed in alluvium and residuum derived dominantly from shale.

Typically the Pagosa soil has an organic mat about 1 inch thick on the soil surface. The surface mineral layer is light brownish gray, slightly acid, gravelly clay loam about 8 inches thick; the upper subsoil is brown, neutral, clay about 18 inches thick; and the lower subsoil and substratum is yellow, midly alkaline, gravelly clay loam to 60 inches or more.

Permeability of the Pagosa soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Included in this unit is about 15 percent similar soils with either darker or lighter colored surface layers, and dissimilar soils that contain more than 35 percent coarse fragments.

The potential plant community on the Hub soil in mainly aspen, snowberry, lupine, yarrow, geranium, and slender wheatgrass.

The potential plant community on the Pagosa soil is mainly aspen, snowberry, lupine, geranium, and slender wheatgrass.

Hub and Pagosa are in an Aspen site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

These soils have moderate limitations for roads, drill pads, and pipelines. They receive extra moisture in the form of snow drifts, dry out later in the spring than adjacent nonforested soils, and have small landslides in some areas. On-site stability investigations need to be made for construction activities in these areas. These soils have good potential for revegetation. About 16 inches of surface soil is available for use as top dressing in reclamation of disturbed areas.

66E - Hub-Pagosa complex, 15 to 30 percent slopes

This map unit is on upland hillslopes that often receive extra moisture in the form of snowdrifts. The native vegetation is mainly aspen, snowberry, buffaloberry, Oregon grape, geranium, lupine, yarrow, slender wheatgrass, and pinegrass. Elevation is 7,800 to 9,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 50 percent Hub and 35 percent Pagosa soils. On the Springman Creek quadrangle, Pagosa is the dominant soil. These soils are intermingled on the landscape.

The Hub soil is deep and well drained. It formed in alluvium and residum derived dominantly from shale and sandstone.

Typically, the Hub soil has an organic mat 2 inches thick on the soil surface. The surface mineral layer is reddish brown, neutral, clay loam about 6 inches thick; the subsoil is reddish brown, neutral, clay loam or gravelly clay loam about 35 inches thick; and the substratum is reddish brown and yellow, calcareous, moderately alkaline clay loam to 60 inches or more.

Permeability of the Hub soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid and the hazard of water erosion is severe.

The Pagosa soil is deep and well drained. It formed in alluvium and residuum derived dominantly from shale.

Typically, the Pagosa soil has an organic mat about 1 inch thick on the soil surface. The surface mineral layer is light brownish gray, slightly acid gravelly clay loam about 8 inches thick; the upper subsoil is brown, neutral, clay about 18 inches thick; and the lower subsoil and substratum is yellow, mildly alkaline, gravelly clay loam to 60 inches or more.

Permeability of the Pagosa soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

Included in this unit is about 15 percent similar soils with either darker or lighter colored surface layers, and dissimilar soils with more than 35 percent coarse fragments.

The potential plant community on the Hub soil is mainly aspen, snowberry, lupine, yarrow, geranium, and slender wheatgrass.

The potential plant community on the Pagosa soil is mainly aspen, snowberry, lupine, yarrow, geranium, and slender wheatgrass.

Hub and Pagosa are in an Aspen site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

These soils have moderate to severe limitations for roads and pipelines and severe limitations for drill pads. They receive extra moisture in the form of snow drifts, dry out later in the spring than adjacent non-forested soils, and have small landslides in some areas. On-site stability investigations need to be made for construction activities in these areas.

These soils have good potential for revegetation. About 16 inches of surface soil is available for use as top dressing in reclamation of disturbed areas.

66F - Mulgon-Hub complex, 30 to 50 percent slopes

This map unit is on steep ridges and mountain slopes. The native vegetation is mainly aspen with an understory of snowberry, roses, sedges, grasses, and forbs. Elevation is 7,700 to 8,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 60 percent Mulgon soils and 30 percent Hub soils. Both soils have similar slopes.

The Mulgon soil is deep, slightly acid, loamy skeletal, and well drained. It formed in alluvium derived dominantly from sandstones, quartzite, and shales.

Typically the soil has a thin organic mat of 1 to 2 inches at the surface. The mineral surface layer is dark grayish brown gravelly loam about 3 inches. The next layer about 14 inches thick is brown gravelly loam. The upper subsoil layer about 20 inches thick, is light brown very cobbly sandy clay loam. The lower subsoil about 10 inches thick is pale brown, very light clay loam. The substratum to a depth of 60 inches or more is extremely cobbly loam.

Permeability of the Mulgon soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slight and the hazard of water erosion is severe.

The Hub soil is deep, loamy, slightly acid, and well drained. It formed in alluvium derived dominantly from sandstone and shales.

Typically the surface has a thin organic mat about 2 inches thick. The mineral surface layer about 6 inches thick is reddish brown clay loam. The next layer, about 10 inches thick, is reddish brown clay loam. The upper subsoil, about 8 inches thick, is reddish brown clay loam and the lower subsoil, about 18 inches thick, is reddish brown gravelly clay loam. The substratum to a depth of 60 inches is reddish brown clay loam.

Permeability of the Hub soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. Included in this unit is about 10 percent Brownsto soils.

The potential plant community on the Mulgon and Hub soils is mainly aspen with an understory of snowberry, rose, big sage, sedges, and grasses. As the ecological condition deteriorates, forbs and brush species increase.

Mulgon and Hub are in an Aspen site, 15 to 19-inch precipitation zone.

Use and Management Consideration:

These soils are poorly suited to development of drill pads, pipelines, and roads. These soils are highly erosive and are subject to slippage and landslides because of steep slopes, moderate and moderately rapid permeability, and in resting on clay shales at depths of 7 to 15 feet.

Numerous slips and land slides occur in most units. Deep cuts and fills should be avoided. For salvageable soil resource up to 20 inches of upper soil materials may be stockpiled for revegetation use.

70 - Silas-Cryaquolls complex, 2 to 8 percent slopes

This map unit occurs in narrow stream drainages and swales. The native vegetation is mainly bluegrass, silver sagebrush, big sagebrush, and rabbitbrush, with some areas dominated by sedges, willows, and woody cinquefoil. Elevation is 7,500 to 8,600 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 60 percent Silas, and 25 percent Cryaquolls. Silas soils occur along the edges of swales and stream drainages. Cryaquolls occur near seeps, springs, and other wet, depressional areas.

The Silas soil is deep and moderately well drained. It formed in mixed alluvium from streams and local runoff.

Typically, the surface layer is a very dark grayish brown, calcareous loam 21 inches thick. The next layer, 23 inches thick, is a brown, calcareous loam. The underlying material is a brown, calcareous, very gravelly loam to a depth of 60 inches or more.

Permeability of the Silas soil is moderate. The available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is slight.

The Cryaquolls soils are deep and poorly drained. They formed in alluvium derived dominantly from mixed sources. Typically, the soils are clay loams with a dark colored surface layer. In small areas near springs, a layer of peat occurs on top of the mineral soil. Some of these soils are underlain by gravel at 20 to 40 inches.

Permeability of the Cryaquolls soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is slight.

Included in this unit is about 15 percent soils similar to Silas, but having thinner dark-colored surface layers.

The potential plant community on the Silas soil is mainly big sagebrush, silver sagebrush, woody cinquefoil, bluegrasses, sedges, and rabbitbrush. As the ecological condition deteriorates, big sagebrush, rabbitbrush, bluegrass increase. The potential plant community produces about 2,500 pounds of air-dry vegetation per acre in normal years. Production varies from 3,000 pounds in favorable to 1,500 in unfavorable years.

The potential plant community on the Cryaquolls soil is mainly willow, sedges and rushes, and tuffed hairgrass. As the ecological condition deteriorates, willow and rushes increase. The potential plant community produces about 6,000 pounds of air-dry vegetation per acre in normal years. Production varies from 7,500 pounds in favorable years to 5,500 pounds in unfavorable years.

Silas: Overflow range site, 15 to 19-inch precipitation zone.

Cryaquolls: Wetland range site 15 to 19-inch precipitation zone.

71 - Maxville-Tine complex, 0 to 3 percent slopes

This map unit is on low terraces adjacent to streams. The vegetation is mainly irrigated hay and pasture with brome, timothy, meadow foxtail, orchardgrass, sedges, and rushes. Elevation is 7,400 to 8,000 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 50 percent Maxville gravelly sandy loam, and 30 percent Tine gravelly loam. These soils can occur as large areas of each individual soil or they can occur in an intermingled pattern.

The Maxville soil is deep and well to moderately well drained. It formed in alluvium derived dominantly from mixed sources.

Typically the surface layer is a grayish brown, mildly alkaline, gravelly sandy loam about 6 inches thick; the upper subsoil is a brown, mildly alkaline, gravelly loam about 6 inches thick; the lower subsoil is a pale brown, calcareous, moderately alkaline, gravelly loam about 10 inches thick; and the substratum is calcareous gravel, cobble, and sand to 60 inches or more. Fluctuating water tables may occur in these soils during parts of the year.

Permeability of the Maxville soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Tine soil is deep and well to moderately well drained. It formed in alluvium derived dominantly from mixed sources.

Typically the surface layer is a grayish brown, neutral, gravelly loam about 8 inches thick; the underlying layer is a light brown, calcareous, moderately alkaline, gravelly sandy loam about 6 inches thick; and the substratum is a pinkish gray, calcareous, moderately alkaline, extremely gravelly loamy sand to 60 inches or more. Fluctuating water tables may occur in these soils during parts of the year.

Permeability of the Tine soil is very rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Included in this unit is about 20 percent soils similar to Maxville that have either sandy loam or heavy clay loam textures in the upper part, similar soils that have water tables near the surface, and small areas on the edges of the valleys where slopes are 3 to 10 percent and gravel is deeper than 40 inches.

Subirrigated range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

Most of these areas are used for irrigated hay and pasture. They are generally well suited for road and pipeline corridors, however, new road construction or drill pads on these lands would probably disrupt the existing irrigation water distribution systems. These areas have a fair suitability for drill pads. Excavated reserve pits used during a drilling operation would most likely extend into highly permeable gravels where drilling fluids could seep to the groundwater or groundwater could flow into the pit.

One to 3 feet of surface soil that overlies relatively clean gravel and sand can be salvaged as needed for use in reclamation. These soils have a good potential for revegetation if a large amount of the very gravelly substratum material is not left on the surface.

72 - Foxcreek-Turson complex, 0 to 3 percent slopes

This map unit is on bottomlands. The native vegetation is mainly willows, sedges, rushes, tuffed hairgrass, and red top. Elevation is 7,400 to 8,000 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 34 to 37 degrees F, and the average frost-free season is 70 to 85 days.

This unit is 40 percent Foxcreek and 40 percent Turson soils. These soils are intermingled on the landscape or they may also occur as large areas of each individual soil.

The Foxcreek soil is deep and poorly drained. It formed in alluvium derived dominantly from mixed sources.

Typically the surface layer is a very dark gray to dark gray, calcareous, moderately alkaline loam about 14 inches thick; the underlying layer is a grayish brown, calcareous, moderately alkaline loam about 18 inches thick; and the substratum is a very gravelly sand substratum to 60 inches or more.

Permeability of the Foxcreek soil is moderate in the upper part and rapid in the substratum. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Turson soil is deep and somewhat poorly drained. It formed in alluvium derived dominantly from mixed sources.

Typically the surface is a light brownish gray, calcareous, moderately alkaline loam about 12 inches thick; the underlying layer brownish gray, calcareous, moderately alkaline loam about 18 inches thick; and the substratum is a very gravelly sand to 60 inches or more.

Permeability of the Turson soil is moderate in the upper part and rapid in the substratum. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Included in this unit is about 20 percent similar soils that lack dark colored surface layers, similar soils with a thick layer of peat on the surface, and similar soils that have gravel at either less than 20 inches or more than 40 inches deep.

The potential plant community on the Foxcreek soil is mainly willows, Nebraska sedge, tuffed hairgrass, and redtop. As the ecological condition deteriorates, willows, sedges, and rushes increase. The potential plant community produces about 6,000 pounds of air-dry vegetation per acre in normal years. Production varies from 7,500 pounds in favorable years to 5,500 pounds in unfavorable years.

The potential plant community on the Turson soil is mainly willows, tuffed hairgrass, Nebraska sedge, and western wheatgrass. As the ecological condition deteriorates, willows, sedges, iris, and rushes increase. The potential plant community produces about 4,500 pounds of air-dry vegetation

per acre in normal years. Production varies from 5,500 pounds in favorable years to 4,500 pounds in unfavorable years.

Foxcreek: Wetland range site, 15 to 19-inch precipitation zone.

Turson: Subirrigated range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

These areas lie immediately adjacent to streams and are poorly suited for roads, pipelines, and drill pads. Roads and pipelines should cross these long narrow areas at right angles to minimize the amount of area disturbed. The primary limiting factors are wetness and a hazard of water contamination.

Two to 3 feet of surface soil that overlies relatively clean gravel and sand can be salvaged as needed for use in reclamation. These soils have a good potential for revegetation if a large amount of the very gravelly substratum material is not left on the surface.

73 - Wilsonville Variant - McKinney Variant complex, 0 to 3 percent slopes

This map unit is on bottomlands along streams. The native vegetation is mainly willows, strawberry, sedges, bluegrass, tuffed hairgrass, and redtop. Elevation is 7,300 to 7,500 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 34 to 37 degrees F, and the average frost-free season is 70 to 85 days.

This unit is 50 percent Wilsonville Variant and 30 percent McKinney Variant. These soils are intermingled on the landscape or they may occur as large areas of each individual soil.

The Wilsonville Variant soil is deep and somewhat poorly drained. It formed in alluvium derived dominantly from mixed sources.

Typically the surface layer is a grayish brown, calcareous, moderately alkaline loam about 3 inches thick; the underlying layer is a light brownish gray, calcareous, moderately alkaline, stratified fine sandy loam and loam about 31 inches thick; and the substratum is a light brownish gray, calcareous, moderately alkaline, very gravelly sandy loam to 60 inches or more.

Permeability of the Wilsonville Variant soil is moderate in the upper part and rapid in the lower part. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The McKinney Variant soil is deep and poorly drained. It formed in alluvium derived dominantly from mixed sources.

Typically the surface layer and underlying layers are a light brownish gray, calcareous, moderately alkaline loam about 24 inches thick; and the substratum is a light brownish gray, calcareous, moderately alkaline, very gravelly sand substratum to 60 inches or more.

Permeability of the McKinney Variant soil is moderate in the upper part and rapid in the substratum. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Included in this unit is about 20 percent similar soils with dark colored surface layers, similar soils with a thick layer of peat on the surface, similar soils that are highly calcareous, and soils that have gravel at either less than 20 inches or more than 40 inches of depth.

The potential plant community on the Wilsonville Variant soil is mainly willows, tuffed hairgrass, Nebraska sedge, and western wheatgrass. As the ecological condition deteriorates, willows, sedges, iris, and rushes increase. The potential plant community produces about 3,700 pounds of air-dry vegetation per acre in normal years. Production varies from 4,300 pounds in favorable years to 3,000 pounds in unfavorable years.

The potential plant community on the McKinney Variant soil is mainly willows, Nebraska sedge, tuffed hairgrass, and redtop. As the ecological condition deteriorates, willows, sedges, and rushes increase. The potential plant community produces about 5,000 pounds of air-dry vegetation per acre in normal years. Production varies from 6,000 pounds in favorable years to 4,000 pounds in unfavorable years.

Wilsonville Variant: Subirrigated range site, 10 to 14-inch precipitation zone.

McKinney Variant: Wetland range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

These areas are poorly suited for roads, pipelines, and drill pads because of wetness and a hazard of water contamination, particularly adjacent to streams.

Parts of these areas are presently used for irrigated hay and pasture. New developments, particularly roads, can disrupt these uses.

Two to 3 feet of surface soil that overlies relatively clean gravel and sand can be salvaged as needed for use in reclamation. These soils have a good potential for revegetation if a large amount of the very gravelly substratum is not left on the surface.

74 - Alcova Variant fine sandy loam, 2 to 12 percent slopes

This deep soil is well drained. It formed in alluvium derived dominantly from mixed sources. The native vegetation is mainly big sagebrush, rabbitbrush, and western wheatgrass. Elevation is 7,350 to 7,600 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

Typically the surface layer is a brown, mildly alkaline, fine sandy loam about 3 inches thick; the upper subsoil is a brown, mildly alkaline sandy clay loam about 7 inches thick; the lower subsoil is a pale brown, calcareous, strongly alkaline, gravelly sandy clay loam about 5 inches thick; and the substratum is a very pale brown, calcareous, strongly alkaline, very gravelly loam to 60 inches or more.

Included in this unit are small areas of soils that are very gravelly to the surface on slope breaks. Included areas make up about 15 percent of the total acreage.

Permeability of this deep soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight.

The potential plant community on this unit is mainly big sagebrush, rabbitbrush, western wheatgrass, and bluebunch wheatgrass. As the ecological condition deteriorates, rabbitbrush, yarrow, and big sagebrush increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

Loamy range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

These soils are well suited for roads, pipelines, and drill pads. They are also suitable for gravel borrow areas.

Portions of these soils are presently being used for irrigated hay and pasture. New developments, particularly roads and drill pads, would probably disrupt the existing irrigation water distribution systems.

About 12 to 18 inches of surface soil that overlies the very gravelly substratum material can be salvaged as needed for use in reclamation. Productivity is limited by droughtiness due to shallow depth to the very gravelly substratum.

75 Heath Variant-Jerry-Brownsto complex, 5 to 15 percent slopes

This map unit is on sloping pediments mantled with layers of gravelly and clayey colluvium. The native vegetation is mainly low sagebrush, big sagebrush, black sagebrush, phlox, buckwheat, western wheatgrass, spike fescue, and bluebunch wheatgrass. Elevation is 7,800 to 8,500 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 35 percent Heath variant, 30 percent Jerry soils, and 15 percent Brownsto soils. Heath variant is on low sagebrush communities, Jerry soils are on big sagebrush communities, and Brownsto is on sites with a mixture of scattered big sagebrush, low sagebrush, and black sagebrush. The soils are intricately intermingled on the landscape.

The Heath Variant soil is deep and well drained. It formed in clayey and gravelly colluvium derived dominantly from shale, sandstone, and quartzite. Typically, the Heath variant has a dark brown to reddish brown, mildly alkaline gravelly loam or gravelly light clay loam surface and upper subsoil layer about 9 inches thick; a reddish brown to light reddish brown, moderately alkaline heavy clay loam middle and lower subsoil layers that are calcareous in the lower part; a light reddish brown, calcareous, moderately alkaline extremely gravelly clay loam upper substratum about 32 inches thick; and a red, calcareous, moderately alkaline gravelly clay loam lower substratum layer to 82 inches or more.

Permeability of the Heath variant soil is very slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Jerry soil is deep and well drained. It formed in alluvium derived dominantly from shale, sandstone, and quartzite. Typically, Jerry has a dark brown, neutral, gravelly loam surface layer about 14 inches thick; a brown to reddish brown neutral, heavy clay loam or clay upper subsoil about 16 inches thick; a reddish brown, calcareous, moderately alkaline clay or heavy clay loam lower subsoil about 16 inches thick; and a light red, calcareous, moderately alkaline clay loam or cobbly clay loam to 60 inches or more.

Premeability of the Jerry soil is very slow. Available water capacity is high. Effective rooting depth if 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Brownsto soil is deep and somewhat excessively drained. It formed in gravelly alluvium derived dominantly from quartzite, sandstone, and shale. Typically, Brownsto has a brown to reddish brown, calcareous, mildly to moderately alkaline, very cobbly clay loam surface layer about 10 inches thick; a pink to light reddish brown, highly calcareous, moderately alkaline, very gravelly and cobbly clay loam about 32 inches thick; and a reddish brown, calcareous, moderately alkaline, clay loam to 60 inches or more.

Permeability of the Brownsto soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Included in this unit is about 20 percent soils similar to Heath variant and Jerry that have more than 35 percent coarse fragments throughout; soils similar to Heath Variant that lack a very gravelly substratum; soils similar to Brownsto that have a clay loam substratum at 20 to 40 inches; and soils similar to Jerry that have a dark colored surface layer that is more than 16 inches thick.

The current plant community on the Heath variant soil is mainly low sagebush, low rabbitbrush, phlox, western wheatgrass. and spike fescue.

As the ecological condition deteriorates, low sagebush, annual forbs increase.

The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable to 800 pounds in unfavorable years.

The potential plant community on the Jerry soil is mainly big sagebrush, buckwheat, spike fescue, needle grasses, squirreltail, and bluegrasses. As the ecological condition deteriorates, big sagebrush, yarrow, rabbitbrush, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds in unfavorable years.

The potential plant community on the Brownsto soil is mainly black sagebrush, phlox, bluebunch wheatgrass, bottlebrush squirreltail, and bluegrasses. As the ecological condition deteriorates, woody plants and forbs increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,250 pounds in favorable years to 650 pounds in unfavorable years.

Heath variant: Dense Clay range site, 15 to 19-inch precipitation zone.

Jerry: Loamy range site, 15 to 19-inch precipitation zone.

Brownsto: Gravelly range site, 15 to 19-inch precipitation zone.

Use and Management Considerations

These soils are generally well suited for road locations, drill pads, and pipeline corridors.

The very gravelly and cobbly layers in the Heath variant and Brownsto soils provide bearing strength and erosion protection for roads and drill pads, but when the upper few feet of very gravelly material is removed, the underlying soil is susceptible to accelerated erosion.

Revegetation potential for the Heath variant soil is fair due to the high clay content and presence of very gravelly layers. About 9 inches of salvageable surface soil is available for use in reclamation.

Revegetation potential for the Jerry soil is fair. About 14 inches of salvageable surface soil is available for use in reclamation.

Revegetation potential for the Brownsto soil is poor due to the high coarse fragment content and droughtiness. About 10 inches of poor quality very gravelly and cobbly topsoil can be salvaged for use in reclamation or topsoil can be imported from other areas.

77E - Rooset-Jerry-Brownsto complex, 15 to 30 percent slopes

This map unit is on moderately steep pediments mantled with layers of gravelly and clayey alluvium, and colluvium. The native vegetation is mainly big sagebrush, bitterbrush, buckwheat, bluebunch wheatgrass, spike fescue, prairie junegrass, and bluegrasses. Elevation is 7,600 to 8,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 35 percent Rooset, 30 percent Jerry, and 15 percent Brownsto. These soils are intermingled on the landscape.

The Rooset soil is deep and well drained. It formed in colluvium derived dominantly from shale, sandstone, and quartzite.

Typically the surface layer is a reddish brown, neutral, very gravelly loam about 7 inches thick; the upper subsoil is a reddish brown, mildly alkaline very gravelly heavy clay loam about 8 inches thick; the middle subsoil is a dark reddish brown, calcareous, moderately alkaline, extremely gravelly heavy clay loam about 17 inches thick; the lower subsoil is a red, calcareous, moderately alkaline, gravelly clay loam about 9 inches thick; and the substratum is a red calcareous, moderately alkaline, very gravelly clay loam to 60 inches or more.

Permeability of the Rooset soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is moderate.

The Jerry soil is deep and well drained. If formed in alluvium derived dominantly from shale, sandstone, and quartzite.

Typically the surface layer is a dark brown, neutral, gravelly loam about 14 inches thick; the upper subsoil is brown to reddish brown, neutral, heavy clay loam or clay about 16 inches thick; the lower subsoil is a reddish brown, calcareous, moderately alkaline clay or heavy clay loam about 16 inches thick; and the substratum is a light red, calcareous, moderately alkaline clay loam or cobbly clay loam to 60 inches or more.

Permeability of the Jerry soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Brownsto soil is deep and somewhat excessively drained. It is found in gravelly alluvium derived dominantly from quartzite, sandstone, and shale. Typically, the surface layer is a brown, neutral, very gravelly loam about 5 inches thick; the subsoil is a brown to yellowish brown, calcareous, mildly to moderately alkaline, very gravelly clay loam about 11 inches thick; the upper substratum is a yellow, highly calcareous, strongly alkaline, very gravelly clay loam about 24 inches thick; the middle substratum is a red, calcareous, moderately alkaline, very gravelly clay loam about 11 inches thick; and the lower substratum is a red, calcareous, moderately alkaline, gravelly clay to 60 inches or more.

Permeability of the Brownsto soil is moderate in the upper part and slow in the lower part. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Included in this unit is about 20 percent Heath Variant, Southace Variant, soils similar to Brownsto that have red clay at 20 to 40 inches of depth, soils similar to Rooset that have less than 35 percent clay in the B horizon, and soils similar to Rooset and Jerry that lack well developed B horizons.

The potential plant community on the Rooset soil is mainly big sagebrush, bitterbrush, bluebunch wheatgrass, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, yarrow, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 in unfavorable years.

The potential plant community on the Jerry soil is mainly big sagebrush, bitterbrush, bluebunch wheatgrass, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, yarrow, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds in unfavorable years.

The potential plant community on the Brownsto soil is mainly big sagebrush, bitterbrush, bluebunch wheatgrass, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, yarrow, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds in unfavorable years.

Rooset: Loamy range site, 15 to 19-inch precipitation zone.

Jerry: Loamy range site, 15 to 19-inch precipitation zone.

Brownsto: Loamy range site 15 to 19-inch precipitation zone.

Use and Management Considerations:

These soils have fair suitability for pipelines and roads and poor suitability for drill pads because of slopes. The very gravelly and cobbly layers in the Rooset and Brownsto soils provide bearing strength and erosion protection for roads and drill pads. When the gravelly upper soil layers are removed, the underlying soil is susceptible to accelerated erosion.

Revegetation potential on the Rooset soil is poor due to the combination of high content of coarse fragments, slope and droughtiness. About 7 to 12 inches of fair quality surface soil is available for use in reclamation.

Revegetation potential on the Jerry soil is also poor. About 14 inches of surface soil is available for revegetation.

Revegetation potential on the Brownsto soil is poor due to the high content of coarse fragments and droughtiness. About 10 inches of poor quality surface soil can be salvaged for use in reclamation or topsoil can be imported from other areas.

77F - Rooset-Southace Variant-Brownsto complex, 30 to 50 percent slopes

This map unit is on sideslopes of narrow valleys. The native vegetation is mainly big sagebrush, bitterbrush, low sagebrush, black sagebrush, rabbitbrush, buckwheat, phlox, bluebunch wheatgrass, spike fescue, prairie junegrass, and bluegrasses. Elevation is 7,600 to 8,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 35 percent Rooset, 30 percent Southace Variant, and 15 percent Brownsto. These soils are intermingled on the valley sideslopes.

The Rooset soil is deep and well drained. It formed in colluvium derived dominantly from shale, sandstone, and quartzite.

Typically the surface layer is a reddish brown, neutral, very gravelly loam about 7 inches thick; the upper subsoil is a reddish brown, milkly alkaline, very gravelly heavy clay loam about 8 inches thick; the middle subsoil is a dark reddish brown, calcareous, moderately, alkaline, extremely gravelly heavy clay loam about 17 inches thick; the lower subsoil is a red, calcareous, moderately alkaline, gravelly clay loam aobut 9 inches thick; and the substratum is a red, calcareous, moderately alkaline, very gravelly clay loam to 60 inches or more.

Permeability of the Rooset soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate.

The Southace Variant soil is deep and well drained. It formed in colluvium derived dominantly from shale, sandstone, and quartzite.

Typically the surface layer is a reddish brown, calcareous, moderately alkaline, very gravelly clay loam or gravelly clay loam about 8 inches thick; the upper substratum is a red, calcareous, moderately alkaline, very gravelly clay loam or extremely gravelly clay loam about 16 inches thick; and the lower substratum is a red, calcareous, moderately alkaline, shaly clay loam to 60 inches or more.

Permeability of the Southace Variant soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate.

The Brownsto soil is deep and somewhat excessively drained. It formed in colluvium derived dominantly from sandstone, quartzite, and shale.

Typically the surface layer is a brown, neutral, very gravelly loam about 5 inches thick; the subsoil is a brown to yellowish brown, calcareous, mildly to moderately alkaline, very gravelly loam about 11 inches thick; the upper substratum is a yellow, highly calcareous, strongly alkaline, very gravelly clay loam about 24 inches thick; the middle substratum layer is a red, calcareous, moderately alkaline, very gravelly clay loam about 11 inches thick; and the lower substratum is a red, calcareous, moderately alkaline, gravelly clay to 60 inches or more.

Permeability of the Brownsto soil is moderate in the upper part and very slow in the lower part. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate.

Included in this unit is about 20 percent Heath Variant, Jerry soils, soils similar to Southace Variant that have more than 35 percent clay, soils similar to Brownsto that have red hues thorughout and lack layers of high calcium. Carbonate content, and soils similar to Rooset that lack well developed B horizons.

The potential plant community on the Rooset soil is mainly big sagebrush, bitterbrush, rabbitbrush, bluebunch wheatgrass, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, buckwheat and yarrow increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds in unfavorable years.

The potential plant community on the Southace Variant soil is mainly black sagebrush, rabbitbrush, phlox, and bluebunch wheatgrass. As the ecological condition deteriorates, woody plants and forbs increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,250 pounds in favorable years to 650 pounds in unfavorable years.

The potential plant community on the Brownsto soil is mainly big sagebrush, bitterbrush, rabbitbrush, bluebunch wheatgrass, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, yarrow, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds in unfavorable years.

Rooset: Loamy range site, 15 to 19-inch precipitation zone.

Southace Variant: Gravelly range site, 15 to 19-inch precipitation zone.

Brownsto: Loamy range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

These soils are poorly suited for roads, pipelines, and drill pads due to steep slopes, difficulty of revegetation, and erosion hazard of the nongravelly underlying layers.

Revegetation potential is fair to poor. About 1 foot of poor quality, very gravelly surface soil can be salvaged for use in reclamation.

Note: Heavy stands of big sagebrush and bitterbrush predominate on south-facing slopes. North-facing slopes have predominately bluebunch wheatgrass with scattered big and low sagebrush.

81D - Patent gravelly loam, 5 to 15 percent slopes

This deep, well drained soil is on upland sideslopes, benches, and fans. It formed in residuum and locally re-worked alluvium derived dominantly from interbedded Wasatch shales and siltstones. The native vegetation is mainly black sagebrush, shadscale, rabbitbrush, woody buckwheat, and bluebunch wheatgrass. Elevation is 7,100 to 7,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, the the average growing season is 75 to 90 days.

Typically the surface layer is a pale brown, calcareous, very gravelly loam 4 inches thick. The next layer is a light yellowish brown, calcareous loam 4 inches thick. The upper part of the underlying layer is a very pale brown, calcareous loam 26 inches thick. The middle part of the underlying layer is a pale yellow, calcareous silty clay 24 inches thick. The lower part of the underlying layer is a pale yellow, calcareous and gypsiferous silty clay to a depth of 60 inches or more. Highly weathered shaly rock structure occurs below a depth of 34 inches. Included in this unit are small areas of Delphill soils on similar positions. This inclusion makes up about 15 percent of the unit.

Permeability of the Patent soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is low.

The potential plant community on this unit is mainly big sagebrush, rabbitbrush, shadscale, bluebunch wheatgrass, thick spike wheatgrass, battlebrush, squirreltail, bluegrasses. As the ecological condition deteriorates, big sagebrush, rabbitbrush, and yarrow increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

Loamy range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

The Patent soil is moderately well suited to construction of drill pads, roads, and pipelines. Although the slope is suitable, shaly rock structure and potentially high salinity levels somewhat limit the reclamation suitability of this soil. For use as a recoverable soil resource, this Patent soil may be salvaged as needed to a depth of 24 inches.

81E - Patent gravelly loam, 15 to 30 percent slopes

This deep, well drained soil is on upland sideslopes, benches, and fans. It formed in residuum and locally re-worked alluvium derived dominantly from interbedded Wasatch shales and siltstones. The native vegetation is mainly black sagebrush, shadscale, rabbitbrush, woody buckwheat, and bluebunch wheatgrass. Elevation is 7,100 to 7,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

Typically the surface layer is a pale brown, calcareous very gravelly loam about 4 inches thick. The next layer is a light yellowish brown, calcareous loam 4 inches thick. The upper part of the underlying layer is a very pale brown calcareous loam 26 inches thick. The middle part of the underlying layer is a pale yellow, calcareous silty clay loam 24 inches thick. The substratum to a depth of 60 inches is pale yellow calcareous gypsiferous silty clay. Highly weathered shaly rock structure occurs below a depth of 34 inches.

Included in this unit are small areas of Delphill soils on similar positions. This inclusion makes up about 15 percent of the unit.

Permeability of this Patent soil is very slow. Available water capacity is high. Effective depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is moderate.

The potential plant community on this unit is mainly big sagebrush, rabbitbrush, shadscale, bluebunch wheatgrass, thickspike wheatgrass, bottlebrush squirreltail, and bluegrasses. As the ecological condition deteriorates, big sagebrush, rabbitbrush, and forbs increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

Loamy range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

This mapping unit is poorly suited to development of drill pads, pipelines, and roads. Slope and erosion hazard are limitations. For use as a recoverable soil resource up to 24 inches of top material may be salvaged as needed for revegetative use. Revegetative plant mixtures should include species adapted to 10 to 14-inch precipitation zone.

81F - Patent gravelly loam, 30 to 50 percent slopes

This deep, well drained soil is on upland sideslopes, benches, and fans. It formed in residuum and locally transported alluvium derived dominantly from interbedded Wasatch shales and sandstones. The native vegetation is mainly black sagebrush, shadscale, rabbitbrush, and woody buckwheat. Elevation is 7,100 to 7,400 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

Typically the surface layer is a pale brown, calcareous, very gravelly loam about 4 inches thick. The next layer is light yellowish brown calcareous loam 4 inches thick. The upper part of the underlying layer is a very pale brown calcareous loam 26 inches thick. The middle of the underlying layer is pale yellow, calcareous silty clay 24 inches thick. The lower part of the underlying layer to a depth of 60 inches is pale yellow, calcareous, gypsiferous silty clay. Highly weathered shaly rock structure occurs below a depth of 34 inches.

Included in this unit are small areas of Delphill soils on similar positions. This inclusion makes up about 15 percent of the unit.

Permeability of this Patent soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is moderate and the hazard of water erosion is high.

The potential plant community on this unit is mainly big sagebrush, rabbitbrush, shadscale, bluebunch wheatgrass, thickspike wheatgrass, bottlebrush squirreltail, and bluegrasses. As the ecological condition deteriorates, big sagebrush, rabbitbrush, and forbs increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

Loamy range site, 10 to 14-inch precipitation zone.

Use and Management Consideration:

This mapping unit is poorly suited to development of drill pads, pipelines, and roads. Steep slopes and high erosion hazard are major construction and maintenance limitations. Cuts and fills should be limited to avoid exposing erosive saline shales and sandstones. For use as a recoverable soil resource, up to 24 inches or top materials may be salvaged as needed for use in revegetation. Plant materials for revegetation should include plants adapted to a 10 to 14-inch precipitation zone.

82 - Cundick Variant very gravelly clay loam, 30 to 50 percent slopes

This moderately deep, well drained soil is on mountain ridges and toeslopes. It formed in fine-textured residuum derived dominantly from red shales. The native vegetation is mainly black sagebrush, low sagebrush, bluebunch wheatgrass, spike fescue, and forbs. Elevation is 7,600 to 8,200 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

Typically the surface layer is a red very gravelly clay loam about 3 inches thick. The upper part of the underlying layer about 8 inches thick is a red clay with moderate angular blocky structure, and the lower part is red massive clay to a depth of 36 inches. Red shale beds are at a depth of 36 inches.

Included in the unit are small areas of Brownsto on soils on similar slopes. Included areas make up about 5 percent of the total acreage.

Permeability of this well drained soil is very slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is high, and the hazard of water erosion is high.

The potential plant community on this unit is mainly black sagebrush, low sagebrush, fringed sage, bluebunch wheatgrass, thickspike wheatgrass, spiny phlox. As the ecological condition deteriorates, forbs and low sagebrush increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 500 pounds in unfavorable years.

Shallow Clayey range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

The unit is poorly suited to development of drill pads, pipelines, and roads, because of steep slopes requiring excessive cuts and fills. Revegetation potential is very poor because of clayey textures and a high erosion hazard. For recoverable soil resources about 10 inches may be salvaged for use as needed; however, this material is of marginal suitability for reclamation use.

84D - Delphill-Glassner Variant complex, 5 to 15 percent slopes

This map unit is on upland ridges, fans, and toeslopes. The native vegetation is mainly big sagebrush, black sagebrush, rabbitbrush, bluebunch wheatgrass, spike fescue, western wheatgrass, and forbs. Elevation is 7,000 to 7,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

This unit is 50 percent Delphill loam and 45 percent Glassner Variant. Also in this unit is about 5 percent patent gravelly loam on similar slopes. Both Delphill and Glassner variant soils are on ridges, fans, and slopes.

The Delphill soil is moderately deep, loamy, calcareous, and well drained. It formed in residuum and outwash materials derived dominantly from sandstone and silty shales.

Typically the surface layer is a pale brown loam about 5 inches thick. The upper 12 inches of the underlying layer is a light yellowish brown light clay loam and the lower part is pale yellow loam to a depth of 37 inches. Pale yellow soft platy shale is below 37 inches.

Permeability of the Delphill soil is moderate. Available water capacity is moderate. Effective rooting depth is 30 to 40 inches. Runoff is moderate, and the hazard of water erosion is high.

The Glassner Variant soil is moderately deep, clayey, calcareous, and well drained. It formed in residuum and outwash derived dominantly from red clay shales.

Typically the surface is a red clay about 3 inches thick. The subsoil about 6 inches thick is red clay. The substratum to a depth of 38 inches is a massive to coarse blocky red clay. Weathered red clay shale is below a depth of 38 inches.

Permeability of the Glassner variant soil is very slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is moderately rapid, and the hazard of water erosion is high.

The potential plant community on the Delphill soil is mainly big sagebrush, rabbitbrush, black sagebrush, bluebunch wheatgrass, western wheatgrass, needlegrass, and forbs. As the ecological condition deteriorates, big sagebrush, rabbitbrush, annual weeds, and forbs increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years, to 700 pounds in unfavorable years.

The potential plant community on the Glassner variant soil is mainly black sagebrush, bluebunch wheatgrass, western wheatgrass, junegrass, and forbs. As the ecological condition deteriorates, black sagebrush, forbs, and annual weeds increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 500 pounds in unfavorable years.

Delphill: Loamy range site, 10 to 14-inch precipitation zone.

Glassner Variant: Shallow clayey range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

This unit is moderately well suited to the development of drill pads, pipelines, and roads because of moderate slopes. Excessive cuts and fills should be avoided since soft erosive sandstone and shales are at depths of 30 to 40 inches. Revegetation potential of disturbed areas is limited by clayey soils, high carbonate content, and lack of suitable topsoil materials. Both soils are highly erodible when disturbed. For recoverable soil resources about 10 inches of topsoil materials may be salvaged from both soils and used as needed.

84 - Delphill-Glassner variant complex, 30 to 50 percent slopes

This map unit is on upland ridges, fans, and steep toeslopes. The native vegetation is mainly big sagebrush, black sagebrush, rabbitbrush, bluebunch wheatgrass, spike fescue, western wheatgrass, and forbs. Elevation is 7,000 to 7,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

This unit is 50 percent Delphill, and 45 percent Glassner variant. Also in this unit is about 5 percent Patent gravelly loam on similar slopes. Both the Delphill and Glassner variant soils are on ridges, fans, and toeslopes.

The Delphill soil is moderately deep, loamy and calcareous, and well drained. It formed in residuum and outwash materials derived dominantly from sandstone and silty shales.

Typically the surface layer is a pale brown loam about 5 inches thick. The upper 12 inches of the underlying layer is a light yellowish brown, light clay loam, and the lower part is pale yellow loam to a depth of 37 inches. Pale yellow soft platy shale is below 37 inches.

Permeability of the Delphill soil is moderate. Available water capacity is moderate. Effective rooting depth is 30 to 40 inches. Runoff is moderate, and the hazard of water erosion is high.

The Glassner variant soil is moderately deep, clayey, calcareous, and well drained. It formed in residuum and outwash derived dominantly from red clay shales.

Typically the surface layer is a red clay about 3 inches thick. The subsoil about 6 inches thick is a red clay. The substratum to a depth of 38 inches is a massive to coarse blocky red clay. Weathered red clay shale is below a depth of 38 inches.

Permeability of the Glassner variant soil is very slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is moderately rapid, and the hazard of water erosion is high.

The potential plant community on the Delphill soil is mainly big sagebrush, rabbitbrush, black sagebrush, bluebunch wheatgrass, western wheatgrass, needlegrass, and forbs. As the ecological condition deteriorates, big sagebrush, rabbitbrush, annual weeds, and forbs increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

The potential plant community on the Glassner variant soil is mainly black sagebrush, bluebunch wheatgrass, western wheatgrass, junegrass, and forbs. As the ecological condition deteriorates, black sagebrush, forbs, and annual weeds increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 500 pounds in unfavorable years.

Delphill: Loamy range site, 10 to 14-inch precipitation zone.

Glassner Variant: Shallow Clayey range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

This unit is very poorly suited to development of drill pads, pipelines, and roads. Very steep slopes make erosion an extreme hazard. Development of roads and drill pads require excessive cut and fills into the erosive substratum of the units. Revegetation of the steep slopes would be difficult. For salvagable soil resources up to 10 inches of top materials may be stockpiled for futher uses as needed.

85 - Unnamed Complex, 25 to 60 percent slopes

This mapping unit is on mountain sideslopes in the northeastern portion of the well field. The native vegetation is mainly rabbitbrush, big sagebrush, serviceberry, bluebunch wheatgrass, spike fescue, and bluegrass. Elevation is 7,300 to 7,800 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

The Unit is 35 percent unnamed deep cryorthents (Unnamed 85A), 25 percent unnamed shallow Cryorthents (Unnamed 85B), and 25 percent unnamed Cryoborolls (Unnamed 85C). The Unnamed 85A soil occurs on steep sideslopes below ridgecrests, the Unnamed 85B soils occurs on ridge crests, and the Unnamed 85C soil occurs on sheltered concave areas below ridgecrests.

The Unnamed 85A soil is deep and well drained. If formed in residumm and colluvium derived dominantly from calcareous sandstones.

Typically the surface layer is a brown sandy loam 16 inches thick. The underlying material is a pale brown sand to a depth of 52 inches. Fractures weathered calcareous sandstone occurs at 52 inches. The Unnamed 85A soil is calcareous throughout its depth.

Permeability of the Unnamed 85A soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 50 inches or more. Runoff is rapid, and the hazard of water erosion is moderate.

The Unnamed 85B soil is shallow and somewhat excessively well drained. It formed in residuum derived dominately from calcareous sandstones.

Typically the surface layer is a pale brown light sandy loam 2 inches thick. The next layer is a very pale brown sandy loam 3 inches thick. The underlying material is a varigated very pale brown and yellow loamy sand to a depth of 14 inches. Fractured, weathered, calcareous sandstone occurs at 14 inches.

Permeability of the Unnamed 85B soil is moderately rapid. Available water holding capacity is low. Effective rooting depth is 10 to 14 inches. Runoff is rapid and the hazard of water erosion is low.

The Unnamed 85C soil is deep and well drained. It formed in residuum and colluvium derived dominantly from calcareous sandstones.

Typically the surface layer is a brown sandy loam 9 inches thick. The upper part of the subsoil is a brown sandy loam 7 inches thick. The lower part of the subsoil is a yellowish brown loamy sand 13 inches thick. The upper part of the underlying material is a light gray clay loam 16 inches thick. The lower part of the underlying material is a pink silty clay loam to a depth of at least 60 inches. The soil is calcareous throughout.

Permeability of the Unnamed 85C soil is moderate, available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid and the hazard of water erosion is moderate.

Included in this unit is about 15 percent rock outcrop.

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The potential plant community on the Unnamed 85 soils is mainly bluebunch wheatgrass, sagebrush, mountain mahogany and spiney phlox. As the ecological condition deteriorates, mustards, annual grasses and annual weeds increase.

Loamy range site, 15 to 19 inch precipitation zone.

86 - Delphill-Glassner Variant complex, 15 to 30 percent slopes

This map unit is on upland ridges, fans, and toeslopes. The native vegetation is mainly big sagebrush, black sagebrush, rabbitbrush, bluebunch wheatgrass, spike fescue, western wheatgrass, and forbs. Elevation is 7,000 to 7,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

This unit is 50 percent Delphill loam, and 45 percent Glassner variant. Included in this unit is about 5 percent Patent gravelly loam on similar slopes. Both Delphill and Glassner variant are on ridges, fans, and toe slopes.

The Delphill soil is moderately deep, loamy and calcareous, and well drained. It formed in residuum and slopewash materials derived dominantly from sandstone and silty shales.

Typically the surface layer is a pale brown loam about 5 inches thick. The upper 12 inches of the underlying layer is a light yellowish brown, light clay loam, and the lower part is pale yellow loam to a depth of 37 inches. Pale yellow soft platy shale is below 37 inches.

Permeability of the Delphill soil is moderate. Available water capacity is moderate. Effective rooting depth is 30 to 40 inches. Runoff is moderate, and the hazard of water erosion is high.

The Glassner variant soil is moderately deep, clayey, calcareous, and well drained. It formed in residuum and outwash materials derived dominantly from red clay shales.

Typically the surface layer is a red clay about 3 inches thick. The subsoil about 6 inches thick is red clay. The substratum to a depth of 38 inches is a massive red clay. Weathered red clay shale is at depths below 38 inches.

Permeability of the Glassner variant soil is very slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Effective rooting depth is 30 to 40 inches. Runoff is moderately rapid, and the hazard of water erosion is high.

The potential community on the Delphill soil is mainly big sagebrush, rabbitbrush, black sagebrush, bluebunch wheatgrass, western wheatgrass, needlegrasses, and forbs. As the ecological condition deteriorates, big sagebrush, rabbitbrush, annual weeds, and forbs increase. The potential plant community produces about 1,200 pounds of air-dry vegetation per acre in normal years. Production varies from 1,500 pounds in favorable years to 700 pounds in unfavorable years.

The potential plant community on the Glassner variant soil is mainly black sagebrush, bluebunch wheatgrass, western wheatgrass, june grass, and forbs. As the ecological condition deteriorates, black sagebrush, forbs, and annual weeds increase. The potential plant community produces about 750 pounds of air-dry vegetation per acre in normal years. Production varies from 1,000 pounds in favorable years to 500 pounds in unfavorable years.

Delphill: Loamy range site, 10 to 14-inch precipitation zone.

Glassner Variant: Shallow clayey range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

This unit is poorly suited to the development of drill pads, pipelines, and roads because of steep slopes requiring excessive cuts and fills. Soft shales and sandstones are at depths of 30 to 40 inches and are highly erosive. Revegetation of disturbed areas is difficult because of clayey soils, high lime, and lack of suitable topsoil materials. Both soils are highly erodible when disturbed. For recoverable soil resources, about 10 inches of the upper materials may be salvaged from both soils and used as needed.

88 - Bead very gravelly sandy clay loam, 2 to 10 percent slopes

This deep, well drained soil is on mountain benches and flat, broader ridge crests under coniferous forests. It formed in mixed fine-textured and gravelly colluvium derived dominantly from quartzites, limestones, and shales west of Deadline Ridge. The native vegetation is mainly lodgepole pine, subalpine fir, yarrow, Douglas fir, spike fescue, spike trisetum, currant, and letterman's needlegrass. Elevation is 8,500 to 9,300 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F, and the average growing season is 60 to 75 days.

Typically, the surface layer is a pinkish gray very gravelly sandy clay loam 16 inches thick. The upper part of the subsoil is a light reddish brown gravelly clay 12 inches thick. The middle part of the subsoil is a reddish brown clay 13 inches thick. The lower part of the subsoil is a red extremely gravelly clay loam 13 inches thick. The substratum is a reddish brown extremely gravelly clay loam to a depth of 60 inches or more.

Included in this unit are small areas of soils which have medium-textured or very gravelly subsoils on similar surfaces. Included areas make up about 15 percent of the total acreage.

Permeability of this Bead soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate.

The Bead soil is in a Conifer range site, 20+ inch precipitation zone.

90 - Bata-Cluff complex, 15 to 30 percent slopes

The map unit is on forested mountain sideslopes. The native vegetation is mainly lodgepole pine, subalpine fir, and spike trisetum, with occasional whitebark pine, arnica, pachistima, and bluegrasses. Elevation is 8,800 to 9,800 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F., and the average frost-free season is 60 to 75 days.

This unit is 40 percent Bata soils and 35 percent Cluff soils. Both soils are on mountain sideslopes.

The Bata soil is deep and well drained. It formed in colluvium derived dominantly from quartzites.

Typically the surface layer is a light gray extremely gravelly sandy loam 15 inches thick. The next layer is a pink very gravelly sandy loam 19 inches thick. The subsoil is a light brown extremely gravelly clay loam 12 inches thick. The substratum is a pink very gravelly sandy clay loam to a depth of 60 inches or more. The soil is noncalcareous throughout its depth.

Permeability of the Bata soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow and the hazard of water erosion is moderate.

The Cluff soil is deep and well drained. It formed in colluvium derived dominantly from quartzites and noncalcareous shales. Typically the ground surface is covered by a 2-inch thick mat of undecomposed needles and twigs. The mineral surface layer is a brown gravelly sandy loam 6 inches thick. The subsurface layer is a pinkish gray very gravelly loam 11 inches thick. The upper part of the subsoil is a brown very gravelly clay loam 11 inches thick. The lower part of the subsoil is a brown very cobbly clay to a depth of 60 inches or more.

Permeability of the Cluff soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Included in this unit is about 25 percent Leighcan and Granile soils on similar mountain sideslopes and on slightly flatter areas.

The potential plant community on the Bata soil is mainly lodgepole pine, Douglas-fir, subalpine fir, pachistima, and spike trisetum.

The potential plant community on the Cluff soil is mainly lodgepole and whitebark pine, subalpine fir, arnica, spike trisetum, and bluegrasses.

The Bata soil is in a conifer site, 20 to 25- inch precipitation zone.

The Cluff soil is in a conifer site, 20 to 25-inch precipitation zone.

91 - Hobacker-Hoodle gravelly loams, 20 to 40 percent slopes

This map unit is on mountain sideslopes and colluvial toe slopes. The native vegetation is mainly mountain mahogany, snowberry, big sagebrush, bluebunch wheatgrass, spike fescue, and Letterman's needlegrass. Elevation is 7,700 to 8,200 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 50 percent Hobacker soils and 35 percent Hoodle soils. Included in this unit is about 15 percent Pishkun soils. The Hobacker soil is on steep, protected sideslopes, and depressions; the Hoodle soil is on open sideslopes and toes; and the Pishkun soil is on convex, less stable slopes.

The Hobacker soil is deep and somewhat excessively drained. It formed in calcareous colluvium and slopewash derived dominantly from limestones and dolomite.

Typically the upper part of the surface layer is a calcareous, dark grayish brown gravelly loam 7 inches thick. The next layer is a calcareous, brown, very gravelly to extremely gravelly loam 30 inches thick. The underlying material is a strongly calcareous, very pale brown, extremely gravelly loam to a depth of 60 inches or more.

Permeability of the Hobacker soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Hoodle soil is deep and somewhat excessively drained. If formed in calcareous colluvium and slopewash derived dominantly from limestones and dolomite.

Permeability of the Hoodle soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The potential plant community on this mapping unit is mainly mountain mahogany, big sagebrush, snowberry, bluebunch wheatgrass, spike fescue, needlegrasses, arrowleaf balsamroot, and woody buckwheat. As the ecological condition deteriorates, big sagebrush, arrowleaf balsamroot, and woody buckwheat increase.

Shallow Loamy range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This mapping unit is poorly suited to construction of roads, drill pads, and pipelines due to steep slopes and the need for extensive cuts and fills. Drainage diversions such as water bars, berms, ditches, and culverts are important management practices for controlling erosion and runoff caused by construction on this unit. Revegetation potential is moderate to poor, due to steep slopes and drouthiness of the soils. High content of rock fragments limits the amount of moisture provided for plant growth and establishment. The Hobacker and Hoodle soils may be salvaged to a depth of 24 inches as necessary for use as recoverable soil resources.

92 - Jerry Variant-Hoodle complex, 2 to 8 percent slopes

This map unit is on alluvial fans and terraces. The native vegetation is mainly big sagebrush and bitterbrush mixed with some low sagebrush and black sagebrush, phlox, buckwheat, spike fescue, western wheatgrass, Letterman's needlegrass, and bluebunch wheatgrass. Elevation is 7,600 to 8,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 45 percent Jerry variant, and 35 percent Hoodle soils. These soils are intermingled on the landscape.

The Jerry Variant soil is deep and well drained. If formed in alluvium derived dominantly from mixed sources.

Typically the surface layer and upper subsoil layer are a reddish gray to reddish brown, neutral, loam to light clay loam about 9 inches thick; the middle subsoil layer is a reddish brown neutral, heavy clay loam about 8 inches thick; the lower subsoil is a yellowish red, calcareous, moderately alkaline, very gravelly clay loam about 6 inches thick; the upper substratum is a reddish yellow, calcareous, moderately alkaline, extremely gravelly sandy clay loam about 40 inches thick; and the lower substratum is a reddish yellow, calcareous, moderately alkaline, extremely gravelly loamy sand to 93 inches or more.

Permeability of the Jerry Variant soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

The Hoodle soil is deep and well drained. If formed in alluvium derived dominantly from mixed sources.

Typically the surface layer is a brown, neutral, gravelly loam about 9 inches thick; the subsoil is a brown or strong brown, very gravelly clay loam about 16 inches thick; the upper substratum is a brown, calcareous, moderately alkaline, extremely gravelly sandy clay loam about 8 inches thick; the middle substratum is a brown, calcareous, moderately alkaline, extremely gravelly loamy sand about 25 inches thick; and the lower substratum is a light reddish brown, calcareous, moderately alkaline extremely gravelly sandy clay loam to 75 inches or more.

Permeability of the Hoodle soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Included in this unit is about 20 percent soils like Hoodle with more than 35 percent clay in the subsoil, and similar soils that lack well developed B horizons.

The potential plant community on the Jerry Variant soil is mainly big sagebrush, bitterbrush, bluebunch wheatgrass, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, yarrow, and buckwheat increase. The potential plant community produces about

2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds in unfavorable years.

The potential plant community on the Hoodle soil is mainly big sagebrush, bitterbrush, bluebunch wheatgrass, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, yarrow, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds in unfavorable years.

Jerry Variant: Loamy range site, 15 to 19-inch precipitation zone.

Hoodle: Loamy range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

These soils have good suitability for roads, pipelines, and drill pads. Some of these soils may be suitable for use as gravel borrow areas.

Revegetation potential is fair to good if topsoil is used in reclamation. About 8 to 10 inches of surface soil can be salvaged for reclamation use.

93E - Granile-Leighcan-Nutras complex, 15 to 30 percent slopes

This map unit is on mountain sideslopes mantled with colluvium. The native vegetation is mainly lodgepole pine and subalpine fir with a sparse understory of arnica, pachistima, lupine, and bluegrass. Elevation is 8,300 to 9,300 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F, and the average growing season is 60 to 75 days.

This unit is 40 percent Granile soils, 35 percent Leighcan soils, and 15 percent Nutras soils. These soils are intermingled on the landscape.

The Granile soil is deep and well drained. It formed in colluvium derived dominantly from sandstone, quartzite, and a small amount of limestone and shale. Typically, the Granile soil has a mat of organic material about 2 inches thick on the soil surface; a very pale brown slightly acid, very gravelly sandy loam surface layer about 12 inches thick; a very pale brown and brownish yellow, neutral, very gravelly sandy loam underlying layer about 10 inches thick; a brownish yellow, neutral, very gravelly sandy clay loam upper subsoil layer about 8 inches thick; a light yellowish brown, mildly alkaline, extremely cobbly sandy loam lower subsoil layer about 13 inches thick; and a very pale brown, calcareous, moderately alkaline, extremely cobbly sandy loam substratum to 60 inches or more.

Permeability of the Granile soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Leighcan soil is deep and well drained. It formed in colluvium derived dominantly from quartzite and sandstone. Typically, the Leighcan soil has a mat of organic materials about 2 inches thick on the soil surface. The surface layer is pale brown, slightly acid, extremely gravelly sandy loam about 23 inches thick; the subsoil is very pale brown and yellow, slightly acid, very gravelly sandy loam or extremely gravelly sandy loam to 60 inches or more.

Permeability of the Leighcan soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Nutras soil is deep and well drained. It formed in colluvium derived dominantly from shale, quartzite, and sandstone. Typically, the Nutras soil has a mat of organic material about 1 inch thick on the soil surface; a light brown, slightly acid, very gravelly sandy clay loam surface layer about 10 inches thick; a reddish yellow, slightly acid, very cobbly sandy clay loam underlying layer about 5 inches thick; a reddish yellow to dark red, slightly acid, very gravelly and cobbly heavy clay loam upper subsoil layer about 30 inches thick; and a varigated reddish yellow and reddish brown, neutral, very gravelly clay loam lower subsoil to 60 inches or more.

Permeability of the Nutras soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Included in this unit is about 10 percent soils like Granile with less than 35 percent rock fragments in the surface and subsoils, and soils similar to the named components except that the substrata have 90 percent rock fragments with little or no soil in the voids between the fragments.

The potential plant community on the Granile soils is mainly lodgepole pine and subalpine fir with a sparse understory of arnica, pachistima, lupine, and bluegrasses.

The potential plant community on the Leighcan soil is mainly lodgepole pine and subalpine fir with a sparse understory of arnica, pachistima, lupine, and bluegrasses.

The potential plant community on the Nutras soil is mainly lodgepole pine and subalpine fir with a sparse understory of arnica, pachistima, lupline, and bluegrasses.

Granile is in a conifer site, 20+ inch precipitation zone.

Leighcan is in a conifer site, 20+ inch precipitation zone.

Nutras is in a conifer site, 20+ inch precipitation zone.

Use and Management Considerations:

These soils have fair suitability for roads and pipelines and poor suitability for drill pads because of slopes and difficulty of revegetation. About 12 inches of fair quality surface soil can be salvaged for use in reclamation. Revegetation potential is fair on these very gravelly and cobbly soils.

93F - Leighcan-Granile-Nutras complex, 30 to 50 percent slopes

This map unit is on mountain sideslopes mantled with colluvium. The native vegetation is mainly lodgepole pine and subalpine fir with a sparse understory of arnica, pachistima, lupine, and bluegrasses. Elevation is 8,000 to 9,400 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F, and the average growing season is 60 to 75 days.

This unit is 40 percent Leighcan, 35 percent Granile, and 15 percent Nutras. These soils are intermingled on the landscape.

The Leighcan soil is deep and well drained. It formed in colluvium derived dominantly from quartzite and sandstone.

Typically Leighcan has a mat of organic material about 2 inches thick on the soil surface. The surface layer is pale brown, slightly acid, extremely gravelly sandy loam about 23 inches thick; the subsoil is very pale brown and yellow, slightly acid, very gravelly sandy loam or extremely gravelly sandy loam to 60 inches or more. The subsoil contains a few thin bands of sandy clay loam or clay loam material.

Permeability of the Leighcan soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is rapid and the hazard of water erosion is high.

The Granile soil is deep and well drained. It formed in colluvium derived dominantly from sandstone, quartzite, and a small amount of limestone and shale.

Typically, Granile has a mat of organic material about 2 inches thick on the soil surface; the surface layer is a very pale brown, slightly acid, very gravelly sandy loam about 12 inches thick; the underlying layer is a very pale brown and brownish yellow, neutral, very gravelly sandy loam about 10 inches thick; the upper subsoil is a brownish yellow, neutral, very gravelly sandy clay loam about 8 inches thick, the lower subsoil is a light yellowish brown, mildly alkaline, extremely cobbly sandy loam about 13 inches thick; and the substratum is a very pale brown, calcareous, moderately alkaline, extremely cobbly sandy loam to 60 inches or more.

Permeability of the Granile soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Nutras soil is deep and well drained. It formed in colluvium derived dominantly from shale, quartzite, and sandstone.

Typically, Nutras has a mat of organic material about 1 inch thick on the soil surface; the surface layer is a light brown, slightly acid, very gravelly sandy clay loam about 10 inches thick; the underlying layer is a reddish yellow, slightly acid, very cobbly sandy clay loam about 5 inches thick; the upper subsoil is a reddish yellow to dark red, slightly acid, very gravelly and cobbly loam about 30 inches thick; the lower subsoil is a varigated reddish yellow and reddish brown, neutral, very gravelly clay loam to 60 inches or more.

Permeability of the Nutras soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Included in this unit is about 10 percent soils like Granile except these are less than 35 percent rock fragments in the surface and subsoils; and soils similar to the named components except that the substrata have 90 percent rock fragments with little or no soil in the voids between the fragments.

The potential plant community on the Leighcan soil is mainly lodgepole pine, subalpine fir, and Douglas fir with a sparse understory of arnica, pachistima, lupine, and bluegrasses.

The potential plant community on the Granile soil is mainly lodgepole pine, subalpine fir, and Douglas fir with a sparse understory of arnica, pachistima, lupine, and bluegrasses.

The potential plant community on the Nutras soil is mainly lodgepole pine, subalpine fir, and Douglas fir with a sparse understory of arnica, lupine, and bluegrasses.

Leighcan is in a Conifer site, 20+ inch precipitation zone.

Granile is in a Conifer site, 20+ inch precipitation zone.

Nutras is in a Conifer site, 20+ inch precipitation zone.

Use and Management Considerations:

These areas are poorly suited for roads, pipelines, and drill pads due to steep slopes and difficulty of revegetation. Deep cuts may be unstable if shale beds are encountered.

About 12 inches of fair quality, gravelly surface soil can be salvaged for use in reclamation. Revegetation potential is fair on these very gravelly and cobbly soils.

94 - Granile-Nutras complex, 5 to 15 percent slopes

This map unit is on broad rolling ridgetops. The native vegetation is mainly lodgepole pine, subalpine fir, whitebark pine, currant, arnica, and lupine. Elevation is 9,200 to 9,600 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F, and the average growing season is 60 to 75 days.

This unit is 60 percent Granile, and 30 percent Nutras soils. These soils are intermingled on the landscape.

The Granile soil is deep and well drained. It formed in colluvium derived dominantly from sandstone, quartzite, and a small amount of limestone and shale.

The Granile soil is deep and well drained. It formed in colluvium derived dominantly from sandstone, quartzite, and a small amount of limestone and shale. Typically, the Granile soil has a mat of organic materials about 2 inches thick on the soil surface; a very pale brown slightly acid, very gravelly sandy loam surface layer about 12 inches thick; a very pale brown and brownish yellow, neutral, very gravelly sandy loam underlying layer about 10 inches thick; a brownish yellow, neutral, very gravelly sandy clay loam upper subsoil layer about 8 inches thick; a light yellowish brown, mildly alkaline, extremely cobbly sandy loam lower subsoil layer about 13 inches thick; and a very pale brown, calcareous, moderately alkaline, extremely cobbly sandy loam substratum to 60 inches or more.

Permeability of the Granile soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

The Nutras soil is deep and well drained. It formed in colluvium derived dominantly from shale, sandstone, and quartzite.

The Nutras soil is deep and well drained. It formed in colluvium derived dominantly from shale, quartzite, and sandstone. Typically, the Nutras soil has a mat of organic material about 1 inch thick on the soil surface; a light brown, slightly acid, very gravelly sandy clay loam surface layer about 10 inches thick; a reddish yellow, slightly acid, very cobbly sandy clay loam underlying layer about 5 inches thick; a reddish yellow to dark red, slightly acid, very gravelly and cobbly heavy clay loam upper subsoil layer about 30 inches thick; and a varigated reddish yellow and reddish brown, neutral, very gravelly clay loam lower subsoil to 60 inches or more.

Permeability of the Nutras soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Permeability of the Nutras soil is very slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is low.

Included in this unit is about 10 percent similar soils with dark colored surface layers.

The potential plant community on the Granile soil is mainly lodgepole pine, subalpine fir, whitebark pine, currant, arnica, and lupine.

The potential plant community on the Nutras soil is mainly lodgepole pine, subalpine fir, whitebark pine, currant, lupine, and arnica.

Granile is in a Conifer site, 20+ inch precipitation zone.

Nutras is in a Conifer site, 20+ inch precipitation zone.

Use and Management Considerations:

These soils are well suited for roads, pipelines, and drill pads.

Revegetation potential is fair due to the high content of coarse fragments. About 12 inches of fair quality, gravelly surface soil can be salvaged for use in reclamation.

95 - Bead-Nutras Complex, 5 to 15 percent slopes

This map unit is on broad rolling ridges and benches mantled with alluvium and colluvium. The native vegetation is mainly lodgepole pine and alpine fir with a sparse understory of arnica, box leaf myrtle, elk sedge, and a few grasses. Elevation is 7,800 to 8,600 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F, and the average growing season is 60 to 75 days.

This unit is 50 percent Bead, and 40 percent Nutras soils. Also in this unit is about 10 percent Granile soils. Both Bead and Nutras soils occur on the same general slopes and landscape.

The Bead soil is deep, slightly acid, clayey, and well drained. It formed in alluvium and outwash derived dominantly from shale and sandstones.

Typically the surface has an organic mat 2 to 3 inches thick. The upper mineral surface layer is grayish brown very gravelly loam about 3 inches thick. The lower portion about 13 inches thick is light brown gravelly clay loam. The subsoil is yellowish red clay about 34 inches thick. The substratum to a depth of more than 60 inches is reddish yellow clay loam.

Permeability of the Bead soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slight, and the hazard of water erosion is slight.

The Nutras soil is deep, slightly acid, clayey, and well drained. It formed in alluvium derived dominantly from shale and sandstone.

Typically the surface layer has an organic mat 2 to 3 inches thick. The upper mineral surface layer about 19 inches thick is light reddish brown, very gravelly clay loam, the subsoil about 34 inches thick is yellowish red, very cobbly clay. The sustratum to a depth of 60 inches or more is light reddish brown, very gravelly clay.

Permeability of the Nutras soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slight, and the hazard of water erosion is slight.

The potential plant community on the Bead and Nutras soils is mainly lodgepole pine and subalpine fir with an understory of sedges, arnica, box leaf myrtle, and grasses. As the ecological condition deteriorates, grass and forbs increase. The potential plant community produces about 70 to 90 cubic feet per acre per year in normal years.

The Bead soil is in a conifer site, 20+ inch precipitation zone.

The Nutras soil is in a conifer site, 20+ inch precipitation zone.

Use and Management Considerations:

This unit is moderately well suited to the development of drill pads, pipelines, and roads. For recoverable soil resources, up to 20 inches of the upper soil material may be salvaged for use as needed. The erosion hazard is moderate.

96 - Farlow-Starley very gravelly loams, 20 to 50 percent slopes

This map unit is on mountain sideslopes and benches. The native vegetation is mainly big sagebrush, spike fescue, bluebunch wheatgrass, wild currant, twistleaf rabbitbrush, and scattered limber and white bark pines. At the head of Beaver Dam Creek and nearby drainages on the Lake Mountain Quadrangle, aspen stands occur on these soils. Elevation is 8,600 to 9,600 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F, and the average growing season is 60 to 75 days. This unit also occurs in the 15 to 19-inch precipitation zone.

This unit is 70 percent Farlow soils, and 15 percent Starley soils. The Farlow soil is on mountain sideslopes and benches, and the Starley soil is on isolated knolls.

The Farlow soil is deep and somewhat excessively drained. It formed in colluvium and slopewash derived dominantly from dolomites, limestone, and quartzite.

Typically the surface layer is a dark brown very gravelly loam 11 inches thick. The subsoil is a brown, calcareous extremely gravelly loam 11 inches thick. The substratum is a very pale brown, calcareous extremely gravelly loam to a depth of 60 inches or more.

Permeability of the Farlow soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and hazard of water erosion is moderate.

The Starley soil is shallow and somewhat excessively drained. It formed in residuum derived dominantly from limestones and dolomites.

Typically the surface layer is a dark grayish brown, calcareous, very gravelly loam 4 inches thick. The next layer is a brown, calcareous, extremely gravelly loam 4 inches thick. The underlying material is a very pale brown, calcareous, extremely gravelly sandy loam 6 inches thick. Hard bedrock occurs below 14 inches. Depth to rock ranges from 10 to 20 inches.

Permeability of the Starley soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is slight.

Included in this unit is about 15 percent deep and shallow soils lacking dark-colored surface layers. At the head of Beaver Dam Creek and nearby drainages on the Lake Mountain Quadrangle, soils similar to Farlow are noncalcareous.

The potential plant community on the Farlow soil is mainly bluebunch wheatgrass, needlegrasses, spike fescue, buckwheat, big sagebrush, wild currant and snowberry. As the ecological condition deteriorates, sagebrush, rabbitbrush, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable to 1,400 pounds in unfavorable years.

The potential plant community on the Starley soil is mainly bluebunch wheatgrass, spike fescue, Letterman needlegrass, spiny phlox, buckwheat, and big sagebrush. As the ecological condition deteriorates, big sagebrush and buckwheat increase. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Farlow: Loamy range site, 15 to 19-inch precipitation zone.

Starley: Very Shallow range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This mapping unit is poorly suited to construction of roads, drill pads, and pipelines due primarily to steep slopes and the need for extensive cuts and fills. Hard, unrippable bedrock would also be occasionally encountered. Revegetation potential is poor, due to steep slopes, high content of rock fragments, and resulting limitations to slope stability and available water capacity. For recoverable soil resources, the Farlow soil may be salvaged to a depth of 12 inches as needed.

97 - Farlow-Starley very gravelly loams, 10 to 25 percent slopes

This map unit is on mountain ridge crests and breaks. The native vegetation is mainly spike fescue, bluebunch wheatgrass, twistleaf rabbitbrush, and scattered aspen. Elevation is 8,500 to 9,500 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F, and the average growing season is 60 to 75 days. This unit also occurs in the 15 to 19-inch precipitation zone.

This unit is 50 percent Farlow very gravelly loam, and 35 percent Starley very gravelly loam. The Farlow soil is on ridge sideslopes, and the Starley soil is on convex shoulder slopes and knolls.

The Farlow soil is deep and somewhat excessively drained. It formed in residuum from limestone, dolomite, and quartzite.

Typically the surface layer is a dark brown very gravelly loam 11 inches thick. The next layer is pale brown very gravelly loam 14 inches thick. The upper part of the underlying layer is very pale brown calcareous extremely gravelly loam 10 inches thick. The lower part of the underlying material is very pale brown, calcareous, extremely gravelly loam to a depth 60 inches or more.

Permeability of the Farlow soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is low.

The Starley soil is shallow and somewhat excessively drained. It formed in residuum derived dominantly from limestones, dolomites, and quartzite.

Typically the surface layer is a dark grayish brown, calcareous very gravelly loam 4 inches thick. The next layer is a brown, calcareous, extremely gravelly loam 4 inches thick. The underlying material is a very pale brown, calcareous, extremely gravelly sandy loam 6 inches thick. Hard bedrock occurs below 14 inches. Depth to rock ranges from 10 to 20 inches.

Permeability of the Starley soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is low.

Included in this unit are about 15 percent of soils which are noncalcareous and lack dark-colored surface layers.

The potential plant community on the Farlow soil is mainly bluebunch wheatgrass, needlegrasses, spike fescue, buckwheat, big sagebrush, twistleaf rabbitbrush, and snowberry. As the ecological condition deteriorates, sagebrush, rabbitbrush, and buckwheat increase. The potential plant community produces about 2,000 pounds of air-dry vegetation per acre in normal years. Production varies from 2,400 pounds in favorable years to 1,400 pounds unfavorable years.

The potential plant community on the Starley soil is mainly bluebunch wheatgrass, spike fescue, Letterman's needlegrass, spiny phlox, buckwheat, and big sagebrush. As the ecological condition deteriorates, big sagebrush and buckwheat increase. The potential plant community produces about

600 pounds of air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Farlow: Loamy range site, 15 to 19-inch precipitation zone.

Starley: Very Shallow range site, 15 to 19-inch precipitation zone.

Use and Management Considerations:

This mapping unit is poorly suited to construction of roads, drill pads, and pipelines due to hard, unrippable bedrock at shallow depth in much of the unit. Revegetation potential is poor, due to shallow bedrock depths and high content of rock fragments in these drouthy soils. High wind speeds and exposed slopes further limit revegetation potential on this unit in most areas. Recoverable soil resources are limited to small areas of Farlow soils on sideslopes, where 12 inches of material may be salvaged as needed.

98 - Hub Variant-Irigul-Rock Outcrop complex, 15 to 30 percent slopes

This map unit is on moderately steep mountain sideslopes. The native vegetation is mainly Douglas-fir, subalpine fir, lodgepole and limber pines, spike fescue, mountain big sagebrush, and holly grape. Elevation is 8,800 to 9,400 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 32 to 35 degrees F., and the average growing season is 60 to 75 days.

This unit is 50 percent Hub variant soil, 25 percent Irigul, and 25 percent Rock Outcrop. The components are intermingled on the landscape.

The Hub variant is deep, loamy and calcareous, and well drained. It formed in residuum from weathered dolomites.

Typically the surface layer is a brown light clay loam about 5 inches thick. The upper part of the subsoil is a pale brown clay loam about 10 inches thick. The lower part of the subsoil is a pale brown gravelly clay loam about 7 inches thick. The substratum is a light yellowish brown extremely gravelly light clay loam to a depth of 60 inches or more.

Permeability of the Hub variant is moderately slow. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate.

The Irigul soil is shallow, very gravelly, and somewhat excessively drained. It formed in residuum from weathered dolomites.

Typically the surface layer is a dark brown gravelly loam about 3 inches thick. The substratum is a brown very gravelly loam about 14 inches thick. Hard non-rippable dolomite is at depths below 14 inches.

Permeability of the Irigul soil is rapid. The available water capacity is low. Runoff is moderate and the erosion hazard is slight.

The potential plant community on the Hub variant is mainly a mixed stand of conifers with a sparse understory of spike fescue. Occasionally, mixed aspen-conifer stands occur on this soil.

The potential plant community on the Irigul soil is mainly spike fescue, phlox, mountain big sagebrush, holly grape, pachistima, and scattered lodgepole and limber pines. As the ecological condition deteriorates, big sagebrush, phlox, and holly grape increase.

99 - Kremlin loam, 2 to 5 percent slopes

This deep, well drained soil occurs along intermittent drainageways and on terraces and alluvial fans. It formed in mixed alluvium derived dominantly from limestone and shales. The native vegetation is mainly big sagebrush, rabbitbrush, rose, woody cinquefoil, larkspur, alder, golden currant, western wheatgrass, spike fescue, sedge, and basin wildrye. Elevation is 7,100 to 7,400 feet. The average annual precipitation is about 10 to 14 inches, the average annual air temperature is 37 to 40 degrees F, and the average growing season is 75 to 90 days.

Typically the surface layer is a brown, calcareous loam 5 inches thick. The subsoil is a brown, calcareous loam 5 inches thick. The subsoil is a brown, calcareous loam 5 inches thick exhibiting coarse subangular blocky structure. The upper part of the substratum is a pale brown, calcareous loam 25 inches thick. The middle part of the substratum is a very pale brown, calcareous loam 10 inches thick. The lower part of the substratum is a very pale brown, calcareous silty clay loam to a depth of 60 inches ore more.

Permeability of this Kremlin soil is moderate to moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is low.

The potential plant community on this unit is mainly big sagebrush, western wheatgrass, basin wildrye, sedge, and spike fescue. As the ecological condition deteriorates, big sagebrush, rabbitbrush, and larkspur increase. The potential plant community produces about 1,800 pounds of air-dry vegetation per acre in normal years. Production varies from 2,200 pounds in favorable years to 1,200 pounds in unfavorable years.

Overflow range site, 10 to 14-inch precipitation zone.

Use and Management Considerations:

The Kremlin soil is well suited to construction of roads, drill pads, and pipelines. Reclamation potential is good, due to nearly level to gently rolling slopes, and deep, loamy soils. The Kremlin soil may be salvaged to a depth of 3 feet as needed for use in potential reclamation efforts. Accumulation of calcium salts may present a minor limitation of revegetation efforts, but this can be largely overcome by re-seeding drought- and salt-tolerant plant species.

ROS - Rock Outcrop-Starman complex, 30 to 70 percent slopes

This map unit is on very steep faulted beds of limestone and dolomite on the Hogsback. The native vegetation is mainly scattered limber pines with a sparse cover of fringed sage, bluebunch wheatgrass, phlox, and forbs. Elevation is 7,500 to 8,000 feet. The average annual precipitation is about 15 to 19 inches, the average annual air temperature is 34 to 37 degrees F, and the average growing season is 70 to 85 days.

This unit is 60 percent Rock Outcrop, 30 percent Starman. Also in this unit is about 5 percent Pishkun very gravelly loam on similar slopes.

The rock outcrop is mainly steeply dipping, faulted limestones and dolomites, which contribute to runoff from this mapping unit.

The Starman soil is shallow, gravelly, calcareous, and well drained. It formed in residuum derived dominantly from limestone and dolomite.

Typically the surface layer is a light brownish gray, very gravelly loam about 3 inches thick. The underlying layer about 7 inches thick is pale brown very cobbly loam. Hard limestone or dolomite is at 10 to 15 inches.

Permeability of the Starman soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 15 inches. Runoff is moderate, and the hazard of water erosion is moderate.

The potential plant community on the Starman soil is mainly scattered limber pines with a sparse cover of fringed sage, bluebunch wheatgrass, and forbs. As the ecological condition deteriorates, pines, fringed sage and forbs increase. The potential plant community produces about 600 pounds of air-dry vegetation per acre in normal years. Production varies from 750 pounds in favorable years to 450 pounds in unfavorable years.

Starman: Very Shallow range site, 15 to 19-inch precipitation zone.

APPENDIX A2

MAPPING UNIT DESCRIPTIONS - BIO/WEST SURVEY AREA

(In Numerical Order by Map Symbol)

(Source: Bio/West 1982.)

Soil Map Unit Descriptions

The map units shown on the soil maps that accompany this report represent the kinds of soil within this project area. The map units are described in this section of the report. The soil maps along with these descriptions and the Interpretations table contained in this report provide information about the nature of the soils and their capabilities and limitations for management.

#1

Unnamed One - Unnamed Two - Unnamed Three Complex, 15 to 30 percent slopes.

This map unit is on upland breaks, sideslopes, ridges and shoulders of foothills.

The native vegetation is mainly bluebunch wheatgrass, stunted big sagebrush and low sagebrush.

Elevation is 7200 to 8500 feet.

The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F, and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed One soils, 25 percent Unnamed Two soils and 20 percent Unnamed Three soils.

Unnamed One soil is on sideslopes.

Unnamed Two soil is on ridge crests.

Unnamed Three soil is on shoulder slopes of breaks.

Included in this unit are about 5 percent Unnamed Six soil on sideslopes, about 5 percent Rock Outcrop, 3 percent Unnamed Forty Five soil

on concave sideslopes, 2 percent Unnamed Three soils on 5 to 9 percent slopes on concave shoulder slopes and Unnamed One soil on 30 to 50 percent sideslopes.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on convex to slightly concave slopes of 15 to 30 percent.

Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick.

The underlying material is yellowish red gravelly clay loam about 12 inches thick.

The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow.

Coarse fragments are 15 to 25 percent, mainly gravel with some cobble and a few stones.

Present vegetative composition is bluebunch wheatgrass and stunted big sagebrush.

Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

The Unnamed Two soil is shallow and well drained. It formed in residuum derived dominantly from sandstone. It is on convex short and medium length slopes of 15 to 39 percent.

Typically the surface layer is pale brown very fine sandy loam about 2 inches thick.

The underlying material is pale brown very fine sandy loam or loam about 14 inches thick over sandstone.

Permeability of the Unnamed Two soil is moderate.

Present vegetative composition is stunted sagebrush and bluebunch wheatgrass.

Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

The Unnamed Three soil is reddish brown clay loam that is shallow and well drained. It formed in clayey residuum derived dominantly from shale. It is on convex to slightly concave slopes of 15 to 30 percent.

Typically the surface layer is reddish brown clay loam about 3 inches thick.

The underlying material is reddish brown clay about 12 inches thick. The bedrock is shale at 15 inches.

Permeability of the Unnamed Three soil is slow.

Present vegetative composition is low sagebrush and bluebunch wheatgrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

These soils are used for range and wildlife habitat. The suitability for range is limited by low productivity.

#2

Unnamed One - Unnamed Four Complex, 5 to 15 percent slopes

This map unit is on rolling upland sideslopes and ridge crests of foothills.

The native vegetation is mainly bluebunch wheatgrass, western wheatgrass, big sagebrush, sandberg bluegrass and nuttall saltbush.

Elevation is 7200 to 8200 feet.

The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 35 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed One soil and 30 percent Unnamed Four soil. Unnamed One soil is on ridge crests, Unnamed Four soil is on fan sideslopes.

Included in this unit are about 10 percent Unnamed Two soil on ridge crests, 10 percent badland, 5 percent Unnamed Three soil on concave shoulder slopes and 5 percent Unnamed One soil on 15 to 30 percent slopes.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on convex to slightly concave medium slopes of 5 to 15 percent slopes. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay laom about 12 inches thick. The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

The Unnamed Four soil is deep and well drained. It formed in alluvium derived dominantly from mixed rocks. it is on smooth to concave short slopes of 5 to 9 percent and longer slopes if downstream. Typically the surface layer is brown silt loam, 6 inches thick. The

underlying material is light brown silty clay loam to about 45 inches underlain by clay to 60 inches or more.

Permeability of the Unnamed Four soil is moderately slow to about 45 inches and then slow. Present vegetative composition is big sagebrush, western wheatgrass, sandberg bluegrass and nuttall saltbush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#3

Unnamed Forty Five - Unnamed One Complex, 0 to 5 percent slopes

This map unit is on summits and ridge crests of smooth upland foothills. The native vegetation is mainly bluebunch wheatgrass, big sagebrush, sandberg bluegrass, western wheatgrass and Idaho fescue. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 65 percent Unnamed Forty Five soil and 15 percent Unnamed One soil. Unnamed Forty Five soil is on foothill summits, Unnamed One soil is on ridge crests of foothills.

Included in this unit are about 5 pecent Unnamed Four soils on drainageways and toeslopes, 5 percent Unnamed Two soil on ridges, 5 percent Unnamed one soil on slopes of 5 to 9 percent, and 5 percent loamy-skeletal, mixed (calc), shallow, Typic Cryorthents on summits.

The Unnamed Forty Five soil in deep and well drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth to slightly concave slopes of 0 to 5 percent. Typically the surface layer is brown gravelly fine sandy loam about 4 inches thick. The subsoil is light brown gravelly sandy clay loam about 14 inches thick. The substatum material is pink gravelly sandy clay loam.

Permeability of the Unnamed Forty Five soil is moderate. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is big sagebrush, sandberg bluegrass, western wheatgrass and Idaho fescue. Effective rooting depth is 50 to 60 or more inches. Water erosion hazard is slight.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on short smooth convex slopes of 3 to 5 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#4

Unnamed Nine - Unnamed Four Complex, 0 to 5 percent slopes

This map unit is on alluvial plains and floodplains. The native vegetation is mainly big sagebrush, western wheatgrass, sandberg bluegrass and nuttall saltbush. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 70 percent Unnamed Nine soil and 20 percent Unnamed Four soil. Unnamed Nine soil is on smooth to slightly concave alluvial plains, Unnamed Four soil is on smooth to slightly concave floodplains.

Included in this unit are about 5 percent Unnamed One soil on 5 to 15 percent slopes, 5 percent Unnamed Nineteen on floodplains, 3 percent slickspots on floodplains, and 2 percent loamy-skeletal over fragmental, mixed (calc), Typic Cryorthents on upland plains.

The Unnamed Nine soil is deep and well drained. It formed in gravelly alluvium derived dominantly from mixed rocks. It is on smooth long slopes of 0 to 5 percent. Typically the surface layer is brown fine sandy loam about 4 inches thick. The subsoil material is strong brown and reddish yellow very gravelly sandy clay loam about 18 inches thick. The substatum material is brown very gravelly sandy loam.

Permeability of the Unnamed Nine soil is moderate to 18 inches and then moderately rapid. Coarse fragments are 35 to 50 percent, mainly

gravel with some cobble. Present vegetative composition is big sagebrush, western wheatgrass and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Four soil is deep and well drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth convex medium length slopes of 5 to 9 percent. Typically the surface layer is brown silt loam about 6 inches thick. The underlying material is light brown silty clay loam to about 45 inches underlain by clay to 60 or more inches.

Permeability of the Unnamed Four soil is moderately slow to about 45 inches and the slow to 60 inches. Present vegetative composition is big sagebrush, western wheatgrass, sandberg bluegrass and nuttall saltbush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#5

Unnamed Forty Five - Unnamed Seven - Unnamed One Complex, 3 to 15 slopes

This map unit is on sideslopes, summits and ridge crests of foothills. The native vegetation is mainly big sagebrush, western wheatgrass, sandberg bluegrass, Idaho fescue and bluebunch wheatgrass. Elevation is 7200 to 8200 feet. The annual precipitation is aout 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 45 percent Unnamed Forty Five soils, 25 percent Unnamed Seven soil and 15 percent Unnamed One soil. Unnamed Forty Five soil is on foothill summits, Unnamed Seven soil is on foothill ridge crests, Unnamed one soil is on sideslopes.

Included in this unit are about 5 percent Unnamed Nine soil on drainageways and narrow alluvial plains, 5 percent Unnamed One soil on slopes of 9 to 15 percent on sideslopes and 5 percent Unnamed Two soil on foothill benches.

The Unnamed Forty Five soil is deep and well drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth long slopes of 0 to 5 percent. Typically the surface layer is brown gravelly fine sandy loam about 4 inches thick. The subsoil is light brown gravelly sandy clay loam about 14 inches thick. The substratum material is pink gravelly sandy clay loam.

Permeability of the Unnamed Forty Five soil is moderate. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is big sagebrush, western wheatgrass, sandberg bluegrass, and Idaho fescue. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Seven soil is deep and well drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth convex short slopes of 3 to 9 percent. Typically the surface layer is yellowish brown gravelly fine sandy loam about 3 inches thick. The subsoil is brown silty clay loam about 4 inches thick. The substratum is light brown silt loam, sandy clay loam and sandy loam.

Permeability of the Unnamed Seven soil is moderate. Coarse fragments are 15 to 25 percent gravel in the surface and 0 to 10 percent in the subsoil and substratum. Present vegetative composition is big sagebrush, and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on slightly concave short slopes of 5 to 15 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

These soils are used for range and wildlife habitat.

#6

Unnamed Four - Unnamed One - Unnamed Twenty Complex, 5 to 15 percent slopes

This map unit is on drainageways, fans and foothills. The native vegetation is mainly big sagebrush, sandberg bluegrass, nuttall

saltbush, bluebunch wheatgrass and western wheatgrass. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 50 percent Unnamed Four soil, 20 percent Unnamed One and 15 percent Unnamed Twenty soil. Unnamed Four soil is on drainageways and fans, Unnamed one soil is on sideslopes, Unnamed Twenty soil is on foothill ridges.

Included in this unit are about 5 percent Unnamed Two soil on ridge crests, 3 percent loamy-skeletal, mixed (calc), shallow Typic Cryorthents on sideslopes, 3 percent Unnamed Nineteen soil on drainageways and 3 percent Unnamed Four soil on 0 to 5 percent slopes and narrow floodplains.

The Unnamed Four soil is deep and well drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth convex to slightly concave medium length slopes of 5 to 9 percent. Typically the surface layer is brown silt loam about 6 inches thick. The underlying material is light brown silty clay loam to 45 inches and clay to 60 or more inches.

Permeability of the Unnamed Four soil is moderately slow to 45 inches and slow to 60 inches. Present vegetative composition is big sagebrush, western wheatgrass, sandberg bluegrass and nuttall saltbush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on smooth convex to slightly concave medium length slopes of 5 to 15 percent. Typically the

surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

The Unnamed Twenty soil is moderately deep and well drained. It formed in residuum derived dominantly from shale. It is on smooth convex to slightly concave short slopes of 5 to 15 percent. Typically the surface layer is pale brown very fine sandy loam about 4 inches thick. The subsoil is yellowish red loam and brown silty clay loam to 24 inches. The substratum is shale.

Permeability of the Unnamed Twenty soil is moderately slow. Present vegetative composition is big sagebrush, western wheatgrass and sandberg bluegrass. Effective rooting depth is 20 to 40 inches. Water erosion hazard is moderate.

These soils are used for range and wildlife habitat.

#7

Unnamed Ten - Unnamed Eleven - Unnamed Four Complex, 5 to 30 percent slopes

This map unit is on mountain summits, sideslopes and drainageways. The native vegetation is mainly big sagebrush, Idaho fescue, prairie junegrass, sandberg bluegrass, western wheatgrass and nuttall saltbush. Elevation is 8200 to 9500 feet. The annual precipitation is about 15 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed Ten soil, 25 percent Unnamed Eleven soil and 20 percent Unnamed Four soil. Unnamed Ten soil is on summits, Unnamed Eleven soil is on sideslopes, Unnamed Four soil is on drainageways.

Included in this unit are about 5 percent loamy-skeletal, mixed (calc), Typic Cryorthents on ridge crests, 5 percent Unnamed Sixteen soil on mountain shoulders and 5 percent Unnamed Eight soil on flood-plains.

The Unnamed Ten soil is deep and well drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth convex to slightly concave medium length slopes of 5 to 30 percent. Typically the surface layer is dark reddish gray very fine sandy loam about 4 inches thick. The subsoil is dark reddish brown cobbly silt loam to 10 inches, reddish brown cobbly clay loam to 19 inches and reddish brown clay loam to 30 inches. The substatum material is light reddish brown clay loam.

Permeability of the Unnamed Ten soil is moderately slow. Coarse fragments are 10 to 30 percent, mainly cobble with some gravel and a trace of surface stones. No fragments below 19 inches. Present vegetative composition is big sagebrush, Idaho fescue and prairie junegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is moderate.

The Unnamed Eleven soil is deep and well drained. It formed in gravelly residuum derived dominantly from mixed rocks. It is on convex to slightly concave summits and sideslopes of 5 to 30 percent. Typically the surface layer is dark brown very gravelly loam about 3 inches thick. the subsoil is dark brown very gravelly sandy clay loam to 8 inches, yellowish brown very gravelly sandy clay loam to about 15 inches. The substratum material is light brownish gray very gravelly loam and yellow very gravelly sandy clay loam.

Permeability of the Unnamed Eleven soil is moderate. Coarse fragments are 35 to 60 percent mainly gravel with some cobble. Present vegetative composition is Idaho fescue, sandberg bluegrass and big sagebrush. Effective rooting depth is 60 inches or more. Water erosion hazard is moderate.

The Unnamed Four soil is deep and well drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly concave drainageways on slopes of 5 to 9 percent. Typically the surface layer is brown silt loam about 6 inches thick. The underlying material is light brown silty clay loam.

Permeability of the Unnamed Four soil is moderately slow. Present vegetative composition is big sagebrush, western wheatgrass, sandberg

bluegrass and nuttall saltbush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#8

Unnamed Twelve - Unnamed Eleven Complex, 5 to 15 percent slopes

This map unit is on mountain sideslopes, the native vegetation is mainly aspen, slender wheatgrass, mountain brome, big sagebrush, Idaho fescue and sandberg bluegrass. Elevation is 8200 to 9500 feet. The annual precipitation is about 18 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 55 percent Unnamed Twelve soil and 30 percent Unnamed Eleven. Unnamed Twelve soil is on mountain sideslopes, Unnamed Eleven soil is on mountain sideslopes.

Included in this unit are about 5 percent Unnamed Thirteen soil on north sideslopes of 15 to 30 percent, 5 percent Unnamed Eight soil on floodplains, and 5 percent Unnamed Ten soil on mountain summits.

The Unnamed Twelve soil is deep and well drained. It formed in residuum derived dominantly from shale. It is on smooth convex to slightly concave medium length slopes of 5 to 15 percent. Typically the surface layer is dark reddish brown loam about 3 inches thick. The subsoil is dark reddish brown clay loam to 16 inches, reddish brown clay

loam to about 30 inches. The substratum material is light reddish brown clay loam.

Permeability of the Unnamed Twelve soil is moderately slow. Present vegetative composition is aspen, slender wheatgrass and mountain brome. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Eleven soil is deep and well drained. It formed in gravelly residuum derived dominantly from mixed rocks. It is on smooth convex to slightly concave medium length slopes of 5 to 15 percent. Typically the surface layer is dark brown very gravelly loam about 3 inches thick. The subsoil is dark brown very gravelly sandy clay loam to 8 inches, yellowish brown very gravelly sandy clay loam to about 15 inches. The substratum material is light brownish gray and yellow very gravelly sandy clay loam.

Permeability of the Unnamed Eleven soil is moderate. Coarse fragments are 30 to 60 percent, mainly gravel with some cobble. Present vegetative composition is big sagebrush, sandberg bluegrass and Idaho fescue. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for wildlife habitat and range.

#9

Unnamed Eight - Unnamed Twenty Eight Complex, 0 to 5 percent slopes

This map unit is on floodplains. The native vegetation is mainly willows, rushes, hairgrass and carex. Elevation is 7600 to 9500 feet. The annual precipitation is about 12 to 18 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed Eight soil and 25 percent Unnamed Twenty Eight soil. Unnamed Eight soil is on floodplains, Unnamed Twenty Eight soil is on floodplains.

Included in this map unit is about 35 percent sandy-skeletal, mixed (calc), Mollic Cryofluvents; loamy-skeletal, mixed (calc), Typic Cryoquolls; fine-loamy over sandy or sandy-skeletal, mixed (calc), Typic Cryaquents; fine-loamy, mixed (calc), Typic Cryaquents; and fine-loamy or sandy or sandy-skeletal, carbonatic, Typic Cryaquents. These soils occur on floodplains and have high water tables. Their management capabilities and limitations are generally similar to the dominant components in the map unit.

The Unnamed Eight soil is deep and poorly drained. It formed in alluvium derived dominantly from mixed rocks. It is on slightly concave undulating slopes of 0 to 5 percent. Typically the surface layer is very dark grayish brown loam about 11 inches thick. The underlying material is pinkish gray loam to about 41 inches and pale brown very gravelly sand to 50 or more inches.

Permeability of the Unnamed Eight soil is moderate to more than 40 inches and very rapid below. Coarse fragments are 35 to 70 percent gravel. Present vegetative composition is willows, carex, rushes and hairgrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Twenty Eight soil is deep and somewhat poorly drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly convex slopes of 0 to 5 percent. Typically the surface layer is very dark grayish brown loam about 8 inches thick. The underlying material is stratified dark grayish brown loam, very fine sandy loam, grayish brown fine sandy loam, dark grayish brown sandy clay loam to about 43 inches and grayish brown very gravelly sand to 60 or more inches.

Permeability of the Unnamed Twenty Eight soil is moderately slow. Coarse fragments are 35 to 60 percent gravel below 40 inches. Present vegetative composition is willows, rushes, hairgrass and carex. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range, irrigated hayland and pasture, and wildlife habitat.

#10

Unnamed Thirteen - Unnamed Fourteen Complex, 30 to 50 percent slopes

This map unit is on north exposures of mountain sideslopes. The native vegetation is mainly conifer. Elevation is 8200 to 9500 feet. The annual precipitation is about 18 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 50 percent Unnamed Thirteen soil and 35 percent Unnamed Fourteen soil. Unnamed Thirteen soil is on north mountain sideslopes, Unnamed Fourteen is on north mountain sideslopes.

Included in this unit is about 5 percent Unnamed Twelve soil on mountain sideslopes, 5 percent loamy-skeletal, mixed, Typic Cryoborolls on mountain sideslopes, 3 percent Unnamed Eight soil on floodplains and 2 percent Unnamed Ten soil on mountain summits.

The Unnamed Thirteen soil is deep and well-drained. It formed in residuum derived dominantly from shale. It is on smooth corvex to slightly concave medium length slopes of 30 to 50 percent and includes benches of lesser slopes. Typically the surface layer is organic needles 2 inches thick, yellowish brown loam about 4 inches thick, or light brown light sandy clay loam about 4 inches thick. The subsoil is reddish yellow silty clay loam, and gravelly silty clay loam to 30 inches. The substratum material is shale.

Permeability of the Unnamed Thirteen soil is moderately slow. Coarse fragments are 0 to 25 percent gravel. Present vegetative

composition is Douglas fir. Effective rooting depth is 20 to 40 inches. Water erosion hazard is severe.

The Unnamed Fourteen soil is deep and well drained. It formed in gravelly residuum derived dominantly from shale and limestone. It is on smooth to slightly convex medium length north sideslopes of 20 to 50 percent. Typically the surface layer is 2 inches of organic needles, 3 inches of brown loam, 9 inches of light brown very fine sandy loam. The subsoil is reddish brown very gravelly clay loam about 21 inches thick. The substratum material is brown very gravelly clay loam.

Permeability of the Unnamed Fourteen soil is moderate. Coarse fragments are 10 to 15 percent in the surface and 35 to 50 percent in the subsoil and substratum, mainly gravel with some cobble. Present vegetative composition is Douglas fir. Effective rooting depth is 40 to 60 inches. Water erosion hazard is severe.

These soils are used for timbering, wildlife habitat and limited range in openings.

#11

Unnamed Ten - Unnamed Fifteen - Unnamed Four Complex, 5 to 15 percent slope

This map unit is on mountain summits shoulders and sideslopes. The native vegetation is mainly big sagebrush, Idaho fescue, prairie junegrass, bluebunch wheatgrass, sandberg bluegrass and nuttall

saltbush. Elevation is 8200 to 9500 feet. The annual precipitation is about 15 to 20 inches, the average annual air temperature is 32 to 36 degrees F, and the frost-free season is 22 to 28 days.

This unit is 35 percent Unnamed Ten soil, 25 percent Unnamed Fifteen soil and 15 percent Unnamed Four soil. Unnamed Ten soil is on summits, Unnamed Fifteen soil is on shoulders, Unnamed Four soil is on sideslopes.

Included in this unit are about 5 percent of areas with slopes 15 to 30 percent, 5 percent Unnamed Sixteen soil on ridges, 5 percent Unnamed Eight soil on floodplains, 5 percent Unnamed Eleven soil on sideslopes, and 5 percent Unnamed Twenty Four soil on gentle slopes that are wet part of the year.

The Unnamed Ten soil is deep and well drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth convex to slightly concave medium length slopes of 5 to 15 percent. typically the surface layer is dark reddish gray very fine sandy loam about 4 inches thick. The subsoil is dark reddish brown cobbly silt loam to 10 inches, reddish brown cobbly clay loam to 19 inches and reddish brown clay loam to 30 inches. The substratum material is light reddish brown clay loam.

Permeability of the Unnamed Ten soil is moderately slow. Coarse fragments are 10 to 30 percent mainly cobble with some gravel and a trace of surface stones. No fragments below 19 inches. Present vegetative composition is big sagebrush, Idaho fescue and prairie junegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Fifteen soil is deep and well-drained. It formed in residuum derived dominantly from shale and limestone rocks. It is on smooth convex short slopes of 5 to 9 percent. Typically the surface layer is dark grayish brown gravelly silt loam about 4 inches thick. The subsoil is dark brown gravelly silty clay loam to 10 inches, reddish brown clay to 20 inches and pink silty clay to 45 inches. The substratum is very pale brown clay loam.

Permeability of the Unnamed Fifteen soil is very slow. Coarse fragments are 15 to 25 percent to 15 inches and 0 to 10 percent to 20 inches, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass, Idaho fescue and low sagebrush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Four soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to concave short slopes of 5 to 9 percent. Typically the surface layer is brown silt loam about 6 inches thick. The underlying material is light brown silty clay loam.

Permeability of the Unnamed Four soil is moderately slow. Present vegetative composition is big sagebrush, western wheatgrass, sandberg bluegrass and nuttall saltbush. Effective depth rooting is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#12

Unnamed Sixteen - Unnamed One - Unnamed Twenty Five Complex, 30 to 50 percent

This map unit is on mountain shoulders, crests, sideslopes and south facing sideslopes. The native vegetation is mainly sandberg bluegrass, bluebunch wheatgrass, fringed sagebrush, big sagebrush, king fescue and balsamroot. Elevation is 8100 to 9500 feet. The annual precipitation is about 16 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 35 percent Unnamed Sixteen soil, 30 percent Unnamed One and 20 percent Unnamed Twenty Five soil. Unnamed Sixteen is on shoulders and crests, Unnamed One is on sideslopes, Unnamed Twenty Five soil is on south-facing sideslopes.

Included in this unit are about 5 percent slopes of 15 to 30 percent, 5 percent Unnamed Ten soil on mountain summits and 5 percent fine-loamy, mixed, Typic Cyoborolls on gentle sideslopes.

The Unnamed Sixteen soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on convex short slopes of 30 to 50 percent. Typically the surface layer is reddish brown very gravelly loam about 4 inches thick. The underlying material is very pale brown and light gray very gravelly loam about 14 inches thick. The substratum material is shale.

Permeability of the Unnamed Sixteen soil is moderate. Coarse fragments are 35 to 70 percent, mainly gravel and cobble with some

stones. Present vegetative composition is bluebunch wheatgrass and fringed sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on smooth to concave medium slopes of 30 to 50 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

The Unnamed Twenty Five soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on convex to slightly concave medium slopes of 30 to 50 percent. Typically the surface layer is dark brown cobbly loam about 3 inches thick. The subsoil is dark brown cobbly silty clay loam about 9 inches thick. The substratum is shale.

Permeability of the Unnamed Twenty Five soil is moderately slow. Coarse fragments are 35 to 50 percent, mainly cobble and gravel with some stones. Present vegetative composition is big sagebrush, bluebunch wheatgrass, king fescue and balsamroot. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

These soils are used for range and wildlife habitat. The suitability for range is limited by steep slopes.

#13

Unnamed Seventeen - Rock Outcrop - Unnamed One Complex, 15 to 50 percent slopes

This map unit is on sideslopes, breaks and ridges of foothills. The native vegetation is mainly bluebunch wheatgrass and stunted sagebrush. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 34 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed Seventeen soil, 25 percent Rock Outcrop and 20 percent Unnamed One soil. Unnamed Seventeen soil is on breaks and ridges. Rock Outcrop and Unnamed One soil are on sideslopes.

Included in this unit are about 3 percent of slopes less than 15 percent, 3 percent of Unnamed Four soil on toeslopes, 3 percent Unnamed Ten soil in aspen, 3 percent Unnamed Thirteen soil in conifer and 3 percent Unnamed Two soil on sideslopes.

The Unnamed Seventeen soil is shallow and well-drained. It formed in gravelly residuum derived dominantly from sandstone. It is on smooth convex to slightly concave medium slopes of 15 to 30 percent. Typically the surface layer is yellowish brown very gravelly fine sandy loam about 3 inches thick. The underlying material is yellow very

gravelly very fine sandy loam about 13 inches thick. The substratum material is shale.

Permeability of the Unnamed Seventeen soil is moderate. Coarse fragments are 35 to 50 percent, mainly gravel with some cobble and a trace of stones. Present vegetative composition is bluebunch wheatgrass and big sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

The Rock Outcrop is exposed hard bedrock.

The Unnamed One soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on smooth to slightly concave medium slopes of 30 to 50 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

These soils are used for range and wildlife habitat. The suitability for range is limited by steep slopes.

#14

Unnamed Four - Unnamed One - Unnamed Sixteen Complex, 0 to 9 percent slopes

This map unit is on valleys and foothills. The native vegetation is mainly big sagebrush, sandberg bluegrass, nuttall saltbush, bluebunch wheatgrass and western wheatgrass. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 34 degrees F and the frost-free season is 22 to 28 days.

This unit is 45 percent Unnamed Four soil, 30 percent Unnamed One soil and 15 percent Unnamed Sixteen soil. Unnamed Four soil is on fans and floodplains, Unnamed One soil is on foothill sideslopes, Unnamed Sixteen soil is on foothill crests transitional to mountain.

Included in this unit are about 5 percent Unnamed Forty Five soil on foothill summits, and 5 percent badland.

The Unnamed Four soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly concave alluvial plains on slopes of 0 to 5 percent. Typically the surface layer is brown silt loam about 6 inches thick. The underlying material is light brown silty clay loam.

Permeability of the Unnamed Four soil is moderately slow. Present vegetative composition is sandberg bluegrass, big sagebrush, western wheatgrass, and nuttall saltbush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on smooth to slightly concave slopes of 5 to 9 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly silty clay loam about 12 inches thick. The substratum is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

The Unnamed Sixteen soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on foothill shoulders and crests on convex short slopes of 5 to 9 percent. Typically the surface layer is reddish brown very gravelly loam about 4 inches thick. The underlying material is very pale brown and light gray very gravelly loam about 13 inches thick. The substratum is shale.

Permeability of the Unnamed Sixteen soil is moderate. Coarse fragments are 50 to 70 percent, mainly gravel and cobble with some stones. Present vegetative composition is bluebunch wheatgrass and fringed sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#15

Unnamed Four - Unnamed Nine Complex, 0 to 5 percent slopes

This map unit is on alluvial plains and fans. The native vegetation is mainly big sagebrush, western wheatgrass, nuttall saltbush and sandberg bluegrass. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 60 percent Unnamed Four soil and 35 percent Unnamed Nine soil. Unnamed Four is on fans, Unnamed Nine is on alluvial plains.

Included in this unit is about 5 percent of Unnamed One soil on sideslopes.

The Unnamed Four soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly convex medium slopes of 0 to 5 percent. Typically the surface layer is brown silt loam about 6 inches thick. The underlying material is light brown silty clay loam.

Permeability of the unnamed Four soil is moderately slow. Present vegetative composition is big sagebrush, western wheatgrass and nuttall saltbush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Nine soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly concave long slopes of 0 to 5 percent. Typically the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is

strong brown and reddish yellow very gravelly sandy clay loam. The substratum is brown very gravelly sandy loam.

Permeability of the Unnamed Nine soil is moderate to 18 inches and moderately rapid below. Coarse fragments are 35 to 60 percent, mainly gravel with some cobble. Present vegetative composition is big sagebrush, western wheatgrass and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is low.

These soils are used for range and wildlife habitat.

#16

Unnamed Eighteen - Unnamed Twenty Three Complex, 0 to 5 percent slopes

This map unit is on floodplains and fans. The native vegetation is mainly big sagebrush, western wheatgrass, sandberg bluegrass, willow, sedge, rush and tufted hairgrass. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 70 percent Unnamed Eighteen soil and 20 percent Unnamed Twenty Three. Unnamed Eighteen soil is on fans and floodplains, Unnamed Twenty Three soil is on floodplains.

Included in this unit are about 5 percent Unnamed Four soil on fans and 5 percent Unnamed Twenty Six soil on floodplains.

The Unnamed Eighteen soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth long slopes of 0 to 5 percent. Typically the surface layer is light brown silty clay loam about 4 inches thick. The underlying material is light reddish brown silty clay loam to 32 inches and pink light silty clay to 60 or more inches.

Permeability of the Unnamed Eighteen soil is moderately slow. Present vegetative composition is big sagebrush, western wheatgrass and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Twenty Three soil is deep and poorly drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly concave short slopes of 0 to 2 percent. Typically the surface layer is light brownish gray silt loam about 4 inches thick. The underlying material is gray and light brownish silty clay loam.

Permeability of the Unnamed Twenty Three soil is moderately slow. Present vegetative composition is willow, sedge, Baltic rush and tufted hairgrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#17

Unnamed Forty Five - Unnamed Fifteen - Unnamed Three Complex, 5 to 30 percent slopes

This map unit is on foothills. The native vegetation is mainly big sagebrush, sandberg bluegrass, western wheatgrass, bluebunch wheatgrass, Idaho fescue and low sagebrush. Elevation is 7200 to 8000 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed Forty Five soil, 30 percent Unnamed Fifteen soil and 15 percent Unnamed Three soil. Unnamed Forty Five soil is on upland plains, Unnamed Fifteen soil is on summits and crests, Unnamed Three soil is on sideslopes.

Included in this unit are about 5 percent loamy-skeletal, mixed (calc), shallow, Typic Cryorthents on sideslopes, 5 percent Unnamed One soil on sideslopes and 5 percent Unnamed Three soil on ridges and shoulders.

The Unnamed Forty Five soil is deep and well-drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth to slightly concave slopes of 5 to 9 percent. Typically the surface layer is brown gravelly fine sandy loam about 4 inches thick. The subsoil is light brown gravelly sandy clay loam. The substratum material is pink gravelly sandy clay loam.

Permeability of the Unnamed Forty Five soil is moderate. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is big sagebrush, western wheatgrass and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Fifteen soil is deep and well-drained. It formed in residuum derived predominantly from shale and limestone. It is on summits and crests with smooth to convex short slopes of 15 to 30 percent. Typically the surface layer is dark grayish brown gravelly silt loam about 4 inches thick. The subsoil is dark brown silty clay loam to 10 inches, reddish brown clay to 20 inches and pink clay to 45 inches. The substratum is very pale brown clay loam.

Permeability of the Unnamed Fifteen soil is very slow to 45 inches and moderately slow to 70 inches. Coarse fragments are 10 to 25 percent to 20 inches. Present vegetative composition is bluebunch wheatgrass, Idaho fescue and low sagebrush. Effective rooting depth is 60 inches or more. Water erosion hazard is moderate.

The Unnamed Three soil is shallow and well drained. It formed in clayey residuum derived dominantly from shale. It is on smooth to slightly concave short slopes of 15 to 30 percent. Typically the surface layer is reddish brown clay loam about 3 inches thick. The underlying material is reddish brown clay about 12 inches thick. The substratum is shale.

Permeability of the Unnamed Three soil is slow. Present vegetative composition is low sagebrush and bluebunch wheatgrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

These soils are used for range and wildlife habitat.

#18

Unnamed Twenty Four - Unnamed Ten Complex, 3 to 15 percent slopes

This map unit is on mountain summits and sideslopes. The vegetation is mainly mutton bluegrass, sandberg bluegrass, sedge, big sagebrush, Idaho fescue and prairie junegrass. Elevation is 8200 to 9500 feet. The annual precipitation is about 15 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 55 percent Unnamed Twenty Four soil and 35 percent Unnamed Ten soil. Unnamed Twenty Four soil is on intermediate sideslopes, Unnamed Ten soil is on summits.

Included in this unit are about 5 percent Unnamed Eleven soil on sideslopes and 5 percent Unnamed Twenty Seven soil on intermediate sideslopes.

The Unnamed Twenty Four soil is shallow and moderately well-drained. It formed in residuum derived dominantly from shale. It is on smooth convex medium slopes of 3 to 15 percent. Typically the surface layer is dark brown gravelly loam about 9 inches thick. The subsoil is reddish brown gravelly clay loam. The substratum material is shale.

Permeability of the Unnamed Twenty Four soil is moderately slow. Some of this soil is moist for much of the year. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is mutton bluegrass, sandberg bluegrass, Idaho fescue and sedge. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

The Unnamed Ten soil is deep and well-drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth to slightly concave medium slopes of 5 to 9 percent. Typically the surface layer is dark reddish gray very fine sandy loam about 4 inches thick.

The subsoil is reddish brown cobbly silt loam to 10 inches, reddish brown cobbly clay loam to 19 inches and reddish brown clay loam to 30 inches. The substratum is light reddish brown clay loam.

Permeability of the Unnamed Ten soil is moderately slow. Coarse fragments are 5 to 15 percent in the surface and 15 to 35 percent to 19 inches, mainly cobble and gravel with a trace of stones. Present vegetative composition is big sagebrush, Idaho fescue and prairie junegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#19

Unnamed Twenty One - Unnamed Twenty Four - Unnamed Twelve Complex, 9 to 15 percent slopes

This map unit is on mountain ridges and sideslopes. The native vegetation is mainly big sagebrush, sandberg bluegrass, mutton bluegrass, needle and thread, king fescue, Idaho fescue, aspen, slender wheatgrass and mountain brome. Elevation is 8200 to 9500 feet. The annual precipitation is about 15 to 20 inches, the average annual air

temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 45 percent Unnamed Twenty One soil, 25 percent Unnamed Twenty Four soil and 15 percent Unnamed Twelve soil. Unnamed Twenty One soil is on mountain south slopes, Unnamed Twenty Four soil is on intermediate mountain sideslopes, Unnamed Twelve soil is on mountain sideslopes.

Included in this unit are about 5 percent Unnamed Sixteen soil on mountain ridge crests, 4 percent Unnamed Ten soil on mountain summits, 3 percent clayey-skeletal, montmorillonitic, Borollic Haplargids, and 3 percent slopes less than 5 percent and more than 15 percent.

The Unnamed Twenty One soil is moderately deep and well-drained. It formed in residuum derived dominantly from shale. It is on smooth to slightly concave medium slopes of 9 to 15 percent. Typically the surface layer is grayish brown gravelly very fine sandy loam about 2 inches thick. The subsoil is grayish brown gravelly loam to 8 inches, dark yellowish brown gravelly sandy clay loam to 18 inches. The substratum material is light brown gravelly loam underlain by shale at 24 inches.

Permeability of the Unnamed Twenty One soil is moderate. Coarse fragments are 15 to 25 percent, mainly gravel and some cobble. A trace of stones is on the surface. Present vegetative composition is big sagebrush, mutton bluegrass, needle and thread grass and king fescue. Effective rooting depth is 20 to 40 inches. Water erosion hazard is slight.

The Unnamed Twenty Four soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on intermediate

smooth and slightly convex medium slopes of 5 to 9 percent. Typically the surface layer is dark brown gravelly loam about 9 inches thick. The subsoil is reddish brown gravelly clay loam about 9 inches thick. The substratum is shale.

Permeability of the Unnamed Twenty Four soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is mutton bluegrass, sandberg bluegrass and Idaho fescue. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

The Unnamed Twelve soil is deep and well-drained. It formed in residuum derived dominantly from shale. It is on smooth to slightly concave medium slopes of 5 to 15 percent. Typically the surface layer is dark reddish brown loam about 3 inches thick. The subsoil is dark reddish brown clay loam to 16 inches and reddish brown clay loam to 30 inches. The substratum is light reddish brown clay loam.

Permeability of the Unnamed Twelve soil is moderately slow. Present vegetative composition is aspen, slender wheatgrass and mountain brome. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#20

Unnamed Sixteen - Unnamed One - Unnamed Twenty Five Complex, 50 to 75 percent slopes

This map unit is on mountain shoulders, crests, sideslopes and south-facing sideslopes. Numerous land slips are in this map unit. The native vegetation is mainly sandberg bluegrass, bluebunch wheatgrass, stunted sagebrush, king fescue and fringed sagebrush. Elevation is 8100 to 9500 feet. The annual precipitation is about 16 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 35 percent Unnamed Sixteen soil, 35 percent Unnamed One and 25 percent Unnamed Twenty Five soil. Unnamed Sixteen soil is on shoulders and crests, Unnamed One soil is on sideslopes, Unnamed Twenty Five soil is on south-facing sideslopes.

Included in this unit is about 5 percent slopes of 30 to 50 percent.

The Unnamed Sixteen soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on convex short slopes of 30 to 50 percent. Typically the surface layer is reddish brown very gravelly loam about 4 inches thick. The underlying material is very pale brown and light gray very gravelly loam. The substratum material is shale.

Permeability of the Unnamed Sixteen soil is moderate. Coarse fragments are 35 to 70 percent, mainly gravel and cobble with some

stones. Present vegetative composition is bluebunch wheatgrass and fringed sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

The Unnamed One soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on convex to slightly concave medium slopes of 50 to 70 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay laom about 12 inches thick. The substratum is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

The Unnamed Twenty Five soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on smooth to slightly concave south slopes of 50 to 70 percent. Typically the surface layer is dark brown cobbly loam about 3 inches thick. The subsoil is dark brown cobbly silty clay loam about 9 inches thick. The substratum is shale.

Permeability of the Unnamed Twenty Five soil is moderately slow. Coarse fragments are 35 to 50 percent, mainly cobble and gravel with some stones. Present vegetative composition is big sagebrush, king fescue and bluebunch wheatgrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

These soils are used for range and wildlife habitat. The suitability for range is limited by steep slopes.

#21

Unnamed One - Unnamed Ten - Unnamed Twelve, 15 to 30 percent slopes

This map unit is on mountain sideslopes and summits. The native vegetation is mainly bluebunch wheatgrass, big sagebrush, Idaho fescue, prairie junegrass, aspen and slender wheatgrass. Elevation is 8200 to 9500 feet. The annual precipitation is about 15 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed One soil, 25 percent Unnamed Ten soil and 15 percent Unnamed Twelve soil. Unnamed One soil is on sideslopes, Unnamed Ten soil is on summits, Unnamed Twelve soil is on sideslopes.

Included in this unit are about 5 percent Unnamed Twenty Four soil on sideslopes, 5 percent Unnamed Six soil on ridges, 5 percent Unnamed Five soil on summits, 3 percent Unnamed Sixteen soil on ridge crests and 2 percent slopes 30 to 50 percent.

The Unnamed one soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on convex to slightly concave short slopes of 15 to 30 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present

vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

The Unnamed Ten soil is deep and well-drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth to slightly concave medium slopes of 15 to 30 percent. Typically the surface layer is dark reddish gray very fine sandy loam about 4 inches thick. The subsoil is dark reddish brown cobbly silt loam to 10 inches, reddish brown cobbly clay loam to 19 inches and reddish brown clay loam to 30 inches. The substratum is light reddish brown clay loam.

Permeability of the Unnamed Ten soil is moderately slow. Coarse fragments are 10 to 30 percent, mainly cobble with some gravel and a trace of stone on the surface. Present vegetative composition is big sagebrush, Idaho Fescue and prairie junegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is severe.

The Unnamed Twelve soil is deep and well-drained. It formed in residuum derived predominantly from shale. It is on smooth to slightly convex medium slopes of 15 to 30 percent. Typically the surface layer is dark reddish brown loam about 3 inches thick. The subsoil is dark reddish brown clay loam to 16 inches and reddish brown clay loam to 30 inches. The substratum is light reddish brown clay loam.

Permeability of the Unnamed Twelve soil is moderately slow. Present vegetative composition is aspen, slender wheatgrass and mountain brome. Effective rooting depth is 60 inches or more. Water erosion hazard is severe.

These soils are used for range and wildlife habitat. The suitability for range is limited by steep slopes.

#22

Unnamed One - Unnamed Ten Complex, 5 to 30 percent slopes

This map unit is on mountain sideslopes and summits. The native vegetation is mainly bluebunch wheatgrass, big sagebrush, Idaho fescue and prairie junegrass. Elevation is 8200 to 9500 feet. The annual precipitation is about 16 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 45 percent Unnamed One soil and 40 percent Unnamed Ten soil. Unnamed One soil is on sideslopes and Unnamed Ten soil is on summits.

Included in this unit are about 5 percent Unnamed Twenty Four soil on intermediate sideslopes, 5 percent loamy-skeletal, mixed (calc), Typic Cryorthents on ridge crests, and 5 percent Unnamed Fifteen soil on slightly concave summits.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on smooth to slightly concave medium slopes of 15 to 30 percent. Typically the surface layer is reddish brown gravelly clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is severe.

Unnamed Ten soil is deep and well-drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth convex to slightly concave medium slopes of 5 to 15 percent. Typically the surface layer is dark reddish gray very fine sandy loam about 4 inches thick. The subsoil is dark reddish brown cobbly silt loam to 10 inches, reddish brown cobbly clay loam to 19 inches, and reddish brown clay loam to 30 inches. The substratum material is light reddish brown clay loam.

Permeability of the Unnamed Ten soil is moderately slow. Coarse fragments are 10 to 30 percent, mainly gravel with some cobble and a trace of stone in the surface. No fragments below 19 inches. Present vegetative composition is big sagebrush, Idaho fescue and prairie junegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#23

Unnamed Eighteen - Unnamed Twenty Six Complex, 0 to 5 percent slopes

This map unit is on floodplains and fans. The native vegetation is mainly big sagebrush, western wheatgrass, sandberg bluegrass and low

sagebrush. Elevation is 7200 to 8200 feet. The annual precipitation is about 14 to 16 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 65 percent Unnamed Eighteen soil and 20 percent Unnamed Twenty Six soil. Unnamed Eighteen soil is on fans and floodplains, Unnamed Twenty Six soil is on floodplains.

Included in this unit are about 5 percent slopes ranging from 5 to 15 percent, 5 percent Unnamed One soil on sideslopes and 5 percent Unnamed Nineteen soil on floodplains.

The Unnamed Eighteen soil is deep and well-drained. It formed in silty alluvium derived dominantly from mixed rocks. It is on smooth to slightly concave medium slopes of 0 to 5 percent. Typically the surface layer is light brown silty clay loam about 4 inches thick. The underlying material is light reddish brown silty clay loam to 32 inches and pink light silty clay loam to 60 inches.

Permeability of the Unnamed Eighteen soil is moderately slow. Present vegetative composition is big sagebrush, western wheatgrass and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Twenty Six soil is deep and well drained. It formed in clayey alluvium derived dominantly from mixed rocks. It is on smooth slightly concave medium slopes of 0 to 2 percent. Typically the surface layer is light reddish brown very fine sandy loam about 4 inches thick. The underlying material is reddish brown silt clay.

Permeability of the Unnamed Twenty Six soil is slow. Present vegetative composition is western wheatgrass, sandberg bluegrass and low

sagebrush. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#30

Unnamed Eighteen - Unnamed Nineteen Complex, 0 to 5 percent slopes

This map unit is on floodplains and fans. The native vegetation is mainly big sagebrush, western wheatgrass and sandberg bluegrass. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 50 percent Unnamed Eighteen soil, 30 percent Unnamed Nineteen soil. Unnamed Eighteen soil is on fans, Unnamed Nineteen soil is on floodplains.

Included in this unit are about 10 percent Unnamed Thirty Six soil on floodplains and 10 percent Unnamed Nine soil on alluvial plains.

The Unnamed Eighteen soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly undulating logn slopes of 0 to 5 percent. Typically the surface layer is light brown silty clay loam about 4 inches thick. The underlying material is light reddish brown silty clay loam to 32 inches and pink light silt clay to 60 or more inches.

Permeability of the Unnamed Eighteen soil is moderately slow. Present vegetative composition is big sagebrush and western wheatgrass.

Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Nineteen soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth convex to slightly concave medium slopes of 0 to 2 percent. Typically the surface layer is brown silt loam about 4 inches thick. The underlying material is pale brown and light reddish brown silty clay loam.

Permeability of the Unnamed Nineteen soil is moderately slow. Present vegetative composition is big sagebrush, sandberg bluegrass and western wheatgrass. Effective rooting depth is 40 to 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#31

Unnamed Eighteen Complex, 0 to 5 percent

This map unit is on floodplains and fans. The native vegetation is mainly big sagebrush, western wheatgrass, sandberg bluegrass, greasewood and bottlebrush squirreltail. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 50 percent Unnamed Eighteen soil and 35 percent Unnamed Eighteen soil, alkaline. Unnamed Eighteen soil is on floodplains and Unnamed Eighteen soil, alkaline, is on fans.

Included in this unit are about 10 percent Unnamed Nineteen soil on floodplains, 5 percent Unnamed Nine soil on alluvial plains.

The Unnamed Eighteen soil is deep and well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly concave long slopes. Typically the surface layer is light brown silty clay loam about 4 inches thick. The underlying material is light reddish brown silty clay loam to 32 inches and light silt clay to 60 or more inches.

Permeability of the Unnamed Eighteen soil is moderately slow. Present vegetative composition is big sagebrush, western wheatgrass and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Eighteen soil, alkaline, is a deep, alkaline phase that is well-drained. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly convex medium slopes. Typically the surface layer is light brown silty clay loam about 4 inches thick. The underlying material is light reddish brown silty clay loam to 32 inches and pink light silt clay to 60 inches or more.

Permeability of the Unnamed Eighteen soil, alkaline, is moderately slow. Present vegetative composition is greasewood, western wheatgrass and bottlebrush squirreltail. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#32

Unnamed One - Unnamed Two Complex, 5 to 15 percent slopes

This map unit is on sideslopes, ridges and summits of foothills. The native vegetation is mainly bluebunch wheatgrass and stunted sagebrush. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 60 percent Unnamed One soil and 30 percent Unnamed Two soil. Unnamed One soil is on sideslopes and Unnamed Two soil is on benches and ridges.

Included in this unit are about 5 percent Unnamed Eighteen soil on toeslopes, 5 percent slopes of 15 to 30 percent.

The Unnamed One soil is shallow and well drained. It formed in residuum derived dominantly from shale. It is on smooth convex to slightly concave, medium slopes of 5 to 15 percent. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 15 to 25 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

Unnamed Two soil is shallow and well-drained. It formed in residuum derived dominantly from sandstone. It is on smooth convex to slightly irregular concave, medium slopes of 5 to 15 percent. Typically the surface layer is pale brown very fine sandy loam about 2 inches thick. The underlying material is pale brown very fine sandy loam and very pale brown loam about 14 inches thick. The substratum material is sandstone.

Permeability of the Unnamed Two soil is moderate. Coarse fragments are 0 to 10 percent surface gravel and cobble. Present vegetative composition is stunted sagebrush and bluebunch wheatgrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

These soils are used for range and wildlife habitat. The suitability for range is limited by low productivity.

#34

Unnamed Twenty Two - Unnamed Two complex, 0 to 15 percent slopes

This map unit is on summits, crests of mesa tops and shoulders. The native vegetation is mainly stunted sagebrush and bluebunch wheatgrass. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 70 percent Unnamed Twenty Two soil and 20 percent Unnamed Two soil. Unnamed Twenty Two soil is on crests and shoulders, Unnamed Two soil is on summits.

Included in this unit are about 5 percent fine-loamy, mixed (calc), moderately deep Typic Cryorthents on mesa shoulders, and 5 percent Rock Outcrop with steeper slopes.

The Unnamed Twenty Two is very shallow and well drained. It formed in residuum derived dominantly from sandstone. It is on smooth to slightly concave slopes. Typically the surface layer is pale brown very fine sandy loam about 2 inches thick. The underlying material is pale brown very fine sandy loam about 5 inches thick. The substratum material is sandstone.

Permeability of the Unnamed Twenty Two soil is moderate. Coarse fragments are 0 to 15 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass. Effective rooting depth is 6 to 10 inches. Water erosion hazard is slight.

The Unnamed Two soil is shallow and well drained. It formed in residuum derived dominantly from sandstone. It is on smooth to slightly concave slopes. Typically the surface layer is pale brown very fine sandy loam about 2 inches thick. The underlying material is pale brown very fine sandy loam and very pale brown loam about 14 inches thick. The substratum is sandstone.

Permeability of the Unnamed Two soil is moderate. Coarse fragments are 5 to 10 percent in the surface, mainly gravel with some cobble. Present vegetative composition is stunted sagebrush and bluebunch wheatgrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

These soils are used for range and wildlife habitat. The suitability for range is limited by low productivity.

#35

Badland - Rock Outcrop Complex, 30 to 50 percent slopes

This map unit is on miscellaneous area. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 50 percent Badland and 30 percent Rock Outcrop.

Included in this unit are about 10 percent Unnamed Two soil on benches, 5 percent Unnamed One soil on sideslopes and 5 percent slopes less than 30 percent and more than 50 percent.

These soils are used for wildlife habitat.

#36

Unnamed One - Unnamed Two - Unnamed Seventeen Complex, 9 to 15 percent slope

This map unit is on foothill sideslopes, ridges and benches. The native vegetation is mainly bluebunch wheatgrass and stunted sagebrush. Elevation is 7200 to 8200 feet. The annual precipitation is about 10 to 14 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed One soil, 30 percent Unnamed Two soil and 15 percent Unnamed Seventeen soil. Unnamed One soil is on sideslopes, Unnamed Two soil is on benches, Unnamed Seventeen soil is on ridges.

Included in this unit are about 5 percent slopes of 15 to 30 percent, 5 percent Unnamed Twelve soil on snowpockets growing aspen, and 5 percent Unnamed Eighteen on drainageways.

The Unnamed One soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on smooth to slightly convex medium slopes. Typically the surface layer is reddish brown gravelly silty clay loam about 3 inches thick. The underlying material is yellowish red gravelly clay loam about 12 inches thick. The substratum material is shale.

Permeability of the Unnamed One soil is moderately slow. Coarse fragments are 0 to 15 percent, mainly gravel and some cobble. Present vegetative composition is bluebunch wheatgrass and stunted sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

The Unnamed Two soil is shallow and well-drained. It formed in residuum derived cave short slopes. Typically the surface layer is pale brown very fine sandy loam about 2 inches thick. The underlying material is pale brown very fine sandy loam and very pale brown loam about 14 inches thick. The substratum is sandstone.

Permeability of the Unnamed Two soil is moderate. Coarse fragments are 0 to 10 percent, mainly gravel with some cobble. Present vegetative

composition is stunted sagebrush and bluebunch wheatgrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

The Unnamed Seventeen soil is shallow and well-drained. It formed in gravelly residuum derived dominantly from sandstone. It is on convex short slopes. Typically the surface layer is yellowish brown very gravelly fine sandy loam about 3 inches thick. The underlying material is yellow very gravelly very fine sandy loam about 13 inches thick. The substratum is sandstone.

Permeability of the Unnamed Seventeen soil is moderately rapid. Coarse fragments are 35 to 50 percent, mainly gravel with some cobble. Present vegetative composition is bluebunch wheatgrass and big sagebrush. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

These soils are used for range and wildlife habitat. The suitability for range is limited by low productivity.

#37

Unnamed Thirty Six silt loam, 0 to 2 percent slopes

The Unnamed Thirty Six soil is deep and well-drained. It formed in silty alluvium derived predominantly from mixed rocks. The native vegetation is mainly big sagebrush, greasewood, nuttall saltbush, thickspike wheatgrass and bottlebrush squirreltail. Elevation is 6500 to 7200 feet. The annual precipitation is about 7 to 9 inches, the average

annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

Unnamed Thirty Six soils are on smooth to slightly concave slopes. Typically the surface layer is light brown silt loam about 4 inches thick, the underlying material is light silty clay loam and pinkish very fine sandy loam that is stratified to 60 inches or more. This soil is strongly alkaline.

Included in this unit are small areas of Unnamed Twenty Nine soil on fans and Unnamed Thirty Nine soil on floodplains. Included areas make up about 15 percent of the total area.

Permeability of this Unnamed Thirty Six soil is moderately slow. Effective rooting depth is 60 inches or more, and the hazard of water erosion is slight.

This soil is used for range and wildlife habitat.

#39

Unnamed Twenty Nine Loam, 5 to 15 percent slopes

This Unnamed Twenty Nine soil is deep and well-drained. It formed in alluvium derived predominantly from mixed rocks. Unnamed Twenty Nine soil is on fans. The native vegetation is mainly big sagebrush, bottlebrush squirreltail, thickspike wheatgrass and sandberg bluegrass. Elevation is 6500 to 7200 feet. The annual precipitation is about 7 to 9 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

The Unnamed Twenty Nine soil is on smooth to slightly concave slopes. Typically the surface layer is light brown loam about 3 inches thick. The underlying material is light brown loam to 60 inches or more.

Included in this unit are small areas of Unnamed Thirty Six on floodplains. Included areas make up about 10 percent of the total area.

Permeability of this Unnamed Thirty Nine soil is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This soil is used for range and wildlife habitat.

#41

Unnamed Thirty Six - Unnamed Forty One Complex, 3 to 9 percent slopes

This map unit is on floodplains. The native vegetation is mainly big sagebrush, bottlebrush squirreltail, sandberg bluegrass, thickspike wheatgrass, needle and thread grass, greasewood, nuttall saltbush and alkali sacaton. Elevation is 6500 to 7200 feet. The annual precipitation is about 7 to 9 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed Thirty Six soil and 40 percent Unnamed Forty One soil. Unnamed Thirty Six soil is on floodplains and Unnamed Forty One soil is on floodplains.

Included in this unit are about 10 percent Unnamed Thirty Nine soil on floodplains, 5 percent fine silty, mixed (calc), frigid, typic torriorthents on floodplains, and 5 percent badland on breaks.

The Unnamed Thirty Six soil is deep, well-drained, and strongly alkaline. It formed in alluvium derived dominantly from mixed rocks. It is on smooth to slightly concave long slopes. Typically the surface layer is light brown silt loam about 4 inches thick. The underlying material is light brown and pinkish gray silty clay loam to 60 inches or more.

Permeability of the Unnamed Thirty Six soil is moderately slow. Present vegetative composition is big sagebrush, bottlebrush squirreltail, sandberg bluegrass and thickspike wheatgrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Forty One soil is deep and well-drained. It formed in alluvium and eolian material derived dominantly from sandstone. It is on smooth covex to slightly undulating short slopes. Typically the surface layer is yellowish brown loamy sand about 3 inches thick. The underlying material is light yellow brown sand to 60 inches or more.

Permeability of the Unnamed Forty One soil is rapid. Present vegetative composition is needle and thread grass, alkali sacaton, greasewood and nuttall saltbush. Effective rooting depth is 60 or more inches. Water erosion hazard is moderate. Wind erosion is slight.

These soils are used for range and wildlife habitat.

#42

Unnamed Thirty Nine - Badland Complex, 5 to 15 percent slopes

This map unit is on upland foothills and breaks. The native vegetation is mainly spareflowered rockcress, saltbush and onion. Elevation is 6500 to 7200 feet. The annual precipitation is about 8 to 9 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 55 percent Unnamed Thirty Nine soil and 30 percent Badland. Unnamed Thirty Nine soil is on uplands, Badland is on breaks.

Included in this unit is about 15 percent Unnamed Forty One soil on uplands.

The Unnamed Thirty Nine soil is shallow and well-drained. It formed in residuum and eolian material derived dominantly from sandstone and shale. It is on smooth to slightly undulating short slopes. Typically the surface layer is pale brown sandy clay loam about 2 inches thick. The underlying material is shale at about 12 inches.

Permeability of the Unnamed Thirty Nine soil is moderately slow. Present vegetative composition is bud sagewort, nuttall saltbush and wild onion. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

The Badland is muscellaneous land type.

This map unit is used for range and wildlife habitat. The suitability for range is limited by low productivity.

#43

Unnamed Thirty Seven - Unnamed Forty One Complex, 3 to 9 percent slopes

This map unit is on floodplains and foothills. The native vegetation is mainly needle and thread, western wheatgrass, big sagebrush, spiny hopsage, nuttall saltbush, greasewood and alkali sacaton. Elevation is 6500 to 7200 feet. The annual precipitation is about 7 to 9 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 40 percent Unnamed Thirty Seven soil and 40 percent Unnamed Forty One soil. Unnamed Thirty Seven soil is on foothills, Unnamed Forty One soil is on floodplains.

Included in this unit are about 10 percent Unnamed Thirty Nine soil on foothills and 10 percent Badland.

The Unnamed Thirty Seven soil is deep and well-drained. It formed in eolian material derived dominantly from sandstone. It is on slightly undulating short slopes. Typically the surface layer is light brownish gray loamy sand about 4 inches thick. The subsoil is light yellowish brown sandy loam. The substratum material is light brownish gray loamy sand to 30 inches and light gray silt loam to 50 or more inches.

Permeability of the Unnamed Thirty Seven soil is moderate. Present vegetative composition is needle and thread, big sagebrush, spiny hopsage and western wheatgrass. Effective rooting depth is 60 or more inches. Water erosion hazard is moderate. Wind erosion hazard is slight.

The Unnamed Forty One soil is deep and well-drained. It formed in alluvium and eolian material derived dominantly from sandstone. It is on smooth convex to slightly undulating short slopes. Typically the surface layer is light yellowish brown loamy sand about 3 inches thick. The underlying material is light yellowish brown sand to 60 inches or more.

Permeability of the Unnamed Forty One soil is rapid. Present vegetative composition is needle and thread, alkali sacaton, greasewood and nuttall saltbush. Effective rooting depth is 60 inches or more. Water erosion hazard is severe. Wind erosion hazard is slight.

These soils are used for range and wildlife habitat.

#44

Unnamed Forty Two - Unnamed Forty Three Complex, 0 to 5 percent slopes

This map unit is on foothills. The native vegetation is mainly big sagebrush and bottlebrush squirreltail. Elevation is 6500 to 7300 feet. The annual precipitation is about 7 to 9 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 70 percent Unnamed Forty Two soil and 30 percent Unnamed Forty Three soil. Unnamed Forty Two soil is on upland plains and swales, Unnamed Forty Three soil is on crests.

The Unnamed Forty Two soil is deep and well-drained. It is on smooth convex to slightly concave medium slopes. Typically the surface layer is light yellowish brown silt loam about 4 inches thick. The subsoil is very pale brown silty clay loam about 8 inches thick. The substratum material is light gray and very pale brown silt loam to 60 inches or more.

Permeability of the Unnamed Forty Two soil is moderate. Present vegetative composition is big sagebrush, bottlebrush squirreltail and thickspike wheatgrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Forty Three soil is shallow and well-drained. It formed in residuum derived dominantly from shale. It is on smooth convex short slopes. Typically the surface layer is light gray silt loam about 3 inches thick. The underlying material is very pale brown silt loam about 13 inches thick. The substratum material is shale.

Permeability of the Unnamed Forty Three soil is moderate. Present vegetative composition is winterfat and western wheatgrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

These soils are used for range and wildlife habitat.

#45

Unnamed Forty Two silt loam, 0 to 2 percent slopes

This Unnamed Forty Two soil is deep and well-drained. It is formed in residuum derived predominantly from mixed rocks. The native vegetation is mainly big sagebrush, bottlebrush squirreltail and thickspike wheatgrass. Elevation is 6500 to 7300 feet. The annual precipitation is about 7 to 9 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

Unnamed Forty Two soils are on smooth to concave slopes. Typically the surface layer is light yellowish brown silt loam about 4 inches thick. The subsoil is very pale brown silty clay loam about 8 inches thick. The substratum material is light gray and very pale brown silt loam to 60 inches or more.

Included in this unit are small areas of Unnamed Thirty Six soils on floodplains. Included areas make up about 5 percent of the total acreage.

Permeability of this Unnamed Forty Two soil is moderately slow to 12 inches and moderate below. Effective rooting depth is 60 inches or more and the hazard of water erosion is slight.

This soil is used for range and wildlife habitat.

#47

Unnamed Ten - Unnamed Eleven - Unnamed Forty Four Complex, 15 to 50 percent slopes

This map unit is on mountain ridges summits and sideslopes. The native vegetation is mainly big sagebrush, Idaho fescue, prairie junegrass, sandberg bluegrass, mutton bluegrass, western wheatgrass, bluebunch wheatgrass and phlox. Elevation is 8200 to 9500 feet. The annual precipitation is about 16 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 30 percent Unnamed Ten soil and 30 percent Unnamed Eleven soil and 20 percent Unnamed Forty Four soil. Unnamed Ten soil is on summits, Unnamed Eleven soil is on sideslopes, Unnamed Forty Four soil is on crests.

Included in this unit are about 5 percent Unnamed Two soil on sideslopes, 5 percent loamy-skeletal, mixed (calc), Typic Cryorthents on crests, 5 percent Rock Outcrop and 5 percent loamy, mixed, Lithic Cryoboralfs on benches that support conifer.

The Unnamed Ten soil is deep and well-drained. It formed in residuum derived dominantly from mixed rocks. It is on smooth convex to slightly concave medium slopes. Typically the surface layer is dark reddish brown very fine sandy loam about 4 inches thick. The subsoil is dark reddish brown cobbly silt loam to 10 inches, reddish brown cobbly clay loam to 19 inches and reddish brown clay loam to 30 inches. The substratum material is light reddish brown clay loam.

Permeability of the Unnamed Ten soil is moderately slow. Coarse fragments are 10 to 30 percent, mainly cobble with some gravel and a trace of surface stones. Present vegetative composition is big sagebrush, Idaho fescue and prairie junegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Eleven soil is deep and well-drained. It formed in gravelly residuum derived predominantly from mixed rocks. It is on convex to slightly concave summits and sideslopes. Typically the surface layer is dark brown very gravelly sandy clay loam about 3 inches thick. The subsoil is dark brown very gravelly sandy clay loam to 8 inches and yellowish brown very gravelly sandy clay loam to 15 inches. The substratum material is light brownish gray and yellow sandy clay loam.

Permeability of the Unnamed Eleven soil is moderate. Coarse fragments are 35 to 60 percent, mainly gravel with some cobble. Present vegetative composition is big sagebrush, Idaho fescue, and sandberg bluegrass. Effective rooting depth is 60 inches or more. Water erosion hazard is slight.

The Unnamed Forty Four soil is shallow and well-drained. It formed in residuum derived predominantly from sandstone and quartzite. It is on smooth convex short slopes. Typically the surface layer is dark brown very gravelly loam about 4 inches thick. The underlying material is brown very gravelly loam about 8 inches thick. The substratum material is sandstone.

Permeability of the Unnamed Forty Four soil is moderately rapid. Coarse fragments are 35 to 50 percent, mainly gravel and cobble with some stones. Present vegetative composition is western wheatgrass,

bluebunch wheatgrass, phlox and mutton bluegrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is slight.

This soil is used for range and wildlife habitat. The suitability for range is limited by steep slopes.

#48

Unnamed Forty Four - Unnamed Twenty Seven Complex, 5 to 30 percent slopes

This map unit is on mountain summits shoulders and crests. The native vegetation is mainly western wheatgrass, bluebunch wheatgrass, phlox, mutton bluegrass, big sagebrush, Idaho fescue and prairie junegrass. Elevation is 8200 to 9500 feet. The annual precipitation is about 18 to 20 inches, the average annual air temperature is 32 to 36 degrees F and the frost-free season is 22 to 28 days.

This unit is 45 percent Unnamed Forty Four soil and 40 percent Unnamed Twenty Seven soil. Unnamed Forty Four soil is on crests, Unnamed Twenty Seven soil is on summits and shoulders. Included in this unit is about 15 percent Rock Outcrop.

The Unnamed Forty Four soil is shallow and well-drained. It formed in residuum derived dominantly from sandstone. It is on smooth convex short slopes. Typically the surface layer is dark brown gravelly

loam about 4 inches thick. The underlying material is brown very gravelly loam about 8 inches thick. The substratum material is sandstone.

Permeability of the Unnamed Forty Four soil is moderate. Coarse fragments are 35 to 50 percent, mainly gravel and cobble with some stones. Present vegetative composition is western wheatgrass, bluebunch wheatgrass, phlox and mutton bluebrass. Effective rooting depth is 10 to 20 inches. Water erosion hazard is moderate.

The Unnamed Twenty Seven soil is deep and well-drained. It formed in residuum derived dominantly from shale. It is on smooth convex to slightly concave medium slopes. Typically the surface layer is very dark grayish brown gravelly loam about 8 inches thick. The underlying material is yellowish brown loam.

Permeability of the Unnamed Twenty Seven soil is moderate. Coarse fragments are 0 to 15 percent, mainly gravel and cobble. Present vegetative composition is big sagebrush, Idaho fescue and prairie junegrass. Effective rooting depth is 40 to 60 inches. Water erosion hazard is moderate.

These soils are used for range and wildlife habitat.

APPENDIX A3

MAPPING UNIT DESCRIPTIONS - FS SURVEY AREA

(In Numerical Order by Map Symbol)

(Source: USDA Forest Service 1979.)

ERT has used the VIEWIT computerized slope map (see Map 1-3 in the Map Pocket) to supplement FS map units in determining rehabilitiation units and other interpretations. See Table 1-6 for slope ranges for different soil phases.

MAP UNIT 103

GENERAL CHARACTERISTIC: This unit has very gently undulating topography often containing many wet draws.

GEOLOGY: Fanglomerate or till, and alluvium that mantles mixed sedimentary rocks.

GEOMORPHOLOGY: Gently undulating basin-like lands that have received deposition from surrounding lands.

TOPOGRAPHY:

Slope (percent):	0-25
Aspect:	All
Elevation (feet):	7,000-8,500 feet

PRECIPITATION: 30-60 inches

VEGETATION: This unit is a mosaic of Big sagebrush/grass and forb/grass communities on the dry sites, and sedge and willow/sedge communities on the wet sites.

SOILS

Comp.	Classification	Prop.	Location
	Argic Cryoboroll, loamy-skeletal, mixed	40%	These 2 soils are
6Ee	Argic Pachic Cryoboroll, fine-loamy, mixed	40%	intermixed on dry sites.
6Ge	Pachic Cryoboroll, fine-loamy, mixed (Wet phase)	20%	Wet sites

INCLUSIONS: Pachic Cryoborolls, fine-loamy, mixed; Typic Cryoborolls, loamy-skeletal, mixed; Mollic Cryoboralfs, fine, montmorillonitic.

BRIEF SOIL DESCRIPTIONS

Soil 6Db: These are deep, well-drained soils. Textures range from sandy loam to clay loam. They are well-developed and reaction ranges from neutral to moderately alkaline. Rock fragments range from 35-70 percent.

Soil 6Ee: These are deep, well-drained soils. Textures range from sandy loam to clay loam. The dark colored surface horizon is a least 16 inches thick. Reaction is neutral to moderately alkaline. Rock fragments make up less than 35 percent of the soil.

Soil 6Ge: These are deep, somewhat poorly-drained soils that have a watertable within a few feet of the surface. Textures range from sandy loam to clay loam and rock fragments make up less that 35 percent of the soil.

MAP UNIT 106

GENERAL CHARACTERISTIC: This unit consists of the relatively flat bottomlands of many major streams.

GEOLOGY: Alluvium

GEOMORPHOLOGY: Bottomland

TOPOGRAPHY:

Slope (percent):	0-5
Aspect:	All
Elevation (feet):	8,000-8,500

PRECIPITATION:

VEGETATION: This unit is 80 percent willow-sedge communities and 20 percent sage-grass-forb communities.

SOILS

Comp.	Classification	Prop.	Location
6Ae	Typic Cryaquoll, coarse-loamy, mixed	60%	These 2 soils are
3Fo	Typic Cryofluvent, sandy-skeletal, mixed (calcareous)	40%	intermixed.

INCLUSIONS: Cumulic Cryaquolls, of fine-loamy, coarse-loamy and sandy-skeletal, mixed families; Typic Cryaquolls, of loamy-skeletal, and fine-loamy, mixed families; Typic Cryborolls, of loamy-skeletal, coarse-loamy sandy-skeletal, and fine-loamy, mixed families; Argiaquic Cryoborolls, clayey-skeletal, montmorillonitic.

BRIEF SOIL DESCRIPTIONS

Soil 6Ae: This is a dark colored wet soil. Textures range from sandy-loam to silt loam. There are very few gravels in the upper 2 feet of soil, but gravel may occur at greater depths. Reaction is mildly alkaline.

Soil 3Fo: This is a coarse-textured, poorly-drained soil. It is relatively undeveloped. Textures range from loam to sand. Coarse fragments vary in volume from 35-85 percent.

MAP UNIT 107

GENERAL CHARACTERISTIC: These are the nearly level, sagebrush terraces that occur along many major rivers.

GEOLOGY: Alluvium

GEOMORPHOLOGY: Terrace

TOPOGRAPHY:

Slope (percent):	0-5
Aspect:	All
Elevation (feet):	8,000-9,000

PRECIPITATION: 25-40 inches

VEGETATION: 80% Big sagebrush-forb-grass plant community with 20% scattered conifer stands.

SOILS

Comp.	Classification	Prop.	Location
6Bb	Typic Cryoboroll, loamy-skeletal, mixed	40%	These soils are
6De	Argic Cryoboroll, fine-loamy, mixed	60%	intermixed.

INCLUSIONS: Included in the mapping unit are soils that have characteristics similar to the principal components or are intergrades between them. They include:

1. Pachic Cryoborolls, loamy-skeletal, mixed
2. Typic Cryochrepts, loamy-skeletal, mixed
3. Argic Pachic Cryoborolls, fine-loamy, mixed

BRIEF SOIL DESCRIPTIONS

Soil 6Bb: These soils are generally deep and well-drained. Textures range from silt loam to sandy loam. Coarse fragments range in volume from 35-85 percent. The depth to continuous gravel ranges from less than 16 inches to greater than 40 inches.

Soil 6De: These soils are generally deep and well-drained. Textures range from loam to clay loam. Coarse fragments range in volume from 0-35 percent.

MAP UNIT 120

GENERAL CHARACTERISTIC: These are alluvial fans that occur on toeslopes.

GEOLOGY: Alluvium and colluvium

GEOMORPHOLOGY: Alluvial Fan

TOPOGRAPHY:

Slope (percent):	0-20
Aspect:	All
Elevation (feet):	8,000-9,000

PRECIPITATION: 25-40 inches

VEGETATION: This is a unit of rangeland consisting of Big sage-forb-grass communities.

SOILS

Comp.	Classification	Prop.	Location
6Db	Argic Cryoboroll, loamy-skeletal, mixed	60%	These soils are
3Dk	Typic Cryorthent, coarse-loamy, mixed (calcareous)	40%	intermixed.

INCLUSIONS: Typic Cryoborolls, loamy-skeletal, mixed; Mollic Cryoboralfs, clayey-skeletal, montmorillonitic.

BRIEF SOIL DESCRIPTIONS

Soil 6Db: These are deep, medium-textured soils. They are well-developed. Rock fragments range from 35-70 percent of the soil.

Soil 3Dk: These are deep, calcareous soils. Textures range from sandy loam to clay loam. Coarse fragments vary in volume from 0-35 percent.

MAP UNIT 124

GENERAL CHARACTERISTIC: These are rolling or hummocky lands that support rangeland vegetation.

GEOLOGY: Glacial Till

GEOMORPHOLOGY: Glacial Moraines

TOPOGRAPHY:

Slope (percent):	10-30
Aspect:	All
Elevation (feet):	8,000-9,000 feet

PRECIPITATION: 30-40 inches

VEGETATION: Big sage/silvic sage-forb-grass communities dominate the deeper, more developed soils with forb-grass communities on the shallower soils on the ridge tops.

SOILS

Comp.	Classification	Prop.	Location
6Bb	Typic Cryoboroll, loamy-skeletal, mixed	60%	Ridges
6C	Pachic Cryoboroll, loamy-skeletal, mixed	40%	Basins

INCLUSIONS: Typic Cryorthents, loamy-skeletal; Typic Cryoborolls, loamy-skeletal.

BRIEF SOIL DESCRIPTIONS

Soil 6Bb: These soils are moderately deep and well-drained. Texture ranges from silt loam to sandy loam. Coarse fragments range in volume from 5-80 percent.

Soil 6Gb: These are deep, gravelly and cobbly soils. They are dark and texture ranges from loam to sandy loam. Coarse fragments range in volume from 35-70 percent.

MAP UNIT 154

GENERAL CHARACTERISTIC: These are rolling, heavily timbered lands.

GEOLOGY: Glacial till and colluvium

GEOMORPHOLOGY: Glacial till and colluvial deposits

TOPOGRAPHY:

Slope (percent):	10-40
Aspect:	Easterly
Elevation (feet):	9,000-9,500

PRECIPITATION: 30-50 inches

VEGETATION: This is a forested unit.

SOILS

Comp.	Classification	Prop.	Location
1Bb	Mollic Cryoboralf, loamy-skeletal, mixed	45%	These soils are
1Be	Mollic Cryoboralf, fine-loamy, mixed	35%	intermixed.
1Bg	Mollic Cryoboralf, fine, montmorillonitic	20%	

INCLUSIONS: Included in the unit are soils with more coarse fragments, and other soils with high clay contents. Mollic Cryoboralfs, clayey-skeletal, montmorillonitic; Typic Cryoboralfs, of the loamy-skeletal, and fine-loamy, mixed families, and fine, montmorillonitic family; Argic Cryoboroll, loamy-skeletal, mixed; Typic Cryoboroll, loamy-skeletal, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 1Bb: This is a deep, well-drained soil. Textures range from light loams to clay loams. Coarse fragments range from 35-70 percent. Reaction varies from medium and to moderately alkaline.

Soil 1Be: The textures in this soil range from silt loam to clay loam. They are deep. Coarse fragments range from 0-35 percent by volume.

Soil 1Bg: This is a deep, medium to strongly acid soil. Surface texture ranges from loam to silty clay loam and subsurface texture from sandy clay loam to silty clay. Coarse fragments range in volume from 10-30 percent.

MAP UNIT 200

GENERAL CHARACTERISTIC: Heavily timbered lands with benchy or gentle topography.

GEOLOGY: Conglomerate, sandstone, siltstone, mudstone.

GEOMORPHOLOGY: Very weakly dissected slopes

TOPOGRAPHY:

Slope (percent):	10-45
Aspect:	All
Elevation (feet):	8,000-9,000

PRECIPITATION: 25-40 inches

VEGETATION: Conifer

SOILS

Comp.	Classification	Prop.	Location
1Ab	Typic Cryoboralf, loamy-skeletal, mixed	70%	These soils are
1Ae	Typic Cryoboralf, fine-loamy, mixed	30%	intermixed.

INCLUSIONS:

BRIEF SOIL DESCRIPTIONS

Soil 1Ab: Surface texture ranges from loam to sandy loam. Subsurface textures range from sandy loam to clay loam. Coarse fragments range from 35-60 percent. These are deep soils.

Soil 1Ae: These are deep soils. Surface textures range from loam to silt loam. Subsurface textures range from silt loam to clay loam. Coarse fragments range from 0-35 percent.

MAP UNIT 203

GENERAL CHARACTERISTIC: Open ridgetops.

GEOLOGY: Mostly Wasatch formation, conglomerate, sandstone, siltstone, mudstone.

GEOMORPHOLOGY: Weakly dissected ridgetops.

TOPOGRAPHY:

Slope (percent):	5-50
Aspect:	Easterly
Elevation (feet):	8,000-9,500

PRECIPITATION: 25-40 inches

VEGETATION: Approximately 50% is grass and very scattered sagebrush with the other 50% Big sagebrush.

SOILS

Comp.	Classification	Prop.	Location
6De	Argic Cryoborolls, fine-loamy, mixed	35%	These 2 soils
6Dg	Argic Cryoborolls, fine, montmorillonitic	45%	are intermixed.
3Dm	Typic Cryorthents, loamy, mixed calcareous), shallow	20%	Shallow ridgetops

INCLUSIONS:

BRIEF SOIL DESCRIPTIONS

Soil 6De: These soils are deep and well-drained. Textures range from loam to clay loam and coarse fragments from 0-35 percent by volume. They are moderately alkaline.

Soil 6Dg: These are deep, fine-textured soils. Reaction ranges from strongly acid to moderately alkaline. Texture of the subsoil ranges from silty clay loam to clay. Coarse fragments range from 0-35 percent by volume.

Soil 3Dm: These are shallow, calcareous soils. Textures are loamy and coarse fragments are less than 35 percent of the soil by volume. They are moderately alkaline.

MAP UNIT 220

GENERAL CHARACTERISTIC: These lands are on north aspects along drainages and are dominantly conifer covered.

GEOLOGY: Wasatch formation, conglomerate, sandstone, mudstone, siltstone.

GEOMORPHOLOGY: These are north aspects along major stream dissections.

TOPOGRAPHY:

Slope (percent):	10-45
Aspect:	Dominantly North
Elevation (feet):	8,000-9,500

PRECIPITATION: 25-40 inches

VEGETATION: This is a forested unit, dominantly lodgepole pine.

SOILS

Comp.	Classification	Prop.	Location
1Be	Mollic Cryoboralf, fine-loamy, mixed	40%	These soils are
1Ab	Typic Cryoboralf, loamy-skeletal, mixed	35%	intermixed.
1Bc	Mollic Cryoboralf, clayey-skeletal, montmorillonitic	25%	

INCLUSIONS: Mollic Cryoboralf, loamy-skeletal, mixed; Typic Cryochrept, loamy-skeletal, mixed; Argic Cryoboroll, clayey-skeletal, montmorillonitic; Typic Cryoboroll, fine, montmorillonitic.

BRIEF SOIL DESCRIPTIONS

Soil 1Be: The textures in this soil range from silt loam to clay loam. They are deep and red colored. Coarse fragments range from 0-35 percent by volume.

Soil 1Ab: Surface textures range from loam to sandy loam and subsurface textures from sandy loam to clay loam. Coarse fragments range from 35-60 percent. These are deep soils and range from moderately acid to mildly alkaline.

Soil 1Bc: These are deep, gravelly soils. Textures are heavy, ranging from loam to clay. The clay has a high shrink-swell potential. Coarse fragments range in volume from 35-70 percent. They are reddish in color.

MAP UNIT 221

GENERAL CHARACTERISTIC: These lands are moderately sloping south aspects along drainages. These slopes are smooth.

GEOLOGY: Wasatch formation, conglomerate, sandstone, siltstone, mudstone.

GEOMORPHOLOGY: These are south aspects along major stream dissections.

TOPOGRAPHY:

Slope (percent):	10-45
Aspect:	South
Elevation (feet):	8,000-9,500

PRECIPITATION: 25-40 inches

VEGETATION: 60% of the unit is conifer with scattered aspen and 40% is sagebrush.

SOILS

Comp.	Classification	Prop.	Location
6Db	Argic Cryoboroll, loamy-skeletal, mixed	45%	Rangeland sites
1Be	Mollic Cryoboralf, fine-loamy, mixed	35%	Forested sites
6Ee	Argic Pachic Cryoboroll, fine-loamy, mixed	20%	Rangeland and aspen sites

INCLUSIONS: Argic Cryoboroll, fine-loamy, mixed; Typic Cryoborolls, loamy-skeletal, mixed; Typic Cryoboralfs, of the fine-loamy and loamy-skeletal, mixed families; Mollic Paleboralfs, fine-loamy, mixed; Typic Cryochrept, loamy-skeletal, mixed; Typic Cryorthents, loamy, mixed (calcareous), shallow.

BRIEF SOIL DESCRIPTIONS

Soil 6Db: These are deep soils. Textures range from sandy loam to clay loam. They are well-developed and range from neutral to moderately alkaline in reaction. Rock fragments range from 35-70 percent of the soil. They are reddish in color.

Soil 1Be: The textures in this soil range from silt loam to clay loam. They are deep and red colored. Coarse fragments range from 0-35 percent by volume.

Soil 6Ee: These are deep, well-drained soils. Surface textures range from loam to clay loam and subsurface textures from heavy loam to clay loam. Coarse fragments vary in volume from 0-35 percent.

MAP UNIT 255

GENERAL CHARACTERISTIC: These are steep timbered north aspects. The slopes are usually short.

GEOLOGY: Blind Bull formation interbedded conglomoritic sandstone, siltstone, and shale. Hilliaid shale. Glacial till.

GEOMORPHOLOGY: Weakly dissected mountain slopes often mantled with glacial till.

TOPOGRAPHY:

Slope (percent):	30-50
Aspect:	Northerly
Elevation (feet):	8200-8700

PRECIPITATION: 30-40 inches

VEGETATION: This is a forested unit of mixed conifer.

SOILS

Comp.	Classification	Prop.	Location
1Ab	Typic Cryoboralf, loamy-skeletal, mixed	50%	These soils are intermixed
1Bb	Mollic Cryoboralf, loamy-skeletal, mixed	50%	

INCLUSIONS: Included in the unit are similar soils with finer textures. Typic Cryoboralf, fine, mixed; Typic Cryoboralf, fine-loamy, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 1Ab: Surface texture in this soil ranges from loam to sandy loam and subsurface textures from sandy loam to clay loam. Coarse fragments range from 35 to 60 percent. These are deep soils.

Soil 1Bb: This is a deep, well drained soil. Textures range from light loams to clay loams. Coarse fragments range from 35 to 70 percent. Reaction varies from medium acid to moderately allcaline.

MAP UNIT 355

GENERAL CHARACTERISTIC: These are steep escarpment-like slopes.

GEOLOGY: Jurassic silty claystone, stump sandstone. Twin Creek limestone, sandy siltstone. Aspen formation shale.

GEOMORPHOLOGY: Moderately dissected escarpment-like slopes.

TOPOGRAPHY:

Slope (percent):	30-75
Aspect:	south and east
Elevation (feet):	6500-8500

PRECIPITATION: 20-40 inches

VEGETATION: 80 percent of the unit is big sagebrush-grass. The remainder is conifer.

SOILS

Comp.	Classification	Prop.	Location
6Gb	Pachic Cryoborolls, loamy-skeletal, mixed	30	These soils are intermixed
3El	Lithic Cryorthants, loamy-skeletal, mixed (calc.)	35	
6Fb	Lithic Cryoborolls, loamy-skeletal, mixed	35	

INCLUSIONS: Included are deeper, more well developed soils and other shallow soils. Typic Cryoborolls, loamy-skeletal, mixed shallow; Typic Cryorthents, loamy-skeletal, mixed (calc.), shallow; Argic Pachic Cryoborolls, loamy-skeletal, mixed; Typic Cryoboralfs, fine, montmorillionitic.

BRIEF SOIL DESCRIPTIONS

Soil 6Gb: These are deep gravelly and cobbly soils. They are dark and texture ranges from loam to sandy loam. Coarse fragments range in volume from 35 to 70 percent.

Soil 3El: These are shallow, gravelly soils. Texture ranges from loam to clay loam. Coarse fragments vary in volume from 40 to 50 percent.

Soil 6Fb: These soils are shallow with many rock fragments. Textures range from sandy loam to clay loam. Coarse fragments vary in volume from 35 to 80 percent. Depth to bedrock ranges from 6 to 20 inches.

MAP UNIT 360

GENERAL CHARACTERISTIC: Forested lands with broken topography.

GEOLOGY: limestone, sandstone, shale

GEOMORPHOLOGY: Moderately dissected, steep mountain slope land.

TOPOGRAPHY:

Slope (percent):	20-60
Aspect:	All
Elevation (feet):	8000-9500

PRECIPITATION: 30-40 inches

VEGETATION: Cconiferous forest.

SOILS

Comp.	Classification	Prop.	Location
1Ab	Typic Cryoboralf, loamy-skeletal, mixed	50%	These soils are intermixed
5Bb	Typic Cryochrept, loamy-skeletal, mixed	50%	

INCLUSIONS: Typic Cryochrepts, loamy-skeletal; Typic Cryoboralfs, fine, montmorillionitic; Mollic Cryoboralfs, clayey-skeletal.

BRIEF SOIL DESCRIPTIONS

Soil 1Ab: Surface texture ranges from loam to sandy loam and subsurface textures range from sandy loam to clay loam. Coarse fragments range from 35 to 60 percent. These are deep soils and range from moderately alkaline to moderately acid in reaction.

Soil 5Bb: These soils are deep and well drained. Textures range from sandy loam to silt loam. Coarse fragments range in volume from 35 to 70 percent.

MAP UNIT 391

GENERAL CHARACTERISTIC: Steep conifer covered north aspects.

GEOLOGY: Mixed sedimentary rocks dominated by sandstone, limestone, siltstone and shale.

GEOMORPHOLOGY: Moderately dissected, steep, mountain slopes.

TOPOGRAPHY:

Slope (percent):	30-65
Aspect:	northerly
Elevation (feet):	8,500-10,000

PRECIPITATION: 40-50 inches

VEGETATION: Coniferous forest.

SOILS

Comp.	Classification	Prop.	Location
1Ab	Typic Cryoboralf, loamy-skeletal, mixed	50%	These soils are intermixed.
3Db	Typic Cryorthent, loamy-skeletal, mixed	50%	

INCLUSIONS: Included are a variety of closely related soils. Mollic Cryoboralfs, of the fine-loamy, loamy-skeletal, and clayey skeletal, mixed families; Typic Cryoboralfs, of the fine and loamy-skeletal and fine-loamy, mixed families; Argic Cryoborolls, loamy-skeletal, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 1Ab: Surface texture in this soil ranges from loam to sandy loam and subsurface textures from sandy loam to clay loam. Coarse fragments range from 35 to 60 percent. These are deep soils and range from moderately acid to mildly alkaline.

Soil 3Db: These soils are moderately deep and very gravelly. Textures are loamy. They are strongly acid. Coarse fragments range in volume from 35 to 85 percent.

MAP UNIT 492

GENERAL CHARACTERISTIC: These lands consist of long steep mountain slopes with deep, V-shaped drainages. They are covered with open or patchy forest vegetation.

GEOLOGY: Limestone, sandstone, siltstone, and shale.

GEOMORPHOLOGY: Strongly dissected mountain slopes.

TOPOGRAPHY:

Slope (percent):	30-90
Aspect:	All
Elevation (feet):	9,000-10,200

PRECIPITATION: 40-50 inches

VEGETATION: 75% of the unit is mixed winter with 25% in rangeland communities.

SOILS

Comp.	Classification	Prop.	Location
5Bb	Typic Cryochrept, loamy-skeletal, mixed	50%	denser forest sites
[illegible]	Pachic Cryoboroll, loamy-skeletal, mixed	30%	open forest or rangeland
[illegible]	Lithic Cryoboroll, loamy-skeletal, mixed	20%	shallow sites

INCLUSIONS: Included are other dark soils and soils with more development. Mollic Cryoboralfs, loamy-skeletal, mixed; Typic Cryoboralfs, loam-skeletal, mixed; Lithic Cryoboralfs, loamy-skeletal, mixed; Typic Cryoborolls, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed; Argic Pachic Cryoborolls, loamy-skeletal, mixed; rock outcrop.

BRIEF SOIL DESCRIPTIONS

Soil 5Bb: These soils are deep and well drained. Textures range from sandy loam to loam. Coarse fragments range in volume from 35 to 70 percent.

Soil 6Gb: These are deep, gravelly, and cobbly soils. They are dark and texture ranges from loam to sandy loam. Coarse fragments range in volume from 35 to 70 percent.

Soil 6Fb: These soils are shallow with many rock fragments. Textures range from sandy loam to clay loam. Coarse fragments range in volume from 35 to 80 percent. Depth to bedrock ranges from 6 to 20 inches.

MAP UNIT 502

GENERAL CHARACTERISTIC: Rocky high elevation glaciated mountain slopes and cirques.

GEOLOGY: Limestone, dolomite, sandstone, siltstone.

GEOMORPHOLOGY: Dominately glaciated mountain slopes and cirques. Includes both strong and week glaciation.

TOPOGRAPHY:

Slope (percent):	40-100
Aspect:	All
Elevation (feet):	9,000-11,000

PRECIPITATION: 40-60 inches

VEGETATION: 60 percent of the unit is forb-grass with very scattered conifer on the lower parts. The remainder of the unit is barren rock outcrop and talus.

SOILS

Comp.	Classification	Prop.	Location
6[illegible]	Typic Cryoboroll, loamy-skeletal, mixed	30%)	
6	Lithic Cryoborolls, loamy-skeletal, mixed	30%)	These soils are intermixed.
	Talus & Rock Outcrop	40%)	

INCLUSIONS: Lithic Cryorthents, loamy-skeletal, mixed (calc.); Typic Cryorthents, loamy-skeletal, mixed (calc.); Typic Cryoborolls, coarse-loamy, mixed; Typic Cryoborolls, fine-loamy, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 6Bb: These soils are deep and well drained. Texture ranges from sandy loam to clay loam. Coarse fragments range in volume from 35-80 percent.

Soil 6Fb: These soils are shallow and very gravelly. Textures range from sandy loam to clay loam. Coarse fragments range in volume from 35 to 80 percent. Depth to bedrock is 6 to 20 inches.

MAP UNIT 650

GENERAL CHARACTERISTIC: This unit has patchy timber cover, is on south aspects, and has scattered landslides.

GEOLOGY: Sandstone, siltstone, and shale.

GEOMORPHOLOGY:

TOPOGRAPHY: Slope (percent): 10-50
Aspect: south
Elevation (feet): 6500-9000

PRECIPITATION: 20-50 inches

VEGETATION: The unit is 40 percent patchy and open conifer, 20 percent aspen, and 40 percent big sagebrush-grass and forb-grass communities.

SOILS

Comp.	Classification	Prop.	Location
6Dg	Argic Cryoboroll, fine, montmorillonitic	60%	These soils are intermixed
6Gb	Pachic Cryoboroll, loamy-skeletal, mixed	40%	

INCLUSIONS: Typic Cryoborolls, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed; Argic Cryoborolls, fine-loamy, mixed; Mollic Cryoboralfs, fine, montmorillonitic; Typic Cryoboralfs, fine-loamy, mixed; Aquic Cryoboralfs, fine, montmorillonitic; Argic Pachic Cryoborolls, fine, montmorillonitic.

BRIEF SOIL DESCRIPTIONS

Soil 6Dg: These are deep fine textured soils. Reaction ranges from strongly acid to moderately alkaline. Texture of the control section ranges from silty clay loam to clay. Coarse frequenty range from 0 to 35 percent by volume.

Soil 6Gb: These are deep, gravelly and cobbly soils. They are dark and texture ranges from loam to sandy loam. Coarse fragments range in volume from 35 to 70 percent.

MAP UNIT 660

GENERAL CHARACTERISTIC: This unit is made up of steep, forested slopes containing numerous debris flows, landslides, and avalanche chutes.

GEOLOGY: Described primarily as rock debris and hill wash.

GEOMORPHOLOGY: Debris flow and colluvial deposits at the base of very steep slopes.

TOPOGRAPHY:

Slope (percent):	20-60
Aspect:	Easterly
Elevation (feet):	8,500-9,500

PRECIPITATION: 40-50 inches

VEGETATION: 70% cover of mixed conifer with high proportion of Douglas fir. The remainder is open avalanche paths.

SOILS

Comp.	Classification.	Prop.	Location
1Bb	Mollic Cryoboralf, loamy-skeletal, mixed	50%	These soils are
6Bb	Typic Cryoboroll, loamy-skeletal, mixed	25%	intermixed.
5	Typic Cryochrept, loamy-skeletal, mixed	25%	

INCLUSIONS: Mollic Cryoboralfs, fine, montmorillonitic; Argic Pachic Cryoborolls, fine-loamy, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 1Bb: These are deep, gravelly soils. Textures range from light loams to clay loams. Coarse fragments range from 35-70 percent. Reaction varies from medium acid to moderately alkaline.

Soil 6Bb: These soils are deep and well-drained. Texture ranges from silt loam to sandy loam. Coarse fragments range from 35-80 percent by volume.

Soil 5Bb: These soils are deep and well-drained. Texture ranges from sandy loam to silt loam. Coarse fragments range in volume from 35-70 percent.

MAP UNIT 675

GENERAL CHARACTERISTIC: These lands have a steep escarpment on the upper portion that breaks into rolling landslide deposits on the lower parts.

GEOLOGY: Cretaceous sandstone, siltstones and shales with some inclusions of Wasatch conglomerate colluvium.

GEOMORPHOLOGY: Landsliding with weak to moderate amount of dissection.

TOPOGRAPHY:

Slope (percent):	20-60
Aspect:	Westerly
Elevation (feet):	8000-9500

PRECIPITATION: 25-35 inches

VEGETATION: This unit has about 40 percent big sagebrush or forb-grass communities, 25 percent aspen and 35 percent conifer sites.

SOILS

Comp.	Classification	Prop.	Location
6D	Argic Cryoboroll, fine, montmorillionitic	40%	Range sites
1.	Mollic Cryoboralf, fine, montmorillionitic	30%	These soils are intermixed on forest and range sites
1Bb	Mollic Cryoboralf, loamy-skeletal, mixed	30%	

INCLUSIONS: Included are other soils with high clay contents, soils with clay accumulation and high organic matter. Typic Cryoboralfs, fine, montmorillonitic; Argic Cryoborolls, clayey-skeletal, montmorillonitic; Argic Cryoborolls, loamy-skeletal, mixed; Argic Cryoborolls, fine-loamy, mixed; Mollic Cryoboralfs, loamy-skeletal, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 6Dg: These are deep, fine textured soils. Reaction ranges from strongly acid to moderately alkaline. Texture of the control section ranges from silty clay loam to clay. Coarse fragments range from 0 to 35 percent by volume.

Soil 1Bg: This is a deep, medium to strongly acid soil. Surface texture ranges from loam to silty clay loam and the subsurface texture from sandy clay loam to silty clay. Coarse fragments range in volume from 10 to 30 percent.

Soil 1Ab: Surface texture in this soil ranges from loam to sandy loam and subsurface textures from sandy loam to clay loam. Coarse fragments range from 35 to 60 percent. These are deep soils.

MAP UNIT 701

GENERAL CHARACTERISTIC: This unit is a structurally controlled area of rolling ridges and trough topography. It is gently to moderately sloped with colluvium in the troughs.

GEOLOGY: Traissic shale, sandstone, and limestone.

GEOMORPHOLOGY: --

TOPOGRAPHY:

Slope (percent):	10-40
Aspect:	all
Elevation (feet):	7000-9000

PRECIPITATION: 25-45 inches

VEGETATION: This unit is 45 percent sage-grass, 30 percent conifer in open and scattered conifer stands, 20 percent dry grassland, and 5 percent aspen.

SOILS

Comp.	Classification	Prop.	Location
6Fb	Lithic Cryoboroll, loamy-skeletal, mixed	20%	Ridges
6	Argic Cryoboroll, fine-loamy, mixed	20%)	
6Dg	Argic Cryoboroll, fine, montmorillonitic	30%)	These soils are intermixed
6Bb	Typic Cryoboroll, loamy-skeletal, mixed	30%)	

INCLUSIONS: Included are soils with more rock frequents, and other finer textured soils. Typic Cryoboralfs, fine-loamy, mixed; Typic Cryoboralfs, loamy-skeletal, mixed; Typic Cryochrepts, loamy-skeletal, mixed; Lithic Cryorthents, loamy-skeletal, mixed; Pachic Cryoborolls, fine-loamy, mixed; Argic Pachic Cryoborolls, loamy-skeletal, mixed; Typic Cryoborolls, fine, montmorillonitic.

BRIEF SOIL DESCRIPTIONS

Soil 6Fb: These soils are shallow with many rock fragments. Textures range from sandy loam to clay loam. Coarse fragments vary in volume from 35 to 80 percent. Depth to bedrock ranges from 6 to 20 inches.

Soil 6De: These soils are deep and well drained. Textures range from loam to clay loam and coarse fragments from 0 to 35 percent by volume. They are moderately alkaline.

Soil 6Dg: These are deep, fine textured soils. Reaction ranges from strongly acid to moderately alkaline. Texture of the control section ranges from silty clay loam to clay. Coarse fragments range from 0 to 35 percent by volume.

Soil 6Bb: These soils are deep and well drained. Texture ranges from loam to clay loam. Coarse fragments range from 35 to 80 percent by volume.

MAP UNIT 702

GENERAL CHARACTERISTIC: This Dominately forested unit has dipping bedrocks that face west.

GEOLOGY: Steeply dipping mixed Cretaceous sediments.

GEOMORPHOLOGY: West facing dipslopes with weak to moderate dissection.

TOPOGRAPHY:

Slope (percent):	30-60
Aspect:	west
Elevation (feet):	8000-9500

PRECIPITATION: 30-40 inches

VEGETATION: Mixed conifer makes up 80 percent of the unit with scattered open ridges and aspen on the remainder of the area.

SOILS

Comp.	Classification	Prop.	Location
1Be	Mollic Cryoboralf, fine-loamy, mixed	40%)	
1Bb	Mollic Cryoboralf, loamy-skeletal, mixed	30%)	These soils are intermixed
5Bb	Typic Cryochrept, loamy-skeletal, mixed	30%)	

INCLUSIONS: Included are some shallow soils and other soils with clay accumulation including some with dark surface horizons. Lithic Cryorthents, loamy-skeletal, mixed; Mollic Cryoboralfs, clayey-skeletal, mixed; Typic Cryoboralfs, clayey-skeletal, montmorillonitic; Argic Cryoborolls, of the loamy-skeletal, clayey-skeletal, and fine, mixed families; Pachic Cryoborolls, coarse-loamy, mixed; Argic Lithic Cryoborolls, loamy-skeletal, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 1Be: The textures in this soil range from silt loam to clay loam. They are deep. Coarse fragments range in volume from 0 to 35 percent.

Soil 1Bb: These are deep, gravelly soils. Textures range from light loams to clay loams. Coarse fragments range from 35 to 70 percent. Reaction varies from medium acid to moderately alkaline.

Soil 5Bb: These soils are deep and well drained. Texture ranges from sandy loam to clay loam. Coarse fragments range in volume from 35 to 70 percent.

MAP UNIT 711

GENERAL CHARACTERISTIC: Parallel series of small ridges and drainages that slope northward into major stream drainages. Landslides occur in some drainages. Vegetation is coniferous forest.

GEOLOGY: Mixed Cretaceous sedimentary rocks.

GEOMORPHOLOGY: North facing aspects of intricate dip and escarpments structure that slopes north toward major stream dissections that are cut at right angles to the strike of the ridges. Landslides in some draws.

TOPOGRAPHY:

Slope (percent):	20-60
Aspect:	northerly
Elevation (feet):	8,000-10,000

PRECIPITATION: 25-40 inches

VEGETATION: Coniferous forest

SOILS

Comp.	Classification		Prop. Location
	Mollic Cryoboralf, clayey-skeletal, mont-morillonitic	40%)	
1Bb	Mollic Cryoboralf, loamy-skeletal, mixed	35%)	These soils are intermixed
1Ae	Typic Cryoboralf, fine-loamy, mixed	25%)	

INCLUSIONS: Included are similar soils with thick, dark surface horizons. Argic Pachic Cryoborolls, clayey-skeletal, montmorillonitic; Typic Cryoborolls, loamy-skeletal, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 1Bc: These are deep gravelly soils. Textures are heavy with fines ranging from loam to clay. The clay has a high shrink-swell potential. Coarse fragments range in volume from 35 to 70 percent.

Soil 1Bb: These are deep, gravelly soils. Textures range from light loams to clay loams. Coarse fragments range from 35 to 70 percent by volume. Reaction varies from medium acid to moderately alkaline.

Soil 1Ae: These are deep soils. Surface textures range from loam to silt loam and subsurface textures from silt loam to clay loam. Coarse fragments range from 0 to 35 percent.

MAP UNIT 712

GENERAL CHARACTERISTIC: Open ridgetops with shallow soils.

GEOLOGY: limestone, sandstone, shale

GEOMORPHOLOGY:

TOPOGRAPHY:

Slope (percent):	10-30
Aspect:	all
Elevation (feet):	8700-9200

PRECIPITATION: 25-40 inches

VEGETATION: dry grassland

SOILS

Comp.	Classification	Prop.	Location
3Eb	Lithic Cryorthents, loamy-skeletal, mixed	--	--

INCLUSIONS:

BRIEF SOIL DESCRIPTIONS

Soil 3Eb: These soils are shallow and very gravelly. Texture ranges from sandy loam to loam. Coarse fragments range from 35 to 70 percent. Depth to bedrock ranges from 6 to 20 inches.

MAP UNIT 713

GENERAL CHARACTERISTIC: Parallel series of ridges and drainages that slope steeply southward into major stream drainages. Vegetation is mostly rangeland with scattered open forest patches.

GEOLOGY: Mixed Cretaceous sedimentary rocks.

GEOMORPHOLOGY: South facing aspects of dissected dip and escarpment structure that slopes toward major stream drainages that are cut at right angles to the strike of the bedrocks. Landslides in some draws.

TOPOGRAPHY: Slope (percent): 30-60
Aspect: south
Elevation (feet):

PRECIPITATION:

VEGETATION: 50% of the unit is covered by sage-grass communities, 30% is covered by bluebunch wheatgrass-needle grass communities. 20% is covered by conifers.

SOILS

Comp.	Classification	Prop.	Location
3Eb	Lithic Cryorthent, loamy-skeletal, mixed	25%	shallow sites
1Bb	Mollic Cryoboralf, loamy-skeletal, mixed	20%	Forest sites
6Bb	Typic Cryoboroll, loamy-skeletal, mixed	55%	Big sagebrush sites

INCLUSIONS: This is a complex unit with many inclusions. Typic Cryorthents, loamy-skeletal, mixed; Argic Cryoborolls, fine, montmorillonitic; Pachic Cryoborolls, fine-loamy, mixed; Pachic Cryoborolls, fine, montmorillonitic; Lithic Cryoborolls, loamy-skeletal, mixed; Typic Cryoboralfs, loamy-skeletal, mixed; Mollic Cryoboralfs, fine, montmorillonitic; Argic Cryoborolls, fine-loamy-mixed.

BRIEF SOIL DESCRIPTIONS

Soil 3Eb: This soil is shallow and very gravelly. Texture ranges from sandy loam to loam. Coarse fragments range from 35 to 70 percent. Depth to bedrock ranges from 6 to 20 inches.

Soil 1Bb: These are moderately deep, gravelly soils. Textures range from loam to clay loams. Coarse fragments range from 10 to 70 percent by volume. Reaction varies from medium acid to moderately alkaline.

Soil 6Bb: These soils are deep and well drained. Texture ranges from sandy loam to clay loam. Coarse fragments range from 35 to 70 percent.

MAP UNIT 714

GENERAL CHARACTERISTIC: These are moderately dissected lands with scattered forest cover and areas of shallow soils scattered throughout.

GEOLOGY: Limestone, sandstone, shale.

GEOMORPHOLOGY: Moderately dissected, weakly expressed dip and escarpment structure. Bedrocks dip steeply.

TOPOGRAPHY:

Slope (percent):	10-50
Aspect:	easterly
Elevation (feet):	8,700-10,300

PRECIPITATION: 30-40 inches

VEGETATION: 25% of the unit is dense conifer, 25% sparse winter and sagebrush, 35% big sage-grass, and 15% forb-grass communities.

SOILS

Comp.	Classification	Prop.	Location
6Bb	Typic Cryoboroll, loamy-skeletal, mixed	75%	These soils are intermixed
6Fb	Lithic Cryoboroll, loamy-skeletal, mixed	25%	

INCLUSION: Pachic Cryoborolls, loamy-skeletal, mixed; Argic Cryoborolls, loamy-skeletal, mixed; Mollic Cryoboralfs, loamy-skeletal, mixed.

BRIEF SOIL DESCRIPTIONS

Soil 6Bb: These soils are deep and well drained. Texture ranges from silt loam to sandy loam. Coarse fragments range in volume from 35 to 80 percent.

Soil 6Fb: These soils are shallow with many rock fragments. Textures range from sandy loam to clay loam. Coarse fragments range in volume from 35 to 80 percent. Depth to bedrock ranges from 6 to 20 inches.

MAP UNIT 715

GENERAL CHARACTERISTIC: These are high elevation, gently sloping open ridgetops.

GEOLOGY: Sandstone and limestone.

GEOMORPHOLOGY: Gently sloping dipslopes.

TOPOGRAPHY:

Slope (percent):	5-40
Aspect:	West
Elevation (feet):	10,000-11,000

PRECIPITATION: 40-50 inches

VEGETATION: This is a grass-forb community.

SOILS

Comp.	Classification	Prop.	Location
6Fb	Lithic Cryoborolls, loamy-skeletal, mixed	60%	These soils are
6Gb	Pachic Cryoborolls, loamy-skeletal, mixed	40%	intermixed.

INCLUSIONS: Pachic Cryoborolls, loamy-skeletal, mixed (mod. deep); Lithic Cryorthents, loamy-skeletal, mixed (calcareous).

BRIEF SOIL DESCRIPTIONS

Soil 6Fb: These soils are shallow with many rock fragments. Textures range from 35-80 percent. Depth to bedrock ranges from 6-20 inches.

Soil 6Gb: These are deep, gravelly and cobbly soils. They are dark colored and texture ranges from loam to sandy loam. Coarse fragments range in volume from 35-70 percent.

APPENDIX A4

CORRELATION OF SOIL MAP UNITS FOR THE THREE WELL FIELD SOIL SURVEYS

CORRELATION OF WELL FIELD SOIL SURVEYS

ERT has prepared the following mapping unit conversion discussion in order to correlate the mapping units used in the three surveys within the well field. This correlation is based both on data contained in the three survey narratives as well as on ERT field transects of the FS and Bio/West surveys. Although in some areas there is good correlation between the three surveys, in other areas differences exist in mapping units occurring on geomorphic and topographic surfaces common to all three survey areas. These differences generally occur as a result of geologic complexity, climatic interpretations, slop criteria, relative proportions of mapping unit components, and depth to bedrock. ERT has prepared the following conversion narrative in order to provide a generalized correlation of the different surveys. Mapping unit similarities and differences are identified in order to facilitate soils interpretations throughout the well field. Bio-West mapping units present a short frost-free season and low precipitation on the well field. ERT mapping units reflect a longer growing season for native range plants, and higher precipitation levels based on SCS data. Some of the Bio-West map units have very broad slope ranges, however, interpretations are based on the most dominant slope.

USFS Units	Bio/West Units	Correlation to ERT Mapping Units
	1	Upper areas (higher elevations) Unit 1 Bio/West correlates to ERT Unit 82 Cundick variant very gravelly clay loam, 30 to 50 percent slopes.
	1	Lower areas (lower elevations) Unit 1 Bio/West correlates to ERT Unit 84E, Delphill-Glassner variant complex 15 to 30 percent slopes. In some areas Bio/West has included slopes over 30 percent.
	1	North aspect with 20 to 50 percent slopes correlates to ERT Unit 77F, Rooset-Southace variant-Brownsto complex 30 to 50 percent slopes. These soils occur in Sections 31, 32, T29N, R113W - also Section 1, T28N, R114W.

CORRELATION OF WELL FIELD SOIL SURVEYS (CONTINUED)

USFS Units	Bio/West Units	Correlation to ERT Mapping Units
	2	Upper slope ranges of unit correlate to ERT 86 Delphill-Glassner variant complex 15 to 30 percent slopes. Lower slope ranges of unit correlate to ERT unit 84D Delphill-Glassner variant complex 5 to 15 percent slopes. These soils occur in (Section 21, T20N, R113W, Deer Hill Quad) and constitute very minor unit of total acreage.
	3	Dominant soil in Bio/West map Unit 3 (unnamed 45), correlates to ERT map Unit 62. Also included in Bio/West's map Unit 3 are fine-loamy, Ustic Torriorthents on convex slopes and slope breaks. These soils occur in Sections 23, 24, 25, 26, T28N, R114W., Cretaceous Mtn. Quad. Bio/West's Unit 3 correlates to ERT map Unit 77E on ridge tops. These soils occur in Sections 30 and 36, T29N, R114W, Cretaceous Mtn. Quad.
	4	Bio/West Unit 4 correlates to ERT Unit 92 - Jerry variant-Hoodle complex, 2 to 8 percent slopes. One large area occurs at lower elevations in Sections 33, 34, T29N, R113W. These soils have similar textures but occur in Ustic climate and frigid temperature regime.
	5	This unit correlates to ERT Unit 62, Almy loam, 3 to 12 percent slopes. Soils occur in lower elevations on the east side Cretaceous Mtn. Quad.
	5	This unit correlates to ERT Unit 77E, Rooset-Jerry-Brownsto complex, 15 to 30 percent slopes. This conversion fits all 5 units above about 7,700' feet.
	6	This unit correlates to ERT Unit 62, Almy loam, 3 to 12 percent slopes. Most of Unit 6 areas are adjacent to mapped areas of Unit 5 at lower elevations and have most of the same components. One area of 6 unit in the NW¼ Section 20 T28N, R113, correlates to ERT Unit 51E Pishkun, very gravelly loam 15 to 30 percent slopes.
	7	This unit occurs in the well field Graphite Unit (Lake Mtn. Quad). It has been remapped to ERT map Unit 97.
221	8	All aspen stands on Bio/West have been mapped as Unit 8. This unit correlates to ERT map Units 66D, 66E, 66F, depending on slope. This is valid except on Cretaceous Mtn., Bio/West Unit 8 correlates to ERT map Unit 64. FS units are similar in depth and texture to ERT units, but are Mollisols as opposed to Mollic Cryoboralfs.

CORRELATION OF WELL FIELD SOIL SURVEYS (CONTINUED)

USFS Units	Bio/West Units	Correlation to ERT Mapping Units
106	9	Most of Bio/West map Unit 9 generally correlates to ERT map Unit 72, Fox Creek-Turson. FS Unit 106 correlates generally well with classification, drainage, and textural range.
106	9	Part of Bio/West's Unit 9, which occurs on south side of Deer Hill Quad along South Piney Creek, will generally correlate with ERT's map Unit 73. Part of Bio/West's Unit 9, which occurs on Cretaceous Mtn. Quad along the southwest side of Cretaceous Mtn., generally correlates with ERT's map unit 70.
220, 711 360	10	Bio/West's map Unit 10 was remapped to ERT's map Units 93E, 93F, 94, and 95. These soils occur on the Lake Mountain Quad. FS Units 220, 711 match ERT's Unit 90, 93 depending on location and climate. FS Unit 360 correlates to ERT Unit 93, but lists clayey-skeletal soil (Nutras-like) as an inclusion. Bio/West's dominant component in map Unit 10 correlates to the Nutras series (Pine Grove Ridge Quad). Bio/West describes their clayey skeletal soil as moderately deep to shale, it should be deep. Their "shale" is probably weathered red Wasatch shale that should be considered a C horizon. The typical Bio/West map Unit 10 is on 30 to 50 percent slopes and best correlates to ERT map Unit 93F, Leighcan-Granile-Nutras, 30 to 50 percent slopes, except Nutras is the dominant soil. There are also inclusions of Bead soils in this unit. On the Pine Grove Ridge Quad, some scattered units of Bio/West's Unit 10 are mapped on less than 30 percent slopes. These areas were not field checked. These soils correlate best with ERT map Units 93E (with Nutras soils dominating) and 95. On the Meadow Canyon SW Quad, Bio/West's map Unit 10 on 30 to 50 percent slopes, is similar to ERT's map Unit 93F with Nutras soils dominating. In Sections 5 and 6, T29N, R114W, Bio/West's map Unit 10 is mapped on less than 30 percent slopes. Dominant soils observed at road cuts were Bead and Nutras. Areas with less than 15 percent slopes fit ERT's map Unit 95. Areas with 15 to 30 percent slopes do not correspond to any ERT map units well. They are similar to Bead and Nutras soils on 15 to 30 percent slopes, this has not been set up as a map unit. The most similar ERT map unit would be 93E, with Nutras soils dominating, with inclusions of Bead soils.
203	11, 19	Most of Bio/West's map Units 11 and 19 and FS Unit 203 sloping and tops such as Pine Grove Ridge. The 5 to 15 percent slopes on the tops of the ridges correlate well with ERT's map Unit 75.

CORRELATION OF WELL FIELD SOIL SURVEYS (CONTINUED)

USFS Units	Bio/West Units	Correlation to ERT Mapping Units
203 (Continued)	11, 19	As mapped, Bio/West map Unit 11 and 19 and FS Unit 203 often extend from the sloping ridgetops to moderately steep and steep sideslopes along drainages. These steeper areas correlate to ERT's map Units 77E and 77F. In the Lake Mountain Area, Bio/West's Unit 19 is remapped to ERT Unit 97.
203	12	This unit correlates to ERT Unit 77E, Rooset-Jerry-Brownsto complex 15 to 30 percent slopes; and to Unit 77F Rooset-Jerry-Brownsto complex 30 to 50 percent slopes. Most of the unit is dominated by 77F, with slopes of 30 to 50 percent; based on examination of 4 or 5 areas on Pine Grove Ridge.
	13	This unit correlates to Unit 51F Pishkun-Starman-Rock outcrop complex, 30 to 50 percent slopes. This unit has some areas from 50 to 90 acres in size which are ERT ROS, Rock Outcrop-Starman, 40 to 60 percent slopes. Up to 10 percent of the unit is Cundick very gravelly clay loam, 30 to 50 percent slopes. ERT examined all areas mapped as Unit 13 on Cretaceous Mtn. Quad.
	14	This unit correlates to Unit 81E - Patent gravelly loam, 15 to 30 percent slopes. Some small areas on lower slopes are in this unit and would correlate to 81D Patent very gravelly loam, 5 to 15 percent slopes. ERT examined two areas in Section 29, T28N, R113W, Cretaceous Mtn. Quad.
	15	This is a minor unit, it appears to be similar to ERT Unit 92, Jerry variant-Hoodle complex 2 to 8 percent slopes. Unit 15 contains gravelly alluvium from limestone and dolomite which is not typical for the 92 unit, however, soil interpretations are similar.
	16	This unit is very similar to ERT map Unit 70 - Silas-Cryaquolls complex, 2 to 8 percent slopes. In the areas examined, up to 15 percent of the unit had saline and alkaline spots up to 3 acres in size. These were covered by spot symbols on ERT maps but are not shown on Bio/West Maps.
	17	This unit is similar to ERT Unit 75, Heath variant-Jerry-Brownsto complex, 5 to 15 percent slopes. However, in Unit 17 Jerry is the dominant soil with less than 20 percent inclusions of the other components and big sagebrush and grasses are the dominant cover. Two or three small deliniations of 17 at lower elevations are very similar to ERT Unit 75. Some areas of map Unit 17 at lower elevations are similar to ERT map Unit 84E Delphill-Glassner variant complex, 15 to 30 percent slopes. These areas are not separated on Bio/West mapping of Unit 17.

CORRELATION OF WELL FIELD SOIL SURVEYS (CONTINUED)

USFS Units	Bio/West Units	Correlation to ERT Mapping Units
	18	Where examined in the field, this unit contains mostly Jerry soils or soils similar to Jerry for soil interpretations use, Unit 75 Heath variant-Jerry-Brownsto complex, 5 to 15 percent slopes. A part of the 3 or 4 delineations examined have slopes of 15 to 30 percent.
203	19	See Units 11 and 19 (Units are combined).
355, 714, 715	20	This unit is similar to ERT Unit 77F. Rooset-Southace variant-Brownsto complex 30 to 50 percent slopes. Also this unit includes up to 20 percent unit 96, Farlow-Starley very gravelly loams, 25 to 50 percent slopes. The 96 inclusion is on the highest elevations toward the Deadline Ridge uplift. Slopes in part of the unit are up to 65 percent. These units occur on Pine Grove Ridge and Lake Mountain quads; the FS Units correlate generally to ERT Unit 96.
	20	Meadow Canyon SW. Unit 20, in the Meadow Canyon SW quad, has no direct correlation to any ERT unit. The soils are Typic Cryorthents, fine, montmorillonitic-Typic Cryoborolls, loamy skeletal mixed, shallow to moderately deep over conglomerate; Argic Cryoborolls, fine and clayey skeletal soils occurs on east facing slopes; slopes are 35 to 70 percent. Also included in this unit are outcrops of conglomerate materials and sandstone.
	21	These area were not field checked. They occur on north-facing slopes on the north side of the Pine Grove Ridge Quad and the south side of the Meadow Canyon SW Quad. There is no correlation with ERT map units.
	22	Same comments as 21.
	23	Very minor in extent, should be included with ERT map Unit 71.
	30	This unit does not correlate to an ERT map unit; it occurs on gently sloping fans and floodplains. Where examined, soils were Borollic Natrargids, fine loamy mixed, frigid (Tisworth series) and Ustic Torrifluvents, fine loamy mixed, calcareous frigid, saline, as with Havre saline.

CORRELATION OF WELL FIELD SOIL SURVEYS (CONTINUED)

USFS Units	Bio/West Units	Correlation to ERT Mapping Units
	35	This unit does not correlate to any ERT map unit, it occurs on very steep and extremely steep Wasatch shale bluffs. The unit consists of Badland with up to 20 percent Horsley series which occur on 20 to 30 percent slopes.
355, 714, 715	47	The Bio/West map unit was remapped on Lake Mountain Quad to ERT map Unit 96; FS Units correlate well but have thicker mollic epipedons than mapped by ERT.
712	48	This map unit was remapped on Lake Mountain Quad to ERT map Unit 97.
713		This FS map unit corresponds to ERT Unit 98 as mapped west of the Deadline Ridge area.
103, 107, 120, 124, 154, 200, 225, 391, 492, 502, 650, 660, 675, 701, 702, 710.	36, 37 39, 41 42, 43, 44, 45	These units do not join ERT map units and are apparently not similar to any ERT units as mapped. However, separate components within these units may be similar to other components from survey to survey.

APPENDIX B

SOIL SERIES CLASSIFICATION AND DESCRIPTIONS FOR THE WELL FIELD

Appendix B1 - ERT Survey Area
Appendix B2 - Bio/West Survey Area
Appendix B3 - USFS Survey Area

APPENDIX B1

SOIL SERIES CLASSIFICATION AND DESCRIPTIONS - ERT SURVEY AREA

(In Alphabetical Order by Series Name)

TABLE 1-3

GUIDE TO CLASSIFICATION OF THE SOILS
(ERT SURVEY AREA)

Series	Taxonomic Classification
Alcova Var.	Borollic Haplargids, fine loamy, mixed
Almy	Borollic Haplargids, fine loamy, mixed
Bata	Typic Paleboralfs, loamy skeletal, mixed
Bead	Typic Cryoboralfs, fine montmorillonitic
Brownsto Var.	Borollic Calciorthids, loamy skeletal, mixed
Cluff	Mollic Cryoboralfs, clayey skeletal, montmorillonitic
Cryaquolls	
Cundick Var.	Typic Cryorthents, clayey, montmorillonitic (calcareous), shallow
Delphill	Ustic Torriorthents, fine loamy, mixed (calcareous), frigid
Farlow	Typic Cryoborolls, loamy skeletal, mixed
Foxcreek	Typic Cryaquolls, fine loamy over sandy or sandy-skeletal, mixed
Glassner Var.	Borollic Camborthids, fine, montmorillonitic
Granile	Typic Cryoboralfs, loamy skeletal, mixed
Heath	Argic Cryoborolls, fine montmorillonitic
Hobacker	Pachic Cryoborolls, loamy skeletal, mixed
Hoodle	Argic Cryoborolls, loamy skeletal, mixed
Hoodle[1]	Argic Cryoborolls, loamy skeletal, mixed
Hub[1]	Mollic Cryoboralfs, fine loamy, mixed
Hub[1] Var.	Mollic Cryoboralfs, fine loamy, mixed
Irigul	Lithic Cryoborolls, loamy skeletal, mixed
Jerry Var.	Argic Cryoborolls, fine montmorillonitic
Kremlin	Aridic Haploborolls, fine loamy, mixed

TABLE 1-3 (CONTINUED)

Series	Taxonomic Classification
Leighcan	Dystric Cryochrepts, loamy skeletal, mixed
Maxville	Typic Cryoborolls, fine loamy over sandy or sandy-skeletal, mixed
McKinney Var.	Typic Cryaquents, fine loamy, mixed (calcareous)
Nutras	Typic Cryoboralfs, clayey skeletal, montmorillonitic
Pagosa	Mollic Cryoboralfs, fine, montmorillonitic
Patent	Ustic Torriorthents, fine loamy, mixed (calcareous), frigid
Pishkun	Typic Cryorthents, loamy skeletal, mixed (calcareous)
Rooset	Argic Cryoborolls, clayey skeletal, mixed
Silas	Cumulic Cryoborolls, fine loamy, mixed
Southace Var.	Ustic Torriorthents, loamy skeletal, mixed (calcareous), frigid
Starley	Lithic Cryoborolls, loamy skeletal, mixed
Starman	Lithic Cryorthents, loamy skeletal, mixed (calcareous)
Tine	Typic Cryoborolls, sandy skeletal, mixed
Turson	Aquic Cryoborolls, fine loamy over sandy or sandy-skeletal, mixed
Unnamed 85A	Typic Cryorthents, coarse loamy (calcareous)
Unnamed 85B	Typic Cryorthents, coarse loamy (calcareous) shallow
Unnamed 85C	Pachic Cryborolls, coarse loamy
Wilsonville Var.	Mollic Cryofluvents, coarse loamy, mixed, nonacid

[1]Taxadjunct

ALCOVA VARIANT

The Alcova Variant consists of deep, well drained soils on alluvial fans and terraces. These soils formed in alluvium derived from mixed sources. Slope is 2 to 12 percent. Average annual precipitation is 10 to 14 inches, and average annual temperature is 35 to 38 degrees F.

These soils are fine-loamy, mixed Borollic Haplargids.

Typical pedon of Alcova Variant fine sandy loam has been taken from the Sublette County Soil Survey handbook, Soil Conservation Service. Since there was no access to the privately owned lands where these soils occur, no description within the project area was obtained.

A1 - 0 to 3 inches; brown (10 YR 5/3) fine sandy loam, dark brown (10 YR 4/3) moist; weak very fine crumb structure; soft, very friable, nonsticky and nonplastic; 15 percent gravel; mildly alkaline; clear smooth boundary.

Bzt - 3 to 10 inches; brown (7.5 YR 5/4) sandy clay loam, dark brown (7.5 YR 4/4) moist; moderate medium and fine angular blocky structure; hard, friable, sticky and plastic; moderately thick continuous clay films on all ped faces; few gravel fragments; mildly alkaline; clear wavy boundary.

B3ca - 10 to 15 inches; pale brown (10 YR 6/3) gravelly sandy clay loam, brown (10 YR 5/3) moist; weak medium and fine subangular blocky structure; hard, friable, sticky and plastic; thin patchy clay films on all ped faces; 25 percent gravel fragments with pendants of secondary lime; common fine threads and seams and some disseminated secondary lime; stongly calcareous; strongly alkaline; gradual wavy boundary.

IICca - 15 to 60 inches; very pale brown (10 YR 7/3) very gravelly loam, pale brown (10 YR 6/3) moist; massive; slightly hard, very friable, sticky and plastic; 50 percent gravel and cobble; strong accumulation of secondary lime, mostly disseminated; very strongly calcareous; strongly alkaline.

Depth to calcareous material ranges from 7 to 15 inches. Depth to materials containing more than 35 percent coarse fragments varies from 11 to 20 inches. Thickness of the solum is less than 15 inches.

The A horizon has hue of 2.5y to 7.5 YR, value of 5 or 6 when dry and 4 to 5 when moist, and chroma is 2 or 3. The BZT horizon has hue of 2.51 to 7.5 YR, value is 5 or 6 when dry and 4 or 5 when moist, and chroma is 2 to 4. Texture is typically sandy clay loam but the clay content may range from 18 to 30 percent. More than 35 percent of the sand fraction is fine sand or coarser.

Note: This soil is a variant from the Alcova series because it has very gravelly material above 20 inches. Alcova has very gravelly material at 20 to 40 inches.

On-site information for this soil is not available due to no access on privately owned lands within the project area. Characteristics of the soil were obtained from uncorrelated soils maps and descriptions made by the Soil Conservation Service. This soil is identified by the local name of Ginnis in the Sublette County soil survey legend.

ALMY SERIES

The Almy series consists of deep, well drained soils on toeslopes and broad alluvial fans. These soils formed in local alluvium and residuum from sandstones and shales of the Wasatch Formation. Slope is 3 to 12 percent. Average annual precipitation is 10 to 14 inches, and the average annual air temperature is 37 to 40 degrees F.

These soils are fine loamy, mixed Borollic Haplargids.

Typical pedon of Almy fine sandy loam, 3 to 12 percent slopes, in the center of the NE¼, sec. 18, T.29N., R.113W.

A1 - 0 to 2 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; moderate medium platy structure parting to strong coarse granular; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

B1 - 2 to 8 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocks; slightly hard, vey friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

B21t - 8 to 19 inches; reddish brown (5YR 5/4) heavy clay loam, reddish brown (5YR 4/4) moist; strong coarse subangular blocky structure parting to strong medium subangular blocks; hard, friable, sticky and plastic; nearly continuous, moderately thick clay films on ped faces; slightly calcareous; moderately alkaline; clear wavy boundary.

B22tca - 19 to 24 inches; brown (7.5YR 5/4) light clay loam, dark brown (7.5YR 4/4) moist; strong medium prismatic structure parting to strong medium subangular blocks; very hard, friable, sticky and plastic; nearly continuous, moderately thick clay films on ped faces; calcareous, moderately alkaline; clear wavy boundary.

B3ca - 24 to 30 inches; light brown (7.5YR 6/4) light clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure parting to strong fne subangular blocks; hard, firm, sticky and plastic; few, thin patchy clay films on ped faces; common seams and streaks of secondary calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C1ca - 30 to 47 inches; pink (7.5YR 7/4) sandy clay loam, brown (7.5YR 5/4 moist; massive, retaining weathered rock structure; hard, firm, slightly sticky and slightly plastic; common seams and streaks of secondary calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2ca - 47 to 60 inches; pinkish gray (7.5YR 7/2) light sandy clay loam, brown (7.5YR 5/2) moist; massive, retaining weathered rock structure; hard, firm, slightly sticky and slightly plastic; common seams and streaks of secondary calcium carbonate; calcareous; moderately alkaline.

Depth to strong accumulations of calcium carbonate ranges from 8 to 20 inches. Content of rock fragments is commonly less than 5 percent, but ranges to 15 percent in some pedons. The A horizon is a fine sandy loam to light clay loam. The B horizon is a clay loam or silty clay loam. Hue of the profile is 7.5YR or 5YR.

BATA SERIES

The Bata series consists of deep, well drained soils on mountain sideslopes. These soils formed in colluvium and local alluvium from mixed sedimentary sources. Slopes are 15 to 30 percent. Average annual precipitation is 20 to 25 inches, and the average annual air temperature is 32 to 35 degrees F.

These soils are loamy skeletal, mixed Typic Paleboralfs.

Typical pedon of Bata extremely gravelly sandy loam, in an area of Bata-Cluff complex, 15 to 30 percent slopes, approximately 500 feet west and 1,800 feet north of the center, sec. 8, T.29N., R.115W.

O1 - 2 to 0 inches; decomposing needles and twigs

A2 - 0 to 15 inches; light gray (10YR 7/2) extremely gravelly loam, brown (10YR 4/3) moist; moderate medium granular structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; approximately 15 percent cobble, 50 percent gravel; slightly acid; clear wavy boundary.

B + A - 15 to 34 inches; pink (7.5YR 7/4) very gravelly loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure parting to single grains; soft, very friable, nonsticky and nonplastic; approximately 15 percent cobble, 35 percent gravel; exhibits color of B horizon in about 50 percent of volume; slightly acid; clear smooth boundary.

B2t - 34 to 46 inches; light brown (7.5YR 6/4) extremely gravelly sandy clay loam, strong brown (7.5YR 5/6) moist; weak coarse subangular blocky structure parting to weak medium subangular blocks; slightly hard, very friable, sticky and plastic; approximately 20 percent cobble, 40 percent gravel; few thin patchy clay films on ped faces; neutral; clear smooth boundary.

C - 46 to 60 inches; pink (7.5YR 7/4) very gravelly loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocks; slightly hard, very friable, slightly sticky and slightly plastic; approximately 50 percent gravel; neutral.

Depth to the argillic horizon ranges from 25 to 38 inches. Texture of the B horizon ranges from very gravelly sandy clay loam to extremely cobbly clay loam. Hue of the profile is typically 10YR or 7.5YR, but some pedons have hues ranging to 5YR. Coarse fragments range from 35 to 65 percent throughout the profile.

BEAD SERIES

The Bead series consists of deep, well drained soils on broad rolling mountain ridgetops. These soils formed in residuum and colluvium from shale, sandstone and quartzite. Slope is 5 to 15 percent. Average annual air temperature is 32 to 35 degrees F.

These soils are fine, montmorillonitic Typic Cryoboralfs.

Typical pedon of Bead very gravelly loam is in an area of Bead-Nutras complex, 5 to 15 percent slopes in the SE1/4 SE1/4 of Sec. 8, T.24N., R.114W.

O2 - 1 inch to 0; decomposing organic material.

A1 - 0 to 3 inches; grayish brown (10 YR 5/2) very gravelly silt loam, dark brown (10 YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; 40 percent gravel; slightly acid; clear smooth boundary.

A2 - 3 to 16 inches; light brown (7.5 YR 6/4) very gravelly silt loam, dark brown (7.5 YR 4/4) moist; weak medium subangular blocky structure parting to moderate fine granular structure; slightly hard, friable, sticky and plastic; 40 percent gravel, 5 percent cobbles; slightly acid; clear smooth boundary.

A & B - 16 to 22 inches; light brown (7.5 YR 6/4) gravelly silt loam, strong brown (7.5 YR 4/6) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; few thin clay films; 30 percent gravel; slightly acid; clear wavy boundary.

B2t - 22 to 40 inches; yellowish red (5 YR 5/6) gravelly slit clay loam, yellowish red (5 YR 4/6) moist; strong medium and fine angular blocky structure; very hard, firm, very sticky and very plastic; many moderately thick clay films; 15 percent gravel; neutral; clear smooth boundary.

B3 - 40 to 56 inches; reddish yellow (5 YR 5/6) silty clay loam, reddish yellow (5 YR 4/4) moist; moderate medium and fine angular blocky structure; very hard, firm, very sticky and very plastic; few thin clay films; 10 percent gravel; calcareous; moderately alkaline; clear smooth boundary.

C - 56 to 72 inches; pale brown (10YR 6/3) silty loam, dark yellowish brown (10 YR 4/4) moist; massive; very hard, firm, very sticky and very plastic; 10 percent gravel; calcareous; moderately alkaline.

The A2 horizon has hue of 7.5 YR to 5 YR, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 2 to 4. Texture loam or clay loam with 15 to 50 percent gravel and cobble. The B2t horizon has hue of 5 YR or 2.5 YR, value or 4 to 5 when dry and 3 or 4 when moist. Texture is clay or clay loam with 1 to 35 percent gravel and cobble. The C horizon has hue of 10 YR ot 2.5 YR, value of 5 or 6 when dry, and chroma is 4 to 6. Texture is clay loam or silty clay loam with 10 to 50 percent gravel.

BROWNSTO SERIES

The Brownsto series consists of deep, somewhat excessively drained soils on upland colluvial fans and sideslopes. These soils formed in colluvium derived mainly from sandstone, quartzite, and shale. Slope is 5 to 50 percent. - Average annual precipitation is about 15 to 19 inches, and average annual air temperature is about 32 to 35 degrees F.

These soils are loamy-skeletal, mixed (calcareous), Borollic Calciorthids.

Typical pedon of a Brownsto very cobbly clay loam in an area of Heath Variant - Jerry - Brownsto Complex, 5 to 15 percent slopes in the NE1/4 SE1/4 of Sec. 3 T.27N., R.114W.

A1 - 0 to 5 inches; brown (7.5 YR 4/2) very cobbly loam, dark brown (19 YR 3/2) moist; moderate medium granular structure parting to weak fine granular; soft, very friable, slightly sticky and slighly plastic; 30 percent cobbles and 30 percent gravel; lime pendants on bottom of coarse fragments; abrupt wavy boundary.

AC - 5 to 10 inches; reddish brown (5 YR 5/3) very cobbly clay loam, reddish brown (5 YR 4/4) moist; weak medium granular structure parting to single grain; slightly hard, friable, slightly sticky and slightly plastic; 25 percent cobbles and 30 percent gravel; lime rinds on coarse fragments; calcareous; moderately alkaline; clear wavy boundary.

C1ca - 10 to 26 inches; pink (5 YR 7/4) extremely cobbly clay loam, reddish brown (5 YR 5/4) moist; massive; hard, friable, sticky and plastic; 50 percent cobbles and 15 percent gravel; lime rinds on coarse fragments and many medium nodules and threads of lime; calcareous; strongly alkaline; gradual wavy boundary.

C2ca - 26 to 42 inches; light reddish brown (5 YR 6/4) very gravelly clay loam, reddish brown 5 YR 5/4) moist; massive; hard, friable, sticky and plastic; 45 percent gravel; lime rinds on coarse fragments; calcareous; moderately alkaline; abrupt wavy boundary.

IIC3 - 42 to 60 inches; reddish brown (2.5 YR 5/4) shaly clay loam, reddish brown (2.5 YR 4/4) moist; massive; hard, firm, sticky and plastic; 20 percent soft shale chips; calcareous; moderately alkaline.

Depth to calcareous material is less than 6 inches. Some pedons have nongravelly clay loam or clay above 40 inches, but the weighted average content of gravel and cobble between 10 to 40 inches of depth is 35 to 70 percent.

The A horizon has hue of 7.5 YR or 10 YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 or 3. Texture is very gravelly loam, very gravelly clay loam, or very cobbly clay loam. It is neutral to mildly alkaline. The Cca horizon has hue of 5 YR to 10 YR, value of 6 or 7 when dry and 5 or 6 when moist, and chroma of 4 to 6. Texture is extremely cobbly clay loam, very cobbly clay loam, or very gravelly loam. Calcium carbonate equivalent is 15 to 30 percent in the upper part. It is moderately or strongly alkaline. The IIC horizon has value of 4 or 5 when

dry and 3 or 4 when moist, and chroma of 4 to 6. Texture is shaly clay loam, cobbly clay loam, cobbly clay, gravelly clay, or clay.

Some pedons have calcareous cambic B horizons.

Note: This soil is a taxadjunct to the Brownsto series because it has a cryic temperature regime, has 18 to 35 percent clay in the soil matrix, and often has red hues.

CLUFF SERIES

The Cluff series consists of deep, well drained soils on mountain sideslopes. These soils formed in colluvium and local alluvium from medium- to fine-textured sources. Slopes are 15 to 30 percent. Average annual precipitation is 20 to 25 inches, and the average annual air temperature is 32 to 35 degrees F.

These soils are clayey skeletal, montmorillonitic, Mollic Cryoboralfs.

Typical pedon of Cluff gravelly sandy loam, in an area of Bata-Cluff complex, 15 to 30 percent slopes, approximately 250 feet east and 500 feet north of the southwest corner, sec. 5, T.28N., R.115W.

A1 - 0 to 6 inches; brown (7.5YR 5/2) gravelly silt loam, brown (7.5YR 5/2) gravelly sandy loam, brown (7.5YR 4/2) moist; strong coarse granular structure parting to moderate medium grains; hard, friable, nonsticky and nonplastic; 20 percent cobble and 10 percent cobble; slightly acid; clear smooth boundary.

A2 - 6 to 17 inches; pinkish gray (7.5YR 7/2) very gravelly silt loam, brown (7.5YR 5/4) moist; moderate coarse granular structure parting to moderate fine grains; hard, friable, slightly sticky and slightly plastic; 25 percent gravel and 10 percent cobble; slightly acid; clear smooth boundary.

B21t - 17 to 28 inches; brown (7.5YR 5/4) very gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate coarse subangular blocky structure parting to moderate fine subangular blocks; hard, firm, sticky and plastic; 30 percent gravel and 20 percent cobble; common moderately thick clay films on ped faces; neutral; clear smooth boundary.

B22t - 28 to 50 inches plus; brown (7.5YR 5/4) very cobbly clay, brown (7.5YR 4/4) moist; weak very coarse blocky structure parting to weak coarse subangular blocks; very hard, very firm, very sticky, and very plastic; 15 percent gravel, 25 percent cobble and 10 percent stone; nearly continuous moderately thick clay films on ped faces; mildly alkaline.

Hue of the profile is 7.5YR or 5YR. The A1 horizon has dry chroma, after mixing to a depth of 6 inches, of 2 or 3 and value of less than 6. Fine earth texture of the B horizon ranges from heavy clay loam to clay or silty clay. Coarse fragment content ranges from 35 to 65 percent, consisting of gravel, cobble, and stone.

CRYAQUOLLS

Cryaquolls consist of deep, poorly, and somewhat poorly drained soils on stream bottoms and on hillsides with isolated springs and seeps. These soils formed in streamlain alluvium or in residuum from shales mantled by mixed alluvium. Slopes are 2 to 8 percent. The average annual precipitation is about 17 inches and the average annual air temperature is about 36 degrees F.

Taxonomic classification of these soils ranges over the subgroup. The following profile is described as an example.

Representative profile of Cryaquolls, in an area of Silas - Cryaquolls complex, 2 to 8 percent slopes, in the NE¼, NE¼, Sec. 12, T.27N., R.114W.

A11 - 0 to 9 inches; very dark grayish brown (10 YR 3/2) loam, very dark brown (10 YR 2/2) moist; weak medium subangular blocky structure parting to moderate medium grains; soft, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

A12 - 9 to 25 inches; very dark grayish brown (10 YR 3/2) silt loam, black (10 YR 2/1) moist; strong medium granular structure; soft, very friable, sticky and slightly plastic; calcareous, moderately alkaline; clear wavy boundary.

C1 - 25 to 41 inches; dark brown (7.5 YR 3/2) moist silty clay loam; weak medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few fine distinct strong brown (7.5 YR 5/6 moist) mottles; calcareous; moderately alkaline; clear wavy boundary.

IIC2g - 41 to 60 inches; olive gray (5Y 5/2) moist silty clay; massive; extremely hard, extremely firm very sticky and plastic; common distinct strong brown and reddish yellow (7.5 YR 5/8, 6/8) mottles; calcareous; mildly alkaline.

Thickness of the mollic epipedon ranges from 20 to 40 inches. Depth to the water table ranges from 20 to 60 inches. In a few pedons, a thin layer of peat occurs above the mineral surface.

CUNDICK VARIANT

The Cundick variant consists of moderately deep, well drained soils on rolling to steep mountain slopes, ridges and fans. These soils formed in residuum and outwash materials from red clay shales. Slopes are 30 to 50 percent. The average annual precipitation is about 17 inches and the average annual air temperature is about 37 degrees F.

These soils are clayey, montmorillonitic calcareous, shallow Typic Cryorthents. Cundick variant is moderately deep: 20 to 40 inches to shale bedrock.

Typical pedon of Cundick Variant, 30 to 50 percent slopes, NW1/4 SW1/4 Sec. 25, T27N., R114W.

A1 - 0 to 3 inches; red (2.5 YR 5/6) very gravelly clay loam, red (2.5 YR 4/6) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; 25 to 30 percent gravel; calcareous; moderately alkaline; clear smooth boundary.

AC - 3 to 11 inches; red (2.5 YR 4/6) silty clay dark red (2.5 YR 3/6) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocks; very hard, very firm very sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

C - 11 to 36 inches; light red (2.5 YR 6/6) silty clay, red (2.5 YR 5/6) moist; massive; hard, firm, very sticky and very plastic; calcareous; moderately alkaline; clear wavy boundary.

CR - 36 inches plus; weathered red platy shale.

Depth to soft weathered shale with platy structure ranges from 20 to 40 inches. In a few pedons, soft platy shale occur below 40 inches. The soil has hue of 5 YR or 2.5 YR in most pedons and is calcareous and moderately alkaline throughout.

This soil is a variant of the Cundick series by being moderately deep as opposed to shallow.

DELPHILL SERIES

The Delphill series consists of moderately deep, well drained soils on rolling upland fans, ridges and toeslopes. These soils formed in residiuum and outwash from sandstones and silty shales. Slopes are 5 to 30 percent. The average annual precipitation is about 12 inches and the average annual air temperature is about 40 degrees.

These soils are fine-loamy, mixed (calcareous) frigid. Ustic Torriorthents.

Typical pedon of Delphill loam in an area of Delphill-Glassner Variant complex, 15 to 30 percent slopes, in the SW1/4 SW1/4, Sec. 29, T27N. R113W.

A - 0 to 5 inches; pale brown (10 YR 6/3) loam, brown (10 YR 5/3) moist; weak fine granular structure; soft, friable, sticky and plastic; 5 percent fine gravel; calcareous; moderately alkaline; clear smooth boundary.

AC - 5 to 17 inches; light yellowish brown (2.5 YR 6/3) silty clay, light olive brown (2.5 YR 5/4) moist; weak medium subangular blocky structure parting to weak fine granules; soft, friable, sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.

C - 17 to 37 inches; pale yellow (2.5 YR 7/4) silty clay loam, light yellowish brown (2.5 YR 6/4) moist; weak coarse platy structure; slightly hard, friable, sticky and plastic; few thin seams of soft sandstone and silty shales; calcareous; moderately alkaline; clear wavy boundary.

CR - 37 to 60 inches; pale yellow (2.5 YR 7/4) weathered silty and sandy shales; light yellowish brown (2.5 YR 6/4) moist; calcareous, visible gypsum; moderately alkaline.

Depth to to soft silty and sandy shales ranges from 30 to 40 inches. In a few pedons, soft silty and sandy shales occur below 40 inches. The soil is calcareous and moderately alkaline throughout. The soil has hue of 10 YR or 2.5 YR. This soil has a heavier texture than typical for the Delphill series.

FARLOW SERIES

The Farlow series consists of deep, well drained soils on mountain ridges, fans. These soils formed in colluvial and alluvial materials from limestone and dolomite. Slope are 10 to 40 percent. Average annual precipitation is about 18 inches and average annual air temperature is about 37 degrees F.

These soils are loamy-skeletal, mixed, Typic Cryoborolls.

Typic profile of Farlow very gravelly loam in an area of Farlow-Starley very gravelly loams is in NE1/4, SW1/4, Sec. 8, T27N R113 W.

A1 - 0 to 11 inches; brown (10 YR 4/3) very gravelly loam, dark brown (10 YR 3/3) moist; moderate fine granular structure; soft, friable; slightly sticky and slightly plastic; 30 percent gravel and 5 percent cobble; noncalcareous; mildly alkaline; clear smooth boundary.

AC - 11 to 25 inches; pale brown (10 YR 6/3) very gravelly loam, brown (10 YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granules; soft, friable, slightly sticky and slightly plastic; 35 percent cobble; calcareous; moderately alkaline; clear smooth boundary.

C1ca - 25 to 35 inches; very pale brown (10 YR 7/3) extremely gravelly loam, brown (10 YR 5/3) moist; massive, slightly hard, friable, slightly sticky and slightly plastic; 45 percent gravel and 5 percent cobble; calcareous; moderately alkaline; clear wavy boundary.

C2ca - 35 to 60 inches; very pale brown (10 YR 8/3) extremely gravelly loam, pale brown (10 YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 50 percent gravel and 10 percent cobble; calcareous; moderately alkaline.

Depth of the mollic epipedon ranges from 9 to 15 inches. Depth to bedrock is more than 40 inches. The soil has hue of 10 YR or 2.5 Y. In the C horizons calcium carbonate coatings are on the undersides of rock fragments.

FOXCREEK SERIES

The Foxcreek series consists of deep, poorly drained soils on bottomlands. These soils formed in alluvium derived from mixed sources. Slope is 0 to 3 percent. Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 degrees F.

These soils are fine-loamy over sandy or sandy-skeletal, mixed, Typic Cryaquolls.

Typical pedon of Foxcreek loam is in an area of Foxcreek - Turson soils; 1 to 3 percent slopes in the NW1/4 NW1/4 of Sec. 8, T.30N., R.114W.

O1 - 2 inches to 0, organic mat of undecomposed roots and grasses.

A11 - 0 to 7 inches; very dark gray (10 YR 3/1) loam, black (10 YR 2/1) moist; moderate fine granular structure; soft, friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

A12g - 7 to 14 inches; dark gray (10 YR 4/1) loam, very dark gray (10 YR 3/1) moist; weak medium subangular blocky structure; soft, friable, sticky and plastic; common medium distinct, strong brown (7.5 YR 5/6) mottles; calcareous, moderately alkaline; clear smooth boundary.

Cig - 14 to 32 inches; light brownish gray (10 YR 6/2) very gravelly loamy sand, dark grayish brown (10 YR 4/2) moist; single grain; loose, nonsticky and nonplastic; 70 percent gravel; calcareous; moderately alkaline.

Depth to very gravelly material is 20 to 40 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon has value of 3 to 5 when dry and 2 or 3 when moist, and chroma is 1 or 2. It is mottled in the lower part. Texture is fine sandy loam, loam or clay loam. The C horizon has value of 5 or 6 when moist and 4 or 5 when dry, and chroma of 1 or 2. It is mottled. Texture is fine sandy loam, loam or clay loam and is sometimes stratified. The IIC horizon contains 50 to 70 percent gravel.

GLASSNER VARIANT

The Glassner Variant consists of moderately deep, well drained soils on rolling upland fans, ridges and toeslopes. These soils formed in residuum and outwash materials from red clay shales. Slopes are 5 to 30 percent. The average annual precipitation is about 12 inches and the average annual air temperature is about 40 degrees F.

These soils are fine, montmorillonitic, Borollic Camborthids.

Typical pedon of Glassner Variant in an area of Delphill-Glassner Variant complex, 15 to 30 percent slopes, in the SW1/4 SW1/4, Sec. 29, T27N, R113W.

A1 - 0 to 3 inches; red (2.5 YR 5/6) clay, dark red (2.5 YR 3/6) moist; moderate fine granular structure; hard, firm, very sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

B2 - 3 to 10 inches; red (2.5 YR 5/6) clay, red (2.5 YR 4/6) moist; weak to moderate medium prismatic structure, parting to moderate fine granules; hard, firm, very sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

C - 10 to 38 inches; red (2.5 YR 5/6) clay, red (2.5 YR 4/6) moist; weak coarse prismatic structure; very hard, very firm, very sticky and very plastic; calcareous; moderately alkaline; clear wavy boundary.

CR - 38 inches plus; weathered red Wasatch shale.

Depth to soft shale with platy structure ranges from 20 to 40 inches. In a few pedons, soft platy shale occur below 40 inches. The soil is calcareous and moderately alkaline throughout. The soil has hue of 5 YR or 2.5 YR in most pedons.

GRANILE SERIES

The Granile series consists of deep, well drained soils on mountain sideslopes and broad rolling ridgetops. These soils formed in colluvium derived from sandstone, quartzite, shale, and limestone. Slope is 5 to 50 percent. Average annual precipitation is 15 to 19 inches, and the average annual air temperature is 32 to 35 degrees. F.

These soils are loamy-skeletal, mixed, Typic Cryoboralfs.

Typical pedon of Granile very gravelly sandy loam is in an area of Leighcan-Granile-Nutras Complex, 15 to 30 percent slopes, in the NW1/4 NW1/4 of Sec. 9, T.27N., R.114W.

O1 - 2 to 1 inch; Undecomposed needles, twigs, and pieces of wood.

O2 - 1 inch to 0; Decomposed organic material.

A2 - 0 to 12 inches; very pale brown (10 YR 7/3) very gravelly sandy loam, brown (10 YR 5/3) moist; weak medium granular structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; 40 percent gravel; slightly acid; clear smooth boundary.

A & B - 12 to 22 inches; very pale brown (10 YR 8/3) with lamellae that are brownish yellow (10 YR 6/6) very gravelly loam, brownish yellow (10 YR 6/6) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; slightly sticky and slightly plastic; few thin clay films; 30 percent gravel and 5 percent cobbles; neutral; clear wavy boundary.

B2t - 22 to 30 inches; brownish yellow (10 YR 6/6) very gravelly loam, yellowish brown (10 YR 5/6) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic common moderately thick clay films; 40 percent gravel and 5 percent cobbles; neutral; clear wavy boundary.

B3 - 30 to 43 inches; light yellowish brown (10 YR 6/4) very cobbly sandy loam, yellowish brown (10 YR 5/4) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; 35 percent gravel and 25 percent cobble; slightly calcareous in spots; mildly alkaline; gradual wavy boundary.

C - 43 to 60 inches; very pale brown (10 YR 7/3) extremely cobbly sandy loam, yellowish brown (10 YR 5/4) moist; massive; soft, very friable; nonsticky and nonplastic; 40 percent cobbles; calcareous; moderately alkaline.

Depth to uniformly calcareous material is greater than 40 inches.

The A horizon has hue of 10 YR or 7.5 YR, value of 6 or 7 when dry and 4 or 5 when moist. Texture is gravelly, very gravelly or very cobbly sandy loam or loam. Reaction is slightly acid to neutral. The B2t horizon has hue of 10 YR or 7.5 YR, value 5 or 6 when dry and 4 or 5 when moist, and chroma of 4 to 6. Texture is very gravelly or very cobbly sandy clay loam, loam, or

clay loam. Reaction is mildly acid to neutral. The C horizon has hue of 10 YR or 7.5 YR, value is 6 to 8 when dry and 5 to 7 when moist, and chroma is 2 to 4. Texture is very gravelly, very cobbly or extremely cobbly sandy loam or loam. Reaction is neutral to moderately alkaline.

HEATH VARIANT

The Heath Variant consists of deep, well drained soils on upland benches. These soils formed in colluvium and residuum from shale, quartzite and sandstone. Slope is 5 to 15 percent. Average annual precipitation is about 15 to 19 inches, and average annual air temperature is about 32 to 35 degrees F.

These soils are fine, montmorillonitic, Argic Cryoborolls.

Typical pedon of Heath Variant gravelly loam is in an area of Heath Variant-Jerry-Brownsto Complex, 5 to 15 percent slopes in the NE1/4 SW 1/4 of Sec. 3, T.27N., R.114W.

A1 - 0 to 4 inches; brown (7.5 YR 4/2) gravelly silt loam, dark brown (7.5 YR 3/2) moist; weak fine granular structure parting to single grain; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent gravel; mildly alkaline; clear smooth boundary.

B1 - 4 to 9 inches; reddish brown (5 YR 4/3) gravelly silt loam, dark reddish brown (5 YR 3/3) moist; weak medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; 15 percent gravel; mildly alkaline; clear smooth boundary.

B21t - 9 to 16 inches; reddish brown (5 YR 4/3) gravelly silt clay loam, dark reddish brown (5 YR 3/4) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky, plastic; 5 percent gravel; many fine nodules and threads of lime; calcareous; moderately alkaline; clear wavy boundary.

B22t - 16 to 21 inches; light reddish brown (2.5 YR 6/4) silty clay loam, reddish brown (2.5 YR 5/4) moist; strong medium angular blocky structure parting to strong fine angular blocky; hard firm, very sticky and very plastic; common moderately thick clay films; 5 percent gravel; calcareous; moderately alkaline; clear wavy boundary.

B3ca - 21 to 28 inches; light reddish brown (5 YR 6/4) clay loam, reddish brown (5 YR 5/4) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky plastic; 5 percent gravel; many fine modules and threads of lime; calcareous; moderately alkaline; clear wavy boundary.

IIC1ca - 28 to 60 inches; light reddish brown (5 YR 6/4) extremely cobbly clay loam; reddish brown (5 YR 5/4) moist; massive; hard, firm, sticky, plastic; 25 percent cobble and 45 percent gravel; many fine nodules and threads of lime and lime crusts on rock fragments; calcareous; moderately alkaline; gradual wavy boundary.

III C2ca - 60 to 82 inches; red (2.5 YR 5/6) gravelly silt loam, red (2.5 YR 4/6) moist; massive; hard, firm sticky and plastic; 5 percent cobble and 25 percent gravel; common medium threads of lime and lime crusts on coarse fragments; moderately alkaline.

Thickness of the mollic epipedon and depth to the top of the fine B2t horizon is 7 to 9 inches. Depth to calcareous material ranges from 9 to 17 inches.

The A horizon has hue of 7.5 YR or 5 YR, value of 4 or 5 when dry, and chroma of 2 or 3. Texture is gravelly loam or very gravelly loam. Gravel and cobble content ranges from 15 to 35 percent. Reaction is neutral to mildly alkaline. The B2t horizon has hue of 5 YR to 2.5 YR, value of 5 or 6 when dry and 3 to 5 when moist, and chroma of 4 to 6. Texture is gravelly clay loam, clay loam, or silty clay loam. Gravel and cobble content ranges from 5 to 35 percent. Reaction is mildly to moderately alkaline. The IICca horizon has hue of 2.5 YR or 5 YR, value of 5 to 7 when dry and 4 to 6 when moist. Texture is extremely gravelly clay loam, extremely cobbly clay loam, or very cobbly clay loam. Gravel and cobble content ranges from 35 to 80 percent. Calcium carbonate equivalent is 15 to 30 percent in all or part of this layer. The IIIC horizon has 5 to 30 percent gravel.

Note: This soil differs from the Heath Series by having a skeletal substratum and in having red hues.

HOBACKER SERIES

The Hobacker series consists of deep, well drained soils on moderately steep and steep mountain slopes and fans. The soils formed in colluvial and alluvial materials from limestone and dolomite. Slopes are 20 to 40 percent. Average annual precipitation is about 17 inches and average annual air temperature is about 37 degrees F.

These soils are loamy-skeletal, mixed Pachic Cryoborolls.

Typical pedon of Hobacker gravelly loam in an area of Hobacker-Hoodle gravelly loams, 20 to 40 percent slopes, is in NW¼, NE¼, Sec 19, T27N, R113W.

A11 - 0 to 7 inches; dark grayish brown (10 YR 4/2) gravelly loam, very dark grayish brown (10 YR 3/2) moist; moderate to strong fine granular structure; soft, friable, slightly sticky and slightly plastic; 15 percent gravel and 5 percent cobble; calcareous; moderately alkaline; clear smooth boundary.

A12 - 7 to 25 inches; brown (10 YR 4/3) very gravelly silt loam, dark brown (10 YR 3/3) moist; moderate fine granular structure, soft, friable, slightly sticky and slightly plastic; 30 percent gravel and 10 percent cobble; calcareous; moderately alkaline; clear smooth boundary.

A13 - 25 to 37 inches; brown (10 YR 4/3) extremely gravelly silt loam, dark brown (10 YR 3/3) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; 35 percent gravel and 15 percent cobble; calcareous; moderately alkaline; clear wavy boundary.

Cca - 37 to 60 inches; very pale brown (10 YR 7/3) extremely gravelly sandy loam, pale brown (10 YR 6/3) moist; massive; slightly hard, friable slightly sticky and slightly plastic; 40 percent gravel and 15 percent cobble; calcareous; moderately alkaline.

Depth of the mollic epipedon ranges from 17 to 37 inches. Depth to bedrock is more than 60 inches. The soil has hue of 10 YR or 2.5 Y. In the C horizon accumulations of calcium carbonate are on the undersides of rock fragments.

HOODLE SERIES

The Hoodle series consists of deep, well drained soils on moderately steep and steep mountain slopes and fans. These soils formed in colluvial and alluvial materials from limestone and dolomite. Slopes are 20 to 40 percent. Average annual precipitation is about 17 inches and average annual air temperature is about 37 degrees F.

These soils are loamy-skeletal, mixed, Argic Cryoborolls.

Typical pedon of Hoodle gravelly loom in an area of Hobacker-Hoodle gravelly loams, 20 to 40 percent slopes, is in NW¼, NE¼, Sec 19, T27N, R113W.

A1 - 0 to 9 inches; dark grayish brown 10 YR (4/2) gravelly silt loam, very dark grayish brown (10 YR 3/2) moist; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; 15 percent fine gravel; calcareous; moderately alkaline; clear smooth boundary.

B2t - 9 to 19 inches; brown (10 YR 5/3) gravelly silt loam, dark brown (10 YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; 30 percent gravel and 10 percent cobble; few thin patchy clay films on peds; calcareous; moderately alkaline; clear smooth boundary.

B3ca - 19 to 27 inches; very pale brown (10 YR 7/3) very gravelly loam, pale brown (10 YR 6/3) moist; weak medium subangular structure; slightly hard, friable, slightly sticky and slightly plastic; 35 percent gravel, 15 percent cobble; calcareous; moderately alkaline; visible lime on rock fragements; clear smooth boundary.

Cca - 27 to 60 inches; very pale brown (10 YR 8/3) extremely gravelly loam, pale brown (10 YR 6/3) moist; massive, slightly hard, friable, slightly sticky and slightly plastic; 40 percent gravel and 15 percent cobble; calcareous; moderately alkaline.

Depth to bedrock is more than 60 inches. The A horizon on some pedons is non-calcareous. The soil has hue of 10 YR throughout. The B3 and C horizons have calcium carbonate accumulations on the undersides of rock fragments.

HOODLE TAXADJUNCT

The Hoodle series consists of deep, well drained soils on alluvial fans. These soils formed in alluvium derived from sandstone, quartzite and shale. Slope is 2 to 8 percent. Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 degrees F.

These soils are loamy-skeletal, mixed Argic Cryoborolls.

Typical pedon of Hoodle gravelly loam is in an area of Jerry Variant-Hoodle Complex, with 2 to 8 percent slopes.

A1 - 0 to 9 inches; brown (7.5 YR 5/3) gravelly loam, dark brown (7.5 YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and plastic; 20 percent gravel and 10 percent cobbles; neutral; clear smooth boundary.

B21t - 9 to 15 inches; brown (7.5 YR 5/4) gravelly clay loam, dark brown (7.5 YR 3/4) moist; weak medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common moderately thick clay films; 20 percent gravel and 10 percent cobbles; neutral; clear smooth boundary.

B22t - 15 to 27 inches; strong brown (7.5 YR 5/6) very gravelly clay loam, brown (7.5 YR 4/4) moist; weak coarse subangular blocky structure parting to moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films; 30 percent gravel and 10 percent cobbles; mildly alkaline; gradual wavy boundary.

C1ca - 27 to 35 inches; brown (7.5 YR 5/4) extremely gravelly sandy clay loam, brown (7.5 YR 4/4) moist; massive parting to single grain; hard, very friable, slightly sticky and slightly plastic; 55 percent gravel and 20 percent cobbles; lime crusts on gravel and cobbles and common medium nodules and threads of lime in soil matrix; calcareous; moderately alkaline; clear wavy boundary.

IIC2ca - 35 to 60 inches; brown (7.5 YR 5/4) extremely gravelly loamy coarse sand, brown (7.5 YR 5/4) extremely gravelly loamy coarse sand, brown (7.5 YR 4/4) moist; massive parting to single grain; hard, friable, nonsticky and nonplastic; 45 percent gravel and 20 percent cobbles; lime crusts on gravel and cobbles and lime cementation between sand grains and gravels; calcareous; moderately alkaline, diffuse wavy boundary.

IIIC3 - 60 to 75 inches; light reddish brown (5 YR 6/4) extremely gravelly sandy clay loam, reddish brown (5 YR 4/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; 45 percent gravel and 20 percent cobble; calcareous; moderately alkaline.

Thickness of the mollic epipedon is 7 to 12 inches.

The A horizon has hue of 7.5 YR or 5 YR. Texture is loam with 20 to 50 percent gravel and cobble. The B2t horizon has hue of 7.5 YR or 5 YR, value

of 5 or 6 when dry and 3 to 5 when moist, and chroma of 4 to 6. Weighted average texture is very gravelly or very cobbly clay loam with 35 to 60 percent gravel and cobbles. The C horizon has hue of 7.5 YR to 5 YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 or 4. Texture is sandy clay loam, sandy loam, or loamy coarse sand with 50 to 80 percent gravel and cobbles.

Note: This soil is a taxadjunct to the Hoodle series because it has a sandy-skeletal substratum and red hues.

HUB SERIES

The Hub series consists of deep, well drained soils on upland benches and sideslopes. These soils formed in colluvium and landslide deposits derived from shale, sandstone and quartzite. Slope is 5 to 50 percent. Average annual precipitation is 15 to 19 inches, adn the average annual temperature is 32 to 35 degrees F.

These soils are fine-loamy, mixed Mollic Cryoboralfs.

Typical pedon of Hub clay loam is in an area of Hub-Pagosa Complex, 5 to 15 percent slopes in teh SW1/4 SW1/4 of Sec. 4, T.27N., R.114W.

O1 - 2 to 1 inch; Undecomposed leaves and twigs.

O2 - 1 inch to 0; Decomposed organic material.

A1 0 to 6 inches; reddish brown (5 YR 5/4) clay loam, dark reddish brown (5 YR 3/4) moist; moderate coarse and medium subangular blocky structure; hard, friable, sticky and plastic; 5 percent gravel; neutral; clear smooth boundary.

B1 - 6 to 16 inches; reddish brown (5 YR 5/4) clay loam, dark reddish brown (5 YR 3/4) moist; moderate medium and fine angular blocky structure; hard, friable, sticky and plastic; 5 percent gravel; neutral; clear smooth boundary.

B21t - 16 - 24 inches; reddish brown (5 YR 5/4) clay loam, reddish brown (5 YR 4/4) moist; weak medium and fine angular blocky; very hard, firm, sticky and plastic; common moderately thick clay films; 5 percent gravel; neutral clear smooth boundary.

B22t - 24 to 34 inches; reddish brown (5 YR 5/4) gravelly clay loam, reddish brown (5 YR 4/4) moist; weak medium prismatic sturcture parting to strong coarse and medium angular blocky; very hard, firm, sticky and plastic; common moderately thick clay films; 25 percent gravel; neutral; clear smooth boundary.

B3 - 24 to 41 inches; reddish brown (5 YR 5/4) and yellow (2.5 Y 7/6) gravelly clay loam, brown (7.5 YR 4/4) moist; weak coarse subangular blocky parting to weak medium and fine subangular blocky; hard, friable, sticky and plastic; 20 percent gravel; neutral; abrupt smooth boundary.

C - 41 to 60 inches; yellow (2.5 Y 7/6) and light reddish brown (5 YR 6/4) clay loam, brown (7.5 YR 5/4) moist; massive; hard, friable, sticky and plastic; calcareous; moderately alkaline.

The A horizon has hue of 10 YR to 5 YR, value is 5 or 6 when dry, and chroma is 3 or 4. The A horizon typically does not have the combination of colors and depth to qualify for a mollic epipedon. Texture is clay loam, loam, gravelly clay loam, or gravelly loam. The B2t horizon has hue of 7.5 YR or 5 YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma or 4 to 6. Texture is clay loam or gravelly clay loam. The C horizon has hue of 5 YR

to 2.5 Y, value of 6 or 7 when dry and 5 or 6 when moist, and chroma of 3 to 6. Texture is clay loam or gravelly clay loam. Calcareous material is typically below 40 inches.

Note: This soil is a taxadjunct to the Hub series because it has red hues and lacks A2 and A&B horizons.

HUB VARIANT

The Hub variant consists of deep, well drained soils on mountain sideslopes. These soils formed in residuum from limestones and dolomites. Slopes are 15 to 30 percent. Average annual precipitation is 20 to 25 inches, and the average annual air temperature is 32 to 35 degrees F.

These soils are fine loamy, mixed Mollic Cryoboralfs.

Typical pedon of Hub variant, in an area of Hub variant-Irigul-Rock Outcrop complex, 15 to 30 percent slopes, about 250 feet southwest of the center SE¼, SW¼, sec. 34, T.29N., R.115W.

A2 - 0 to 5 inches; brown (7.5YR 5/4) silt loam, dark brown (10YR 3/3) moist; moderate coarse granular structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B2t - 5 to 15 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine subangular blocks; hard, friable, sticky and plastic; common moderately thick clay films on ped faces; mildly alkaline; clear wavy boundary.

B3 - 15 to 22 inches; pale brown (10YR 6/3) gravelly silt loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure parting to weak fine subangular blocks; hard, friable, sticky and plastic; approximately 10 percent cobble, 20 percent gravel; mildly alkaline; clear smooth boundary.

Cca - 22 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly silt loam, brown (10YR 4/3) moist; massive, slightly hard, friable, slightly sticky and slightly plastic; approximately 25 percent cobble, 40 percent gravel; calcareous, mildly alkaline.

Depth to secondary calcium carbonates ranges from 20 to 40 inches. Content of rock fragments ranges from 35 to 60 percent below a depth of 20 inches. Hue of the profile ranges from 7.5YR through 2.5Y. The A horizon is loam, fine sandy loam, or light clay loam. The B horizon is heavy loam or clay loam.

IRIGUL SERIES

The Irigul series consists of shallow, well to somewhat excessively drained soils on mountain sideslopes and ridge crests. These soils formed in residuum from weakly weathered dolomites. Slopes are 15 to 30 percent. Average annual precipitation is 20 to 25 inches, and the average annual air temperature is 32 to 35 degrees F.

These soils are loamy skeletal, mixed Lithic Cryoborolls.

Typical pedon of Irigul gravelly loam, in an area of Hub variant-Irigul-Rock Outcrop complex, about 275 feet east of the southeast corner, SE¼, SW¼, sec. 34, T.29N., R.115W.

A1 - 0 to 3 inches; brown (10YR 4/3) gravelly loam, very dark brown (10YR 3/2) moist; soft, very friable, slightly sticky and slightly plastic; approximately 30 percent gravels; neutral; clear smooth boundary.

C - 3 to 14 inches; brown (10YR 5/3) very gravelly loam, brown (10YR 3/3) moist; soft, very friable, slightly sticky and slightly plastic; approximately 50 percent angular gravels; clear smooth boundary.

R - 14 inches plus; hard non-rippable dolomite.

JERRY SERIES

The Jerry series consists of deep, well drained soils on upland benches and sideslopes. These soils formed in residuum and colluvium derived from shale, sandstone and quartzite. Slope is 5 to 30 percent. Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 degrees F.

These soils are fine, montmorillonitic, Argic Cryoborolls.

Typical pedon of Jerry gravelly loam is in an area of Heath Variant-Jerry-Brownsto complex, 5 to 15 percent slopes, 5 to 15 percent slopes, in the NE1/4 SW1/4 of Sec. 3, T.27N., R.114W.

A11 - 0 to 9 inches; brown (7.5 YR 4/2) gravelly silt loam, dark brown (7.5 YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable; slightly sticky and slightly plastic; 20 percent gravel; neutral; gradual wavy boundary.

A12 - 9 to 14 inches; brown (7.5 YR 4/2) gravelly silt loam, dark brown (7.5 YR 3/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable; slightly sticky and slightly plastic; 25 percent gravel; neutral; clear smooth boundary.

B21t - 14 to 23 inches; brown (7.5 YR 5/4) silt clay loam, dark brown (7.5 YR 4/4) moist; weak medium prismatic structure parting to strong medium angular blocky; hard, firm, sticky and plastic; common moderately thick clay films; neutral; gradual wavy boundary.

B22t - 23 to 30 inches; reddish brown (5 YR 5/4) silt clay loam, reddish brown (5 YR 4/4) moist; moderate medium prismatic structure parting to strong coarse angular blocky; very hard, firm, very sticky and very plastic; common moderately thick clay films; few fine nodules of lime; calcareous; moderately alkaline; clear smooth boundary.

B3tca - 30 to 39 inches; reddish brown (5 YR 5/4) silt clay loam, reddish brown (5 YR 5/4) moist; moderate medium prismatic structure parting to strong coarse angular blocky; hard, firm, very sticky and very plastic; common moderately thick clay films; many fine noduler and treads of lime; calcareous; moderately alkaline; clear smooth boundary.

C1ca - 39 to 52 inches; reddish brown (5 YR 5/4) clay loam, reddish brown (5 YR 4/4) moist; massive; hard, firm, sticky and plastic; 10 percent gravel; many fine nodules and threads of lime; calcareous; moderately alkaline; gradual smooth boundary.

II C2ca - 52 to 64 inches; light red (2.5 Yr 6/6) cobbly clay loam, red (2.5 YR 5/6) moist; massive; hard, firm, sticky and plastic; 15 percent cobbles and 20 percent gravel; many fine nodules and threads of lime; calcareous; moderately alkaline.

Thickness of the mollic epipedon and depth to the fine B2t horizon is 10 to 16 inches. Depth to calcareous material ranges from 15 to 30 inches.

The A horizon has hue of 7.5 YR or 5 YR, and chroma of 2 or 3. Texture is loam or gravelly loam. Gravel and cobble content is 0 to 30 percent. The B2t horizon has hue of 7.5 YR or 5 YR and value is 4 or 5 when dry. Texture is clay loam or clay. Reaction is neutral to mildly alkaline. The C horizon has hue of 5 YR or 2.5 YR, value is 4 to 6 when dry and 4 or 5 when

moist, and chroma is 4 to 6. Texture is clay loam or gravelly clay. Gravel and cobble content is 10 to 35 percent. The IIC horizon occurs in the lower part of some pedons. Gravel and cobble content ranges from 35 to 60 percent.

Note: This soil is a taxadjunct to the Jerry series because it has red hues.

JERRY VARIANT

The Jerry Variant consists of deep, well drained soils on alluvial fans. These soils formed in alluvium dervied from shale, sandstone and quartzite. Slope is 2 to 8 percent. Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 degrees F.

These soils are fine, montmorillonitic Argic Cryoborolls.

Typical pedon of Jerry Variant loam is in an area of Jerry Variant-Hoodle Complex, 2 to 6 percent slopes located 2,250 feet W., 1,500 feet N of the SE corner, Sect. 11, T.27N., R.114W.

A1 - 0 to 4 inches; reddish gray (5 YR 5/2) loam, dark reddish brown (5 YR 3/2) moist; weak medium subangular blocky structure porting to moderate fine granular; soft, friable, slightly sticky and slightly plastic; 10 percent gravel; neutral; clear smooth boundary.

B1 - 4 to 9 inches; reddish brown (5 YR 5/3) clay loam, dark reddish brown (5 YR 3/3) moist; weak medium subangular blocky sturcture parting to moderate fine subangular blocky; soft, friable, sticky and plastic; 10 percent gravel; neutral; clear smooth boundary.

B21t - 9 to 17 inches; reddish brown (5 YR 4/4) gravelly clay loam, reddish brown (5 YR 4/4) moist; strong medium angular blocky structure parting to strong fine angular blocky structure parting to strong fine angular blocky; very hard, firm, very sticky and very plastic; common moderately thick clay films; 15 percent gravel; mildly alkaline; gradual wavy boundary.

B22tca - 17 to 23 inches; yellowish red (5 YR 4/6) very gravelly clay loam, yellowish red (5 YR 4/6) moist; moderate medium angular blocky structure parting to moderate medium angular blocky structure parting to moderate fine angular blocky; very hard, firm, very sticky and very plastic; common moderately thick clay films; 30 percent gravel and 10 percent cobbles; common fine modules and threads of lime; calcareous; moderately alkaline; gradual wavy boundary.

C1ca - 23 to 63 inches; reddish yellow (5 YR 6/8) very gravelly sandy clay loam, reddish brown (5 YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; 40 percent gravel and 20 percent cobbles; lime rinds on gravel and cobbles; calcareous; moderately alkaline; gradual wavy boundary.

C2 - 63 to 93 inches; reddish yellow (5 YR 6/6) extremely cobbly loamy coarse sand stratified with extremely cobbly sandy loam; yellowish red (5 YR 4/6) moist; massive parting to single grain; soft, very friable, nonsticky and nonplastic; 45 percent gravel and 30 percent cobbles; slightly calcareous; moderately alkaline.

Thickness of the mollic epipedon is 7 to 12 inches. Depth to material containing more than 35 percent gravel and cobble is typically 15 to 20 inches.

The A horizon has hue of 7.5 YR or 5 YR, and chroma is 2 or 3. Texture is loam, clay loam, gravelly loam or gravelly clay loam. The B2t horizon has hue of 7.5 YR or 5 YR, value or 4 or 5 when dry, and chroma of 4 to 6. Texture is clay loam, gravelly clay loam, and may be very gravelly or very cobbly clay loam in the lower part. Weighted average of gravel and cobble is 15 to 35 percent. The C horizon has hue of 7.5 YR or 5 YR, value of 6 or 7 when dry and 4 or 5 when moist, and chroma is 3 to 6. Texture ranges from sandy clay loam in the upper part to sandy loam or loamy sand in the lower part and gravel and cobble content ranges from 50 to 80 percent.

Note: This soil is a variant from the Jerry series because it is skeletal in the lower part.

KREMLIN SERIES

The Kremlin series consists of deep, well drained soils on gently sloping terraces and ephemeral drainageways. These soils formed in alluvium derived from sandstones and shales. Slopes are 1 to 5 percent. Average annual precipitation is about 12 inches and average annual air temperature is about 40 degrees F.

These soils are fine-loamy, mixed, Aridic Haploborolls.

Typical pedon of Kremlin loam, 2 to 5 percent slopes, in the SW1/4, NE1/4 Sec. 26, T27N, R113W.

A1 - 0 to 5 inches; brown (10 YR 5/3) loam; dark brown (10 YR 3/3) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

B2 - 5 to 12 inches; brown (10 YR 5/3) loam, dark brown (10 YR 3/3) moist; moderate medium subangular blocky structure parting to moderate fine granules; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C1 - 12 to 37 inches pale brown (10 YR 6/3) loam, brown (10 YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; few thin streaks and seams of calcium carbonate; clear wavy boundary.

C2 - 37 to 60 inches; light gray (10 YR 7/3) loam, brown (10 YR 5/3) moist; massive, slightly hard, firm, slightly sticky and slightly plastic; 3 to 5 percent gravel; calcareous; moderately alkaline.

The mollic epipedon is 10 to 14 inches thick. C horizons have visible calcium carbonate in thin streaks and seams. The soil has hue of 10 YR or 2.5 YR throughout. Depth to bedrock is more than 60 inches.

LEIGHCAN SERIES

The Leighcan series consists of deep, somewhat excessively drained soils on mountain sideslopes. These soils formed in colluvium derived from sandstone and quartzite. Slope is 15 to 50 percent. Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 degrees F.

These soils are loamy-skeletal, mixed, Dystric Cryochrepts.

Typical pedon of Leighcan very gravelly sandy loam is in an area of Granile-Leighcan-Nutras complex, 15 to 30 percent slopes in the NW1/4 NE1/4 of Sec. 9, T. 27N., R.114W.

O1 - 2 to 1 inch; Undecomposed needles and twigs.

O2 - 1 inch to 0; Decomposed organic material.

A2 - 0 to 11 inches; Pale brown (10 YR 6/3) very gravelly loam, dark brown (10 YR 3/3) moist; weak medium granular structure parting to single grain; soft, very friable, nonsticky and slightly plastic; 50 percent gravel and 10 percent cobbles; slightly acid; clear smooth boundary.

A & B - 11 to 23 inches; pale brown (10 YR 6/3) very gravelly sandy loam, brown (10 YR 4/3) moist; weak medium granular structure parting to single grain; soft, very friable, nonsticky and slightly plastic; 50 percent gravel and 10 percent cobbles; slightly acid; clear smooth boundary.

B21 - 23 to 45 inches; very pale brown (10 YR 7/3) very gravelly sandy loam, yellowish brown (10 YR 5/4) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; 45 percent gravel; slightly acid; clear wavy boundary.

B22t - 45 to 72 inches; very pale brown (10 YR 7/4) very gravelly sandy loam; light yellowish brown (10 YR 6/4) moist; thin lamellae and small rounded masses that are yellow (19 YR 7/6) sandy loam, sandy clay loam and clay loam, yellowish brown (10 YR 5/6) moist; massive; soft, very friable, nonsticky and nonplastic; 60 percent gravel; slightly acid.

The sum of lamellae greater than one centimeter thick is less than 6 inches. Many pedons lack lamellae throughout the soil profile ranges from very strongly acid to slightly acid. Gravel and cobble content ranges from 35 to 80 percent.

The A horizon has value of 6 to 8 when dry and 3 to 7 when moist. The B2 horizon has hue of 7.5 YR or 10 YR, value of 6 or 7 when dry and 3 to 6 when moist; and chroma of 2 to 6. Some pedons have C horizons that have hue of 10 YR, value of 7 or 8 when dry and 6 or 7 when moist, and chroma of 2 or 3. They have extremely gravelly sandy loam or extremely gravelly loamy sand texture.

MAXVILLE SERIES

The Maxville series consists of deep, well to moderately well drained soils on low terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 3 percent. Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 degrees F.

These soils are fine-loamy over sandy or sandy-skeletal, mixed, Typic Cryoborolls.

Typical pedon of Maxville gravelly sandy loam has been taken from the Sublette County Soil surrey handbook, Soil Conservation Service. Since there was no access to privately owned lands where these soils occur, no description within the project area was obtained.

A1 - 0 to 6 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10 YR 3/2) moist; weak very fine crumb structure; soft, very friable, nonsticky and nonplastic; 15 percent gravel; mildly alkaline; abrupt wavy boundary.

B2 - 6 to 12 inches; brown (10 YR 5/3) gravelly loam, dark brown (10 YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; 20 to 30 percent gravel and some cobble; mildly alkaline; clear wavy boundary.

B3ca - 12 to 22 inches; pale brown (10 YR 6/3) gravelly loam, dark brown (10 YR 6.3) gravelly loam, dark brown (10 YR 3/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 30 percent gravel and cobble; calcareous; moderately alkaline; clear wavy boundary.

IIC - 22 to 60 inches; calcareous but relatively clean gravel, cobble and sand.

Thickness of the mollic epipedon ranges from 7 to 16 inches. Depth to clean gravel, cobble and sand ranges from 20 to 40 inches. The soil material above the very gravelly substratum is typically loam, clay loam or sandy clay loam with 0 to 35 percent gravel and cobble.

Note: On-site information for this soil is not available due to no access on privately owned lands. Characteristics of the soil were obtained from uncorrelated soils maps and descriptions made by the Soil Conservation Service. This description was adapted from the soil identified by the local name of Kelson in the Sublette County Soil Survey legend. This description is intended to provide interpretive characteristics for the soils mapped as Kelson and Redhill, gravelly substratum, on existing soil surveys in the area.

MCKINNEY VARIANT

The McKinney Variant consists of deep, poorly drained soils or bottomlands. These soils formed in alluvium derived from mixed sources. Slopes are 0 to 3 percent. Average annual precipitation is 10 to 14 inches, and the average annual air temperature is 35 to 38 degrees F.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Typic Cryaquents.

Typical pedon of McKinney Variant loam is in an area of Wilsonville Variant-McKinney Variant complex, 0 to 3 percent slopes in the NE1/4 SE1/4 of Sec. 7, T.29N., R.113W.

A1g - 1 to 10 inches; light brownish gray (10 YR 6/2) and grayish brown (10 YR 5/2) loam, very dark grayish brown (10 YR 3/2) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; hard, friable, sticky and plastic; common medium distinct, strong brown (7.5 YR 5/6) mottles; calcareous; moderately alkaline; clear smooth boundary.

C1g - 10 to 21 inches; light brownish gray (10 YR 6/2) loam, dark grayish brown (10 YR 4/2) moist; massive; hard friable, sticky and plastic; common medium distinct strong brown (7.5 YR 5/6) mottles; calcareous; moderately alkaline; clear smooth boundary.

A1bg - 21 to 24 inches; light brownish gray (10 YR 6/2) and very dark gray (10 YR 6/2) extremely gravelly loamy sand, dark grayish brown (10 YR 4/2) moist; single grain; loose, nonsticky and nonplastic; 70 percent gravel; calcareous.

Depth to very gravelly material is 20 to 40 inches.

The A horizon has value of 5 or 6 when dry and 3 to 5 when moist and chroma of 1 or 2. It lacks the combination of colors and thickness to qualify as a mollic epipedon. Texture is fine sandy loam, loam, or clay loam. The C horizon has value or 5 to 7 when dry and 4 or 5 when moist, and chroma of 1 or 2. Texture is fine sandy loam, loam or clay loam and is often stratified. The IIC horizon contains 50 to 80 percent gravel.

These soils are mottled throughout.

Note: This soil is a variant from the McKinney series because it has a very gravelly substratum.

NUTRAS SERIES

The Nutras series consists of deep, well drained soils on mountain sideslopes and broad rolling ridgetops. These soils formed in colluvium from shale, quartzite and sandstone. Slope is 5 to 50 percent. Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 degrees F.

These soils are clayey-skeletal, montmorillonitic Typic Cryoboralfs.

Typical pedon of Nutras gravelly loam is in an area of Bead-Nutras Complex, 5 to 15 percent slopes in the SW1/4 SW1/4 of Sec. 15, t.27N., R.114W.

O1 - 2 to 1 inch; Twigs and needles

O2 - 1 inch to 0; Decomposed organic material

A2 - 0 to 17 inches; Pinkish gray (5 YR 6/2) gravelly loam, dark reddish gray (5 YR 4/2) moist, weak medium subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; 20 percent gravel and 5 percent cobbles; clear wavy boundary.

B & A - 17 to 24 inches; light reddish brown (5 YR 6/4) extremely cobbly clay loam, reddish brown (5 YR 4/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; 20 percent gravel, 25 percent cobbles and 20 percent stones; clear wavy boundary.

B2t - 24 to 39 inches; yellowish red (5 YR 5/6) very stony clay; yellowish red (5 YR 4/6) moist; moderate and strong medium subangular blocky structure; hard firm, very sticky and very plastic; 10 percent gravel, 15 percent cobbles and 35 percent stones; clear wavy boundary.

B3 - 39 to 49 inches; light yellowish red (5 YR 6/4) very gravelly clay loam, reddish brown (5 YR 4/4) moist; weak medium prismatic sturcture parting to moderate medium subangular blocky; slightly hard; friable, sticky and plastic; 35 percent gravel, 5 percent cobbles and 5 percent stones; clear wavy boundary.

C - 49 to 60 inches; pink (5 YR 7/4) very gravelly loam, reddish brown (5 YR 5/4) moist; massive; slightly hard friable, sticky and plastic; 35 percent gravel, 5 percent cobbles and 5 percent stones.

The A horizon has hue of 7.5 YR or 5 YR value is 4 or 5 when moist, and chroma is 2 to 4. Texture is gravelly or very gravelly loam or sandy clay loam. The B2t horizon has hue of 7.5 YR to 2.5 YR, value is 3 to 6 when dry and 3 to 5 when moist, and chroma is 4 to 6. Texture is very gravelly, very cobbly or very stony clay loam or clay. The C horizon has hue of 7.5 YR to 2.5 YR value of 5 to 7 when dry and 4 or 5 when moist. Texture is very gravelly or very cobbly loam or clay loam.

PAGOSA SERIES

The Pagosa series consists of deep, well drained soils on upland benches and sideslopes. These soils formed in residuum, colluvium and landslide deposits derived from shale, sandstone, and quartzite. Slope is 5 to 30 percent. -Average annual precipitation is 15 to 19 inches, and average annual air temperature is 32 to 35 inches.

These soils are fine, montmorillonitic Mollic Cryoboralfs.

Typical pedon of Pagosa gravelly clay loam is in an area of Hub-Pagosa complex, 15 to 30 percent slopes in the NE1/4 of Sec. 18, T.30N., R114W.

O2 - 1 inch to 0; Decomposed organic material.

A1 - 0 to 8 inches; light brownish gray (10 YR 6/2) and grayish brown (10 YR 5/2) gravelly clay loam, dark brown (10 YR 3/3) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; 15 percent gravel; slightly acid; clear smooth boundary.

B2t - 8 to 26 inches; brown (7.5 YR 4/4) clay, dark brown (7.5 YR 4/4) moist; moderate coarse and medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; common moderately thick clay films; 10 percent gravel; neutral; clear smooth boundary.

B3 - 26 to 38 inches; yellow (10 YR 7/6) gravelly clay loam, yellowish brown (10 YR 5/6) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films; 30 percent gravel; mildly alkaline; gradual smooth boundary.

C - 38 to 60 inches; yellow (10 YR 7/6) gravelly clay loam, yellowish brown (10 YR 5/6) moist; massive; hard, friable, sticky and plastic; 30 percent gravel; mildly alkaline.

The A horizon has hue of 10 YR to 5 YR, value of 5 or 6 when dry, and chroma is 2 to 4. The A horizon typically does not have the combination of colors and depth to qualify as a mollic epipedon. Texture is clay loam or gravelly clay loam. Reaction is neutral to slightly acid. The B2t horizon has hue of 7.5 YR to 5 YR, value of 4 to 6 when dry and 4 or 5 when moist, and chroma is 4 to 6. Texture is clay loam, clay, gravelly clay loam, or gravelly clay. The C horizon has hue of 10 YR to 5 YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma is 3 to 6. Texture is clay loam, clay, gravelly clay loam, or gravelly clay. Calcareous material is typically below 40 inches.

PATENT SERIES

The Patent series consists of deep, well drained soils on sideslopes and alluvial fans. These soils formed in residuum and slopewash from interbedded sandstones and shales. Slopes are 5 to 50 percent. Average annual precipitation is 10 to 14 inches, and the average annual air temperature is 37 to 40 degrees F.

These soils are fine loamy, mixed (calcareous), frigid, Ustic Torriorthents.

Typical pedon of Patent very gravelly loam, 5 to 15 percent slopes, in the NE¼, NE¼, Sec. 32, T.27N., R.113W.

A1 - 0 to 4 inches; pale brown (10 YR 6/3) very gravelly loam, brown (10 YR 4/3) moist; weak fine granular structure parting to single grains; soft, very friable, slightly sticky and slightly plastic; approximately 30 percent gravel and 5 percent cobble; calcareous; mildly alkaline; clear smooth boundary.

AC - 4 to 8 inches; light yellowish brown (10 YR 6/4) loam, yellowish brown (10 YR 5/4) moist; weak medium subangular blocky structure parting to weak fine grains; soft, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C1 - 8 to 17 inches; very pale brown (10 YR 7/4) sandy clay loam, brownish yellow (10 YR 6/6) moist; weak coarse platy structure parting to weak medium subangular blocks; slightly hard, friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear wavy boundary.

C2 - 17 to 34 inches; very pale brown (10 YR 7/4) loam, brownish yellow (10 YR 6/6) moist; massive; hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C3 - 34 to 58 inches; pale yellow (2.5 Y 7/4) shaly silty clay loam, light olive brown (2.5 Y 5/4) moist; massive; hard, friable, sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.

C4cs - 58 to 65 inches; pale yellow (2.5 Y 7/4) shaly silty clay, light olive brown (2.5 Y 5/4) moist; massive; hard, friable, very sticky and plastic; common medium streaks of gypsum; calcareous; moderately alkaline.

Depth to a paralithic contact is greater than 40 inches. Hue of the profile ranges from 7.5 YR to 2.5 Y. Texture of the A and AC horizons ranges from sandy clay loam to light clay loam. The texture of the C horizon ranges from sandy clay loam to clay loam in the upper part, and from clay loam to silty clay in the lower part. Highly weathered interbedded siltones and shales typically occur below a depth of about 40 inches. The profile is typically calcareous throughout its depth.

PISHKUN SERIES

The Pishkun series consists of deep, well drained soils on mountain slopes, fans and ridges. These soils formed in gravelly and stony colluvium and residuum from limestones and dolomite. Slopes are 10 to 50 percent. Average annual precipitation is about 14 inches. Average annual air temperature is about 37 degrees F.

These soils are loamy-skeletal, mixed (calcareous) Typic Cryorthents.

Typical pedon of Pishkun very gravelly loam, 15 to 30 percent slopes, SW1/4, NE1/4, Sec. 30 T27N, R113W.

A1 - 0 to 4 inches; brown (10 YR 4/3) very gravelly loam, dark brown (10 YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; moderately alkaline; clear smooth boundary.

AC - 4 to 14 inches; pale brown (10 YR 5/3) very gravelly loam, brown (10 YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granules; slightly hard, friable, slightly sticky and slightly plastic; 25 percent gravel, 10 to 15 percent cobble; moderately alkaline; clear wavy boundary.

C1ca - 14 to 32 inches; very pale brown (10 YR 8/3) extremely cobbly loam, pale brown (10 YR 6/3) moist; massive, slightly hard, friable, slightly sticky and slightly plastic; 10 percent gravel, 65 percent cobble, 10 percent stone; calcium carbonate coatings on undersides of all coarse fragements; moderately alkaline; clear smooth boundary.

C2ca - 32 to 60 inches; very pale brown (10 YR 8/3) extremely cobbly loam, pale brown (10 YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 10 percent gravel, 65 percent cobble, 10 percent stone; somewhat less calcium carbonate than horizon above; moderately alkaline.

The A horizon is calcareous in most places. In a few pedons, the upper 2 inches of the A may be noncalcareous. The control section averages more than 50 percent coarse fragements.

ROOSET SERIES

The Rooset series consists of deep, well drained soils on upland sideslopes. These soils formed in colluvium derived from shale, sandstone and quartzite. Slope is 15 to 50 percent. Average annual precipitation is 15 to 19 inches, and average annual temperature is 32 to 35 inches.

These soils are clayey-skeletal, montmorillonitic Argic Cryoborolls.

Typical pedon of Rooset very gravelly loam is in an area of Rooset-Southace Variant-Brownsto complex, 20 to 50 percent slopes in the NW1/4 SE1/4 of Sec. 3, T.27N., R114W.

A1 - 0 to 7 inches; reddish brown (5 YR 4/3) very gravelly loam, dark reddish brown (5 YR 3/3) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and plastic; 40 percent gravel and 10 percent cobble; neutral; clear smooth boundary.

B21t - 7 to 15 inches; reddish brown (5 YR 4/4) very gravelly clay loam, dark reddish brown (5 YR 3/4) moist; moderate medium and fine angular blocky structure; hard, friable, very sticky and very plastic; common moderately thick clay films; 35 percent gravel and 10 percent cobble; mildly alkaline; abrupt wavy boundary.

B22tca - 15 to 32 inches; dark reddish brown (2.5 YR 3/4) very gravelly clay loam, dark red (2.5 YR 3/6) moist; strong medium and fine angular blocky structure; very hard, firm very sticky and very plastic; common moderately thick clay films; 50 percent gravel and 10 percent cobbles; lime rinds on bottom side of rock fragments; calcareous; moderately alkaline; clear smooth boundary.

B3ca - 32 to 41 inches; red (2.5 YR 4/6) gravelly clay loam, dark red (2.5 YR 3/6) moist; moderate medium and fine angular blocky structure; very hard, firm, sticky and plastic; lime rinds on bottom side of rock fragments; calcareous; moderately alkaline; clear wavy boundary.

Cca - 41 to 60 inches; red (2.5 YR 4/6) very gravelly clay loam, dark red (2.5 YR 3/6)moist; massive; very hard, firm, sticky and plastic; 50 percent gravel; lime rinds on gravels; calcareous; moderately alkaline.

Thickness of the mollic epipedon is 7 to 12 inches.

The A horizon has value of 7.5 YR or 5 YR and value of 4 or 5 when dry. Texture is gravelly loam or very gravelly loam with 20 to 60 percent gravel and cobble. The B2t horizon has hue of 5 YR or 2.5 YR, value is 3 to 6 when dry and 3 to 5 when moist, and chroma of 4 to 6. Texture is very gravelly clay loam or very cobbly clay loam with 35 to 70 percent gravel and cobble. The C horizon has hue of 5 YR or 2.5 YR, value is 4 to 6 when dry and 3 to 5 when moist, and chroma is 4 to 6. Texture is clay loam with 0 to 60 percent gravel and cobble. The nongravelly C horizons occur where weathered red shale is mantled by 40 to 60 inches of gravelly alluvium.

SILAS SERIES

The Silas series consists of deep, well to moderately well drained soils along stream bottoms and on hillsides with isolated springs and seeps. These soils formed in alluvium from streams and slopewash. Slopes are 2 to 8 percent. Average annual precipitation is 15 to 19 inches, and the average annual air temperature is about 36 degrees F.

These soils are fine loamy, mixed Cumulic Cryoborolls.

Typical pedon of Silas loam, in an area of Silas-Cryaquolls complex, 2 to 8 percent slopes, in the SW¼, SW¼, Sec. 12, T.27N., R.114W.

A11 - 0 to 6 inches; very dark grayish brown (10 YR 3/2) loam, very dark brown (10 YR 2/2) moist; weak medium subangular blocky structure parting to weak medium grains; soft, very friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; clear smooth boundary.

A12 - 6 to 21 inches; very dark grayish brown (10 YR 3/2) loam, very dark brown (10 YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; clear wavy boundary.

C1 - 21 to 45 inches; brown (10 YR 4/3) loam, dark brown (10 YR 3/3) moist; massive; soft, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C2 - 45 to 60 inhces; brown (10 YR 5/3) very gravelly loam, brown (10 YR 4/3) moist; massive; soft, friable, slightly sticky and slightly plastic; approximately 40 percent gravel; calcareous; moderately alkaline.

Depth to a water table or low chroma mottles is greater than 40 inches. Thickness of the mollic epipedon is greater than 16 inches and commonly greater than 30 inches. Hue of the profile is 7.5 YR through 2.5 Y. Textures are commonly loam, sandy clay loam, or clay loam. Very gravelly horizons occur below 30 to 40 inches in most pedons.

SOUTHACE VARIANT

The Southace Variant consists of deep, well drained soils on upland sideslopes. These soils formed in colluvium and residuum derived from shale, siltstone, sandstone, and conglomerate. Slope is 30 to 50 percent. Average annual precipitation is 15 to 19 inches, and average annual precipitation is 32 to 35 degrees F.

These soils are fine-loamy, mixed Typic Cryorthents.

Typical pedon of Southace Variant very gravelly clay loam in an area of Rooset-Southace Variant-Brownsto complex, 30 to 50 percent slopes in the NE1/4 SE1/4 of Sec. 3, T.27.N., R.114.W.

A11 - 0 to 3 inches; reddish brown (2.5 YR 5/4) very gravelly clay loam, reddish brown (2.5 YR 4/4) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, sticky and plastic; 40 percent gravel and 10 percent cobbles; calcareous; moderately alkaline; clear smooth boundary.

A12 - 3 to 8 inches; reddish brown (2.5 YR 4/4) gravelly clay loam, red (2.5 YR 4/6) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; 30 percent gravel; calcareous; moderately alkaline; clear wavy boundary.

C1 - 8 to 14 inches; red (2.5 YR 5/6) very gravelly clay loam, red (2.5 YR 4/6) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; 40 percent gravel and 10 percent cobbles; calcareous; moderately alkaline; clear wavy boundary.

C2 - 14 to 24 inches; red (2.5 YR 5/6) extremely gravelly clay loam, red (2.5 YR 4/6) moist; massive; slightly hard, friable, sticky and plastic; 55 percent gravel and 10 percent cobbles; calcareous; moderately alkaline; clear wavy boundary.

C3 - 24 to 52 inches; red (2.5 YR 5/6) shaly clay loam, red (2.5 YR 4/6) moist; massive; slightly hard, friable, sticky and plastic; 25 percent soft shale chips; calcareous; moderately alkaline.

C4 - 52 to 60 inches; red (2.5 YR 5/6) gravelly clay loam, red (2.5 YR 4/6) moist; massive; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline.

Typically, the content of gravel and cobble ranges from 35 to 70 percent in the upper part of the soil and is less than 35 percent in the lower part. The weighted average of gravel and cobble content between 10 to 40 inches of depth is less than 35 percent.

The A horizon has hue of 7.5 YR to 2.5 YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4. The C horizon has hue of 7.5 YR to 2.5 YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 to 6.

STARMAN SERIES

The Starman series consists of shallow, well to somewhat excessively drained soils on rolling ridges and mountain slopes. These soils formed in residuum derived from limestone and dolomite. Slopes are 5 to 60 percent. Average annual precipitation is about 14 inches and average annual air temperature is about 37 degrees F.

These soils are loamy-skeletal, mixed (calcareous) Lithic Cryorthents.

Typical pedon of a Starman extremely gravelly loam, in Phiskun-Starman-Rock Outcrop complex, 15 to 30 percent slopes, SW1/4, NE1/4, Sec. 30, T27N. R113W.

A - 10 to 3 inches; pale brown (10 YR 6/3) extremely gravelly silt loam, brown (10 YR 4/3) moist; weak fine granular sturcture; soft, friable, slightly sticky and slightly plastic; 30 percent gravel, 5 percent cobble; calcareous; moderately alkaline; clear smooth boundary.

AC - 3 to 10 inches; very pale brown (10 YR 7/3) extremely cobbly silt loam, brown (10 YR 5/3) moist; weak medium granular structure; soft, friable, slightly sticky and slightly plastic; 35 percent cobble, 15 percent gravel; calcareous; moderately alkaline; clear wavy boundary.

R - 10 inches plus, hard Madison limestone.

Depth to a lithic contact is 10 to 20 inches. The profile is calcareous and moderately alkaline throughout. The AC horizon is 60 to 70 percent rock fragments, mostly of cobble size.

TINE SERIES

The Tine series consists of deep, well to moderately well drained soils on low terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 3 percent. Average annual precipitation is 15 to 19 inches; and average annual air temperature is 32 to 35 degrees F.

These soils are sandy-skeletal, mixed, Typic Cryoborolls.

Typical pedon of Tine gravelly loam has been taken from the Sublette County soil survey handbook, Soil Conservation Service. Since there was no access to privately owned lands where these soils occur, no description within the project area was obtained.

A11 - 0 to 2 inches; grayish brown (10 YR 5/2) loam, very dark grayish brown (10 YR 3/2) moist; weak fine crumb structure; soft, very friable; slightly sticky and slightly plastic; 10 to 15 percent gravel; mildly alkaline; abrupt smooth boundary.

A12 - 2 to 8 inches; brown (7.5 YR 5/2) gravelly loam, dark brown (7.5 YR 3/2) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 20 to 30 percent gravel; mildly alkaline; abrupt smooth boundary.

C1 - 8 to 14 inches; brown (7.5 YR 5/3) gravelly sandy loam; dark brown (7.5 YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few fine faint, strong brown (7.5 YR 4/5) mottles; 30 to 40 percent gravel; calcareous; thin lime rinds on bottom side of gravels; moderately alkaline; clear wavy boundary.

C2 - 14 to 60 inches; pinkish gray (7.5 YR 6/2) extremely gravelly loamy sand, dark brown (7.5 YR 4/2) moist; single grain, loose, nonsticky and nonplastic; 70 to 90 percent gravel; calcareous; moderately alkaline.

Depth to very gravelly material is less than 20 inches.

The A horizon has hue of 10 YR to 5 YR, value of 4 or 5 when dry and 2 or 3 when dry and 2 or 3 when moist, and chroma is 1 to 3. Texture is loam or sandy loam with 10 to 30 percent gravel. The C horizon has hue of 10 YR to 5 YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma is 2 to 4. This horizon may be mottled. Texture is sandy loam in the upper part and loamy sand in the lower part with 30 to 90 percent gravel.

Note: This soil is a taxadjunct to the Tine series because Tine is calcareous and apparently has a fluctuating water table during part of the year.

On-site information for this soil is not available due to no access on privately owned lands within the project area. Characteristics of the soil were obtained from uncorrelated soils maps and descriptions made by the Soil Conservation Service. This soil is identified by the local name of North Piney series in the Sublette County soil survey legend.

Unnamed 85A Soil

These soils are deep, well drained soils occurring on valley side slopes. These soils found in residium and colluvium from calcareous sandstones. Average annual precipitation is about 16 inches, and the average annual air temperature is 32 to 35 degrees F.

These soils are coarse loamy (calcareous), Typic Cryotherns.

Typical pedon of the Unnamed 85A sandy loam, in an area of the Unnamed 85 complex, 25 to 60 percent slopes located SW¼, NW¼, Sec. 7, T29N, R113W.

A1 - 0 to 4 inches; brown (10 YR 5/3) sandy loam, brown (10 YR 4/3) moist; moderate coarse granular structure parting to single grains; soft, very friable, nonsticky and nonplastic; calcareous; clear smooth boundary.

AC - 4 to 16 inches; brown (10 YR 5/3) sandy loam, brown (10 YR 4/3) moist; moderate coarse granular structure parting to moderate medium granular structure; soft, very friable, nonsticky and nonplastic; calcareous; clear smooth boundary.

C1 - 16 to 32 inches; pale brown (10 YR 6/3) sand brown (10 YR 5/3) moist; weak medium granular structure parting to single grains; soft, very friable, nonsticky and nonplastic; calcareous; clear smooth boundary.

C2 - 32 to 52 inches; very pale brown (10 YR 7/3) sand pale brown (10 YR 6/3) moist; single grains; loose, loose, nonsticky and nonplastic; calcareous.

CR - 52 inches; fractured sandstone.

Depth to bedrock ranges from 41 to 60 inches. The surface layer is covered with rounded gravels on most profiles. Rock fragments are generally less than 15 percent. The soil has hue of 10 YR throughout.

Unnamed 85B Soil

These soils are shallow, somewhat excessively drained soils occurring on ridge crests. These soils formed in residum and colluvium from calcareous sandstones. Average annual precipitation is about 16 inches, and the average annual air temperature is 32 to 35 degrees F.

These soils are coarse loamy (calcareous) shallow Typic Cryorthents.

Typical pedon of the Unnamed 85B sandy loam, in an area of the Unnamed 85 complex, 25 to 60 percent slopes located SW¼, NW¼, Sec. 7, T29N, R113W.

A 1 - 0 to 2 inches; pale brown (10 YR 6/3) light sandy loam, yellowish brown (10 YR 5/4) moist; moderate medium platy structure parting to single grains; soft, very friable, nonsticky and nonplastic; calcareous; clear smooth boundary.

AC - 2 to 5 inches; very pale brown (10 YR 7/3) sandy loam, yellowish brown (10 YR 5/4) moist; moderate medium platy structure parting to single grains; soft, very friable, nonsticky and nonplastic; calcareous; clear smooth boundary.

C - 5 to 14 inches; horizon is varigated, 60 percent very pale brown (10 YR 7/3) and 40 percent yellow (10 YR 7/6) loamy sand, 60 percent pale brown (10 YR 6/3) and 40 percent brownish yellow (10 YR 6/6) moist; moderate coarse platy structure parting to single grains; slightly hard, very friable, nonsticky and nonplastic; calcareous; clear smooth boundary.

CR - 14 inches; fractured sandstone.

Depth to bedrock ranges from 10 to 16 inches. The surface layer is commonly covered with rounded gravels. Rock fragments are generally less than 15 percent. The soil has hue of 10 YR throughout.

Unnamed 85C Soil

These soils are deep, well drained soils occurring on sheltered concave positions of valley sideslopes. These soils formed in local alluvium and residum from calcareous sandstones. Average annual precipitation ranges from 16 to 20 inches and average annual air temperature is 32 to 35 degrees F.

These soils are coarse loamy Pachic Cryoborolls.

Typical pedon of the Unnamed 85C sandy loam, in an area of the Unnamed 85 complex, 25 to 60 percent slopes located SW¼, NW¼, Sec. 7, T29N, R113W.

A1 - 0 to 9 inches; brown (10 YR 5/3) sandy loam, very dark grayish brown (10 YR 3/2) moist; weak coarse granular structure parting to weak medium granular structure; soft, very friable, nonsticky and nonplastic; clear smooth boundary.

B21 - 9 to 16 inches; brown (10 YR 5/3) sandy loam, dark brown (10 YR 3/3) moist; moderate coarse subangular blocky structure parting to moderate fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; gradual wavy boundary.

B22 - 16 to 29 inches; yellowish brown (10 YR 5/4) loamy sand, dark brown (10 YR 4/3) moist; moderate coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; clear smooth boundary.

IIC1$_{ca}$ - 29 to 45 inches; light gray (10 YR 7/2) clay loam, brown (10 YR 5/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky structure; slightly hard, friable, very sticky and very plastic; calcareous; clear smooth boundary.

IIC2$_{ca}$ - 45 to 60 inches; pink (7.5 YR 7/4) silty clay loam, light brown (7.5 YR 6/4) moist; massive; hard, firm, sticky and plastic, calcareous.

The mollic epipedon ranges from 16 to 30 inches thick. The A horizon has value of 4 or 5 dry, 1 to 3 moist and chioma 1 to 3. Hue is 10 YR. The B2 horizon has value of 3 to 5 dry, 3 or 4 moist and chroma of 3 or 4. Hue is 10 YR. The C horizon has value of 5 to 7 dry, 5 or 6 moist and chroma ranging from 2 to 4. Hue may be either 7.5 YR or 10 YR. Rock fragments are generally less than 10 percent.

TURSON SERIES

The Turson series consists of deep, somewhat poorly drained soils on bottomlands. These soils formed in alluvium derived from mixed sources. Slope is 0 to 3 percent. Average annual precipitation is 15 to 19 inches, and the average annual air temperature is 32 to 35 degrees F.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Aquic Cryoborolls.

Typical pedon of Terson loam has been adapted from the published soil survey of the Star Valley Area, Wyoming - Idaho. Since there was no access to privately owned lands where these soils occur, no description within the project area was obtained.

A1 - 0 to 12 inches; brown (7.5 YR 5/2) loam, dark brown (7.5 YR 3/2) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C1 - 12 to 30 inches; pinkish gray (7.5 YR 6/2) loam, dark brown (7.5 YR 4/2) moist; common fine distinct, yellowish brown (10 YR 6/4) mottles; massive; slightly hard; friable; slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

II C2 - 30 to 60 inches; pinkish gray (7.5 YR 6/2) very gravelly loamy sand, dark brown (7.5 YR 4/2) moist; single grain; loose, nonsticky and non-plastic; calcareous; moderately alkaline.

Depth to very gravelly material ranges from 20 to 40 inches.

The A horizon has hue of 7.5 YR or 10 YR, value of 4 to 5 when dry and 2 or 3 when moist, and chroma of 1 to 3. Texture is loam, silt loam, clay loam, or silty clay loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has hue of 7.5 YR to 2.5 Y, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 to 4. Mottles are few or common, fine or medium, and faint or distinct. Texture is loam, silt loam, clay loam or silty clay loam. Content of gravel and cobble ranges from 0 to 35 percent. Reaction is mildly alkaline or moderately alkaline. The IIC horizon has 50 to 80 percent gravel and cobble. Texture of the fine earth fraction is loamy sand or sand.

Note: On-site information for this soil is not available due to no access on privately owned lands within the project area. Characteristics of the soil were obtained from uncorrelated soils maps and descriptions made by the Soil Conservation Service, along with general observations made in other parts of the project area on similar kinds of soils. This soil is identified by the local name of Canninger, somewhat poorly drained, in the Sublette County soil survey legend.

WILSONVILLE VARIANT

The Wilsonville Variant consists of deep, somewhat poorly drained soils on bottomlands. These soils formed in alluvium derived from mixed sources. Slope is 0 to 3 percent. Average annual precipitation is 10 to 14 inches, and average annual air temperature is 35 to 38 degrees F.

These soils are fine-loamy, mixed, Aquic Cryofluvents.

Typical pedon of Wilsonville Variant loam is in an area of Wilsonville Variant-McKinney Variant complex, 0 to 3 percent slopes, in the NE1/4 SE1/4 of Sec.7, T.29N., R.113W.

A1 - 0 to 3 inches; grayish brown (10 YR 5/2) loam, very dark grayish brown (10 YR 3/2) moist, weak fine platy structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C1g - 3 to 10 inches; light brownish gray (10 YR 6/2) fine sandy loam, dark grayish brown (10 YR 4/2) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common fine distinct, strong brown (7.5 YR 5/8) mottles; calcareous; moderately alkaline; clear smooth boundary.

C2g - 10 to 15 inches; light brownish gray (10 YR 6/2) loam, dark grayish brown (10 YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium distinct, strong brown (7.5 YR 5/8) mottles; calcareous; clear smooth boundary.

C3g - 15 to 34 inches; light brownish gray (10 YR 6/2) fine sandy loam stratified with loam, dark grayish brown (10 YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium distinct, strong brown (7.5 YR 5/8) mottles; calcareous; clear smooth boundary.

IIC4 - 34 to 60 inches; light brownish gray (10 YR 6/2) extremely gravelly sandy loam, dark grayish brown (10 YR 4/2) moist; massive parting to single grain; slightly hard, very friable, nonsticky and nonplastic; 70 percent gravel; calcareous, moderately alkaline.

Depth to the very gravelly IIC horizon is typically 20 to 40 inches.

The A horizon has texture of fine sandy loam or loam. The C horizon has textures ranging from fine sandy loam to loam or clay loam that are usually stratified. The IIC horizon has textures of sandy loam or loamy sand with 50 to 80 percent gravel and cobbles.

Note: This soil is a variant from the Wilsonville series because it is fine-loamy.

APPENDIX B2

SOIL SERIES CLASSIFICATION AND DESCRIPTIONS - BIO/WEST SURVEY AREA

(In Numerical Order by Series Number)

(Source: Bio/West 1982)

GUIDE TO CLASSIFICATION OF THE SOILS
(BIO/WEST SURVEY AREA)

Series	Name	Classification
Unnamed	1	Typic Cryorthents, loamy, mixed (calcareous) shallow
Unnamed	2	Lithic Cryorthents, loamy, mixed (calcareous)
Unnamed	3	Typic Cryorthents, clayey, montmorillonitic (calcareous) shallow
Unnamed	4	Typic Cryorthents, fine-loamy, mixed (calcareous)
Unnamed	7	Borollic Calciorthids, fine-loamy, mixed
Unnamed	8	Typic Cryaquolls, fine-loamy, mixed
Unnamed	10	Argic Cryoborolls, fine-loamy, mixed
Unnamed	11	Argic Cryoborolls, loamy-skeletal, mixed
Unnamed	12	Argic Pachic Cryoborolls, fine-loamy, mixed
Unnamed	13	Typic Cryoboralfs, fine, montmorillonitic
Unnamed	14	Mollic Cryoboralfs, loamy-skeletal, mixed
Unnamed	15	Argic Cryoborolls, fine, montmorillonitic
Unnamed	16	Typic Cryorthents, loamy-skeletal, mixed (calcareous) shallow
Unnamed	17	Lithic Cryorthents, loamy-skeletal, mixed (calcareous)
Unnamed	18	Typic Cryorthents, fine-silty, mixed (calcareous)
Unnamed	19	Typic Cryofluvents, fine-silty, mixed (calcareous)
Unnamed	20	Borollic Haplargids, fine-loamy, mixed
Unnamed	21	Argic Cryoborolls, fine-loamy, mixed
Unnamed	22	Lithic Cryorthents, loamy, mixed (calcareous)
Unnamed	23	Typic Cryaquents, fine-silty, mixed (calcareous)
Unnamed	24	Argic Cryoborolls, loamy, mixed, shallow
Unnamed	25	Argic Cryoborolls, loamy-skeletal, mixed, shallow
Unnamed	26	Typic Cryorthents, fine montmorillonitic (calcareous)
Unnamed	27	Typic Cryoborolls, fine-loamy, mixed
Unnamed	28	Cumulic Cryoborolls, fine-loamy, mixed
Unnamed	29	Typic Torriorthents, fine-loamy, mixed (calcareous), frigid
Unnamed	36	Typic Torrifluvents, fine-silty, mixed (calcareous) frigid
Unnamed	37	Typic Camborthids, coarse-loamy, mixed, frigid
Unnamed	39	Typic Natrargids, loamy, mixed, frigid, shallow
Unnamed	41	Typic Torripsamments, mixed (calcareous), frigid
Unnamed	42	Typic Camborthids, fine-silty, mixed, frigid
Unnamed	43	Typic Torriorthents, loamy, mixed (calcareous), frigid, shallow
Unnamed	44	Lithic Cryoborolls, loamy-skeletal, mixed
Unnamed	45	Borollic Haplargids, fine-loamy, mixed

Unnamed One Series

The Unnamed One series consists of shallow, well drained soils that formed in loamy residuum from shale. Unnamed One soils are on side-slopes of mountains and foothills at elevations of 7200 to 9500 feet. Slopes are 3 to 75 percent. Mean annual precipitation is about 10 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed one, gravelly silty clay loam is located in an area of Unnamed One - Unnamed Two - Unnamed Three complex, 15 to 30 percent slopes, in the SW¼ of the SE¼ of Sec. 9, T28N, R114W. Site S1 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 3 inches; reddish brown (5 YR 5/4) gravelly silty clay loam, yellowish red (5 YR 4/6) moist; very weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; many fine tubular pores; surficial coarse fragments consist of 1 percent stones, 5 percent cobbles and 10 percent gravels. Strongly effervescent with disseminated lime; mildly alkaline (pH 7.4); clear smooth boundary (2 to 4 inches thick).

C1 -- 3 to 15 inches; yellowish red (5 YR 5/6) gravelly clay loam, yellowish red (5 YR 4/6) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; many fine and medium roots; common tubular pores; 5 percent cobbles, 5 percent gravels; strongly effervescent with disseminated lime; mildly alkaline (pH 7.4); gradual wavy boundary (8 to 16 inches thick).

Cr -- 15 to 20 inches; shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 35 percent clay. Depth to shale bedrock is 10 to 20 inches.

The A horizon structure is granular or subangular blocky. Coarse fragments are 15 to 25 percent.

The C horizon structure is massive or subangular blocky. Texture is loam, clay loam, silty clay loam. Clay content is 28 to 35 percent. Coarse fragments are 0 to 15 percent.

The Cr horizon is massive or blocky shale.

Unnamed Two Series

The Unnamed Two Series consists of shallow, well drained soils that formed in residuum from sandstone rocks. Unnamed two soils are on mesas, benches, ridges and sideslopes at elevations of 7200 to 9500 feet. Slopes are 0 to 50 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Two very fine sandy loam is located in an area of Unnamed Twenty Two - Unnamed Two Complex, 0 to 5 percent slopes, in the SW¼ of the NW¼ Sec. 16, T28N, R113W. Site S2 on Cretaceous Mountain Quadrangle.

A1 -- 0 to 2 inches; pale brown (10 YR 6/3) very fine sandy loam, brown (10 YR 5/3) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; few fine and medium roots; few fine and medium tubular pores; surficial coarse fragments consist of 5

percent cobbles and 5 percent gravels; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (2 to 3 inches).

C1 -- 2 to 10 inches; pale brown (10 YR 6/3) very fine sandy loam, brown (10 YR 5/3) moist; massive; soft, very friable, nonsticky and slightly plastic; few fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (8 to 10 inches thick).

C2 -- 10 to 16 inches; very pale brown (10 YR 8/3) loam, very pale brown (10 YR 7/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.4); abrupt smooth boundary (0 to 6 inches thick).

R -- 16 inches; sandstone.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent clay. Depth to bedrock is 10 to 20 inches.

The A horizon has coarse fragments of 0 to 15 percent.

The C1 horizon has textures of very fine sandy loam, loam, sandy clay loam. Clay content is 18 to 27 percent. Coarse fragments are 0 to 10 percent.

The C2 horizon has textures of loam, very fine sandy loam, sandy clay loam. Clay content is 18 to 27 percent. Coarse fragments are 0 to 10 percent.

The C2 horizon has textures of loam, very fine sandy loam, sandy clay loam. Clay content is 18 to 27 percent. Coarse fragments are 0 to 10 percent.

The R horizon is massive or platy sandstone.

Unnamed Three Series

The Unnamed Three Series consists of shallow, well drained soils that formed in residuum from shale. Unnamed Three soils are on breaks and sideslopes at elevations of 7200 to 9500 feet. Slopes are 15 to 75 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Three clay loam is located in an area of Unnamed One - Unnamed Two - Unnamed Three complex, 15 to 30 percent slopes, in the NW¼ of the SW¼ Sec. 27, T29N, R113W. Site S3 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 3 inches; reddish brown (5 YR 5/4) clay loam, reddish brown (5 YR 4/4) moist; weak fine granular structure; soft, friable, sticky and plastic; few fine and medium roots; few fine interstitial pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (2 to 4 inches thick).

C1 -- 3 to 15 inches; reddish brown (5 YR 4/4) clay, dark reddish brown (5 YR 3/4) moist; weak medium and fine subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); gradual wavy boundary (8 to 16 inches thick).

Cr -- to 15 inches; shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 40 to 50 percent clay. Depth to shale bedrock is 10 to 20 inches.

The C horizon texture is clay, silty clay. Clay content is 40 to 50 percent.

Unnamed Four Series

The Unnamed Four Series consists of deep, well drained soils that formed in alluvium from mixed rocks. Unnamed Four soils are on fans, floodplains and drainageways at elevations of 7200 to 8200 feet. Slopes are 0 to 9 percent. Mean annual precipitation is about 10 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Four silt loam is located in an area of Unnamed Four - Unnamed one - Unnamed Twenty complex, 5 to 15 percent slopes, in the NW½ of the SE¼ Sec. 16, T29N, R113W. Site S4 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 6 inches; brown (10 YR 5/3) silt loam, dark yellowish brown (10 YR 4/4) moist; weak medium and fine clay structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; slightly effervescent with disseminated lime; neutral (pH 7.2); clear smooth boundary (4 to 6 inches thick).

C1 -- 6 to 24 inches; light brown (7.5 YR 6/4) silty clay loam, brown (7.5 YR 4/4) moist; weak medium subangular blocky structure;

slightly hard, firm, sticky and plastic; many fine and medium roots; few fine and medium tubular pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.6); clear smooth boundary (6 to 20 inches thick).

C2 -- 24 to 45 inches; pink (7.5 YR 7/4) silty clay loam, brown (7.5 YR 5/4) moist; massive; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); gradual wavy boundary (15 to 22 inches thick).

C3 -- 45 to 60 inches; brown (7.5 YR 5/4) silty clay, dark brown (7.5 YR 4/4) moist; massive; very hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2) (15 to 28 inches thick).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 35 percent clay. Depth to bedrock is 60 inches or more. Reaction is neutral to moderately alkaline.

The A horizon has 10 YR and 7.5 YR hue; chroma is 3 or 4. Structure is platy or granular.

The C1 horizon has 10 YR and 7.5 YR hue; value of 5 or 6 dry, and 4 or 5 moist; chroma is 3 or 4. Texture is loam, clay loam or silty clay loam. Clay content is 15 to 35 percent.

The C2 horizon has 10 YR and 7.5 YR hue; value of 6 or 7 dry, and 4 or 5 moist; chroma is 3 or 5. Texture is loam, clay loam or silty clay loam. Clay content is 15 to 35 percent.

The C3 horizon has 10 YR and 7.5 YR hue; value of 5 or 6 dry, and 4 or 5 moist; chroma is 3 or 4. Texture is loam, clay loam, silty clay loam or silty clay. Clay content is 15 to 35 percent.

Unnamed Seven Series

The Unnamed Seven series consists of deep, well drained soils that formed in residuum from mixed rocks. Unnamed Seven soils are on upland ridges and crests of foothills at elevations of 7200 to 8200 feet. Slopes are 3 to 9 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Seven fine sandy loam is located in an area of Unnamed Forty Five-Unnamed Seven complex, 3 to 9 percent slopes, in the NW¼ of the NE¼ Sec. 5, T28N, R113W. Site S7 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 3 inches; yellowish brown (10 YR 5/4) gravelly fine sandy loam, dark yellowish brown (10 YR 4/4) moist; weak fine granular structure; loose, very friable, nonsticky and nonplastic; many fine and medium roots; common fine intersticial pores; surficial coarse fragments consist of 25 percent gravels; slightly effervescent with disseminated lime; mildly alkaline (pH 7.8); clear smooth boundary (2 to 4 inches thick).

B2ca -- 3 to 7 inches; brown (7.5 YR 5/4) silty clay loam, dark brown (7.5 YR 4/4) moist; very weak medium subangular blocky structure; hard, firm, slightly sticky and plastic; common fine and medium roots; few fine tubular pores; 10 percent gravels; strongly effervescent with

disseminated lime; mildly alkaline (pH 7.8); gradual smooth boundary (4 to 8 inches thick).

C1ca -- 7 to 14 inches; pink (7.5 YR 7/4) silt loam, light brown (7.5 YR 6/4) moist, massive; slightly hard; firm, slightly sticky and plastic; common fine and medium roots; few fine tubular pores; 10 percent gravels; violently effervescent with disseminated lime; moderately alkaline (pH 8.3); clear wavy boundary (7 to 12 inches thick).

C2ca -- 14 to 38 inches; light brown (7.5 YR 6/4) sandy clay loam, brown (7.5 YR 5/4) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; very few fine and medium roots; few fine tubular pores; violently effervescent with disseminated lime; moderately alkaline (pH 8.4); gradual wavy boundary (20 to 30 inches thick).

C3ca -- 38 to 60 inches; light brown (7.5 YR 6/4) sandy loam, brown (7.5 YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; very few fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.4).

Range in characteristics: These soils have short, cool summers and long, cold winters. When mixed, the control section contains 18 to 35 percent clay. Depth to bedrock is 60 inches or more. Reaction is mildly to moderately alkaline.

The A horizon has coarse fragments of 15 to 30 percent.

The B2ca horizon has textures of clay loam or silty clay loam. Clay content is 28 to 35 percent. Coarse fragments are 0 to 10 percent.

The C1ca horizon has textures of silt loam, very fine sandy loam. Clay content is 18 to 27 percent. The C2ca horizon has textures of silt loam, very fine sandy loam, sandy clay loam. Clay content is 18 to 27 percent.

The C3ca horizon has clay content of 10 to 27 percent.

Unnamed Eight Series

The Unnamed Eight series consists of deep, poorly drained soils that formed in alluvium from mixed rocks. Unnamed Eight soils are on floodplains at elevations of 7500 to 8500 feet. Slopes are 5 percent. Mean annual precipitation is about 12 to 16 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Eight loam is located in an area of Unnamed Eight - Unnamed Twenty Eight - Unnamed Thirty complex, 0 to 5 percent slopes, in the NW¼ of the SE¼ Sec. 29, T30N, R114W. Site S8 on the Meadow Canyon SW (renamed Springman Creek in 1980) Quadrangle.

A1g -- 0 to 11 inches; very dark grayish brown (10 YR 3/2) loam, black (10 YR 2/1) moist; weak medium subangular and weak medium crumb structure; slightly hard, very friable, nonsticky and slightly plastic; common fine and medium roots; few fine tubular pores; few medium distinct (10 YR 5/6) mottles; neutral (pH 7.2); clear wavy boundary (8 to 12 inches thick).

C1g -- 11 to 41 inches; pinkish gray (7.5 YR 6/2) loam, dark brown (7.5 YR 3/2) moist; massive; hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores; many medium distinct (10 YR 5/6) mottles; neutral (pH 7.2); abrupt wavy boundary (30 to 40 inches thick).

IIC2g -- 40 to 50 inches; pale brown (10 YR 6/3) very gravelly sand, dark brown (10 YR 4/3) moist; single grain; nonsticky and nonplastic; common, fine distinct (10 YR 5/6) mottles; 60 percent gravels; slightly effervescent with disseminated lime; mildly alkaline (pH 7.4).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent clay. Depth to bedrock is 60 inches or more. Reaction is neutral to mildly alkaline.

The C1g horizon has texture of loam, silt loam. Clay content is 18 to 27 percent.

The IIC2g horizon has texture of very gravelly sandy loam. Clay content is 5 to 18 percent. Coarse fragments are 35 to 70 percent.

Unnamed Nine Series

The Unnamed Nine Series consists of deep, well drained soils that formed in alluvium from mixed rocks. Unnamed Nine soils are on old alluvial plains, fans and uplands at elevations of 7200 to 8200 feet. Slopes are 3 to 9 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Nine fine sandy loam is located in an area of Unnamed Nine-Unnamed Four complex, 0 to 5 percent slopes, in the SW¼ of the NE¼ Sec. 34, T29N, R113W. Site S9 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 4 inches; brown (7.5 YR 5/4) fine sandy loam, dark brown (7.5 YR 4/4) moist; weak medium platy structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consist of 10 percent gravels; mildly alkaline (pH 7.4); clear smooth boundary (3 to 5 inches thick).

B2t -- 4 to 10 inches; strong brown (7.5 YR 5/6) very gravelly sandy clay loam, strong brown (7.5 YR 4/6) moist; weak medium prismatic structure parting to weak medium subangular blocks; hard, friable, sticky and plastic; many fine and medium roots; few fine tubular pores; 40 percent gravels; common thin clay films on ped faces; mildly alkaline (pH 7.4); clear smooth boundary (6 to 10 inches thick).

B3ca -- 10 to 18 inches; reddish yellow (7.5 YR 6/6) very gravelly sandy clay loam, strong brown (7.5 YR 4/6) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and plastic; few fine and medium roots; few fine tubular pores; few thin clay films on ped faces; 5 percent cobbles, 35 percent gravels; strongly effervescent with soft masses and filaments of lime; mildly alkaline (pH 7.8); clear irregular boundary (6 to 10 inches thick).

C1ca -- 18 to 60 inches; brown (7.5 YR 5/4) very gravelly sandy loam, dark brown (7.5 YR 4/4) moist; single grain; loose, very friable, nonsticky and nonplastic; few fine medium roots; few fine tubular pores; 10 percent cobbles, 50 percent gravels; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 15 to 25 inches. When mixed, the

control section contains 18 to 30 percent clay. Depth to lime is 10 to 20 inches. Depth to bedrock is 60 inches or more. Reaction is mildly to moderately alkaline.

The A horizon has coarse fragments of 5 to 15 percent.

The B2t horizon has textures of sandy clay loam, clay loam that are very gravelly. Clay content is 18 to 20 percent. Coarse fragments are 35 to 50 percent.

The B3ca horizon has textures of sandy clay loam, clay loam that are very gravelly. Clay content is 18 to 30 percent. Coarse fragments are 35 to 50 percent.

The C1ca horizon has textures of sandy loam, sandy clay loam that are very gravelly. Clay content is 10 to 27 percent. Coarse fragments are 35 to 70 percent.

Unnamed Ten Series

The Unnamed Ten Series consists of deep, well drained soils that formed in residuum from mixed rocks. Unnamed Ten soils are on mountain summits, shoulders and slightly concave crests, and sideslopes at elevations of 8200 to 9500 feet. Slopes are 5 to 40 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Ten very fine sandy loam is located in an area of Unnamed Ten - Unnamed Fifteen - Unnamed Four complex, 5 to 15 percent slopes, in the NW¼ of the NW¼ of Sec. 19, T29N, R114W. Site S10 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 4 inches; dark reddish gray (5 YR 4/2) very fine sandy loam, dark reddish brown (5 YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; few fine tubular pores; surficial coarse fragments consist of a trace of stones, 5 percent cobbles and 5 percent gravels; neutral (pH 7.2); clear smooth boundary (3 to 7 inches thick).

B1 -- 4 to 10 inches; reddish brown (5 YR 4/4) cobbly silt loam, dark reddish brown (5 YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine, and few medium roots; few fine and medium tubular pores; 15 percent cobbles, 15 percent gravels; neutral (pH 7.2); clear wavy boundary (0 to 6 inches thick).

B21t -- 10 to 19 inches; reddish brown (5 YR 5/4) cobbly clay loam, reddish brown (10 YR 4/4) moist; weak medium prismatic structure parting to moderate medium angular blocks; very hard, very firm, very sticky and plastic; many medium and fine roots; few fine tubular pores; common moderately thick clay films on ped faces and in pores; 10 percent cobbles, 15 percent gravels; neutral (pH 7.2); clear wavy boundary (5 to 10 inches thick).

B22tca -- 19 to 30 inches; reddish brown (2.5 YR 5/4) clay loam, dark reddish brown (2.5 YR 3/4) moist; moderate medium prismatic structure parting to moderate medium angular blocks; very hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; common moderately thick clay films on ped faces; slightly effervescent with soft masses and filaments of lime; mildly alkaline (pH 7.4); clear wavy boundary (0 to 12 inches thick).

C1ca -- 30 to 60 inches; light reddish brown (2.5 YR 6/4) clay loam, reddish brown (2.5 YR 5/4) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few fine tubular pores; strongly effervescent with nodules and filaments of lime; moderately alkaline (pH 8.0).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 12 to 30 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to lime is 12 to 20 inches. Depth to bedrock is 50 to 60 inches or more. Reaction is neutral to moderately alkaline in the C horizons.

The A horizon has 10 YR to 5 YR hue; value of 4 or 5 dry; chroma is 2 or 3. Structure is granular, crumb or subangular blocky. Coarse fragments are 0 to 25 percent.

The B1 horizon has 7.5 YR or 5 YR hue; chroma is 2 to 4. Texture is cobbly clay loam, cobbly silty clay loam, gravelly clay loam, gravelly silty clay loam. Clay content is 27 to 35 percent. Coarse fragments are 15 to 25 percent.

The B21t horizon has 10 YR to 5 YR hue; chroma is 3 or 4. Texture is clay loam, silty clay loam. Clay content is 27 to 35 percent. Coarse fragments are 0 to 25 percent.

The B22tca horizon has 2.5 YR and 5 YR hue. Texture is clay loam or silty clay loam. Clay content is 27 to 35 percent. Coarse fragments are 0 to 30 percent.

The C1ca horizon has 2.5 YR or 5 YR hue; value of 6 or 7 dry; structure is massive or subangular blocky, clay content is 27 to 35 percent. Coarse fragments are 0 to 25 percent.

Note: Some pedons have B3ca horizons, some pedons have shale between 50 and 60 inches.

Unnamed Eleven Series

The unnamed Eleven series consists of deep, well drained soils that formed in gravelly residuum from mixed rocks. Unnamed Eleven soils are on mountain sideslopes at elevations of 8200 to 9500 feet. Slopes are 15 to 30 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Eleven very gravelly loam is located in an area of Unnamed Ten - Unnamed Fifteen - Unnamed Four complex, 5 to 15 percent slopes, in the NW¼ of the NE¼ Sec. 29, T30N, R114W. Site S11 on the Meadow Canyon SW (renamed Springman Creek in 1980) Quadrangle.

A1 -- 0 to 3 inches; dark brown (10 YR 3/3) very gravelly loam, very dark grayish brown (10 YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consist of 5 percent cobbles and 10 percent gravels; neutral (pH 7.2); clear smooth boundary (2 to 4 inches thick).

B1 -- 3 to 8 inches; dark brown (10 YR 4/3) very gravelly sandy clay loam, dark brown (10 YR 3/3) moist; weak medium and fine subangular

blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; few fine tubular pores; 5 percent cobbles, 25 percent gravels; neutral (pH 7.2); clear wavy boundary (4 to 6 inches thick).

B2t -- 8 to 15 inches; yellowish brown (10 YR 5/4) very gravelly sandy clay loam, dark yellowish brown (10 YR 3/4) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; common fine and medium, and few large roots; few fine and medium tubular pores; few thin clay films on ped faces and in pores; 10 percent cobbles, 30 percent gravels; neutral (pH 7.2); clear wavy boundary (6 to 10 inches thick).

C1 -- 15 to 30 inches; light brownish gray (10 YR 6/2) very gravelly loam, grayish brown (10 YR 5/2) moist; massive; hard, friable, sticky and plastic; few fine and medium roots; few fine tubular pores; 20 percent cobbles, 40 percent gravels; slightly effervescent with filaments of lime; mildly alkaline (pH 7.4); clear wavy boundary (14 to 20 inches thick).

C2ca -- 30 to 50 inches; yellowish (10 YR 7/6) very gravelly sandy clay loam, brownish yellow (10 YR 6/6) moist; massive; very hard, very firm, sticky and plastic; few fine and medium roots; few fine tubular pores; 15 percent cobbles, 45 percent gravels; strongly effervescent with soft masses and filaments of lime; mildly alkaline (pH 7.8).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 15 to 20 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to lime is 15 to 20 inches. Depth to bedrock is 50 inches or more. Reaction is neutral to mildly alkaline.

The A horizon has coarse fragments of 30 to 45 percent.

The B1 horizon has clay content of 25 to 35 percent. Coarse fragments are 30 to 40 percent.

The B2t horizon has clay content of 27 to 35 percent. Coarse fragments of 35 to 50 percent.

The C horizon has 10 YR hue; value of 6 or 7 dry, and 5 or 6 moist; chroma is 2 to 6. Texture is very gravelly loam, very gravelly sandy clay loam. Clay content is 18 to 35 percent. Coarse fragments are 35 to 70 percent.

Unnamed Twelve Series

Unnamed Twelve Series consists of deep, well drained soils that formed in residuum from shale rocks. Unnamed Twelve soils are on concave mountain side slopes at elevations of 8200 to 9500 feet. Slopes are 5 to 15 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twelve loam is located in an area of Unnamed Twelve - Unnamed Eleven complex, 5 to 15 percent slopes, in the SE¼ of the SW¼ Sec. 28, T29N, R114W. Site S12 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 3 inches; dark reddish brown (5 YR 3/2) loam, dark reddish brown (5 YR 2.5/2) moist; weak medium crumb and weak fine granular structure; many fine, medium and large roots; few fine tubular pores; slightly acid (pH 6.4); abrupt smooth boundary (3 to 7 inches thick).

B21t -- 3 to 16 inches; dark reddish brown (5 YR 3/2) clay loam, dark reddish brown (5 YR 2.5/2) moist; weak medium prismatic structure parting to moderate medium blocks; very hard, very firm, sticky and plastic; few fine, medium and large roots; few fine and medium tubular pores; common moderately thick clay films on ped faces and in pores; slightly acid (pH 6.4); clear smooth boundary (12 to 15 inches thick).

B22t -- 16 to 30 inches; reddish brown (5 YR 4/4) clay loam, reddish brown (5 YR 4/3) moist; moderate medium and fine subangular blocky structure; very hard, very firm, sticky and plastic; few fine medium and large roots; few fine and medium tubular pores; common moderately thick clay films on ped faces and in pores; neutral (pH 6.8); abrupt wavy boundary (0 to 14 inches thick).

C1ca -- 30 to 60 inches; light reddish brown (5 YR 6/3) clay loam, reddish brown (5 YR 5/3) moist; massive; hard, friable, sticky and plastic; few fine, medium and large roots; few fine and medium tubular pores; strongly effervescent with soft masses and filaments of lime; neutral (pH 7.0).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 26 to 30 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to lime is 30 to 35 inches. Depth to bedrock is 60 inches or more.

The A horizon has 10 YR to 5 YR hue; value of 2 or 3 dry, and 2 or 2.5 moist; chroma is 1 or 2.

The B21t horizon has 7.5 YR or 5 YR hue; and 2 or 2.5 moist.

Structure is prismatic or blocky. Clay content is 27 to 35 percent.

The C horizon has 5 YR or 2.5 YR hue; value of 4 to 6 dry, and 3 to 5 moist; chroma is 3 or 4. Texture is clay loam, very gravelly clay loam. Clay content is 27 to 35 percent. Coarse fragments are 0 to 40 percent.

Unnamed Thirteen Series

The Unnamed Thirteen Series consists of deep, well drained soils that formed in residuum from shale rocks. Unnamed Thirteen soils are on north aspect mountain benches, terraces and side slopes at elevations of 8200 to 9500 feet. Slopes are 30 to 50 percent. Mean annual precipitation is about 18 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Thirteen loam is located in an area of Unnamed Thirteen - Unnamed Fourteen complex, 30 to 50 percent slopes, in SE¼ of the NW¼ Sec. 19, T29N, R114W. Site S13 on the Pine Grove Ridge Quadrangle.

O1 -- 2 to 0 inches; organic needles.

A1 -- 0 to 4 inches; yellowish brown (10 YR 5/4) loam, dark yellowish brown (10 YR 4/4) moist; weak fine subangular blocky and weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine, and few medium roots; few fine tubular pores; 10 percent gravels; slightly acid (pH 6.2) (3 to 5 inches thick).

A2 -- 4 to 8 inches; light brown (7.5 YR 6/4) light sandy clay loam, dark yellowish brown (10 YR 4/4) moist; weak medium subangular blocky

and weak fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; few fine and few medium roots; few fine tubular pores; 10 percent gravels; slightly acid (pH 6.2); clear wavy boundary (3 to 6 inches thick).

B21t -- 8 to 20 inches; reddish yellow (5 YR 6/6) silty clay loam, yellowish red (5 YR 4/6) moist; weak medium prismatic structure parting to moderate medium and fine blocks; hard, firm, sticky and very plastic; very few fine and few very fine roots; few fine tubular pores; common moderately thick clay films on ped faces and in pores; 10 percent gravels; slightly acid (pH 6.2); clear smooth boundary (10 to 14 inches thick).

B22t -- 20 to 30 inches; reddish yellow (5 YR 6/6) gravelly silty clay loam, yellowish red (5 YR 4/6) moist; weak medium prismatic structure parting to moderate medium and fine angular blocks; very hard, very firm, very sticky and very plastic; very few fine and few very fine roots; few fine tubular pores; 20 percent gravels; slightly acid (pH 6.2); clear wavy boundary (8 to 12 inches thick).

C1 -- 30 to 42 inches; shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 30 to 40 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to shale bedrock is 20 to 40 inches.

The A horizon has coarse fragments of 0 to 10 percent.

The A2 horizon has coarse fragments of 0 to 10 percent.

The B21t horizon has clay content of 27 to 35 percent.

The B22t horizon has clay content of 27 to 35 percent. Coarse fragments are 0 to 20 percent.

Unnamed Fourteen Series

The Unnamed Fourteen Series consists of deep, well drained soils that formed in residuum from shale and limestone rocks. Unnamed Fourteen soils are on the north aspect of mountain slopes at elevations of 8200 to 9500 feet. Slopes are 15 to 50 percent. Mean annual precipitation is about 18 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Fourteen loam is located in an area of Unnamed Thirteen - Unnamed Fourteen complex, 30 to 50 percent slopes, in the NW¼ of the NE¼ Sec. 31, T29N, R114W. Site S14 on the Pine Grove Ridge Quadrangle.

O1 -- 2 to 0 inches; organic conifer needles.

A1 -- 0 to 3 inches; brown (7.5 YR 5/4) loam, dark brown (7.5 YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; common fine interstitial pores; 5 percent cobbles, 5 percent gravels; medium acid (pH 6.0); abrupt smooth boundary (2 to 4 inches thick).

A2 -- 3 to 12 inches; light brown (7.5 YR 6/4) very fine sandy loam, dark brown (7.5 YR 4/3) moist; massive and weak fine granular structure; soft, very friable, nonsticky and slightly plastic; few fine and medium roots; few fine tubular pores; 5 percent cobbles, 5 percent gravels; medium acid (pH 6.0); clear wavy boundary (3 to 9 inches thick).

B2t -- 12 to 33 inches; reddish brown (2.5 YR 4/4) very gravelly clay loam, dark red (2.5 YR 3/6) moist; weak medium and fine subangular blocky structure; hard, firm, sticky and plastic; few fine, medium and large roots; few fine and medium tubular pores; few thin clay films on ped faces and in pores; 10 percent cobbles, 30 percent gravels; medium acid (pH 6.0); gradual wavy boundary (9 to 21 inches thick).

C1 -- 33 to 42 inches; brown (7.5 YR 5/4) very gravelly clay loam, dark brown (7.5 YR 3/4) moist; massive; hard, firm, sticky and plastic; few fine, medium and large roots; pores; 5 percent cobbles, 35 percent gravels; slightly acid (pH 6.4).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 15 to 33 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to bedrock is 42 inches or more. Reaction is medium acid to mildly acid.

The A1 horizon has coarse fragments of 0 to 15 percent.

The A2 horizon has texture of very fine sandy loam, gravelly sandy loam. Clay content is 10 to 20 percent. Coarse fragments are 10 to 20 percent.

The B2t horizon structure is prismatic or blocky. Texture is very gravelly clay loam, very gravelly sandy clay loam. Clay content is 27 to 35 percent. Coarse fragments are 35 to 50 percent.

The C horizon has textures of very gravelly clay loam or cobbly clay loam. Clay content is 27 to 35 percent. Coarse fragments are 35 to 50 percent.

*Note: A B1 horizon occurs in some pedons.

Unnamed Fifteen Series

The Unnamed Fifteen Series consists of deep, well drained soils that formed in residuum from shale and limestone rocks. Unnamed Fifteen soils are on mountain and foothill summits, crests and shoulders at elevations of 8000 to 9500 feet. Slopes are 5 to 30 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Fifteen gravelly silt loam is located in an area of Unnamed Ten - Unnamed Fifteen - Unnamed Four complex, 5 to 15 percent slopes, in the NW¼ of the NW¼ Sec. 19, T29N, R114W. Site S15 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 4 inches; dark grayish brown (10 YR 4/2) gravelly silt loam, very dark grayish brown (10 YR 3/2) moist; weak fine crumb and weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consist of 3 percent cobbles and 20 percent gravels; slightly acid (pH 6.4); clear smooth boundary (3 to 5 inches thick).

B1 -- 4 to 10 inches; dark brown (10 YR 3/3) gravelly silty clay loam, very dark grayish brown (10 YR 3/2) moist; moderate medium and fine subangular blocky structure; slightly hard, firm, sticky and plastic; many fine and medium roots; few fine and medium tubular pores; 5 percent cobbles, 10 percent gravels; mildly acid (pH 6.4); clear smooth boundary (0 to 6 inches thick).

B21t -- 10 to 20 inches; reddish brown (5 YR 4/4) clay, dark reddish brown (5 YR 3/4) moist; weak medium prismatic structure parting to

strong medium blocks; very hard, very firm, very sticky and very plastic; few fine and very fine roots; few fine tubular pores; many moderately thick clay films on ped faces and in pores; trace of cobbles, 10 percent gravels; neutral (pH 6.6); clear wavy boundary (10 to 15 inches thick).

B22tca -- 20 to 45 inches; pink (5 YR 7/3) silty clay, reddish brown (5 YR 4/4) moist; moderate coarse prismatic structure parting to strong medium angular blocks; very hard, very firm, very sticky and very plastic; very few very fine roots; very few fine tubular pores; common moderately thick clay films on ped faces and in pores; violently effervescent with many soft masses and filaments of lime; moderately alkaline (pH 8.2); clear wavy boundary (0 to 25 inches thick).

C1ca -- 45 to 70 inches; very pale brown (10 YR 7/2) clay loam, light yellowish brown (10 YR 6/4) moist; massive; hard, firm, sticky and plastic; few very fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual temperature is 39 to 43 degrees F. Thickness of solum is 20 to 45 inches. When mixed, the control section contains 40 to 60 percent clay. Depth to lime is 12 to 20 inches. Depth to bedrock is 60 inches or more. Reaction is slightly acid to moderately alkaline in the lower depths.

The A horizon has 10 YR to 5 YR hue; chroma is 2 or 3. Structure is granular, crumb or blocky. Coarse fragments are 10 to 25 percent.

The B1 horizon has 10 YR to 5 YR hue; value of 3 or 4 dry; chroma is 2 or 3. Clay content is 27 to 35 percent. Coarse fragments are 0 to 15 percent.

The B21t horizon chroma is 2 to 4. Texture is clay, silty clay. Clay content is 40 to 60 percent. Coarse fragments are 0 to 15 percent.

The B22t horizon chroma is 3 or 4. Clay content is 40 to 60 percent. Coarse fragments are 0 to 15 percent.

The Cca horizon has 10 YR to 5 YR hue; value of 6 or 7 dry, and 4 to 6 moist; chroma is 4 to 6. Clay content is 27 to 35 percent. Coarse fragments are 0 to 15 percent.

Note: Some pedons lack B1 horizons.
Some pedons have B3ca horizons.

Unnamed Sixteen Series

The Unnamed Sixteen Series consists of shallow, well drained soils that formed in very gravelly residuum from shale rocks. Unnamed Sixteen soils are on mountain and foothill shoulders and crests at elevations of 8100 to 9500 feet. Slopes are 5 to 50 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Sixteen very gravelly loam is located in an area of Unnamed Ten - Unnamed Fifteen - Unnamed Four complex, 5 to 15 percent slopes, in the NE¼ of the SW¼ Sec. 33, T30N, R114W. Site S16 on Meadow Canyon SW (renamed Springman Creek in 1980) Quadrangle.

A1 -- 0 to 4 inches; reddish brown (2.5 YR 4/4) very gravelly loam, dark reddish brown (2.5 YR 3/4) moist; weak medium subangular blocky and

weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consists of 5 percent stones, 15 percent cobbles and 30 percent gravels; strongly effervescent with disseminated lime; mildly alkaline (pH 7.6); clear smooth boundary (3 to 5 inches thick).

C1 -- 4 to 10 inches; very pale brown (10 YR 7/3) very gravelly loam, brown (10 YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; 15 percent cobbles, 35 percent gravels; strongly effervescent with disseminated lime; mildly alkaline (pH 7.8); gradual smooth boundary (5 to 7 inches thick).

C2 -- 10 to 17 inches; light gray (10 YR 7/2) very gravelly loam, yellowish brown (10 YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; 20 percent cobbles, 50 percent gravels; strongly effervescent with disseminated lime; mildly alkaline (pH 7.8); clear wavy boundary (6 to 8 inches thick).

Cr -- 17 to 24 inches; shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. the mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 15 to 27 percent clay. Depth to shale bedrock is 10 to 20 inches.

The A horizon has coarse fragments of 35 to 50 percent.

The C1 horizon has clay content of 18 to 27 percent. Coarse fragments are 35 to 50 percent.

The C2 horizon has clay content of 17 to 27 percent. Coarse fragments are 35 to 70 percent.

Unnamed Seventeen Series

The Unnamed Seventeen Series consists of shallow, well drained soils that formed in gravelly residuum from sandstone rocks. Unnamed Seventeen soils are on breaks, ridges and crests at elevations of 7200 to 8200 feet. Slopes are 15 to 30 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Seventeen very gravelly fine sandy loam is located in an area of Unnamed Seventeen - Rock Outcrop - Unnamed One complex, 15 to 50 percent slopes, in the SW¼ of the SE¼ Sec. 12, T28N, R114W. Site S17 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 3 inches; yellowish brown (10 YR 5/4) very gravelly fine sandy loam, dark yellowish brown (10 YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine, very fine and medium roots; common interstitial pores; surficial coarse fragments consist of trace of stones, 15 percent cobbles and 25 percent gravels; slightly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (2 to 4 inches thick).

C1 -- 3 to 16 inches; yellow (2.5 YR 7/6) very gravelly very fine sandy loam, olive yellow (2.5 YR 6/6) moist; massive; soft, very friable, slightly sticky and slightly plastic; many fine, very fine and medium roots; few fine tubular pores; 15 percent cobbles, 30 percent

gravels; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); gradual wavy boundary (8 to 17 inches thick).

R -- 16 inches; sandstone.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 15 to 25 percent clay. Depth to bedrock is 10 to 20 inches.

The A horizon has coarse fragments of 35 to 50 percent.

The C horizon has clay content of 15 to 25 percent. Coarse fragments are 35 to 50 percent.

Unnamed Eighteen Series

The Unnamed Eighteen Series consists of deep, well drained soils that formed in silty alluvium from mixed rocks. Unnamed Eighteen soils are on floodplains and fans at elevations of 7200 to 8200 feet. Slopes are 0 to 5 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Eighteen silty clay loam is located in an area of Unnamed Eighteen - Unnamed Nineteen complex, 0 to 5 percent slopes, in the SE¼ of the SE¼ Sec. 25, T28N, R114W. Site S18 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 4 inches; light brown (7.5 YR 6/4) silty clay loam, dark brown (7.5 YR 4/4) moist; weak medium platy structure parting to weak fine granular; soft, friable, sticky and plastic; many fine, and few medium roots; few fine and medium tubular pores; strongly effervescent

with disseminated lime; mildly alkaline (pH 7.8); clear smooth boundary (3 to 4 inches thick).

C1 -- 4 to 13 inches; light reddish brown (5 YR 6/4) silty clay loam, reddish brown (5 YR 5/4) moist; weak medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and very fine roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (8 to 10 inches thick).

C2 -- 13 to 32 inches; light reddish brown (5 YR 6/4) silty clay loam, reddish brown (5 YR 5/4); massive; hard, firm, very sticky and very plastic; few fine and very fine roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2); gradual smooth boundary (19 to 48 inches thick).

C3 -- 32 to 60 inches; pink (5 YR 7/4) light silty clay, reddish brown (5 YR 5/4) moist; massive; hard, firm, very sticky and very plastic; few fine tubular pores; 5 percent gravels; strongly effervescent with disseminated lime; moderately alkaline (pH 8.4).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 20 to 35 percent clay. Depth to bedrock is 60 inches or more. Reaction is mildly alkaline to moderately alkaline.

The A horizon has 10 YR or 7.5 YR hue; value of 5 or 6 dry. Structure is platy or granular.

The C1 horizon has 10YR to 5 YR hue; value of 5 or 6 dry, and 4 or 5 moist. Structure is platy or blocky. Texture is silt loam, silty clay loam. Clay content is 20 to 35 percent.

The C2 horizon has 10 YR to 5 YR hue; value of 5 or 6 dry, and 4 or 5 moist. Texture is silt loam, silty clay loam. Clay content is 20 to 35 percent.

The C3 horizon has 10 YR to 5 YR hue. Texture is light silty clay. Clay content is 35 to 40 percent.

Note: Some profiles do not have a C3 horizon.
Some pedons are salty.

Unnamed Nineteen Series

The Unnamed Nineteen Series consists of deep, well drained soils that formed in alluvium from mixed rocks. Unnamed Nineteen soils are on floodplains at elevations of 7200 to 8200 feet. Slopes are 0 to 3 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost free season is 22 to 28 days.

A typical pedon of Unnamed Nineteen silt loam is located in an area of Unnamed Eighteen - Unnamed Nineteen complex, 0 to 5 percent slopes, in NE¼ of the NE¼ Sec. 20, T28N, R113W. Site S19 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 4 inches; brown (7.5 YR 5/4) silt loam, dark brown (7.5 YR 4/4) moist; weak medium platy and weak fine granular structure; slightly hard, very friable, slightly sticky and plastic; few fine and medium roots; few fine and medium tubular pores; strongly effervescent

with disseminated lime; moderately alkaline (pH 8.2); abrupt smooth boundary (3 to 5 inches thick).

C1 -- 4 to 24 inches; pale brown (10 YR 6/3) silty clay loam, dark brown (10 YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots, few fine tubular pores, strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); abrupt smooth boundary (18 to 22 inches thick).

C2 -- 24 to 42 inches; light reddish brown (5 YR 6/4) silty clay loam, reddish brown (5 YR 4/4) moist; massive; hard, friable, sticky and plastic; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 27 to 35 percent clay. Depth to bedrock is 42 inches or more.

The C horizon has coarse fragments of 0 to 10 percent.

The C2 horizon has coarse fragments of 0 to 15 percent.

Unnamed Twenty Series

The Unnamed Twenty series consists of moderately deep, well drained soils that formed in residuum from shale rocks. Unnamed Twenty soils are on upland side slopes at elevations of 7200 to 9000 feet. Slopes are 5 to 15 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty very fine sandy loam is located in an area of Unnamed Four - Unnamed One - Unnamed Twenty complex, 5 to 15 percent slopes, in the NW¼ of the NW¼ Sec. 32, T28N, R113W. Site S20 on the Hogsback Quadrangle.

A1 -- 0 to 4 inches; pale brown (10 YR 6/3) very fine sandy loam, dark brown (10 YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; few fine interstitial pores; neutral (pH 7.2); clear smooth boundary (3 to 5 inches thick).

B1 -- 4 to 10 inches; yellowish brown (10 YR 5/4) loam, dark yellowish brown (10 YR 4/4) moist; weak coarse platy and weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; neutral (pH 7.2); clear smooth boundary (5 to 7 inches thick).

B2t -- 10 to 24 inches; brown (7.5 YR 5/4) silty clay loam, dark brown (7.5 YR 4/4) moist; moderate medium and fine angular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few fine tubular pores; few thin clay films on ped faces and in pores; neutral (pH 7.2); clear wavy boundary (12 to 16 inches thick).

Cr -- 24 inches; calcareous shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 20 to 30 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to shale bedrock is 20 to 40 inches.

The A horizon has coarse fragments of 0 to 15 percent.

The B1 horizon structure is platy or blocky. Clay content is 15 to 27 percent. Coarse fragments are 0 to 15 percent.

The B2t horizon has 7.5 YR hue; value of 5 or 6 dry, and 3 or 4 moist. Texture is silty clay loam or cobbly silty clay loam. Clay content of 27 to 35 percent. Coarse fragments are 0 to 15 percent.

Unnamed Twenty One Series

The Unnamed Twenty One Series consists of moderately deep, well drained soils that formed in residuum from shale rocks. Unnamed Twenty One soils are on mountain side slopes, south aspect at elevations of 8200 to 9500 feet. Slopes are 15 to 30 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty One gravelly very fine sandy loam is located in an area of Unnamed Sixteen - Unnamed One - Unnamed Twenty-Five complex, 30 to 50 percent slopes, in the SE¼ of the NW¼ Sec. 20, T29N, R114W. Site S21 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 2 inches; grayish brown (10 YR 5/2) gravelly very fine sandy loam, very dark grayish brown (10 YR 3/2) moist; weak fine crumb and weak fine granular structure; soft, friable nonsticky and nonplastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consist of a trace of stones, 5 percent cobbles and 15 percent gravels; neutral (pH 6.8); clear smooth boundary (2 to 4 inches thick).

B1 -- 2 to 8 inches; grayish brown (10 YR 5/2) gravelly loam, very dark grayish brown (10 YR 3/2) moist; weak medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; 5 percent cobbles, 15 percent gravels; neutral (pH 6.8); clear smooth boundary (4 to 8 inches thick).

B2t -- 8 to 18 inches; dark yellowish brown (10 YR 4/4) gravelly sandy clay loam, dark yellowish brown (10 YR 3/4) moist; moderate medium prismatic structure parting to moderate medium angular blocks; few fine and medium roots; few fine tubular pores; few thin clay films on ped faces and in pores; 5 percent cobbles, 15 percent gravels; neutral (pH 6.8); clear smooth boundary (8 to 12 inches thick).

C1ca -- 18 to 24 inches; light brown (7.5 YR 6/4) gravelly loam dark brown (7.5 YR 4/4) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores; 5 percent cobbles, 20 percent gravels; strongly effervescent with many soft masses and filaments of lime; mildly alkaline (pH 7.8); gradual wavy boundary (6 to 8 inches thick).

Cr -- 24 to 60 inches; shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 18 to 25 inches. When mixed, the control section contains 20 to 30 percent clay. Depth to lime is 18 to 25 inches. Depth to shale bedrock is 20 to 40 inches. Reaction is neutral to mildly alkaline.

The A horizon has 10 YR or 7.5 YR hue; value of 4 or 5 dry; chroma is 2 or 3; coarse fragments of 15 to 25 percent.

The B1 horizon has 10 YR or 7.5 YR hue; value of 4 or 5 dry. Clay content of 18 to 27 percent. Coarse fragments are 15 to 25 percent.

The B2t horizon has 10 YR or 7.5 YR hue; clay content is 20 to 30 percent. Coarse fragments are 15 to 25 percent.

The C1ca horizon is gravelly loam, gravelly sandy clay loam. Clay content is 18 to 27 percent. Coarse fragments are 15 to 25 percent.

Unnamed Twenty Two Series

The Unnamed Twenty Two series consists of very shallow, excessively drained soils that formed in residuum from sandstone rocks. Unnamed Twenty Two soils are on crests of mesa tops at elevations of 7200 to 8200 feet. Slopes are 0 to 5 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty Two very fine sandy loam is located in an area of Unnamed Twenty Two - Unnamed Two complex 0 to 5 percent slopes, in the SE¼ of the NE¼ Sec. 17, T28N, R113W. Site S22 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 2 inches; pale brown (10 YR 6/3) very fine sandy loam, brown (10 YR 5/3) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; very fine and medium roots; few fine interstitial pores; trace of cobbles and 10 percent gravels; rock outcrop is 5 percent; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (2 to 3 inches thick).

C1 -- 2 to 7 inches; pale brown (10 YR 6/3) very fine sandy loam, dark brown (10 YR 4/3) moist; massive; soft, very friable, nonsticky and slightly plastic; few fine and medium roots; few fine tubular pores; 5 percent cobbles, 5 percent gravels; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); abrupt smooth boundary (4 to 6 inches thick).

R -- 7 inches; sandstone.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 15 to 27 percent clay. Depth to bedrock is 5 to 10 inches.

The A horizon has coarse fragments of 0 to 15 percent.

The C1 horizon has clay content of 18 to 27 percent. Coarse fragments are 0 to 15 percent.

Unnamed Twenty Three Series

The Unnamed Twenty Three Series consists of deep, poorly drained soils that formed in alluvium from mixed rocks. Unnamed Twenty Three soils are on floodplains at elevations of 7200 to 8200 feet. Slopes are 0 to 3 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty Three silt loam is located in an area of Unnamed Eighteen - Unnamed Twenty Three complex, 0 to 5 percent slopes, in the NE¼ of the NE¼ Sec. 20, T28N, R113W. Site S23 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 4 inches; light brownish gray (10 YR 6/2) silt loam, dark grayish brown (10 YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (3 to 5 inches thick).

C1 -- 4 to 25 inches; gray (10 YR 5/1) silty clay loam, dark gray (10 YR 4/1) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2); clear smooth boundary (18 to 24 inches thick).

C2 -- 25 to 60 inches; light brownish gray (10 YR 6/2) silty clay loam, grayish brown (10 YR 5/2) moist; massive; hard, friable, sticky and plastic; many fine prominent (10 YR 5/6) mottles; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 27 to 35 percent clay. Depth to bedrock is 60 inches or more. The water table is at the 4 to 25 inch depth unless artificially drained.

Unnamed Twenty Four Series

The Unnamed Twenty Four Series consists of shallow, well drained soils that formed in residuum from shale rocks. Unnamed Twenty Four

soils are on mountain ridges, crests and side slopes at elevations of 8200 to 9500 feet. Slopes are 9 to 40 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of unnamed Twenty Four gravelly loam is located in an area of Unnamed Twenty Four - Unnamed Ten complex, 3 to 15 percent slopes, in the SW¼ of the SE¼ Sec. 31, T29N, R114W. Site S24 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 9 inches; dark brown (7.5 YR 3/2) gravelly loam, very dark brown (7.5 YR 2/2) moist; weak medium crumb structure; soft, very friable, slightly sticky and plastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consist of 5 percent cobbles and 15 percent gravels; slightly acid (pH 6.4); clear smooth boundary (3 to 10 inches thick).

B2t -- 9 to 18 inches; reddish brown (2.5 YR 4/4) gravelly clay loam, dark reddish brown (2.5 YR 3/4) moist; moderate, fine angular blocky structure; hard, firm, sticky and plastic; few thin clay films on ped faces and in pores; many fine and medium roots; few fine tubular pores; 5 percent cobbles, 15 percent gravels; slightly acid (pH 6.4); clear wavy boundary (8 to 10 inches thick).

Cr -- 18 inches; shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 10 to 20 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to lime is 10 to 20 inches. Depth to shale bedrock is 10 to 20 inches.

The A horizon has value of 3 or 4 dry, and 2 or 3 moist. Structure is granular or crumb. Coarse fragments are 15 to 35 percent.

The B2t horizon has 7.5 YR or 2.5 YR hue; value of 3 or 4 dry, and 2 or 3 moist; chroma is 3 or 4. Structure is prismatic and angular blocky. Texture is gravelly clay loam, gravelly silty clay loam. Clay content is 27 to 35 percent. Coarse fragments are 15 to 35 percent.

Unnamed Twenty Five Series

The Unnamed Twenty Five Series consists of shallow, well drained soils that formed in residuum from shale rocks. Unnamed Twenty Five soils are on south aspect of mountain slopes at elevations of 8000 to 9500 feet. Slopes are 30 to 70 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty Five cobbly loam is located in an area of Unnamed Sixteen - Unnamed One - Unnamed Twenty Five complex, 50 to 75 percent slopes, in the NW¼ of the SE¼ Sec. 32, T29N, R114W. Site S25 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 3 inches; dark brown (7.5 YR 4/2) cobbly loam, dark brown (7.5 YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine interstitial pores; surficial coarse fragments consist of 5 percent stones, 25 percent cobbles and 15 percent gravels; rock outcrop is a trace; neutral (pH 6.8); clear wavy boundary (2 to 4 inches thick).

B2t -- 3 to 12 inches; dark brown (7.5 YR 4/4) cobbly silty clay loam, dark brown (7.5 YR 3/4) moist; weak medium and fine subangular blocky structure; slightly hard, firm, sticky and plastic; few thin clay films on ped faces; common medium and fine roots; few fine tubular pores; 25 percent cobbles, 15 percent gravels; neutral (pH 6.8); clear wavy boundary (8 to 16 inches thick).

Cr -- shale.

Range in characteristics: The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 10 to 20 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to shale bedrock is 10 to 20 inches.

The A horizon has coarse fragments of 35 to 50 percent.

The B2t horizon has clay content of 27 to 35 percent. Coarse fragments are 35 to 50 percent.

Unnamed Twenty Six Series

The Unnamed Twenty Six Series consists of deep, well drained soils that formed in clayey alluvium from mixed rocks. Unnamed Twenty Six soils are on floodplains and fans at elevations of 7200 to 8200 feet. Slopes are 0 to 5 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty Six very fine sandy loam is located in an area of Unnamed Eighteen - Unnamed Twenty Six complex, 0 to 5 percent slopes, in the NE¼ of the SE¼ Sec. 28, T30N, R114W. Site

S26 on the Meadow Canyon SW (renamed Springman Creek in 1980) Quadrangle.

A1 -. 0 to 4 inches; light reddish brown (5 YR 6/4) very fine sandy loam, yellowish red (5 YR 4/6) moist; weak medium plates parting to weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common medium and fine roots; few fine tubular pores; coarse fragments consist of 5 percent gravels; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (3 to 5 inches thick).

C1 -- 4 to 36 inches; reddish brown (2.5 YR 5/4) silty clay, dark red (2.5 YR 3/6) moist; massive; hard, firm, sticky and very plastic; common medium and fine to 12 inches then few fine roots; few very fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2); gradual wavy boundary (30 to 34 inches thick).

C2 -- 36 to 60 inches; reddish brown (2.5 YR 5/4) silty clay, dark red (2.5 YR 3/6) moist; massive; hard, firm, sticky and very plastic; few fine roots; few very fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 40 to 50 percent clay. Depth to bedrock is 60 inches or more.

The A horizon has coarse fragments of 0 to 10 percent.

The C1 horizon has clay content of 40 to 50 percent.

The C2 horizon has clay content of 40 to 50 percent.

Unnamed Twenty Seven Series

The Unnamed Twenty Seven Series consists of deep, well drained soils that formed in residuum from shale rocks. Unnamed Twenty Seven soils are on mountain summits and shoulders at elevations of 8200 to 9500 feet. Slopes are 5 to 15 percent. Mean annual precipitation is about 15 to 19 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty Seven loam is located in an area of Unnamed Twenty Four - Unnamed Ten complex, 3 to 15 percent slopes, in the SE¼ of the NW¼ of Sec. 31, T29N, R114W. Site S27 on the Pine Grove Ridge Quadrangle.

A1 -- 0 to 8 inches; very dark grayish brown (10 YR 3/2) gravelly loam, very dark brown (10 YR 2/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine Interstitial pores; 5 percent cobbles and 10 percent gravels; slightly acid (pH 6.4); abrupt smooth boundary (7 to 9 inches thick).

C1 -- 8 to 45 inches; yellowish brown (10 YR 5/4) loam, dark yellowish brown (10 YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; few fine tubular pores; 5 percent cobbles, 10 percent gravels; neutral (pH 6.8).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent

clay. Depth to bedrock is 40 inches or more. Reaction is slightly acid to neutral.

The A horizon has coarse fragments of 0 to 15 percent.

The C horizon has clay content of 18 to 27 percent. Coarse fragments are 0 to 15 percent.

Unnamed Twenty Eight Series

The Unnamed Twenty Eight Series consists of deep, somewhat poorly drained soils that formed in alluvium from mixed rocks. Unnamed Twenty Eight soils are on floodplains at elevations of 7600 to 9500 feet. Slopes are 0 to 5 percent. Mean annual precipitation is about 12 to 16 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty Eight loam is located in an area of Unnamed Eight - Unnamed Twenty Eight complex, 0 to 5 percent slopes, in the SE¼ of the SE¼ Sec. 28, T30N, R114W. Site S28 on the Meadow Canyon SW (renamed Springman Creek in 1980) Quadrangle.

A1 -- 0 to 8 inches; very dark grayish brown (10 YR 3/2) loam, black (10 YR 2/1) moist; weak medium and fine subangular blocky weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine, medium and coarse roots; few fine tubular pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.4); clear smooth boundary (7 to 9 inches thick).

C1 -- 8 to 12 inches; dark grayish brown (10 YR 4/2) loam, very dark grayish brown (10 YR 3/2) moist; weak medium angular blocky structure;

slightly hard, very friable, slightly sticky and slightly plastic; common and fine roots; few fine tubular pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.6); clear smooth boundary (3 to 5 inches thick).

C2 -- 12 to 20 inches; dark grayish brown (10 YR 4/2) very fine sandy loam, very dark grayish brown (10 YR 3/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; few fine tubular pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.6); clear smooth boundary (7 to 10 inches thick).

C3 -- 20 to 29 inches; dark grayish brown (10 YR 4/2) very fine sandy loam very dark grayish brown (10 YR 3/2) moist; weak medium and fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; few fine tubular pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.6); clear smooth boundary (7 to 10 inches thick).

C4 -- 29 to 35 inches; grayish brown (10 YR 5/2) fine sandy loam, dark grayish brown (10 YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; few fine interstitial pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.6); clear smooth boundary (5 to 7 inches thick).

C5 -- 35 to 43 inches; dark grayish brown (10 YR 4/2) sandy clay loam, very dark grayish brown (10 YR 3/2) moist; massive; hard, friable, sticky and plastic; few fine roots; few fine tubular pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.6); abrupt smooth boundary (7 to 9 inches thick).

IIC6 -- 43 to 60 inches; grayish brown (10 YR 5/2) very gravelly sand, dark grayish brown (10 YR 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine roots; many interstitial pores; 50 percent gravels; mildly alkaline (pH 7.4).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent clay. Depth to bedrock is 60 inches or more.

The IIC6 horizon has coarse fragments of 35 to 50 percent.

Unnamed Twenty Nine Series

The Unnamed Twenty Nine Series consists of deep, well drained soils that formed in alluvium from mixed rocks. Unnamed Twenty Nine soils are on fans at elevations of 6500 to 7200 feet. Slopes are 5 to 15 percent. Mean annual precipitation is about 7 to 9 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Twenty Nine loam is located in an area of Unnamed Twenty Nine loam, 5 to 15 percent slopes, in the SW¼ of the SW¼ of Sec. 27, T29N, R112W. Site S29 on the Chimney Butte Quadrangle.

A1 -- 0 to 3 inches; light brown (7.5 YR 6/4) loam, brown (7.5 YR 5/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores; surficial coarse fragments consists of 5 percent gravels; strongly effervescent with disseminated lime; mildly alkaline (pH 7.8); clear smooth boundary (2 to 4 inches thick).

C1 -- 3 to 9 inches; light brown (7.5 YR 6/4) loam, brown (7.5 YR 5/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores; 5 percent gravels; strongly effervescent with disseminated lime; mildly alkaline (pH 7.8); clear smooth boundary (5 to 7 inches thick).

C2 -- 9 to 30 inches; light brown (7.5 YR 6/4) loam, brown (7.5 YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; 10 percent gravels; strongly effervescent with disseminated lime; mildly alkaline (pH 8.0); gradual wavy boundary (19 to 23 inches thick).

C3 -- 30 to 60 inches; light brown (7.5 YR 6/4) loam, brown (7.5 YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; 10 percent gravels; strongly effervescent with few soft masses and filaments of lime; moderately alkaline (pH 8.0).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent clay. Depth to bedrock is 60 inches or more. Reaction is mildly alkaline to moderately alkaline.

Unnamed Thirty Six Series

The Unnamed Thirty Six Series consists of deep, well drained soils that formed in silty alluvium from mixed rocks. Unnamed Thirty Six

soils are on floodplains at elevations of 6500 to 7200 feet. Slopes are 0 to 2 percent. Mean annual precipitation is about 7 to 9 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Thirty Six silt loam is located in an area of Unnamed Thirty Six loam, 0 to 2 percent slopes, in the SW¼ of the NE¼ Sec. 33, T29N, R112W. Site S36 on the Chimney Butte Quadrangle.

A1 -- 0 to 4 inches; light brown (7.5 YR 6/4) silt loam, dark brown (7.5 YR 4/4) moist; weak fine and medium platy structure parting to weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; few fine vesicular pores; moderately effervescent with disseminated lime; moderately alkaline (pH 8.2); clear smooth boundary (3 to 4 inches thick).

C1 -- 4 to 15 inches; light brown (7.5 YR 6/4) silty clay loam, brown (7.5 YR 5/4) moist; massive; slightly hard, firm, sticky and plastic; common fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; strongly alkaline (pH 9.0); clear smooth boundary (12 to 15 inches thick).

C2 -- 15 to 42 inches; pinkish gray (7.5 YR 7/2) very fine sandy loam, brown (7.5 YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; few fine tubular pores; strongly effervescent with disseminating lime; very strongly alkaline (pH 9.2); clear wavy boundary (18 to 27 inches thick).

C3 -- 42 to 50 inches; light brown (7.5 YR 6/4) silty clay loam, dark brown (7.5 YR 4/4) moist; massive; slightly hard, firm, sticky and

plastic; few fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; strongly alkaline (pH 8.8).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent clay. Depth to bedrock is 60 inches or more. Reaction is moderately alkaline in the A horizon to very strongly alkaline in the C horizon.

The A horizon has value of 6 or 7 dry, and 4 or 5 moist. Structure is platy and granular.

The C horizon has value of 6 or 7 dry, and 4 or 5 moist; chroma is 2 to 4. Texture is stratified with very fine sandy loam, silt loam, silty clay loam. Clay content is 18 to 30 percent.

Unnamed Thirty Seven Series

The Unnamed Thirty Seven Series consists of deep, well drained soils that formed in eolian material from sandstone rocks. Unnamed Thirty Seven soils are on rolling uplands at elevations of 6500 to 7200 feet. Slopes are 3 to 9 percent. Mean annual precipitation is about 7 to 9 inches and the mean annual temperature is about 34 degrees F.

A typical pedon of Unnamed Thirty Seven loamy sand is located in an area of Unnamed Thirty Seven - Unnamed Forty One complex, 3 to 9 percent slopes, in the SW¼ of the NE¼ of Sec. 26, T22N, R113W. Site S37 on the Cow Hollow Creek Quadrangle.

A1 -- 0 to 4 inches; light brownish gray (10 YR 6/2) loamy sand, dark brown (10 YR 4/3) moist; single grain; loose, nonsticky and

nonplastic; many fine and medium roots; many interstitial pores; slightly effervescent with disseminatd lime; moderately alkaline (pH 8.0); clear smooth boundary (3 to 5 inches thick).

B2 -- 4 to 11 inches; light yellowish brown (10 YR 6/4) sandy loam, dark brown (10 YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; strongly alkaline (pH 8.6); clear smooth boundary (7 to 10 inches thick).

C1 -- 11 to 30 inches; light brownish gray (10 YR 6/2) loamy sand, dark yellowish brown (10 YR 4/4) moist; massive; slightly hard, many interstitial pores; violently effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (18 to 22 inches thick).

IIC2 -- 30 to 50 inches; light gray (10 YR 7/2) silt loam, light brownish gray (10 YR 6/2) moist; massive; soft, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores; violently effervescent with soft masses and filaments of lime; moderately alkaline (pH 8.4).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 11 to 14 inches. When mixed, the control section contains 10 to 18 percent clay. Depth to bedrock is 50 inches or more.

Unnamed Thirty Nine Series

The Unnamed Thirty Nine Series consists of shallow, well drained soils that formed in residuum and eolian material from shale and sandstone rocks. Unnamed Thirty Nine soils are on upland foothills at elevations of 6500 to 7200 feet. Slopes are 2 to 9 percent. Mean annual precipitation is about 7-9 inches and the mean annual temperature is about 34 degrees F.

A typical pedon of Unnamed Thirty Nine sandy clay loam is located in an area of Unnamed Thirty Nine - Badland complex, 2 to 15 percent slopes, in the NE¼ of the NE¼ Sec. 26, T22N, R113W. Site S39 on the Cow Hollow Creek Quadrangle.

A1 -- 0 to 2 inches; pale brown (10 YR 6/3) sandy clay loam, grayish brown (10 YR 5/2) moist; weak medium and fine platy structure; slightly hard, firm, sticky and plastic; few fine and medium roots; common fine vesicular pores; strongly effervescent with disseminated lime; strongly alkaline (pH 9.0); clear smooth boundary (2 to 3 inches thick).

B2t -- 2 to 6 inches; light yellowish brown (10 YR 6/4) clay loam, brown (10 YR 5/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocks; hard, very firm, very sticky and very plastic; few fine and medium roots; few fine tubular pores; strongly effervescent with few soft masses and filaments of lime; very strongly alkaline (pH 9.2); clear smooth boundary (3 to 5 inches thick).

C1 -- 5 to 12 inches; light yellowish brown (10 YR 6/4) sandy clay loam, yellowish brown (10 YR 5/4) moist; massive; hard, very firm, sticky and plastic; few fine and medium roots; few fine tubular pores;

strongly effervescent with disseminated lime; very strongly alkaline (pH 9.2); clear smooth boundary (5 to 7 inches thick).

Cr -- 12 inches; shale.

Range in characteristics: The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 5 to 8 inches. When mixed, the control section contains 27 to 35 percent clay. Depth to shale bedrock is 10 to 20 inches.

Unnamed Forty One Series

The Unnamed Forty One Series consists of deep, well drained soils that formed in alluvium and eolian material from sandstone rocks. Unnamed Forty One soils are on floodplains at elevations of 6500 to 7200 feet. Slopes are 3 to 8 percent. Mean annual precipitation is about 7 to 9 inches and the mean annual temperature is about 34 degrees F.

A typical pedon of Unnamed Forty One loamy sand is located in an area of Unnamed Thirty Six - Unnamed Forty One complex, 3 to 9 percent slopes, in the SE¼ of the SW¼ Sec. 26, T22N, R113W. Site S41 on the Cow Hollow Creek Quadrangle.

A1 -- 0 to 3 inches; light yellowish brown (10 YR 6/4) loamy sand, yellowish brown (10 YR 5/4) moist; single grain; loose, loose, nonsticky and nonplastic; few fine and medium roots; many interstitial pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2); gradual smooth boundary (2 to 4 inches thick).

C1 -- 3 to 60 inches; light yellowish brown (10 YR 6/4) sand, brown (10 YR 5/3) moist; massive; loose, loose, nonsticky and nonplastic; few

fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; strongly alkaline (pH 8.6).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 3 to 10 percent clay. Depth to bedrock is 60 inches or more. Reaction is moderately alkaline to strongly alkaline.

Unnamed Forty Two Series

The Unnamed Forty Two Series consists of deep, well drained soils that formed in residuum from mixed rocks. Unnamed Forty Two soils are on swales and foothill plains at elevations of 6500 to 7300 feet. Slopes are 0 to 5 percent. Mean annual precipitation is about 7 to 9 inches and the mean annual temperature is about 34 degrees F.

A typical pedon of Unnamed Forty Two is located in an area of Unnamed Forty Two - Unnamed Forty Three complex, 0 to 5 percent slopes, in the SW¼ of the NW¼ of Sec. 21, T28N, R110W. Site S42 on the Sugarloaf NW Quadrangle.

A1 -- 0 to 4 inches; light yellowish brown (10 YR 6/4) silt loam, dark yellowish brown (10 YR 4/4) moist; weak fine and medium platy structure parting to weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; slightly effervescent with disseminated lime; mildly alkaline (pH 7.8); clear smooth boundary (3 to 4 inches thick).

B2 -- 4 to 12 inches; very pale brown (10 YR 7/3) silty clay loam, yellowish brown (10 YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky and plastic; many fine and medium roots; few fine tubular pores; moderately alkaline (pH 8.0); clear smooth boundary (8 to 10 inches thick).

C1 -- 12 to 30 inches; light gray (10 YR 7/2) silt loam, brown (10 YR 5/3) moist; massive; soft, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.4); clear smooth boundary (9 to 18 inches).

C2 -- 30 to 50 inches; very pale brown (10 YR 7/3) silt loam grayish brown (10 YR 5/2) moist; massive; soft, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.4).

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 11 to 12 inches. When mixed, the control section contains 20 to 27 percent clay. Depth to shale bedrock is 40 to 60 inches. Reaction is mildly to moderately alkaline.

The A horizon has value of 6 or 7 dry, and 4 or 5 moist; chroma is 3 or 4.

The B2 horizon has value of 6 or 7 dry, and 4 or 5 moist; chroma is 3 to 5. Texture is loam, silty clay loam. Clay content is 20 to 27 percent.

The C horizon has chroma of 2 to 4. Texture is typically silt loam, but occasionally thin sandy loam layers occur in this horizon. Clay content is 18 to 27 percent. Coarse fragments are 0 to 10 percent.

Unnamed Forty Three Series

The Unnamed Forty Three Series consists of shallow, well drained soils that formed in residuum from shale rocks. Unnamed Forty Three soils are on crests of rolling upland foothills at elevations of 6500 to 7300 feet. Slopes are 0 to 5 percent. Mean annual precipitation is about 7 to 9 inches and the mean annual temperature is about 34 degrees F.

A typical pedon of Unnamed Forty Three silt loam is located in an area of Unnamed Forty Two - Unnamed Forty Three complex, 0 to 5 percent slopes, in the SW¼ of the SW¼ of Sec. 16, T28N, R110W. Site S43 on the Sugarloaf NW Quadrangle.

A1 -- 0 to 3 inches; light gray (10 YR 7/2) silt loam, brown (10 YR 5/3) moist; weak medium platy structure parting to weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; 10 percent gravels; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary (2 to 4 inches thick).

C1 -- 3 to 16 inches; very pale brown (10 YR 7/3) silt loam, yellowish brown (10 YR 5/4) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2); clear smooth boundary (12 to 14 inches thick).

Cr -- 16 inches; shale.

Range in characteristics: The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent clay. Depth to shale bedrock is 10 to 20 inches.

Unnamed Forty Four Series

The Unnamed Forty Four Series consists of shallow, well drained soils that formed in residuum from sandstone and quartzite rocks. Unnamed Forty Four soils are on mountain ridge crests at elevations of 8200 to 9500 feet. Slopes are 5 to 30 percent. Mean annual precipitation is about 15 to 20 inches and the mean annual temperature is about 34 degrees F.

A typical pedon of Unnamed Forty Four very gravelly loam is located in an area of Unnamed Ten - Unnamed Eleven - Unnamed Forty Four complex, 5 to 15 percent slopes, in the SW¼ of the SW¼ Sec. 5, T27N, R114W. Site S44 on the Lake Mountain Quadrangle.

A1 -- 0 to 4 inches; dark brown (7.5 YR 4/3) very gravelly loam, dark brown (7.5 YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consist of 5 percent stones, 15 percent cobbles and 28 percent gravels; neutral (pH 6.8); clear boundary (4 to 10 inches thick).

C1 -- 4 to 12 inches; brown (7.5 YR 5/4) very gravelly loam, dark brown (7.5 YR 4/4) moist; massive; many fine and medium roots; few fine tubular pores; 15 percent cobbles, 30 percent gravels; neutral (pH 6.8); abrupt boundary (2 to 10 inches thick).

R -- 12 inches; sandstone.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. When mixed, the control section contains 18 to 27 percent clay. Depth to bedrock is 10 to 20 inches.

The A horizon has value of 4 or 5 dry; chroma is 2 or 3. Coarse fragments are 35 to 50 percent.

The C horizon has 7.5 YR or 10 YR hue; chroma is 2 or 3. Clay content is 18 to 27 percent. Coarse fragments are 35 to 50 percent.

Unnamed Forty Five Series

The Unnamed Forty Five Series consists of deep, well drained soils that formed in residuum from mixed rocks. Unnamed Forty Five soils are on gently rolling upland summits of foothills at elevations of 7200 to 8200 feet. Slopes are 0 to 9 percent. Mean annual precipitation is about 10 to 14 inches and the mean annual temperature is about 34 degrees F. Frost-free season is 22 to 28 days.

A typical pedon of Unnamed Forty Five gravelly fine sandy loam is located in an area of Unnamed Forty Five - Unnamed One complex, 0 to 5 percent slopes, in the SW¼ of the NW¼ Sec. 27, T29N, R113W. Site S45 on the Cretaceous Mountain Quadrangle.

A1 -- 0 to 4 inches; brown (10 YR 5/3) gravelly fine sandy loam, dark brown (10 YR 3/3) moist; weak fine crumb structure; loose, very friable, slightly sticky and slightly plastic; many fine and medium roots; few fine tubular pores; surficial coarse fragments consist of 5

percent cobbles and 15 percent gravels; mildly alkaline (pH 7.4); abrupt smooth boundary (3 to 5 inches thick).

B2t -- 4 to 8 inches; light brown (7.5 YR 6/4) gravelly sandy clay loam, brown (7.5 YR 5/4) moist; weak medium prismatic structure parting to moderate medium angular blocks; hard, firm, sticky and plastic; many fine and medium roots; few fine tubular pores; 5 percent cobbles, 15 percent gravels; common thin clay films on ped faces and in pores; mildly alkaline (pH 7.4); clear smooth boundary (4 to 10 inches thick).

B3ca -- 8 to 14 inches; pink (7.5 YR 7/4) gravelly sandy clay loam, light brown (7.5 YR 6/4) moist; weak medium prismatic structure parting to moderate medium angular blocks; hard, friable, sticky and plastic; many fine and medium roots; few fine tubular pores; 5 percent cobbles, 20 percent gravels; strongly effervescent with soft masses and filaments of lime; moderately alkaline (pH 8.0); gradual smooth boundary (0 to 7 inches thick).

C1ca -- 14 to 30 inches; pink (5 YR 7/4) gravelly sandy clay loam, light reddish brown (5 YR 6/4) moist; weak fine angular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few fine tubular pores; 5 percent cobbles, 15 percent gravels; violently effervescent with disseminated lime; moderately alkaline (pH 8.4); gradual smooth boundary (16 to 24 inches thick).

C2ca -- 30 to 50 inches; pink (5 YR 7/4) gravelly sandy clay loam, light reddish brown (5 YR 6/4) moist; weak fine angular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few fine tubular pores; 5 percent cobbles, 15 percent gravels; strongly

effervescent with disseminated lime; moderately alkaline (pH 8.0); abrupt smooth boundary (0 to 20 inches thick).

Cr -- 50 inches; shale.

Range in characteristics: These soils have short, cool summers and long, cold winters. The mean annual soil temperature is 39 to 43 degrees F. Thickness of solum is 10 to 20 inches. When mixed the control section contains 25 to 35 percent clay. Depth to lime is 8 to 19 inches. Depth to shale bedrock is 40 to 60 inches or more. Reaction is neutral to moderately alkaline below the solum.

The A horizon has 10 YR or 7.5 YR hue; value of 3 or 4 moist; chroma is 3 or 4. Structure is crumb or granular. Coarse fragments are 15 to 35 percent.

The B2t horizon has 7.5 YR or 5 YR hue; value of 4 or 5 moist; chroma is 4 to 6. Structure is prismatic or blocky. Texture is sandy clay loam, clay loam, silty clay loam with gravelly modifiers. Clay content is 25 to 35 percent. Coarse fragments are 5 to 35 percent.

The C1ca horizon has 5 YR or 7.5 YR hue; value of 6 or 7 dry, and 5 or 6 moist. Structure is blocky or massive. Texture is fine sandy loam, sandy clay loam, silty clay loam, clay loam with gravelly modifiers. Clay content is 10 to 35 percent. Coarse fragments are 15 to 35 percent.

APPENDIX B3

SOIL SERIES CLASSIFICATION AND DESCRIPTIONS - USFS SURVEY AREA

(In Numerical Order by Series Number)

(Source: USDA Forest Service 1979)

GUIDE TO CLASSIFICATION OF THE SOILS
(USFS SURVEY AREA)

Series	Taxonomic Classification
1Ab	Typic Cryoboralfs, loamy-skeletal, mixed
1Ae	Typic Cryoboralfs, fine-loamy, mixed
1Bb	Mollic Cryoboralfs, loamy-skeletal, mixed
1Bc	Mollic Cryoboralfs, clayey-skeletal, montmorillonitic
1Be	Mollic Cryoboralfs, fine-loamy, mixed
1Bg	Mollic Cryoboralfs, fine, montmorillonitic
3Db	Typic Cryorthents, loamy-skeletal mixed
3Dk	Typic Cryorthents, coarse-loamy, mixed (calc.)
3Dm	Typic Cryorthents, loamy, mixed (calc.), shallow
3Eb	Lithic Cryorthents, loamy-skeletal, mixed
3E1	Lithic Cryorthents, loamy-skeletal, mixed (calc.)
3Fo	Mollic Cryofluvents, sandy-skeletal, mixed
5Bb	Typic Cryochrepts, loamy-skeletal, mixed
6Ae	Typic Cryaquolls, coarse-loamy, mixed
6Bb	Typic Cryoborolls, loamy-skeletal, mixed
6Db	Argic Cryoborolls, loamy-skeletal, mixed
6De	Argic Cryoborolls, fine-loamy, mixed
6Dg	Argic Cryoborolls, fine, montmorillonitic
6Eb	Argic Pachic Cryoborolls, loamy-skeletal, mixed
6Ec	Argic Pachic Cryoborolls, fine-loamy, mixed
6Fb	Lithic Cryoborolls, loamy-skeletal, mixed
6Gb	Pachic Cryoborolls, loamy-skeletal, mixed
6Ge	Pachic Cryoborolls, fine-loamy, mixed

Soil 1Ab

Classification: Typic Cryoboralfs, loamy-skeletal, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

O1 5-0 cm (2-0 inches). Forest litter.

A2 0-18 cm (0-7 inches). Dark brown (7.5 YR 4/3) very gravelly sandy loam, pinkish gray (7.5 YR 7/2) dry; moderate, fine, granular structure; slightly hard, very friable, slightly sticky, slightly plastic; 35% gravel, 25% cobble and or few stone; strongly acid (pH 5.5); gradual, wavy boundary; (3-7 inches thick).

B1 18-38 cm (7-15 inches). Dark brown (7.5 YR 4/4) very gravelly sandy loam; weak, medium subangular blocky structure parting to moderate, fine granular; slightly hard, very friable, slightly sticky, slightly plastic; 35% gravel, 25% cobble and a few stone; medium acid (pH 6.0); gradual, wavy boundary; (0-8 inches thick).

B2t 38-71 cm (15-28 inches). Dark brown (7.5 YR 4/4) very gravelly sandy clay loam; weak, medium, subangular blocky structure parting to moderate, fine granular; hard, friable, sticky, plastic, few moderately thick clay films on the ped faces; 35% gravel, 25% cobble and a few stone; mildly alkaline (pH 7.5); gradual, wavy boundary; (5-22 inches thick).

B2 71-112 cm (28-44 inches). Dark brown (7.5 YR 4/4) very gravelly sandy loam; weak, medium, subangular blocky structure parting to moderate, fine granular; slightly hard, very friable, slightly sticky, slightly plastic; few thin clay films on the ped faces; 35% gravel, 25% cobble and a few stones; mildly alkaline (pH 7.5); gradual, wavy boundary; (0-16 inches thick).

C 112-153 + cm (44-60 inches). Dark brown (7.5 YR 4/4) very gravelly sandy loam; moderate, fine, granular structure; slightly hard, very friable, slightly sticky, slightly plastic; 35% gravel, 25% cobble and a few stone; calcareous; mildly alkaline (pH 7.5).

Type Location: Greys River District, Bear Creek; Site G44-78;
Aerial Photo 4-4; 1:40,000

Range in Characteristics: Depth to bedrock is typically greater than 40 inches. Surface texture ranges from loam to sandy loam and the subsurface textures from sandy loam to clay loam. Coarse fragments range in volume from 35% to 60%.

Soil 1Ae

Classification: Typic Cryoboralf, fine-loamy, mixed.

Typifying Pedon: Colors are for a moist soil unless otherwise indicated.

A2 0-31 cm (0-13 inches). Dark yellowish brown (10 YR 4/4) cobbly loam, yellowish brown (10 YR 4.5/4) dry; weak medium subangular blocky parting to moderate fine granular; slightly hard, friable, sticky, plastic; 20% cobbles; slightly acid (pH 6.0); clear, smooth boundary.

B1t 31-53 cm (13-22 inches). Yellowish brown (10 YR 5/8) clay loam, light yellowish brown (10 YR 6/4) dry; strong medium and coarse subangular blocky structure; hard, firm, very sticky, very plastic; 5% gravel; slightly acid (pH 6.0); diffuse smooth boundary.

B2t 53-77 cm (22-32 inches). Yellowish brown (10 YR 5/6) clay loam, light yellowish brown (10 YR 6/4) dry; strong coarse subanuglar blocky structure; hard, firm, very sticky, very plastic; 10% gravel, 5% cobbles; slightly acid (pH 6.0).

Type Location: Greys River District, Upper Little Greys; Site T27-78; Aerial Photo 01-42

Range in Characteristics: Depth to bedrock is typically greater than 95 centimeters (40 inches). Surface texture ranges from loam to silt loam and subsurface textures from silt loam to clay loam. Coarse fragments range in volume from 0% to 35% in the control section.

Soil 1Bb

Classification: Mollic Cryoboralf, lo-sk, mixed.

Typifying Pedon:

A1 0-15 cm (0-6 inches). Very dark grayish brown (10 YR 3/3) gravelly loam; weak medium subangular blocky structure; very friable; very strongly acid; 15% coarse fragments; clear smooth boundary.

B1 15-50 cm (6-20 inches). Yellowish brown (10 YR 5/6) gravelly loam: moderate medium subangular blocky structure; friable; strongly acid; 50% coarse fragments; clear smooth boundary.

B2t 50-68 cm (20-27 inches). Yellowish brown (10 YR 5/8) gravelly clay loam; moderate medium subangular blocky structure; firm; strongly acid; 50% coarse fragments; clear smooth boundary.

C 68-75 + cm (27-30 + inches). Yellowish brown (10 YR 5/6) gravelly loam - gravelly sandy loam; weak medium subangular blocky structure; very friable; strongly acid; 50% coarse fragments.

Type Location: Description #T28-79, taken 7-13-79;
Aerial photo #1-154, 1:40,000

Soil 1Bc

Classification: Mollic Cryoboralf, cl-sk, montmorillinitic.

Typifying Pedon:

A1 0-15 cm (0-6 inches). Dark reddish brown (5 YR 3/4) gravelly silty clay loam; moderate fine to medium subangular blocky structure; friable; slightly acid; 20% coarse fragments; clear smooth boundary.

B1 15-38 cm (6-15 inches). Dark reddish brown (5 YR 4/4) gravelly silty clay; strong medium subangular blocky structure; very firm; neutral; 50% coarse fragments; diffuse smooth boundary.

B3 60-73 cm (24-29 inches). Dark reddish brown (5 YR 3/4) gravelly silt clay loam; strong fine to medium subangular blocky structure; very firm; moderately alkaline; 60% coarse fragments.

Type Location: Description #T53-79, taken 8-28-79;
Aerial photo #1-59, 1:40,000

Soil 1Be

Classification: Mollic Cryoboralfs, fine-loamy, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

O1 2.5-0 cm (1-0 inches). Conifer litter.

A2 0-15 cm (0-6 inches). Dark reddish brown (5 YR 3/3) gravelly loam, light reddish brown (5 YR 6/3) dry; moderate fine granular structure; slightly hard, friable, sticky, plastic; 25% gravel; medium acid (pH 6.0); clear wavy boundary; (4-10 inches thick).

B1 15-41 cm (6-16 inches). Reddish brown gravelly clay loam; weak medium subangular blocky structure that parts to moderate fine granular; hard, friable, sticky, plastic; few thin clay films on the ped faces; 20% gravel; medium acid (pH 6.0); clear wavy boundary; (3-6 inches thick).

t 41-61 cm (16-24 inches). Reddish brown (5 YR 4/4) clay loam; moderate medium and coarse subangular blocky structure; hard, friable, sticky, plastic; 15% gravel; medium acid (pH 6.0); clear wavy boundary; (6-20 inches thick).

C 61-102 cm (24-40 inches). Redish brown (5 YR 4/3) clay loam; massive; hard, friable, sticky, plastic 15% gravel; medium acid (pH 6.0).

Type Location: Greys River District, Greys River between Ridge Creek and South Twin Creek; Site G13-78;
Aerial photo #1-46, 1:40,000

Range in Characteristics: Depth to bedrock is typically greater than 40 inches. Texture ranges from silt loam to clay loam. Coarse fragments range from 0% to 35% by volume.

Soil 1Bg

Classification: Mollic Cryoboralfs, fine, montmorillonitic.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-20 cm (0-8 inches). Very dark grayish brown (10 YR 3/2) loam, light brownish gray (10 YR 6/2) dry; moderate, fine, granular structure; hard, friable, sticky, plastic; 5% gravel and 5% cobble; medium acid (pH 6.0); clear, smooth boundary; (2-8 inches thick).

A3 20-38 cm (8-15 inches). Dark brown (10 YR 3/3) loam, light brownish gray (10 YR 6/2) dry; weak, medium, subangular blocky structure parting to moderate, fine, granular; hard, friable, sticky, plastic; 5% cobble; medium acid (pH 6.0); clear, smooth boundary; (0-7 inches thick).

IIB21+ 38-69 cm (15-27 inches). Dark grayish brown (2.54 Y 4/2) clay loam, light gray (2.5 Y 7/2) dry; moderate, fine and medium angular blocky structure; very hard, friable, very sticky, very plastic; few, moderately thick clay films on the ped faces; 5% gravel and 5% cobble; strongly acid (pH 5.5); clear, smooth boundary; (0-13 inches thick).

IIB22t 69-102 cm (27-40 inches). Dark grayish brown (2.5 Y 4/2) clay loam; strong, medium, angular blocky structure; very hard, firm, very sticky, very plastic; common, moderately thick clay films on the ped faces; 5% gravel and 5% cobble; strongly acid (pH 5.5); clear smooth boundary; (10-13 inches thick).

IIB3 102-122 cm (40-48 + inches). Dark grayish brown (2.5 YR 4/2) clay loam; moderate, fine and medium, subangular blocky structure; very hard, firm, very sticky, very plastic; 5% gravel and 5% cobble: strongly acid (pH 5.5).

Type Location: Greys River District, Elk Creek; Site G38-78
Aerial photo 1-46, 1:40,000

Range in Characteristics: Depth to bedrock is typically deeper than 40 inches. Surface texture ranges from loam to silty clay loam and the subsurface texture fro sandy clay loam to silty clay. Coarse fragments range in volume from 10% to 30%.

Soil 3Db

Classification: Typic Cryothent, 10-sk, mixed.

Typing Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-18 cm (0-7 inches). Reddish brown (5 YR 4/4) gravelly loam (16% clay); moderate fine granular structure; very friable; 50% coarse fragments; strongly acid (pH 5.5); clear smooth boundary.

C1 18-38 cm (7-15 inches). Reddish borwn (5 YR 4/4) gravelly loam (13% clay); moderate fine granular structure; very friable; 50% coarse fragments; strongly acid; clear smooth boundary.

C2 38-53 cm (15-21 inches). Reddish brown (5 YR 4/4) gravelly loam (8% clay); moderate fine granular structure; very friable; 50% coarse fragments; strongly acid.

Type Location: Description #T62-79;
Aerial Photo #157. 1:40,000

Soil 3Dk

Classification: Typic Cryorthent, co-lo, mixed, (calc.).

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-15 cm (0-6 inches). Dark brown (7.5 YR 3/2) silt loam; weak fine to moderate subangular blocky structure; very friable; moderately alkaline (pH. 8); clear smooth boundary.

C1 15-38 cm (6-15 inches). Dark reddish brown (5 YR 3/4) silt loam; weak fine to moderate subangular blocky structure; very friable; moderately alkaline; clear smooth boundary; 30% coarse fragments.

C2 38-80 cm (15-32 inches). Dark reddish brown (5 YR 3/4) silt loam; weak fine to moderate subangular blocky structure; very friable; moderately alkaline; no coarse fragments.

C3 80-95 cm (32-38 + inches). Reddish brown (5 YR 4/4) silt loam; weak fine subangular blocky structure; very friable; moderately alkaline; 40% coarse fragments.

Type Location: Description #T69-79, taken 9-10-79;
Aerial photo #155, 1:40,000

Soil 3Dm

Classification: Type cryorthent, loamy, mixed, (calc.), shallow.

A1 0-18 cm (0-7 inches). Olive brown (2.5 YR 4/4) silt loam; weak medium subangular blocky structure; very friable; moderately alkaline (pH 8.0); 5% coarse fragments; clear smooth boundary.

C 18-30 cm (7-12 inches). Light yellowish brown silt loam; strong, fine angular blocky structure; very firm; moderately alkaline; 5% coarse fragments; clear smooth boundary.

\- 30 cm + (12 + inches). Soft, calcareous claystone and shale; paralithic.

Type Location: Description #T41-79, taken 8-21-79;
Aerial photo #1-158, 1;40,000

Soil 3Eb

Classification: Lithic Cryorthents, lo-sk, mixed.

Typifying Pedon:

A 0-45 (0-18 inches). Dark brown (10 YR 3/3) gravelly sandy loam, light brownish gray (10 YR 6/2) dry; moderate fine granular structure; very friable; neutral; 35% coarse fragments; gradual wavy boundary.

R 45 + cm. Variable hard to soft fractured sandstone.

Type Location; Description #G7-79, taken 9-4-79;
Aerial photo #1-149, 1;40,000

Soil 3E1

Classification: Lithic Cryorthents, loamy-skeletal, mixed (calcareous).

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-18 cm (0-7 inches). Dark brown (10 YR 4/3) gravelly clay loam; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable, sticky, plastic; 40% gravel; moderately alkaline (pH 8.0); clear smooth boundary; (7-13 inches thick).

R 18 + cm (7 + inches). Hard limestone.

Type Location: Greys River District, Sheep Creek; site T52-78; Aerial photo 1-45, 1:40,000

Range in Characteristics: Texture ranges from loam to clay loam. Coarse fragments range in volume from 40% to 50%.

Soil 3Fo

Classification: Mollic Cryofluvents, sandy-skeletal, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-20 cm (0-8 inches). Dark brown (10 YR 3/3) sandy loam; weak, medium platy structure parting to weak, fine, granular; slightly hard, very friable, slightly sticky, slightly plastic; 5% gravel; slightly acid (pH 6.5); gradual, wavy boundary.

C 20-152 cm (8-60 inches). Variable colored (red, white, etc.) very gravelly sand; single grain; loose, nonsticky, nonplastic; 50% gravel.

Type Location: Greys River District, North Coral Creek; Site G53-78; Aerial photo 1-48, 1:40,000

Range in Characteristics: Depth to gravels range from 8 to 24 inches.

Soil 5Bb

Classification: Typic Cryochrepts, loamy-skeletal, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

O1 2.5-0 cm (1-0 inches). Conifer litter.

A1 0-10 cm (0-4 inches). Dark reddish brown (5 YR 3/3) gravelly loam; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; 30% gravel and 10% cobble; clear wavy boundary; (3-16 inches thick).

B2 10-51 cm (4-20 inches). Reddish brown (5 YR 4/3) gravelly loam; weak medium subangular blocky structure that parts to moderate fine granular; slightly hard, very friable, slightly sticky, slightly plastic; 30% gravel and 10% cobble: gradual wavy boundary; (9-24 inches thick).

C 51-102 cm (20-40 inches). Reddish brown (5 YR 4/3) gravelly loam; moderate fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; 30% gravel and 10% cobble.

Type Location: Greys River District, near Ridge Creek, Site G12-77; Aerial photo #1-47, 1:40,000

Range in Characteristics: Depth to bedrock is typically greater than 40 inches. Texture ranges from sandy loam to silt loam. Coarse fragments range from 35% to 70% by volume.

Soil 6Ae

Classification: Typic Cryaquoll, co-lo, mixed.

Typifying Pedon:

A11 0-5 cm (0-2 inches). Dark brown (7.5 YR 3/3) silt loam; weak coarse platy structure; friable; mildly alkaline (pH 7.6); no coarse fragments; abrupt smooth boundary.

A12 5-15 cm (2-6 inches). Dark brown silt loam; weak coarse subangular blocky structure; friable; mildly alkaline; no coarse fragments; abrupt smooth boundary.

A13 15-28 cm (6-11 inches). Dark brown (7.5 YR 3/2) silt loam, weak coarse subangular blocky structure; friable mildly alkaline; no coarse fragments; abrupt smooth boundary.

C 28-83 + cm (11-33 + inches). Brown and dark brown (7.5 YR 4/4 & 3/3) loam and gravelly sandy loam; weak coarse subangular blocky structure ranging to single grain; mildly alkaline; 0 to 80 coarse fragments.

Type Location: Description #T93-79, taken 7-26-79;
Aerial photo #1-154, 1:40,000

Soil 6Bb

Classification: Typic Cryoborolls, loamy-skeletal, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A11 0-8 cm (0-3 inches). Dark brown (10 YR 3/3) fine sandy loam; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; 5% gravel; slightly acid (pH 6.5); clear smooth boundary; (0-7 inches thick).

A12 8-14 cm (3-16 inches). Dark brown (10 YR 3/3) fine sandy loam; moderate medium and coarse subangular blocky structure that parts to weak fine granular; soft, very friable, slightly sticky, slightly plastic; 5% gravel; slightly acid (pH 6.5); abrupt boundary; (7-14 inches thick).

C 41 + cm (16 + inches). Very cobbly sandy loam, 5% gravel and 75% cobble.

Type Location: Greys River District, Greys River near Crow Creek; Site T5-78; Aerial photo 1-47, 1:40,000

Range in Characteristics: Depth to gravel and cobble ranges from 6 inches to 25 inches. Texture ranges from silt loam to sandy loam.

Soil 6Db

Classification: Argic Cryoboroll , loamy-skeletal, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A11 0-8 cm (0-3 inches). Dark reddish brown (5 YR 3/2) loam. Moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; 10% gravel; medium acid (pH 6.0); clear smooth boundary; (3-6 inches thick).

A12 8-20 cm (3-8 inches). Dark reddish brown (5 YR 3/2) loam; weak coarse subangular blocky structure that parts to moderate fine granular; slightly hard, friable, slightly sticky, slightly plastic; 10% gravel; medium acid (pH 6.0); clear smooth boundary; (0-6 inches thick).

B1 20-51 cm (8-20 inches). Reddish brown (5 YR 4/3) loam, reddish brown (5 YR 5/3) dry; moderate medium and coarse subangular blocky structure; very hard, friable, slightly sticky, slightly plastic; very few thin clay films occurring as bridges; 10% gravel; slightly acid (pH 6.5); clear wavy boundary; (0-12 inches thick).

B2t 51-102 cm (20-40 inches). Reddish brown (5 YR 4/3) gravelly clay loam, reddish brown (5 YR 5/3) dry; moderate medium subangular blocky structure; very hard, firm, sticky, plastic; common moderately thick clay films on the ped faces and in the pores; 35% gravel; slightly acid (pH 6.5); (10-20 inches thick).

Type Locations: Greys River District, McCain meadows, Site G1-78; Aerial photo 1-41, 1:40,000

Range in Characteristics: Depth to bedrock is typically greater than 40 inches. Texture ranges from sandy clay loam to silty clay loam. Coarse fragments range from 35% to 70% by volume.

Soil 6De

Classification: Argic Cryoborolls, fine-loamy, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-20 cm (0-8 inches). Dark brown (10 YR 3/3) loam, brown (10 YR 4/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky, plastic; moderately alkaline (pH 8.0); gradual smooth boundary; (6-12 inches thick).

B2t 20-61 cm (8-24 inches). Dark yellowish brown (10 YR 4/4) clay loam; strong fine and medium subangular blocky structure; hard, firm, very sticky, very plastic; many thin clay films on the ped faces; moderately alkaline (pH 8.0); gradual smooth boundary; (7-14 inches thick).

B3 61-107 cm (24-42 inches). Dark yellowish brown (10 YR 4/4) loam; weak coarse and very coarse subangular blocky structure; soft, very friable, sticky, plastic; few thin clay films on the ped faces; calcareous; moderately alkaline (pH 8.0); clear smooth boundary; (0-18 inches thick).

IIC 107 + cm (42 + inches). Fractured limestone.

Type Location: Greys River District, mouth of Greys River, Site T9-78; Aerial photo 2-28 (BT), 1:40,000

Range in Characteristics: Depth to bedrock is typically greater than 40 inches. Texture ranges from loam to clay loam. Coarse fragments range from 0% to 35% by volume.

Soil 6Dg

Classification: Argic Cryoborolls, fine, montmorillinitic.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-10 cm (0-4 inches). Dark brown (10 YR 3/3) silt loam, brown (10 YR 4/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; strongly acid (pH 5.5); clear wavy boundary; (0-17 inches thick).

10-28 cm (4-11 inches). Dark brown (10 YR 3/3) silt loam, brown (10 YR 5/3) dry; weak medium subangular blocky structure that parts to moderate fine granular; slightly sticky, slightly plastic; common thin clay films on the ped faces; medium acid (pH 6.0); clear wavy boundary; (0-7 inches thick).

B2t 28-79 cm (11-31 inches). Dark brown (10 YR 4/4) silty clay loam, dark yellowish brown (10 YR 4/4) dry; strong medium and coarse subangular blocky structure; continuous thin clay films on the ped faces; slightly acid (pH 6.5); clear wavy boundary; (7-20 inches thick).

Cca 79-102 cm (31-40 inches). Yellowish brown (10 YR 5/4) gravelly silty loam; weak medium subangular blocky structure, slightly hard, very friable, slightly plastic; 30% gravel, 10% cobble and 5% stone; calcareous; moderately alkaline (pH 8.0).

Type Location: Greys River District, Trail Creek, Site T58-78;
Aerial photo #1-44, 1:40,000

Range in Characteristics: Depth to bedrock is typically greater than 40 inches, texture of the control section ranges from silty clay loam to clay, coarse fragments range from 0% to 35% by volume.

Soil 6Eb

Classification: Argic Pachic Cryoborolls, loamy-skeletal, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-18 cm. (0-7 in.). Very dark grayish brown (10 yr 3/2) silt loam; weak medium and coarse subangular blocky structure that parts to moderate fine granular; slightly hard, friable, slightly sticky, slightly plastic; 10 percent gravel, 5 percent cobble and a trace of stone; moderately alkaline (ph 8.0); noncalcareous; clear smooth boundary. (4-10 inches thick).

B21t 18-33 cm. (7-13 in.). Dark brown (10 yr 3/3) silty clay loam; moderate fine and medium subangular blocky structure; hard, firm, very sticky, very plastic; many thin clay films on the ped faces; 10 percent gravel; 5 percent cobble and a trace of stone; moderately alkaline (ph 8.0); noncalcareous; clear smooth boundary. (5-10 inches thick).

B22t 33-53 cm. (13-21 in.). Dark brown (10 yr 3/3) gravelly and cobbly silty clay loam; moderate fine and medium subangular blocky structure; hard, firm, very sticky, very plastic; many thin clay films on the ped faces; 30 percent gravel, 40 percent cobble and a trace of stone; moderately alkaline (ph 8.0); noncalcareous; gradual wavy boundary. (10-20 inches thick).

C 53-102^{+} cm. (21-40 in.). Dark brown (10yr 3/3) cobbly sandy loam; single grain; loose, loose, nonsticky, nonplastic; 15 percent gravel, 40 percent cobble and a trace of stone; moderately alkaline (ph 8.0); calcareous.

Type Location: Greys River District, North Three Forks area, site 774-78, photo 1-46, 1:40,000.

Range in Characteristics: Depth to bedrock is typically greater than 40 inches. Texture ranges from loam to silty clay loam. Coarse fragments range from 35 to 70 percent by volume.

Soil 6Ee

Classification: Argic Pachic Cryoboroll, fi-lo, mixed.

Typifying Pedon:

A1 0-15 cm (0-6 inches). Dark brown (7.5 YR 3/2) loam; moderate fine granular structure; friable; neutral; no coarse fragments; clear smooth boundary.

B1 15-45 cm (6-18 inches). Dark brown (7.5 YR 3/2) clay loam; weak coarse subangular blocky structure; friable; neutral; 4% coarse fragments; clear wavy boundary.

B2t 45-73 cm (18-29 inches). Brown (7.5 YR 4/4) clay loam; moderate medium to coarse angular blocky structure; firm; mildly alkaline; 15% coarse fragments; clear wavy boundary.

C 73 + cm (29 + inches). Brown (7.5 YR 4/4) clay loam; weak medium subangular blocky structure; friable; moderately alkaline; 15% coarse fragments.

Type Location: Description #G3-79, taken 7-26-79;
Aerial photo #1-67, 1:40,000

Soil 6Fb

Classification: Lithic Cryoboroll, loamy-skeletal, mixed.

Typifying Pedon: Colors are for moist soil unless otherwise indicated.

A1 0-25 cm (0-10 inches). Dark brown (10 YR 3/3) gravelly and cobbly clay loam; weak medium subangular blocky structure parting to moderate fine granular; hard, friable, sticky, plastic; 30% gravel and 30% cobble; moderately alkaline (pH 8.0); clear wavy boundary; (9-14 inches thick).

R 25 + cm (10 + inches). Hard limestone.

Type Location: Greys River District - Head of Pearson Creek; Site G20-78; Aerial photo 4-7, 1:40,000

Range in Characteristics: Texture range from sandy loam to clay loam. Coarse fragments range in volume from 35% to 80%. Depth to bedrock ranges from 6 to 20 inches.

Soil 6Gb

Classification: Pachic Cryoboralls, laomy-skeletal, mixed.

Typifying Pedon: Colors are for moist soil unless otherwise indicated.

A11 0-3 cm (0-1 inch). Very dark grayish brown (10 YR 3/2) gravelly loam, dark brown (10 YR 4/3) dry; moderate fine granular structure; soft, very friable, nonsticky, nonplastic; 20% gravel; neutral (pH 7.0); clear, smooth boundary; (1-16 inches thick).

A12 3-15 cm (1-6 inches). Dark brown (7.5 YR 3/2) gravelly loam, dark brown (7.5 YR 4/4) dry; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; 20% gravel; meidum acid (pH 6.0); clear smooth boundary; (5-33 inches thick).

B2 15-53 cm (6-21 inches). Dark brown (7.5 YR 3/2) gravelly and cobbly, sandy loam, dark brown (7.5 YR 4/4) dry; weak coarse subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky, slightly plastic; common, thin clay films on the ped faces; 20% gravel, 30% cobble and 5% stone; neutral (pH 7.0), clear smooth boundary; (0-18 inches thick).

C 53-102 cm (21-40 inches). Dark brown (7.5 YR 3/2) gravelly and cobbly sandy loam; moderate fine granular structure; soft, very friable, nonsticky, nonplastic; 25% gravel, 40% cobble and 5% stones; neutral (pH 7.0).

Type Location: Greys River District - East Fork Greys River; site T84-78; Aerial photo 1-50, 1;40,000

Range in Characteristics; Depth to bedrock is greater than 40 inches. Texture ranges from loam to sandy loam. Coarse fragments range in volume from 35% to 70%.

Soil 6Ge

Classification: Pachic Cryoborolls fine-loamy, mixed.

Typifying Pedon: Colors are for moist soils unless otherwise indicated.

A1 0-33 cm (0-13 inches). Very dark grayish brown (10 YR 3/2) silt loam; moderate fine granular structure; slightly hard, friable, sticky, plastic; 5% gravel; strongly acid (pH 5.5), clear smooth boundary; (3-13 inches thick).

B2 33-89 cm (13-35 inches). Dark brown (10 YR 3/3) clay loam; moderate fine and medium subangular blocky structure; hard, friable, sticky, plastic; few thin clay films on the ped faces; 5% gravel; strongly acid (pH 5.5); gradual wavy boundary; (8-24 inches thick).

Cr 89 + cm (35 + inches). Soft sandstone and shale.

Type Location: Greys River District, Blind Bull area, Site G6-78; Aerial photo 1-44, 1:40,000

Range in Characteristics: Depth to bedrock is typically greater than 40 inches. Texture ranges from silt loam to clay loam. Coarse fragments range from 0% to 35% by volume.

APPENDIX C

RANGE SITE DESCRIPTIONS

(In Alphabetical Order by Precipitation Zones,
7-9", 10-14", 15-19" Precipitation Zones)

Technical Guide
Section II E
Major Land Resource Area (34)

CLAYEY (Cy)
7-9" Green River & Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site is found in a lowland position on relatively flat to gently sloping topography. It is found on all exposures. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax planty community is characterized by a variety of plants which prefer a heavy textured soil with slow permeability. The vegetation is a mixture of 70% grasses and grass-like plants, 15% forbs and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Rhizomatous wheatgrasses	20-40
Streambank wheatgrass	
Thickspike wheatgrass	
Western wheatgrass	
Bottlebrush squirreltail	5-15
Indian ricegrass	5-10
All following Grasses and Grass-like Plants	5-15*
Plains reedgrass	
Prairie junegrass	
Sandberg bluegrass	
Needleandthread	
Needleleaf sedge	
Forbs	
All following Forbs	5-15*
Asters	

Biscuitroot
Clovers
Deathcamas
Eriogonums
Fleabane
Hawksbeard
Milkvetch
Onion
Phlox
Pointvetch
Primrose
Pussytoes
Scarlet globemallow
Western yarrow
Woody aster

Woody Plants

Big sagebrush	5-10
All following Woody Plants	5-10*
Alkali sagebrush	
Birdsfoot sagebrush	
Bud sagewort	
Gardner's saltbush	
Low rabbitbrush	
Low sagebrush	
Shadscale	
Spineless horsebrush	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 40-50 percent.

d. Species that do not occupy a position in the climax plant community, but are likely to invade this site if conditon declines are cheatgrass and annual forbs. As condition deteriorates, woody plants and forbs become increasingly more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 700 pounds
Median years - 500 pounds
Unfavorable years - 300 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

LOAMY (Ly)
7-9" Green River and Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site will usually occur in an upland position on relatively flat to moderately sloping land on all exposures. The elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached climate description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by a variety of plants which prefer a medium-textured soil with moderate permeability. Potential vegetation is about 75% grasses and grass-like plants, 10% forbs and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Thickspike wheatgrass	10-30
Needleandthread grass	5-15
Indian ricegrass	5-10
Bluebunch wheatgrass	T-10
Bottlebrush squirreltail	T-10
Prairie junegrass	T-10
All following Grasses and Grass-like Plants	5-10*
Plains reedgrass	
Sandberg bluegrass	
Threadleaf sedge	
Needleleaf sedge	
Canby bluegrass	
Forbs	
All following Forbs	5-15*
Asters	

Biscuitroot
Clovers
Deathcamas
Eriogonums
Fleabane
Goldenweed
Hawksbeard
Locoweed
Penstemons
Phlox
Pussytoes
Sagebrush gilia
Scarlet globemallow
Toadflax
Western yarrow

Woody Plants

Big sagebrush	5-15
All following Woody Plants	5-15*
Birdsfoot sagewort	
Bud sagewort	
Fringed sagewort	
Low rabbitbrush	
Shadscale	
Spiny hopsage	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover ranges from 20-35 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site if condition declines, are cheatgrass, horsebrushes and annual weeds. Rabbitbrush, yarrow and big sagebrush become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 700 pounds
Median years - 500 pounds
Unfavorable years - 300 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

LOWLAND (LL)
7-9" Green River&Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on gently sloping land along perennial or intermittent streams. It is found on all exposures. Slopes vary from 0-10% but are mostly 0-3%. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is characterized by a large number of woody plants that can take advantage of the deep water table. The vegetation of this site is 45% grasses and grass-like plants, 15% forbs and 40% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Needleandthread grass	15-30
Basin wildrye	10-25
Thickspike wheatgrass	10-20
Bottlebrush squirreltail	5-10
All following Grasses and Grass-like Plants	5-15*
Canada wildrye	
Canby bluegrass	
Indian ricegrass	
Letterman needlegrass	
Needleleaf sedge	
Prairie junegrass	
Sandberg bluegrass	
Bluebunch wheatgrass	
Forbs	
All following Forbs	5-15*

American licorice
Asters
Clovers
Eriogonums
Fleabane
Goldenpea
Gromwell
Penstemons
Phlox
Pussytoes
Scarlet globemallow
Scurfpea
Violets
Western yarrow

Woody Plants

Cottonwood	5-20
Buffaloberry	T-10
All following Woody Plants	5-10*
Current	
Roses	
Rubber rabbitbrush	
Silver sagebrush	
Skunkbush	
Willows	
Big sagebrush	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 65-70%.

d. Species that do not occupy a position in the climax plant community, but likely to invade this site if condition declines are annual grasses, annual weeds and thistle. As the condition deteriorates, woody plants become even more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 2,700 pounds
Median years	- 2,000 pounds
Unfavorable years	- 1,400 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SALINE LOWLAND (SL)
7-9" Green River&Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on gently sloping land along perennial or intermittent streams. Slopes vary from 0-10% but are mostly 0-5%. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants which can tolerate high saline and/or alkaline conditions and by woody plants which can take advantage of the deep water table. The vegetation of this site is 60% grasses and grass-like plants, 10% forbs and 30% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Western wheatgrass	5-20
Alkali sacaton	5-15
Basin wildrye	5-10
Bottlebrush squirreltail	5-10
All following Grasses and Grass-like Plants	5-20*
Indian ricegrass	
Inland saltgrass	
Inland sedge	
Nuttalls alkaligrass	
Sandberg bluegrass	
Alkali bluegrass	
Alkali muhly	
Forbs	
All following Forbs	5-10*

Milkvetch
Phlox
Pointvetch
Povertyweed
Woody aster

Woody Plants

Greasewood	10-25
All following Woody Plants	5-20*
Alkali sagebrush	
Four-wing saltbush	
Gardners saltbush	
Rubber rabbitbrush	
Shadscale	
Skunkbush	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 55 to 70 percent.

d. Species that do not occupy a position in the climax plant community, but likely to invade this site if condition declines are cheatgrass, docks, pepperweeds and other annual. As the condition deteriorates, greasewood becomes more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 2,000 pounds
Median years	- 1,200 pounds
Unfavorable years	- 800 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SALINE UPLAND (SU)
7-9" Green River & Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site usually occurs in a lowland position, but can occur on all slopes and in all positions. The slopes vary from 1 to 25%, but are mostly 1 to 10%. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants with high tolerance to salt and capable of withstanding droughty conditions. The vegetation of this site is a mixture of 55% grasses and grass-like plants, 5% forbs and 45% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and grass-like Plants	
Bottlebrush squirreltail	10-25
Indian ricegrass	10-20
All following Grasses and Grass-like Plants	5-20*
Needleandthread	
Salina wildrye	
Sandberg bluegrass	
Western wheatgrass	
Forbs	
All following Forbs	1-5
Asters	
Deathcamas	
Eriogonums	
Fleabane	
Milkvetch	
Phlox	

Pointvetch
Primrose
Princesplume
Pussytoes
Woody aster

Woody Plants

Gardner's saltbush	25-35
All following Woody Plants	5-10*
Birdsfoot sagebrush	
Greasewood	
Bud sagewort	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 20-40 percent.

d. Species that do not occupy a position in the climax plant community, but likely to invade this site if condition declines are halogeton and annual weeds. As the condition deteriorates, grasses and Gardner's saltbush decrease and winterfat increases.

4. Total Annual Production (Pound per Acre Air-dry Weight.)

Favorable years	- 600 pounds
Median years	- 450 pounds
Unfavorable years	- 300 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SANDS (Sa)
7-9" Green River&Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site usually occurs in an upland position on rolling to very rough topography. Slopes may vary from 5 to 60% but are generally 10-30%. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants which prefer highly permeable soils and plants which can survive on unstable, shifting soils. The vegetation of this site is 60% grasses and grass-like plants, 15% forbs and 25% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

m SPECIES	PERCENT
Grasses and Grass-like Plants	
Needleandthread	15-30
Thickspike wheatgrass	15-30
Bottlebrush squirreltail	5-15
Indian ricegrass	5-15
All following Grasses and Grass-like Plants	5-15*
Needleleaf sedge	
Prairie junegrass	
Sandberg bluegrass	
Sand dropseed	
Threeawns	
Galleta	
Bluebunch wheatgrass	
Forbs	
All following Forbs	5-15*
Asters	

Biscuitroot
Clovers
Eriogonums
Fleabane
Fringed sagewort
Milkvetch
Paintbrush
Penstemons
Phlox
Pointvetch
Pussytoes
Sagebrush gilia
Sandwort
Scurfpea
Toadflax
Western yarrow

Woody Plants

Silver sagebrush	5-10
Spiny hopsage	5-10
All following Woody Plants	5-15*
Big sagebrush	
Bitterbrush	
Four-wing saltbush	
Low rabbitbrush	
Rubber rabbitbrush	
Shadscale	
Spiny horsebrush	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 15-25 percent.

d. Species that do not occupy a position in the climax plant community, but likely to invade this site if condition declines are annual forbs and grasses. As the condition deteriorates, woody plants become more dominant, especially sagebrushes, rabbitbrushes and spiny hopsage.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 700 pounds
Median years - 500 pounds
Unfavorable years - 350 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SANDY (Sy)
7-9" Green River&Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site usually occurs on an upland position on relatively flat to moderately sloping land. Slopes are generally 1 to 15%. The elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants that prefer a light to moderately light textured soil with medium permeability. The vegetation of this site is 70% grasses and grass-like plants, 10% forbs and 20% woody plants.

b. Plant species and percentages fround in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Needleandthread	10-30
Thickspike wheatgrass	10-25
Bluebunch wheatgrass	5-10
Bottlebrush squirreltail	5-10
Indian ricegrass	5-10
All following Grasses and Grass-like Plants	5-10*
Needleleaf sedge	
Plains reedgrass	
Prairie junegrass	
Sandberg bluegrass	
Sand dropseed	
Threeawns	
Canby bluegrass	
Gaileta	
Forbs	
All following Forbs	5-10*

Asters
Clovers
Cryptanthas
Deathcamas
Eriogonums
Fleabane
Milkvetch
Paintbrush
Penstemons
Phlox
Pointvetch
Primrose
Pussytoes
Sagebrush gilia
Scarlet globemallow
Toadflax
Western wallflower
Western yarrow
Woody aster
Fringed sagewort

Woody Plants

Big sagebrush	5-10
All following Woody Plants	5-10*
Bitterbrush	
Low rabbitbrush	
Shadscale	
Spiny hopsage	
Spiny horsebrush	
Spineless horsebrush	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 20-30 percent.

d. Species that do no occupy a position in the climax plant community, but likely to invade this site if condition declines are cheatgrass and annual weeds. As the condition deteriorates, woody plants become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 700 pounds
Median years	- 500 pounds
Unfavorable years	- 300 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SHALE (Sh)
7-9" Green River&Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site usually occurs in an upland position. Slopes may vary from 1 to 70 percent but are mostly 5 to 25 percent. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is dominated by plants which can tolerate high salt content and very shallow soils. The vegetation of this site is a mixture of 55% grasses and grass-like plants, 10% forbs and 35% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Thickspike wheatgrass	15-35
All following Grasses and Grass-like Plants	5-25*
Bottlebrush squirreltail	
Indian ricegrass	
Sandberg bluegrass	
Alkali sacaton	
Forbs	
All following Forbs	5-10*
Asters	
Biscuitroot	
Docks	
Fleabane	
Milkvetch	

Onions
Penstemons
Phlox
Pointvetch
Princesplume
Primrose
Scarlet globemallow
Woody aster

Woody Plants

Gardner's saltbush	10-25
All following Woody Plants	5-15*
Greenmolly summercypress	
Spineless horsebrush	
Winterfat	
Birdsfoot sagebrush	
Bud sagewort	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 5-15 percent.

d. Species that do not occupy a position in the climax plant community, but likely to invade this site if condition declines are annual weeds. As the condition deteriorates, greenmolly summercypress and birdsfoot sagebrush become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 300 pounds
Median years - 200 pounds
Unfavorable years - 150 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SHALLOW LOAMY (SwLy)
7-9" Green River&Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site usually occurs in an upland position on rolling to steep slopes. It is found on all exposures, but more commonly on south and west facing slopes. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is dominated by plants which can grow with restricted root depth and droughty conditions. The vegetation of this site is 70% grasses and grass-like plants, 10% forbs and 20% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Bluebunch wheatgrass	10-30
Indian ricegrass	5-10
Needleandthread	5-10
Thickspike wheatgrass	5-10
All following Grasses and Grass-like Plants	5-15*
Needleleaf sedge	
Prairie junegrass	
Salina wildrye	
Sandberg bluegrass	
Bottlebrush Squirreltail	
Letterman needlegrass	
Forbs	
All following Forbs	5-15*
Asters	
Biscuitroot	
Clovers	

Commandra
Eriogonums
Flax
Fleabane
Goldenweed
Milkvetch
Penstemons
Phlox
Pointvetch
Pussytoes
Sagebrush gilia
Scarlet globemallow
Stonecrop
Tansy
Western yarrow

Woody Plants

Winterfat	1-10
All following Woody Plants	5-10*
Big sagebrush	
Birdsfoot sagebrush	
Low rabbitbrush	
Low sagebrush	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover is quite variable depending on amount of exposed parent material. Density of herbage cover will range from 10-30 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site if condition declines are spiny horsebrush, annual grasses and annual forbs. Increasing forbs become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 450 pounds
Median years - 350 pounds
Unfavorable years - 200 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SHALLOW SANDY (SwSy)
7-9" Green River & Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site usually occurs in an upland position on south and west facing slopes, but may be found on all slopes and positions. Elevation ranges from 6,000 to 7,500 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants that can grow with restricted root depth and droughty conditions in a light to moderately light textured soil. The vegetation of this site is a mixture of 70% grasses and grass-like plants, 10% forbs and 20% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Needleandthread	10-25
Indian ricegrass	10-20
Thickspike wheatgrass	5-10
Galleta	T-10
All following Grasses and Grass-like Plants	5-15*
Letterman needlegrass	
Needleleaf sedge	
Prairie junegrass	
Salina wildrye	
Sandberg bluegrass	
Bluebunch wheatgrass	
Bottlebrush squirreltail	
Forbs	
All following Forbs	5-10*

Asters
Common commandra
Cryptanthas
Eriogonums
Fringed sagewort
Goldenweed
Milkvetch
Nailwort
Penstemons
Phlox
Pointvetch
Sagebrush gilia
Stonecrop
Violets
Western yarrow

Woody Plants

All following Woody Plants	5-20*
Big sagebrush	
Low rabbitbrush	
Shadscale	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 10-20 percent.

d. Species that do not occupy a position in the climax plant community, but likely to invade this site if condition declines are annual weeds and horsebrushes. As the condition deteriorates, increasing forbs, needleleaf sedge and sandberg bluegrass become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 450 pounds
Median years	- 350 pounds
Unfavorable years	- 200 pounds

Technical Guide
Section II E
Major Land Resource Area (34)

SUBIRRIGATED (Sb)
7-9" Green River&Great Divide Basins
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site will usually occur on level to nearly level land along perennial or intermittent streams and near seep, springs, and sloughs. It is found on all exposures. Slopes vary from 1 to 10%. The average is 3%. The elevation ranges from 6,000 to over 7,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is dominated by plant species that can benefit from a high water table. Potential vegetation is about 65% grasses and grass-like plants, 20% forbs and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Basin wildrye	35-50
Nebraska sedge	5-10
Tufted hairgrass	5-10
Western wheatgrass	5-10
All following Grasses and Grass-like Plants	5-15*
Bluejoint reedgrass	
Inland sedge	
Mat muhly	
Northern reedgrass	
Nuttalls alkaligrass	
Slender wheatgrass	
Tall mannagrass	
Alkali sacaton	
Baltic rush	

Forbs

All following Forbs	5-20*
American licorice	
Arrowgrass	
Asters	
Buttercup	
Clovers	
Fleabane	
Goldenpea	
Horsetails	
Iris	
Milkvetch	
Pointvetch	
Violets	
Western yarrow	

Woody Plants

Willows	5-10
All following Woody Plants	T-5*
Buffaloberry	
Hawthorn	
Rose	
Rubber rabbitbrush	
Shrubby cinquefoil	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate will vary between 85-100 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site if condition declines are annual grasses, annual weeds, cocklebur, curly cup gumweed. foxtail, poverty weed, bedstraw, rumex, and bull thistle. As site condition deteriorates, willow, low growing sedges, and rushes become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 3,500 pounds
Median years	- 3,000 pounds
Unfavorable years	- 2,300 pounds

Technical Guide
Section II E
Major Land Resource Area (34)(46)(47)

CLAYEY (Cy) 10-14"
Foothills & Basins West of Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site is found in valley bottoms and on gently sloping to steep mountain slopes. It is found on all exposures with a tendency toward north and east slopes at lower elevations. The slopes range from nearly level to 60 percent, but mostly from 5 to 40 percent. Elevations range from 6,200 to 8,000 feet, with most of the area above 7,000 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by a variety of plants which prefer a heavy textured soil with slow permeability. The vegetation is a mixture of 75% grasses and grass-like plants, 15% forbs and 10% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Rhizomatous wheatgrasses	10-30
Streambank wheatgrass	
Thickspike wheatgrass	
Western wheatgrass	
Mutton bluegrass	10-20
Bottlebrush squirreltail	5-10
Indian ricegrass	1-10
Letterman needlegrass	1-10
All following Grasses and Grass-like Plants	5-10*
Needleandthread	

Needleleaf sedge
Plains reedgrass
Prairie junegrass
Sandberg bluegrass
Slender wheatgrass
Spike fescue
Canby bluegrass

Forbs

All following Forbs 5-15*
Agoseris
American vetch
Asters
Biscuitroot
Bluebells
Buttercup
Cerastium
Clovers
Deathcamas
Eriogonums
Fleabane
Groundsel
Hawksbeard
Larkspur
Milkvetch
Onions
Paintbrush
Penstemons
Phlox
Pointvetch
Pussytoes
Sagebrush gilia
Scarlet globemallow
Starwort
Stonecrop
Toadflax
Violets
Western yarrow

Woody Plants

Big sagebrush 1-10

All following Woody Plants T-5*
Alkali sagebrush
Gardners saltbush
Low rabbitbrush
Low sagebrush
Serviceberry
Snowberry

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 55 to 60 percent.

d. Species that do not occupy a position in the climax plant community, but are likely to invade this site if condition declines are cheatgrass, annual forbs, knotweed, gumweed, verbena, and snakeweed. As condition deteriorates, woody plants and forbs become increasingly more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 1,400
Medium years	- 1,100
Unfavorable years	- 600

Technical Guide
Section II E
Major Land Resource Area (34)(46)(47)

LOAMY (Ly)
10-14" Foothills & Basins West of
Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site will usually occur in an upland position on relatively flat to moderately sloping land on all exposures. The elevation ranges from 6,200 to 8,000 feet, with most of the area above 7,000 feet.

2. Climatic Features

See attached climate description

3. Native (climax) Vegetation

a. The climax plant community is characterized by a variety of plants which prefer a medium-textured soil with moderate permeability. Potential vegetation is about 75% grasses and grass-like plants, 10% forbs and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Rhizomatous wheatgrass	10-20
Thickspike wheatgrass	
Streambank wheatgrass	
Western wheatgrass	
Bluebunch wheatgrass	5-10
Canby bluegrass	5-10
Needleandthread	5-10
Letterman needlegrass	5-10
All following Grasses and Grass-like Plants	10-20*
Mutton bluegrass	
Needleleaf sedge	
Plains reedgrass	
Prairie junegrass	
Sandberg bluegrass	
Spike fescue	

Threadleaf sedge	
Bottlebrush squirreltail	
Indian ricegrass	
Forbs	
All following Forbs	5-15*
Agoseris	
American licorice	
Asters	
Biscuitroot	
Buttercup	
Cerastium	
Clovers	
Common commandra	
Common tansy	
Eriogonums	
Fleabane	
Fringed sagewort	
Goldenweed	
Gromwell	
Groundsel	
Hawksbeard	
Larkspur	
Lupine	
Milkvetch	
Nailwort	
Paintbrush	
Penstemons	
Phacelia	
Phlox	
Pointvetch	
Pussytoes	
Sagebrush gilia	
Scarlet globemallow	
Violet	
Western yarrow	
Woody Plants	
Big sagebrush	5-10
All following Woody Plants	5-10*
Birdsfoot sagewort	
Bud sagewort	
Cactus	

Low rabbitbrush
Serviceberry
Shadscale
Spineless horsebrush
Spiny horsebrush
Spiny hopsage
Winterfat

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover ranges from 40-50 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site if condition declines, are cheatgrass and annual weeds. Rabbitbrush, yarrow, and big sagebrush become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 1,500 pounds
Median years - 1,200 pounds
Unfavorable years - 700 pounds

Technical Guide
Section II E
Major Land Resource Area (34)(46)(47)

OVERFLOW (Ov) 10-14"
Foothills & Basins West of Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on gently sloping to moderately sloping flood plains, canyons, and small valley bottoms along intermittent streams. The slopes are generally 1-10 percent. This site is found on all exposures. Elevation ranges from 6,200 to 8,000 feet, with most of the area above 7,000 feet.

2. Climatic Features

See attached climate description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants that can take advantage of periodic flooding and are able to stand short periods of submersion. Potential vegetation is about 65% grasses and grass-like plants, 15% forbs, and 20% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Rhizomatous wheatgrass Western Thickspike Slender	15-25
Canby bluegrass	1-10
Letterman needlegrass	1-10
Needleandthread	1-10
Basin wildrye	1-10

OVERFLOW (Ov) 10-14'
Foothills & Basins West of Continental Divide

All following Grasses and Grass-like Plants	5-10*
Mutton bluegrass	
Needleleaf sedge	
Prairie junegrass	
Sandberg bluegrass	
Slender wheatgrass	
Spike fescue	
Bluebunch wheatgrass	
Bottlebrush squirreltail	
Indian ricegrass	

Forbs

All following Forbs	5-15*
Agoseris	
American licorice	
Asters	
Bluebells	
Buttercups	
Clovers	
Eriogonums	
Fleabane	
Goldenpea	
Groundsel	
Larkspur	
Lupine	
Milkvetch	
Pussytoes	
Scarlet globemallow	
Starwort	
Violets	
Western yarrow	

Woody Plants

Big sagebrush	1-10
All following Woody Plants	5-10*
Chokecherry	
Low rabbitbrush	
Low sagebrush	
Serviceberry	
Silver sagebrush	
Snowberry	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover ranges from 60 to 75 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site if condition declines are cheatgrass, gumweed, mullien, poverty weed, Canadian thistle, rubber rabbitbrush, burdock, and bull thistle. Plants such as big sagebrush, low rabbitbrush, and thickspike wheatgrass become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 2,200
Medium years - 1,800
Unfavorable years - 1,200

Technical Guide
Section II E
Major Land Resource Area (34)(46)(47)

SHALLOW CLAYEY (SwCy) 10-14"
Foothills & Basins West of Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site usually occurs in an upland position on south and west facing slopes, but can be found on all slopes and positions. Elevations range from 6,200 feet to 8,000 feet, with most of the area above 7,000 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants that can grow in heavy soils with restricted root depth and droughty conditions. The vegetation is a mixture of 75% grasses and grass-like plants, 5% forbs, and 20% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Rhizomatous wheatgrasses	15-30
Streambank wheatgrass	
Thickspike wheatgrass	
Western wheatgrass	
Bluebunch wheatgrass	5-15
Bottlebrush squirreltail	1-10
All following Grasses and Grass-like Plants	20-30*
Canby bluegrass	
Indian ricegrass	
Mutton bluegrass	
Needleandthread	
Needleleaf sedge	
Plains reedgrass	

Prairie junegrass
Sandberg bluegrass

Forbs

All following Forbs	1-5*
Asters	
Biscuitroot	
Docks	
Eriogonums	
Fleabane	
Milkvetch	
Onion	
Phlox	
Pointvetch	
Primrose	
Pussytoes	
Western yarrow	

Woody Plants

Low sagebrush	5-10
Winterfat	5-10
All following Woody Plants	5-10*
Alkali sagebrush	
Gardners saltbush	
Greenmolly summercypress	
Low rabbitbrush	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 40 to 50 percent.

d. Species that do not occupy a position in the climax plant community, but likely to invade this site if condition declines, are annual grasses and annual weeds. As the condition deteriorates increasing forbs and low sagebrush become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 1,000
Medium years	- 750
Unfavorable years	- 500

Technical Guide
Section II E
Major Land Resource Area (34)(46)(47)

SHALLOW LOAMY (SwLy) 10-14
Foothills & Basins West of Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site will usually occur in an upland position on rolling to steep slopes, found on all exposures, but is more common on south and west facing slopes. Slopes vary from 5 to 60 percent, but average 5 to 35 percent. Elevation ranges from 6,200 to 8,000 feet, with most of the area above 7,000 feet.

2. Climatic Features

See attached description.

3. Native (climax) Vegetation

a. The climax plant community is dominated by plants which can grow with restricted root depth and in relatively droughty conditions. The vegetation of this site is 75% grasses and grass-like plants, 10% forbs, and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Bluebunch wheatgrass	10-25
Rhizomatous wheatgrasses	10-20
Streambank wheatgrass	
Thickspike wheatgrass	
Western wheatgrass	
Indian ricegrass	5-15
Bottlebrush squirreltail	5-10
Letterman needlegrass	5-10
Needleandthread	5-10
All following Grasses and Grass-like Plants	10-20*
Canby bluegrass	
Mutton bluegrass	

Needleleaf sedge	
Plains reedgrass	
Prairie junegrass	
Sandberg bluegrass	
Forbs	
All following Forbs	5-10*
Asters	
Bluebells	
Cerastium	
Clovers	
Commandra	
Flax	
Fleabane	
Goldenweed	
Hawksbeard	
Milkvetch	
Nailwort	
Paintbrush	
Penstemons	
Phacelia	
Phlox	
Pointvetch	
Princesplume	
Pussytoes	
Sagebrush gilia	
Stonecrop	
Stoneseed	
Western yarrow	
Woody Plants	
Big sagebrush	5-10
All following Woody Plants	5-10*
Bitterbrush	
Low rabbitbrush	
Skunkbush	
Winterfat	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover is quite variable, depending on amount of exposed parent material. Density of herbage cover will range from 15 to 30 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site if condition declines are annual grasses, annual forbs, and perennial weeds such as thistle. Increasing forbs become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 1,200
Medium years	- 900
Unfavorable years	- 700

Technical Guide
Section II E
Major Land Resource Area (43)(46)

DENSE CLAY (DC)
15-19" Foothills & Mtns. West of
Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site can be found in a lowland or upland position, on flat to moderate sloping land. It is found on all exposures. Slopes are nearly level to 60%, but mostly 5-40%. The elevations range from 6,000 to 8,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants which can survive in extremely heavy soils which develop large cracks when dry. The vegetation is a mixture of 75% grasses and grass-like plants 15% forbs and 10% woody plants.

b. Plant species and percentages found in the climax plant community are by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Rhizomatous wheatgrass	10-20
Streambank wheatgrass	
Thickspike wheatgrass	
Western wheatgrass	
Basin wildrye	5-10
Mountain bromegrass	1-10
Slender wheatgrass	1-10
Spike fescue	1-10
All following Grasses and Grass-like Plants	10-20*
Columbia needlegrass	
Idaho fescue	
Letterman needlegrass	
Mutton bluegrass	
Prairie junegrass	
Sandberg bluegrass	
Sun sedge	

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Forbs

All following Forbs	5–15*
American vetch	
Asters	
Astragalus	
Biscuitroot	
Bluebells	
Eriogonums	
Fleabane	
Groundsel	
Hawksbeard	
Herbaceous sage	
Little sunflower	
Milkvetch	
Mulesear	
Phlox	
Pointvetch	
Pussytoes	
Western yarrow	
Yellow sneezeweed	

Woody Plants

Low sagebrush	1–10
Low rabbitbrush	T–5

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 60–65 percent.

d. Species that do not occupy a position in the climax plant community, but are likely to invade this site if condition declines are cheatgrass, annual forbs, Canadian thistle, dandelion, knotweed, gumweed, mullien, tarweed, and snakeweed. As condition deteriorates, low sagebrush and mulesear become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 1,500 pounds
Medium years	- 1,200 pounds
Unfavorable years	- 800 pounds

GRAVELLY (Gr)
15-19" Foothills & Mtns. West of Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on foothills, lake terraces, alluvial and colluvial fans, outwash plains, along streams, and rolling to steep hills. It is found on all exposures. Slopes vary from 1-70%, but are mostly 5-30%. Elevation ranges from 6,000 to 8,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is dominanted by shallow rooted plants and those plants which can exist on unstable, droughty soils. The vegetation of this site is 65% grasses and grass-like plants, 15% forbs and 20% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Bluebunch wheatgrass	10-25
Western needlegrass	10-25
Rhizomatous wheatgrasses	5-10
Streambank wheatgrass	
Thickspike wheatgrass	
Western wheatgrass	
All following Grasses and Grass-like Plants	10-20*
Bottlebrush squirreltail	
California danthonia	
Canby bluegrass	
Idaho fescue	
Indian ricegrass	
Mountain muhly	
Mutton bluegrass	
Needleleaf sedge	

Prairie junegrass
Sandberg bluegrass
Slender wheatgrass
Spike fescue
Spike trisetum
Timber danthonia

Forbs

All following Forbs	5-15*
Asters	
Balsamroot	
Buttercup	
Clovers	
Eriogonums	
Flax	
Fleabane	
Hawksbeard	
Herbaceous sage	
Lupine	
Milkvetch	
Mustard	
Nailwort	
Oregon grape	
Paintbrush	
Penstemon	
Phlox	
Pointvetch	
Pussytoes	
Stonecrop	
Stoneseed	
Violets	
Western yarrow	
Fringed sagewort	

Woody Plants

Bitterbrush	5-10
Black sagebrush	1-10
All following Woody Plants	5-10*
Low rabbitbrush	
Low sagebrush	
Three-tip sagebrush	

*Of plants in these groups no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimante is 35-40 percent.

d. Species that do not occupy a position in the climax plant community, but are likely to invade this site if condition declines are cheatgrass, annual forbs, ragweed, tarweed, and snakeweed. As the condition deteriorates, increasing woody plants and forbs become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 1,250 pounds
Medium years	- 750 pounds
Unfavorable years	- 650 pounds

Technical Guide
Section II E
Major Land Resource Area (43)(46)

LOAMY (Ly)
15-19" Foothills & Mountains West of
Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on gentle to steep mountain slopes, valley bottoms and steep glacial moraines. It is found on all exposures at high elevations, but is found primarily on north and east slopes at the lower elevations. Slopes vary from 2 to 70%, but average 20-50%. The elevations range from 6,000 to 8,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is characterized by a variety of plants which prefer a medium textured soil with moderate permeability. The vegetation is 75% grasses and grass-like plants, 15% forbs and 10% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Bluebunch wheatgrass	10-25
Idaho fescue	10-25
Blue wildrye	5-10
Mountain bromegrass	5-10
Spike sedge	5-10
All following Grasses and Grass-like Plants	10-20*
Big bluegrass	
Basin wildrye	
Bottlebrush squirreltail	
California danthonia	
Columbia needlegrass	
Letterman needlegrass	
Mutton bluegrass	
Prairie junegrass	
Sandberg bluegrass	

Slender wheatgrass
Sun sedge
Thickspike wheatgrass
Timber danthonia
Western needlegrass

Forbs

All following Forbs 5-15*
Agoseris
American licorice
American vetch
Asters
Balsamroot
Bluebells
Buckwheat
Buttercup
Clovers
Eriogonums
Geranium
Green gentian
Groundsel
Hawksbeard
Horsemint
Larkspur
Lupine
Meadowrue
Milkvetch
Mulesear
Oregon grape
Paintbrush
Peavine
Penstemon
Phacelia
Phlox
Pointvetch
Stoneseed
Violet
Western coneflower
Western yarrow
Yellow sneezeweed

Woody Plants

Big sagebrush 1-10
All following Woody Plants T-5*

Bitterbrush
Low rabbitbrush
Serviceberry
Silver sagebrush
Snowberry

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate is 55-60%, woody plant overstory will not exceed 10% and often less than 5%.

d. Species that do not occupy a position in the climax plant community, but are likely to invade this site if condition declines are cheatgrass, sixweeks fescue, threeawn, dandelion, houndstongue, and annual weeds. Rabbitbrush, yarrow, big sagebrush, and buckwheat become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 2,400 pounds
Medium years - 2,000 pounds
Unfavorable years - 1,400 pounds

Technical Guide
Section II E
Major Land Resource Area (43)(46)

OVERFLOW (OV)
15-19" Foothills & Mtns. West of
Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on gently sloping to moderately sloping flood plains, canyons, and small valley bottoms along intermittent streams. The slopes are generally 1-10 percent. This site is found on all exposures. Elevation ranges from 6,000 to 8,500 feet.

2. Climatic Features

See attached climate description

3. Native (climax) Vegetation

a. The climax plant community is characterized by plants that can take advantage of periodic flooding and are able to stand short periods of submersion. Potential vegetation is about 65% grasses and grass-like plants, 20% forbs and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Basin wildrye	10-25
Rhizomatous wheatgrass	10-20
Streambank	
Thickspike	
Western	
Idaho fescue	1-10
Slender wheatgrass	1-10
All following Grasses and Grass-like Plants	5-20*
Big bluegrass	
Blue wildrye	
Bluebunch wheatgrass	
Bottlebrush squirreltail	
Canby bluegrass	
Columbia needlegrass	
Letterman needlegrass	

Mountain bromegrass
Mutton bluegrass
Onion grass
Prairie junegrass
Spike fescue
Sun sedge
Timber danthonia
Western needlegrass

Forbs

All following Forbs 5-20*
Agoseris
American licorice
American vetch
Asters
Bluebells
Clovers
Eriogonums
Fleabane
Geranium
Golden pea
Gromwell
Groundsel
Herbaceous sage
Larkspur
Lupine
Meadowrue
Milkvetch
Oregon grape
Paintbrush
Peavine
Penstemon
Phacelia
Phlox
Pointvetch
Pussytoes
Sandwort
Starwort
Stonecrop
Stoneseed
Violets
Western yarrow

Woody Plants

All following Woody Plants 5-15*

Big sagebrush
Chokecherry
Low rabbitbrush
Rose
Serviceberry
Silver sagebrush
Snowberry

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover ranges from 60-75 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site of condition declines, are cheatgrass, gumweed, mullien, poverty weed, Canadian thistle, rubber rabbitbrush, burdock, bull thistle, houndstongue, and stickseed. Plants such as big sagebrush, low rabbitbrush, and thickspike wheatgrass become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 3,000 pounds
Medium years	- 2,500 pounds
Unfavorable years	- 1,500 pounds

Technical Guide
Section II E
Major Land Resource Area (43)(46)

SHALLOW LOAMY (SwLy)
15- 9" Foothills & Mtns. West of
Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on rolling to steep slopes and ridges. It is found on all exposures, but is more common on south and west facing slopes. Slopes vary from 5-60%, but average 5-35%. Elevation ranges from 6,000 to 8,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is dominated by plants which can grow with restricted root depth and in relatively droughty conditions. The vegetation of this site is 65% grasses and grass-like plants, 10% forbs and 25% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Bluebunch wheatgrass	10-35
Idaho fescue	10-20
Spike fescue	10-20
All following Grasses and Grass-like Plants	10-20*
Big bluegrass	
Bottlebrush squirreltail	
California danthonia	
Canby bluegrass	
Columbia needlegrass	
Indian ricegrass	
Letterman needlegrass	
Mountain bromegrass	
Mutton bluegrass	
Needleleaf sedge	
Oniongrass	

Prairie junegrass
Spike trisetum
Thickspike wheatgrass
Timber danthonia
Western needlegrass
Williams needlegrass

Forbs

All following Forbs	5-10*
American vetch	
Asters	
Balsamroot	
Bluebells	
Clovers	
Eriogonums	
Fleabane	
Groundsel	
Milkvetch	
Oregon grape	
Paintbrush	
Phlox	
Pointvetch	
Pussytoes	
Stonecrop	
Stoneseed	
Western yarrow	

Woody Plants

Mountainmaghogany	10-35
All following Woody Plants	5-10*
Big sagebrush	
Bitterbrush	
Chokecherry	
Low rabbitbrush	
Serviceberry	
Silver sagebrush	
Snowberry	
Snowbrush ceanothus	

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover is quite variable depending on amount of exposed parent material. Density of herbage cover will range

from 30-65 percent.

d. Species that are not part of the climax plant community, but are most likely to invade this site if condition declines are, annual grasses, annual frobs, Kentucky bluegrass, and perennial weeds such as burdock, stickseed, and thistle. Plants such as big sagebrush, low rabbitbrush, and balsamroot become more dominant as range condition deteriorates.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 1,700 pounds
Medium years	- 1,400 pounds
Unfavorable years	- 800 pounds

Technical Guide
Section II E
Major Land Resource Area (43)(46)

SUBIRRIGATED (Sb)
15-19" Foothills & Mtns. West of Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site will usually occur on level to nearly level alnd along perennial or intermittent streams and near seeps, springs, and sloughs. It is found on all exposures. Slopes vary from 1 to 10 percent. The average is 3 percent. The elevation ranges from 6,000 to 8,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is dominated by plant species that can benefit from a high water table. Potential vegetation is about 65% grasses and grass-like plants, 20% forbs and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Tufted hairgrass	35-45
Basin wildrye	5-10
Nebrasks sedge	5-10
Rhizomatous wheatgrass	5-10
Streambank	
Thickspike	
Western	
All following Grasses and Grass-like Plants	5-15*
Alpine timothy	
Baltic rush	
Bearded wheatgrass	
Bentgrasses	
Big bluegrass	
Blue wildrye	

SUBIRRIGATED (Sb)
15-19" Foothills & Mtns. West of Continental Divide

Canby bluegrass
Columbia needlegrass
Dunehead sedge
Inland sedge
Mountain bromegrass
Nodding bromegrass
Northern reedgrass
Redtop bentgrass
Slender wheatgrass
Spike trisetum
Tall mannagrass

Forbs

All following Forbs — 5-20*
American bistort
American licorice
Arrowgrass
Aster
Buttercup
Clovers
Cow parsnip
Elephanthead
Flax
Goldenpea
Goldenrod
Groundsel
Horsetails
Iris
Milkvetch
Mint
Plantain
Pointvetch
Shooting Star
Sweetroot
Violets
Water hemlock
Waterleaf
Western yarrow

Woody Plants

Willows — 5-10
All following Woody Plants — 1-10*
Chokecherry
Rose
Shrubby cinquefoil

Water birch

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover by ocular estimate will vary between 85-100 percent.

d. Species that are not part of the climax plant community, but are most likely to invade this site if condition declines, are annual grasses, annual weeds, cocklebur, curlycup gumweed, fox-tail, poverty weed, bedstraw, rumex, and bull thistle. As site condition deteriorates, willows, low growing sedges, iris and rushed become more dominant.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years - 5,500 pounds
Medium years - 4,500 pounds
Unfavorable years - 3,500 pounds

Technical Guide
Section II E
Major Land Resource Area (43)(46)

VERY SHALLOW (VS)
15-19" Foothills & Mtns. West of
Continental Divide
Correlated Range Site No.____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs in an upland position with steep slopes. It may be found in all positions and on all slopes. Slopes vary from 1 to 70%, but most commonly range from 25-50%. Elevation ranges from 6,000 to 8,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is dominated by plants which can survive with severe root depth limitation and under relatively droughty conditions. The vegetation is a mixture of 65% grasses and grass-like plants, 10% forbs and 25% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Bluebunch wheatgrass	20-40
Rhizomatous wheatgrass	1-10
Streambank wheatgrass	
Thickspike wheatgrass	
Western wheatgrass	
All following Grasses and Grass-like Plants	10-20*
Big bluegrass	
Bottlebrush squirreltail	
California danthonia	
Canby bluegrass	
Idaho fescue	
Indian ricegrass	
Letterman needlegrass	
Mountain bromegrass	
Mountain muhly	

Mutton bluegrass
Needleleaf sedge
Oniongrass
Prairie junegrass
Sandberg bluegrass
Spike fescue
Spike trisetum
Thickspike wheatgrass
Timber danthonia

Forbs

All following Forbs 5-10*
American vetch
Asters
Balsamroot
Bluebells
Buckwheat
Clovers
Eriogonums
Fleabane
Hawksbeard
Milkvetch
Oregon grape
Phlox
Pointvetch
Pussytoes
Stonecrop
Stoneseed
Western yarrow

Woody Plants

Mountain mahogany 1-10
All following Woody Plants 5-15*
Big sagebrush
Bitterbrush
Black sagebrush
Chokecherry
Low rabbitbrush
Serviceberry
Snowberry

*Of these plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Percent ground cover ranges from 30-35 percent.

d. Species that do not occupy a position in the climax plant community, but are likely to invade this site if condition declines are cheatgrass, annual weeds, houndstongue, knotweed, muleaear dock, mullien, pricklypear, mustard, and snakeweed. Increasing forbs, sandberg bluegrass, big sagebrush, and black sagebrush become more dominant as condition deteriorates.

4. Total Annual Production (Pounds per acre air-dry weight)

Favorable years - 750 pounds
Medium years - 600 pounds
Unfavorable years - 450 pounds

Technical Guide
Section II E
Major Land Resource Area (43)(46)

WETLAND (WL)
15-19" Foothills & Mtns. West of
Continental Divide
Correlated Range Site No._____

RANGE SITE DESCRIPTION

A. PHYSICAL CHARACTERISTICS

1. Physiographic Features

This site occurs on level to gently sloping land near springs, seeps, and sloughs. It is found on all exposures. Slopes vary from 0 to 10% but most commonly are less than 3%. Elevation ranges from 6,000 to over 8,500 feet.

2. Climatic Features

See attached description

3. Native (climax) Vegetation

a. The climax plant community is dominated by plants that can withstand long periods of submersion in water. Potential vegetation is about 75% grasses and grass-like plants, 10% forbs and 15% woody plants.

b. Plant species and percentages found in the climax plant community by air-dry weight are:

SPECIES	PERCENT
Grasses and Grass-like Plants	
Nebraska sedge	20-30
Tufted hairgrass	20-30
Bluejoint reedgrass	10-15
All following Grasses and Grass-like Plants	10-20*
Alpine timothy	
American mannagrass	
Baltic rush	
Bearded wheatgrass	
Bentgrasses	
Big bluegrass	
Blue wildrye	
Dunehead sedge	
Inland sedge	
Nodding bromegrass	

Northern reedgrass
Redtop bentgrass
Slim sedge
Tall mannagrass

Forbs

All following Forbs 5-10*
American bistort
Arrowgrass
Bluebells
Blue-eyegrass
Columbine
Elephanthead
Groundsel
Horsetails
Iris
Monkshood
Water hemlock
Waterleaf
Western coneflower

Woody Plants

Willows 5-10
All following Woody Plants 1-10*
Bog kalmia
Current
Rose
Water birch

*Of plants in these groups, no more than 5% of any species is allowable in the potential plant community.

c. Density of herbage cover by ocular estimate may vary from 85-100 percent.

d. Species that are not a part of the climax plant community, but are most likely to invade this site if condition declines are annual grasses, annual forbs, cocklebur, curlycup gumweed, foxtail, poverty weed, and thistle. Willows, low-growing sedges, and rushes become more dominant as conditions deteriorate.

4. Total Annual Production (Pounds per Acre Air-dry Weight)

Favorable years	- 7,500 pounds
Medium years	- 6,000 pounds
Unfavorable years	- 5,500 pounds

APPENDIX D

LABORATORY DATA
(ERT Survey Area)

Laboratory Data

The results of laboratory analyses contained in this Appendix are for soils sampled on the ERT survey areas within the well field. Fifteen soil profiles were sampled for interpretive use on BLM and private lands; 7 were sampled for interpretive purposes on FS lands. These locations were not sampled as a means to correlation; rather, they were analyzed to assist in rehabilitation and erosion control interpretations for the well field.

The results of analyses are preceded by the ERT mapping unit symbol, to facilitate reference to mapping unit descriptions, profile descriptions, and reclamation interpretations within this report. Base saturation percentage data are numbered to correspond with the laboratory sample numbers shown with selected samples from the soil profiles.

Data for Bio/West soil profiles sampled within the well field may be reviewed at the BLM Office of Special Projects, Denver, Colorado.

Inter·Mountain
Laboratories, Inc.

1633 Terra Avenue
Sheridan, Wyoming 82801
Tel. (307) 672-8945

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.

Base Saturation

Lab No.	Calcium meq/100g	Magnesium meq/100g	Sodium meq/100g	Potassium meq/100g	Selenium ppm
16741	44.8	2.88	0.14	0.20	
16742	44.6	2.83	0.15	0.19	
16743	8.54	1.22	0.16	0.49	
16744	4.35	0.77	0.12	0.22	
16745	3.52	0.81	0.10	0.10	
16746	2.56	0.45	0.08	0.02	
16747	4.81	1.22	0.19	0.13	
16748	4.94	1.47	0.10	0.07	
16749	14.0	2.79	0.11	0.09	
16750	16.1	1.41	0.04	0.03	
16751	29.2	2.17	0.09	0.02	

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Laboratories, Inc.

1633 Terra Avenue
Sheridan, Wyoming 82801
Tel. (307) 672-8945

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.

Base Saturation

Lab No.	Calcium meq/100g	Magnesium meq/100g	Sodium meq/100g	Potassium meq/100g	Selenium ppm
16709	45.2	4.39	0.33	0.78	-0.02
16710	45.0	5.05	0.70	0.63	-0.02
16711	41.2	6.91	2.07	0.44	-0.02
16712	42.1	6.71	1.86	0.38	-0.02
16713	48.3	2.83	0.18	0.61	-0.02
16714	40.6	5.98	0.33	0.31	-0.02
16715	41.4	6.67	0.45	0.23	-0.02
16716	38.9	7.62	1.38	0.21	-0.02
16729	25.6	4.05	0.14	1.19	
16730	35.8	3.37	0.11	1.23	
16731	38.4	3.79	0.12	0.48	
16732	48.6	3.69	0.15	0.32	
16733	43.1	3.82	0.18	0.23	
16734	41.7	4.17	0.19	0.24	
16735	26.1	5.51	0.21	0.13	
16736	32.5	3.54	0.17	1.51	
16737	27.8	3.04	0.16	1.03	
16738	32.3	3.89	0.13	0.98	
16739	47.6	3.50	0.18	0.47	
16740	45.0	3.07	0.18	0.31	

TOPSOIL ANALYSIS
PROJECT: ERT

INTER-MOUNTAIN LABORATORIES, INC.
1633 TERRA AVENUE
SHERIDAN, WYOMING

DATE: DECEMBER 15, 1982
FORM: WYOMING DEQ
SHEET: 1 OF 3

Mapping Unit Symbol	Depth In.	Lab No.	pH	Conductivity mmhos/cm	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	% Organic Matter	% Carbonates	% Coarse Fragments	% Very Fine Sand	Sand %	Silt %	Clay %	Texture
66F (Hub)	0-3	17126	5.9	0.88	109.	5.87	1.25	0.19	0.10	8.3	2.2	9.0	18.5	46.4	47.2	6.4	Sandy Loam
	3-17	17127	6.0	0.44	38.7	2.92	0.78	0.49	0.36	2.1	0.9		13.0	47.3	41.8	10.9	Loam
	17-37	17128	6.0	0.33	35.8	1.79	0.65	0.57	0.52	1.3	0.6	10.6	12.1	38.2	43.6	18.2	Loam
75 (Jerry)	0-9	17129	6.4	0.55	43.8	3.45	1.05	0.51	0.34	2.1	1.1		12.1	36.4	47.2	16.4	Loam
	9-19	17130	6.4	0.33	54.5	2.34	0.61	0.55	0.45	0.9	1.4	3.7	5.4	19.8	45.7	34.5	Clay Loam
	19-41	17131	7.1	0.38	61.3	2.94	0.76	0.62	0.46	1.1	15.3	9.7	7.6	20.9	40.0	39.1	Clay Loam
	41-60	17132	7.2	0.55	50.3	2.99	1.32	0.87	0.59	1.0	52.1	10.4	13.5	26.4	32.7	40.9	Clay
77E (Brownsto)	0-4	17133	6.5	1.10	55.5	8.88	2.26	0.35	0.15	3.9	1.8	25.8	20.6	42.7	48.2	9.1	Loam
	4-9	17134	7.2	0.55	54.5	4.21	0.87	0.40	0.25	2.5	13.0	34.4	16.9	39.6	47.7	12.7	Loam
	9-60	17135	7.2	0.44	51.2	3.18	0.73	0.53	0.38	1.5	29.2	56.4	12.9	32.7	46.4	20.9	Loam
73 (Wilsonville variant)	0-3	17136	7.2	3.08	54.9	26.5	12.7	0.59	0.13	4.2	11.9	6.4	20.5	39.1	46.4	14.5	Loam
	3-10	17137	7.3	3.19	47.5	27.1	13.9	3.98	0.88	1.8	12.3		29.4	47.3	40.9	11.8	Loam
	10-15	17138	7.4	1.87	58.1	13.5	5.75	2.47	0.80	1.9	13.9		20.5	23.6	60.9	15.5	Silt Loam
	15-34	17139	7.3	0.77	45.8	5.19	1.72	0.59	0.32	1.4	11.9		19.3	36.4	48.1	15.5	Loam
	34-60	17140	7.4	0.88	27.5	5.60	2.42	0.80	0.40	0.5	22.8	80.3	7.6	67.3	24.5	8.2	Sandy Loam

TOPSOIL ANALYSIS
PROJECT: ERT

INTER-MOUNTAIN LABORATORIES, INC.
1633 TERRA AVENUE
SHERIDAN, WYOMING

DATE: DECEMBER 15, 1982
FORM: WYOMING DEQ
SHEET: 2 OF 3

Mapping Unit Symbol	Depth In.	Lab No.	pH	Conductivity mmhos/cm	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	% Organic Matter	% Carbonates	% Coarse Fragments	% Very Fine Sand	Sand %	Silt %	Clay %	Texture
88 (Bead)	0-8	17141	5.2	0.22	44.5	1.17	0.41	0.45	0.51	2.4	0.5	11.8	12.0	31.5	53.0	15.5	Silt Loam
	8-20	17142	4.9	0.22	28.0	0.68	0.21	0.63	0.94	0.3	0.7	4.3	11.0	29.1	50.9	20.0	Silt Loam
	20-33	17143	4.9	0.11	32.9	0.62	0.14	0.56	0.91	0.3	0.5	0.8	7.0	21.8	50.9	27.3	Clay Loam
	33-60	17144	4.8	0.33	37.0	1.35	0.42	0.57	0.61	0.4	0.8	12.3	14.1	31.8	47.3	20.9	Loam
90 (Cluff)	0-6	17145	5.1	0.22	64.3	0.97	0.13	0.49	0.66	4.2	0.7	30.0	13.2	32.7	61.8	5.5	Silt Loam
	6-17	17146	4.9	0.11	30.2	0.60	0.09	0.45	0.77	0.6	0.4	35.0	9.2	30.9	53.6	15.5	Silt Loam
	17-28	17147	4.6	0.22	41.4	0.89	0.21	0.53	0.71	0.5	0.7	50.0	8.7	25.5	46.3	28.2	Clay Loam
	28-50	17148	4.4	0.22	67.3	1.79	0.43	0.87	0.83	0.3	0.5	50.0	6.9	22.7	27.3	50.0	Clay
90 (Bata)	0-15	17149	4.9	0.22	25.8	0.70	0.03	0.89	1.47	0.6	0.1	65.0	10.7	43.6	46.4	10.0	Loam
	15-34	17150	5.0	0.11	21.1	0.44	0.02	0.62	1.29	0.1	0.3	50.0	16.2	49.1	39.1	11.8	Loam
	34-46	17151	4.8	0.11	32.1	0.35	0.01	0.53	1.25	0.2	1.1	60.0	23.4	51.3	24.2	24.5	Sandy Clay Loam
	46-60	17152	4.8	0.11	26.3	0.40	0.01	0.61	1.35	0.1	0.2	50.0	12.4	45.8	38.7	15.5	Loam
98 (Hub variant)	0-5	17153	6.1	0.33	46.4	1.66	0.53	0.38	0.36	1.2	0.9	12.0	9.2	16.9	63.1	20.0	Silt Loam
	5-15	17154	6.7	0.22	53.2	1.96	0.81	0.51	0.43	1.3	1.7	12.5	9.6	16.0	58.5	25.5	Silt Loam
	15-22	17155	6.9	1.43	59.9	8.04	4.16	0.29	0.12	1.3	7.4	30.0	11.2	16.9	59.5	23.6	Silt Loam
	22-60	17156	7.2	1.21	48.4	6.56	3.25	0.31	0.14	0.9	36.5	65.0	11.1	26.0	61.3	12.7	Silt Loam

TOPSOIL ANALYSIS
PROJECT: ERT

INTER-MOUNTAIN LABORATORIES, INC.
1633 TERRA AVENUE
SHERIDAN, WYOMING

DATE: DECEMBER 15, 1982
FORM: WYOMING DEQ
SHEET: 3 OF 3

Mapping Unit Symbol	Depth In.	Lab No.	pH	Conductivity mmhos/cm	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	% Organic Matter	% Carbonates	% Coarse Fragments	% Very Fine Sand	Sand %	Silt %	Clay %	Texture
98 (Irigul)	0-3	17157	6.9	0.66	90.6	3.47	2.36	0.17	0.10	5.7	4.3	16.3	19.1	24.0	68.7	7.3	Silt Loam
	3-8	17158	7.1	0.66	86.7	3.93	2.70	0.22	0.12	4.4	16.2	46.0	12.5	20.5	73.1	6.4	Silt Loam
	8-14	17159	7.2	0.66	74.3	3.99	2.83	0.26	0.14	3.1	27.3	50.0	12.4	24.2	69.4	6.4	Silt Loam
96 (Farlow)	0-11	17160	7.2	0.44	67.3	2.43	1.87	0.45	0.31	3.4	7.4	51.8	8.0	29.1	62.7	8.2	Silt Loam
	11-23	17161	7.3	0.66	49.8	3.21	2.46	0.19	0.11	1.5	48.2	68.0	10.0	26.7	63.3	10.0	Silt Loam
	23-60	17162	7.3	1.10	42.6	5.18	4.02	0.37	0.17	0.9	52.9	71.1	9.5	24.0	66.9	9.1	Silt Loam
88 (Bead)	0-16	17163	5.0	0.22	28.7	0.76	0.31	0.48	0.66	0.6	0.7	44.7	10.8	37.6	49.7	12.7	Loam
	16-28	17164	4.8	0.11	47.3	0.55	0.18	0.62	1.03	0.2	0.4	38.5	7.7	27.6	40.6	31.8	Clay Loam
	28-35	17165	4.7	0.11	63.7	0.75	0.28	0.87	1.21	0.1	0.3	9.0	5.5	26.7	30.6	42.7	Clay
	35-48	17166	4.7	0.11	57.7	0.53	0.14	0.83	1.43	-0.1	0.8	7.0	6.1	23.1	36.0	40.9	Clay
	48-60	17167	4.7	0.22	45.8	1.06	0.21	1.54	1.93	0.1	0.7	35.2	12.4	32.2	41.4	26.4	Loam

TOPSOIL ANALYSIS
PROJECT: ERT

INTER-MOUNTAIN LABORATORIES, INC.
1633 TERRA AVENUE
SHERIDAN, WYOMING

DATE: NOVEMBER 29, 1982
FORM: WYOMING DEQ
SHEET: 1 OF 4

Mapping Unit Symbol	Depth In.	Lab No.	pH	Conductivity mmhos/cm	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	% Organic Matter	% Carbonates	% Coarse Fragments	% Very Fine Sand	Sand %	Silt %	Clay %	Texture
51E (Pishkin)	0-4	16703	7.1	0.72	45.0	5.21	1.77	0.70	0.37	3.0	35.3	37.8	11.9	39.1	53.6	7.3	Silt Loam
	4-11	16704	7.2	0.53	55.6	4.33	1.78	0.85	0.49	2.8	34.5	40.0	8.3	38.2	53.6	8.2	Silt Loam
	11-30	16705	7.6	1.76	51.9	3.30	5.89	8.20	3.83	2.0	41.1	85.0	6.6	40.0	45.5	14.5	Loam
	30-60	16706	8.0	0.64	33.9	0.92	2.98	3.37	2.41	0.2	38.1	44.2	6.3	30.9	55.5	13.6	Silt Loam
52 (Starman)	0-3	16707	7.2	0.98	50.6	6.28	2.40	0.60	0.29	4.6	23.8	35.0	9.7	40.0	52.7	7.3	Silt Loam
	3-10	16708	7.2	0.65	60.7	9.86	2.02	0.50	0.21	3.4	25.1	50.0	10.5	36.4	55.4	8.2	Silt Loam
86 (Glassner variance)	0-3	16709	7.6	0.33	51.4	2.38	1.41	0.97	0.70	0.5	18.2	12.7	6.6	24.5	33.7	41.8	Clay
	3-9	16710	7.5	3.37	54.6	7.20	8.36	16.3	5.84	1.1	19.6		4.8	21.8	32.7	45.5	Clay
	9-34	16711	7.8	0.32	56.5	1.96	1.32	2.04	1.59	0.1	21.9		8.5	16.4	30.9	52.7	Clay
	34+	16712	7.7	1.63	70.9	3.57	3.80	9.51	4.95	0.2	20.4		1.6	15.5	32.7	51.8	Clay
86 (Delphill)	0-5	16713	7.5	0.45	36.8	3.07	1.08	0.94	0.65	1.3	22.9	5.0	7.0	31.8	44.6	23.6	Loam
	5-17	16714	7.6	0.39	46.4	2.37	1.99	0.96	0.65	1.1	24.7		2.3	11.8	47.3	40.9	Silty Clay
	17-37	16715	7.9	0.45	42.6	1.77	2.53	1.56	1.06	0.5	22.4		2.8	19.1	47.3	33.6	Silty Clay Loam
	37+	16716	7.9	2.60	50.7	4.48	15.1	9.48	3.03	0.1	26.5		3.3	13.6	49.1	37.3	Silty Clay Loam

TOPSOIL ANALYSIS
PROJECT: ERT

INTER-MOUNTAIN LABORATORIES, INC.
1633 TERRA AVENUE
SHERIDAN, WYOMING

DATE: NOVEMBER 29, 1982
FORM: WYOMING DEQ
SHEET: 2 OF 4

Mapping Unit Symbol	Depth In.	Lab No.	pH	Conductivity mmhos/cm	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	% Organic Matter	% Carbonates	% Coarse Fragments	% Very Fine Sand	Sand %	Silt %	Clay %	Texture
91 (Hobacker)	0-7	16717	7.4	0.87	89.0	5.90	1.67	0.56	0.29	10.9	21.8	20.0	22.3	42.2	49.6	8.2	Loam
	7-25	16718	7.4	0.57	67.4	4.38	1.05	0.46	0.28	6.5	23.8	40.0	14.7	39.5	54.1	6.4	Silt Loam
	25-37	16719	7.4	0.46	67.4	3.68	1.05	0.70	0.46	5.3	22.7	50.0	13.6	36.7	53.3	10.0	Silt Loam
	37-60	16720	7.4	0.55	60.4	5.02	2.01	0.60	0.32	2.3	53.1	55.0	4.9	48.5	46.0	5.5	Sandy Loam
91 (Hoodle)	0-9	16725	7.3	0.50	63.7	4.29	1.65	0.38	0.22	5.6	13.9	15.0	18.4	36.7	52.4	10.9	Silt Loam
	9-19	16726	7.5	0.43	49.7	3.62	1.62	0.46	0.28	2.5	17.7	40.0	15.2	34.5	51.0	14.5	Silt Loam
	19-27	16727	7.5	0.39	46.0	2.70	1.23	0.66	0.47	1.2	27.4	50.0	8.5	28.2	47.3	24.5	Loam
	27-60	16728	7.5	0.48	43.4	2.73	0.96	0.67	0.49	0.2	29.3	55.0	7.9	31.8	45.5	22.7	Loam
75 (Heath variant)	0-4	16729	7.1	0.39	53.7	3.10	1.72	0.55	0.35	2.3	2.5	25.0	21.5	32.7	50.9	16.4	Silt Loam
	4-9	16730	7.3	0.35	50.3	2.72	1.10	0.48	0.35	3.4	2.7	15.0	18.8	30.9	58.2	10.9	Silt Loam
	9-16	16731	7.3	0.45	50.3	2.43	1.54	0.82	0.58	0.1	25.8	5.0	11.3	17.3	48.2	34.5	Silty Clay Loam
	16-21	16732	7.5	0.43	45.1	2.92	1.81	0.60	0.39	0.7	36.1	5.0	9.9	17.3	44.5	38.2	Silty Clay Loam
	21-28	16733	7.6	0.40	44.6	2.55	2.03	0.67	0.44	0.8	41.0	5.0	8.8	20.0	42.7	37.3	Clay Loam
	28-60	16734	7.7	0.39	39.4	1.97	2.39	0.87	0.59	0.8	31.3	70.0	6.4	24.5	45.5	30.0	Clay Loam
	60-82	16735	8.1	0.34	37.1	0.99	2.74	1.05	0.77	0.4	26.6	30.0	8.5	21.8	53.7	24.5	Silt Loam

TOPSOIL ANALYSIS
PROJECT: ERT

INTER-MOUNTAIN LABORATORIES, INC.
1633 TERRA AVENUE
SHERIDAN, WYOMING

DATE: NOVEMBER 29, 1982
FORM: WYOMING DEQ
SHEET: 3 OF 4

Mapping Unit Symbol	Depth In.	Lab No.	pH	Conductivity mmhos/cm	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	% Organic Matter	% Carbonates	% Coarse Fragments	% Very Fine Sand	Sand %	Silt %	Clay %	Texture
75 (Jerry variant)	0-9	16736	6.7	0.63	62.4	3.85	1.78	0.46	0.27	4.1	2.9	20.0	13.2	26.4	55.4	18.2	Silt Loam
	9-14	16737	6.6	0.53	51.5	3.14	1.22	0.55	0.37	3.2	1.7	25.0	15.3	26.4	57.2	16.4	Silt Loam
	14-23	16738	6.6	0.64	54.3	3.85	1.50	0.51	0.31	1.2	1.7	14.0	10.8	19.1	50.9	30.0	Silty Clay Loam
	23-30	16739	7.4	0.43	55.0	3.24	1.33	0.51	0.34	1.1	31.1	5.3	8.2	12.7	48.2	39.1	Silty Clay Loam
	30-39	16740	7.4	0.39	49.8	2.57	1.14	0.54	0.40	0.7	31.4	13.5	5.5	11.8	49.1	39.1	Silty Clay Loam
	39-52	16741	7.3	0.39	44.2	2.53	1.30	0.55	0.40	0.5	30.2	12.8	8.6	16.4	49.1	34.5	Silty Clay Loam
	52-64	16742	7.6	0.34	48.5	2.13	1.14	0.71	0.56	0.2	26.8	35.0	10.4	20.9	47.3	31.8	Clay Loam
93E (Leighean)	0-11	16743	5.4	0.20	46.5	1.01	0.48	0.55	0.64	2.0	0.7	60.0	12.5	45.5	47.2	7.3	Loam
	11-23	16744	5.4	0.24	30.4	1.25	0.52	0.79	0.84	1.0	1.1	60.0	10.9	52.7	40.9	6.4	Sandy Loam
	23-45	16745	5.4	0.19	23.3	0.92	0.38	0.57	0.71	-0.1	2.2	45.0	9.0	62.7	29.1	8.2	Sandy Loam
	45-72	16746	5.6	0.18	23.6	0.83	0.34	0.80	1.05	-0.1	0.1	60.0	10.5	67.3	25.4	7.3	Sandy Loam
93E (Granile)	0-12	16747	5.0	0.22	29.1	1.10	0.53	0.71	0.79	0.7	0.2	40.0	8.9	55.5	37.2	7.3	Sandy Loam
	12-22	16748	6.2	0.42	26.7	2.21	1.39	0.65	0.48	0.1	0.4	35.0	10.5	49.1	40.0	10.9	Loam
	22-30	16749	6.9	0.40	31.9	2.46	1.55	0.73	0.52	0.6	2.7	45.0	9.5	44.5	41.0	14.5	Loam
	30-43	16750	7.3	0.39	26.6	2.23	1.49	0.61	0.45	0.3	16.7	60.0	4.3	64.5	30.0	5.5	Sandy Loam
	43-60	16751	7.3	0.47	29.7	3.27	1.84	0.66	0.41	1.3	10.1	40.0	6.9	66.4	29.1	4.5	Sandy Loam

TOPSOIL ANALYSIS
PROJECT: ERT

INTER-MOUNTAIN LABORATORIES, INC.
1633 TERRA AVENUE
SHERIDAN, WYOMING

DATE: NOVEMBER 29, 1982
FORM: WYOMING DEQ
SHEET: 4 OF 4

Mapping Unit Symbol	Depth In.	Lab No.	pH	Conductivity mmhos/cm	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	% Organic Matter	% Carbonates	% Coarse Fragments	% Very Fine Sand	Sand %	Silt %	Clay %	Texture
95 (Bead)	0-3	16752	5.4	0.45	67.5	1.91	1.13	0.49	0.40	8.1	1.1	40.0	18.9	36.4	52.7	10.9	Silt Loam
	3-16	16753	5.2	0.22	36.7	0.93	0.53	0.54	0.63	1.5	0.5	45.0	6.2	21.8	61.8	16.4	Silt Loam
	16-22	16754	5.3	0.16	34.4	0.96	0.55	0.58	0.67	0.8	0.7	30.0	4.5	19.1	57.3	23.6	Silt Loam
	22-40	16755	6.9	0.30	50.8	1.67	1.42	0.60	0.48	0.5	3.5	15.0	2.0	10.0	50.9	39.1	Silty Clay Loam
	40-56	16756	7.5	0.33	47.8	1.78	1.08	0.62	0.52	0.4	14.8	10.0	1.3	12.7	51.8	35.5	Silty Clay Loam
	56-72	16757	7.5	0.31	42.6	1.66	0.93	0.64	0.56	0.3	15.1	10.0	2.3	20.0	53.3	26.7	Silt Loam

APPENDIX E

LIST OF ABBREVIATIONS
USED TO DESCRIBE
RILEY RIDGE PROJECT COMPONENTS

RILEY RIDGE PROJECT FACILITIES

WELL FIELD UNITS (same for proposed action and alternatives)

DMU	Proposed Darby Mt. Unit (AQ)
NRRU	Proposed North Riley Ridge Unit (AQ)
RRU	Riley Ridge Unit (AQ)
SA	Sawmill Area (W)
LRU	Lake Ridge Unit (Ex)
FCU	Fogarty Creek Unit (Ex)
GU	Graphite Unit (Ex)
DPU	Dry Piney Unit (inc. Dry Piney Annex) (Ex)
TTU	Tip Top Unit (M)
HU	Hogsback Unit (M)

PROPOSED ACTION

Non-Linear Facilities

EDB-AQ	East Dry Basin Plant Site (AQ)
WDB	West Dry Basin Plant Site (Ex)
BM	Big Mesa Plant Site (Ex)
CC	Craven Creek Plant Site (NWP)
SL	Sulfur Loadout (Ex)

Linear Facilities

RR-CC	-	Railroad spur to Craven Creek Site (NWP)
TL-1, TL-2, TL-EDB	-	Transmission line from NPP to East Dry Basin (AQ + Ex)
TL-WDB	-	Transmission line branch to West Dry Basin (Ex)
TL-BM	-	Transmission line branch to Big Mesa (Ex)
TL-SL	-	Transmission line branch to sulfur loadout (AQ + Ex)
TL-N-CC	-	Transmission line from NPP to Craven Creek Site (NWP)
SG-EDB-Q	-	Sour gas trunkline to East Dry Basin (AQ)
SG-EDB-W	-	Sour gas trunkline to East Dry Basin (W)
SG-WDB	-	Sour gas trunkline to West Dry Basin (Ex) - within well field
SG-BM	-	Sour gas trunkline to Big Mesa (Ex)
SG-CC	-	Sour gas trunkline to Craven Creek (NWP)
S-CC	-	Sales gas pipeline from Craven Creek site (NWP)
CS-EDB,CS-1, CS-2, CS-3	-	Combined CO_2 and sales gas corridor from East Dry Basin (AQ) to Trailblazer
CS-WDB	-	CO_2 and sales gas branch from West Dry Basin (Ex)
CS-BM	-	CO_2 and sales gas branch from Big Mesa (Ex)

C-CC	-	CO_2 pipeline from Craven Creek Site to MAPCO (NWP)
SP-1, SP-WDB	-	Sulfur pipeline from West Dry Basin to loadout (Ex)
SP-EDB-WDB	-	Sulfur pipeline from East Dry Basin to West Dry Basin (AQ)
SP-BM	-	Sulfur pipeline branch to Big Mesa (Ex)
W-CC	-	Water pipeline from Green River to Craven Creek (NWP)
A-CC	-	Access road to Craven Creek (NWP)
A-BM	-	Access road to Big Mesa (Ex)

Component Options

RR-WDB	-	Railroad from West Dry Basin to Stauffer Chemical spur (Ex)
	-	Construction camp sites
C-WDB		West Dry Basin (Ex)
C-EDB		East Dry Basin (AQ)
C-BM		Big Mesa (Ex)

BUCKHORN ALTERNATIVE

Non-Linear Facilities

BH	Buckhorn (AQ)
WDB	West Dry Basin (Ex)
EDB-Ex	East Dry Basin (Ex)
CC	Craven Creek (NWP)
SL	Sulfur Loadout

Linear Facilities

RR-CC	-	Railroad spur to Craven Creek Site (NWP)
TL-1, TL-BH	-	Transmission line from NPP to Buckhorn (AQ + Ex)
TL-2, TL-WDB	-	Transmission line branch to West Dry Basin (Ex)
TL-EDB	-	Transmission line branch to East Dry Basin (Ex)
TL-SL	-	Transmission line branch to sulfur loadout (AQ + Ex)
TL-N-CC	-	Transmission line from NPP to Craven Creek Site (NWP)
SG-BH-Q	-	Sour gas trunkline to Buckhorn (AQ)
SG-BH-W	-	Sour gas trunkline to Buckhorn (W)
SG-WDB	-	Sour gas trunkline to West Dry Basin (Ex) - within well field
SG-EDB-E	-	Sour gas trunkline to East Dry Basin (Ex)
SG-CC	-	Sour gas trunkline to Craven Creek (NWP)
S-CC	-	Sales gas pipeline from Craven Creek site (NWP)
CS-WDB, CS-1, CS-2, CS-3	-	Combined CO_2 and sales gas corridor from West Dry Basin (Ex) to Trailblazer
CS-BH	-	CO_2 and sales gas branch from Buckhorn (AQ)
CS-EDB	-	CO_2 and sales gas branch from East Dry Basin (Ex)
C-CC	-	CO_2 pipeline from Craven Creek Site to MAPCO (NWP)
SP-1, SP-2 SP-EDB	-	Sulfur pipeline from East Dry Basin (Ex) to loadout
SP-BH	-	Sulfur pipeline from Buckhorn (AQ)
W-CC	-	Water pipeline from Green River to Craven Creek (NWP)
A-CC	-	Access road to Craven Creek (NWP)

Component Options

	-	Construction camp sites
C-WDB		West Dry Basin (Ex)
C-BH		Buckhorn (AQ)

SHUTE CREEK ALTERNATIVE

Non-Linear Facilities

BH		Buckhorn (AQ)
CC		Craven Creek (NWP)
SC		Shute Creek (Ex)
SL		Sulfur Loadout Facility

Linear Facilities

RR-CC	-	Railroad spur to Craven Creek Site (NWP)
TL-1, TL-BH	-	Transmission line from NPP to Buckhorn (AQ + Ex)
TL-SC	-	Transmission line branch to Shute Creek (Ex)
TL-SL	-	Transmission line branch to sulfur loadout (AQ + Ex)
TL-N-CC	-	Transmission line from NPP to Craven Creek (NWP)
SG-BH	-	Sour gas trunkline to Buckhorn (AQ)
SG-BHW	-	Sour gas trunkline to Buckhorn (W)
SG-SC	-	Sour gas trunkline to Shute Creek (Ex)
SG-CC	-	Sour gas trunkline to Craven Creek (NWP)
S-CC	-	Sales gas pipeline from Craven Creek site (NWP)
CS-BH, CS-2, CS-3	-	Combined CO_2 and sales gas corridor from Buckhorn (AQ) to Trailblazer
CS-SC	-	CO_2 and sales gas branch from Shute Creek (Ex)
C-CC	-	CO_2 pipeline from Craven Creek Site to MAPCO (NWP)
SP-1, SP-2, SP-BH	-	Sulfur pipeline from Buckhorn to loadout (AQ)
SP-SC	-	Sulfur pipeline branch to Shute Creek (Ex)
W-CC	-	Water pipeline from Green River to Craven Creek (NWP)
A-CC	-	Access road to Craven Creek (NWP)
	-	Access roads (3) to Shute Creek (Ex)
A-SC-W		
A-SC-S		
A-SC-N		

Component options

RR-SC	-	Railroad spur from Craven Creek to Shute Creek (Ex)
	-	Construction camp sites
C-BH		Buckhorn (AQ)
C-SC		Shute Creek (Ex)

NORTHERN ALTERNATIVE

Non-Linear Facilities

WDB	-	West Dry Basin (Ex)
BH	-	Buckhorn (AQ)
BM	-	Big Mesa (Ex)
EDB-N	-	East Dry Basin (NWP)
SL	-	Sulfur Loadout

Linear Facility

TL-1, TL-2, TL-WDB	-	Transmission line from NPP to West Dry Basin (Ex)
TL-BH	-	Transmission line branch to Buckhorn (AQ)
TL-BM	-	Transmission line branch to Big Mesa (Ex)
TL-EDB	-	Transmission line branch to East Dry Basin (NWP)
TL-SL	-	Transmission line branch to sulfur loadout (AQ, Ex, NWP)
SG-WDB	-	Sour gas trunkline to West Dry Basin (Ex)
SG-BH-Q	-	Sour gas trunkline to Buckhorn (AQ)
SG-BH-W	-	Sour gas trunkline to Buckhorn (W)
SG-BM	-	Sour gas trunkline to Big Mesa (Ex)
SG-EDB-N	-	Sour gas trunkline to East Dry Basin (NWP)
CS-WDB, CS-1, CS-2, CS-3	-	Sales gas and CO_2 pipeline from West Dry Basin to Trailblazer (Ex + AQ
CS-BH	-	Sales gas and CO_2 pipeline branch from Buckhorn (AQ)
CS-BM	-	Sales gas and CO_2 pipeline branch from Big Mesa (Ex)
CS-EDB	-	CO_2 (only) branch from East Dry Basin (NWP)
S-EDB	-	Sales gas pipeline from East Dry Basin (NWP)
SP-1, SP-WDB	-	Sulfur pipeline from West Dry Basin to loadout (Ex + AQ)
SP-BH	-	Sulfur pipeline branch from Buckhorn (AQ)
SP-BM	-	Sulfur pipeline branch from Big Mesa (Ex)
SP-EDB-WDB	-	Sulfur pipeline branch from East Dry Basin (NWP)

Component options

	-	Construction camp sites
C-BM		Big Mesa (Ex)
C-WDB		West Dry Basin (Ex)
C-BH		Buckhorn (AQ)

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R 115 W | R 114 W | R 113 W | R 112 W | R 111 W | R 110 W

T 30 N | T 29 N | T 28 N | T 27 N

Well Field Boundary

WDB 13A

EDB 21A

BM 24A

Marbleton

BRIDGER NATIONAL FOREST

LINCOLN COUNTY

SUBLETTE COUNTY

SUBLETTE LINCOLN COUNTY

SUBLETTE SWEETWATER

LEGEND AND GUIDE TO GEOMORPHIC, SOIL, AND VEGETATION TYPES:
CORRIDORS AS SURVEYED BY ERT

Geomorphic Unit	Corresponding[1] Soil Association	Corresponding Vegetation Types (In general order of dominance)
11 - Well and Moderately Well Drained Streamlain Alluvium	A (102) - Typic Torrifluvents, loamy - Typic Natrargids, loamy and fine. Level and nearly level.	Greasewood Saltbush
	B (104) - Typic Torrifluvents, loamy - Typic Natrargids loamy and fine - Typic Torripsamments. Gently sloping to rolling.	Saltbush Greasewood Mixed Desert Shrub
	C (105) - Typic Torrifluvents, loamy over sandy-skeletal -Typic Natrargids, loamy and clayey over sandy-skeletal. Nearly level to gently sloping.	Saltbush Greasewood
12 - Poorly and Somewhat Poorly Drained Streamlain Alluvium	A (101) - Typic Fluvaquents, loamy over sandy-skeletal - Typic Torrifluvents, loamy over sandy-skeletal. Level and nearly level.	Pasture/Hayfield Riparian Big sagebrush
13 - Alluvial Fans	A (103) - Typic Calciorthids, loamy, -Typic Torriorthents, loamy, nearly level to gently sloping	Big sagebrush
	B (107) - Typic Torrifluvents, loamy -Typic Natrargids, loamy and fine. Gently sloping to rolling.	Greasewood
	C (109) - Ustic Torriorthents, loamy -Ustertic Torriorthents, fine. Gently sloping to rolling.	Big sagebrush Sagebrush complex Bunchgrass
20 - Mesa Caps and Plateaus and 21 - Pediments, gently rolling	A (203) - Typic Camborthids, loamy -Typic Calciorthids, loamy. Gently sloping to rolling.	Big sagebrush Bunchgrass
22 - Pediments and Terraces, moderately dissected, and 23 - Dendritic Basins, strongly dissected	A (206) - Typic Torriorthents, loamy -Typic Calciorthids, loamy. Gently sloping to rolling.	Big sagebrush
	B (204) - Typic Torriorthents, loamy -Typic Calciorthids, loamy, Rolling to steep.	Big sagebrush . Bunchgrass
	C (207) - Badland -Typic Torriorthents, loamy, shallow. Gently sloping to steep.	Saltbush
24 - Mesa Side-slopes, strongly dissected	A (224) - Typic Torriorthents, loamy, shallow -Lithic Torriorthents, loamy - Shale Escarpments. Steep and very steep.	Big sagebrush
3 - Folded and Faulted Lands	A (309) - Lithic Ustic Torriorthents, loamy-skeletal -Ustic Torriorthents, clayey	Big sagebrush Bunchgrass


T 26 N
T 25 N
T 24 N
T 23 N
T. 25½ N.
Corridor Boundary
NORTH SIXTH
PARALLEL
FOURTEENTH
WEST
MERIDIAN
LINCOLN
SWEETWATER
COUNTY
RIVER
FOREST
Fontenelle Basin
Commissary Ridge
Pine Ridge
Slate Creek Ridge
Pomeroy Basin
TOP OF THE WORLD MINE
SUBLETTE CUTOFF
OREGON TRAIL
Fontenelle
11A
11B
11C
12A
13B
13C
20A
21A
21B
22A
23A
23B
24A
3B
SC

shallow. Gently sloping to rolling.

B (310) - Lithic Ustic Torriorthents, loamy-skeletal -Ustic Torriorthents, clayey, shallow. Rolling to steep. — Big sagebrush, Bunchgrass, Mountain shrub

[1]Numbers in parentheses correspond to corridor mapping unit descriptions and rehabilitation units in the Technical Report. Symbols on this map are derived from the geomorphic unit accompanied by a corresponding soil symbol, e.g. 11B on the map corresponds to corridor soil unit 104 in the Technical Report narrative.

T 24 N

T 23 N

T 22 N

T 21 N

T 20 N

T 19 N

T 18 N

FOURTEENTH AUXIL

SIXTH PRINCIPAL MERIDIAN

CC

SL

Frontier

Kemmerer

Diamondville

NORTH FIFTH

Elkol

Opal

STANDARD

Nutria

Granger

Verne

Cumberland Gap

LINCOLN COUNTY

UINTA COUNTY

MOXA OIL FIELD

3B 24A 20A 12A 3A 23B 22B 22A 11A 11B 11C 13B 23A 24A 20A 21A 23B 13A 24A 11A 23B 12A 24A 20A 22A 22B 22A 11B 24A 23A 12A 24A 23A 12A 24A 12A 3B 23B 3B 24A 3B 12A 3B 23C 3B 12A 24A 12A 20A 12A 3B 23B 3B 13C 23B 3B 13B 23B 13B 20A 23B 12A 24A 20A 12A 23B 22A 12A 23B 21A

T 22 N

T 21 N

T 20 N

T 19 N

T 18 N

T 17 N

R 116 W

R 115 W

R 114 W

R 113 W

R 112 W

R 111

Map 1-5
Soil and Vegetation Map For Linear Facilities and Plant Sites, Riley Ridge Project

R 115 W

T 30 N

T 29 N

R 114 W

R 113 W

R 112 W

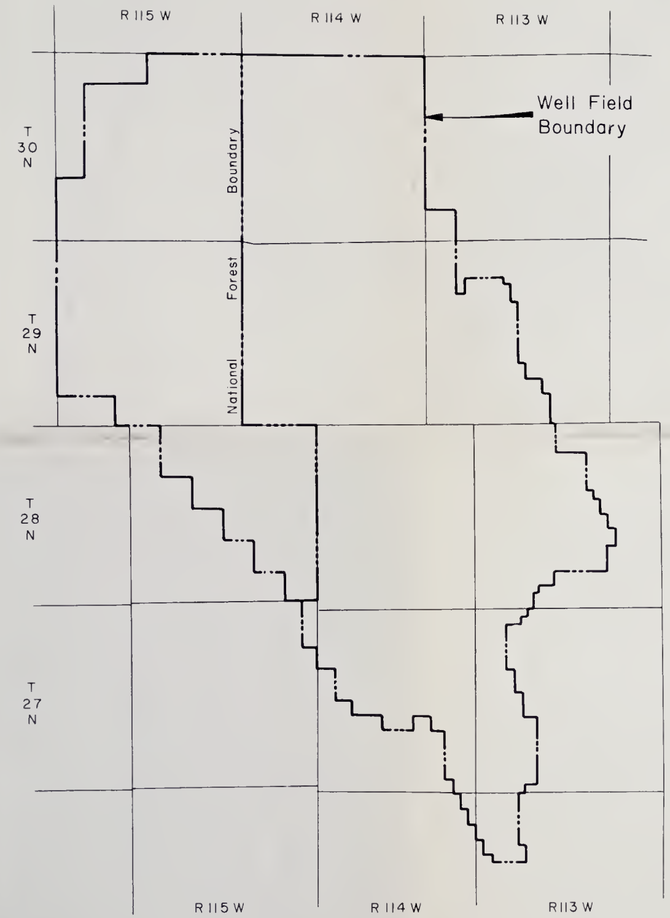
T 30 N

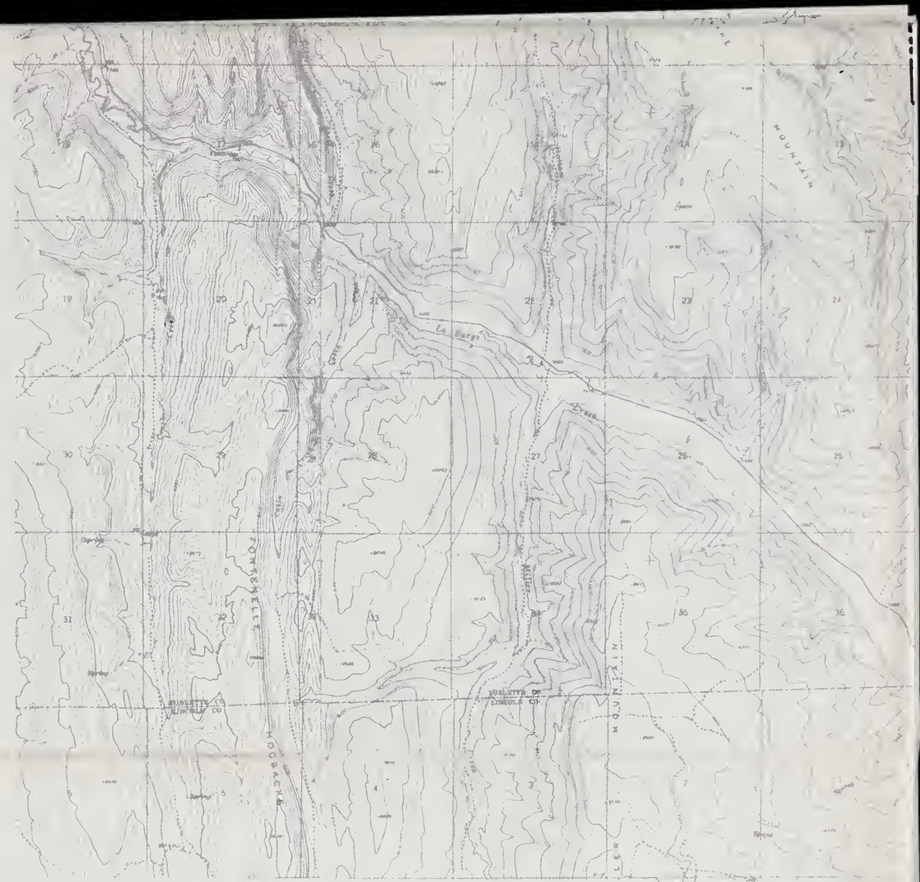
T 29 N

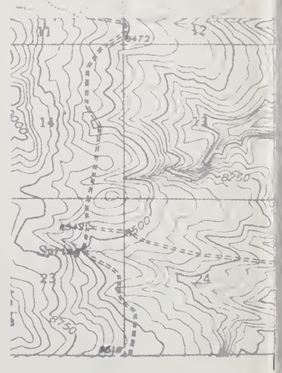
T
28
N

R 116 W

T 28 N







LEGEND

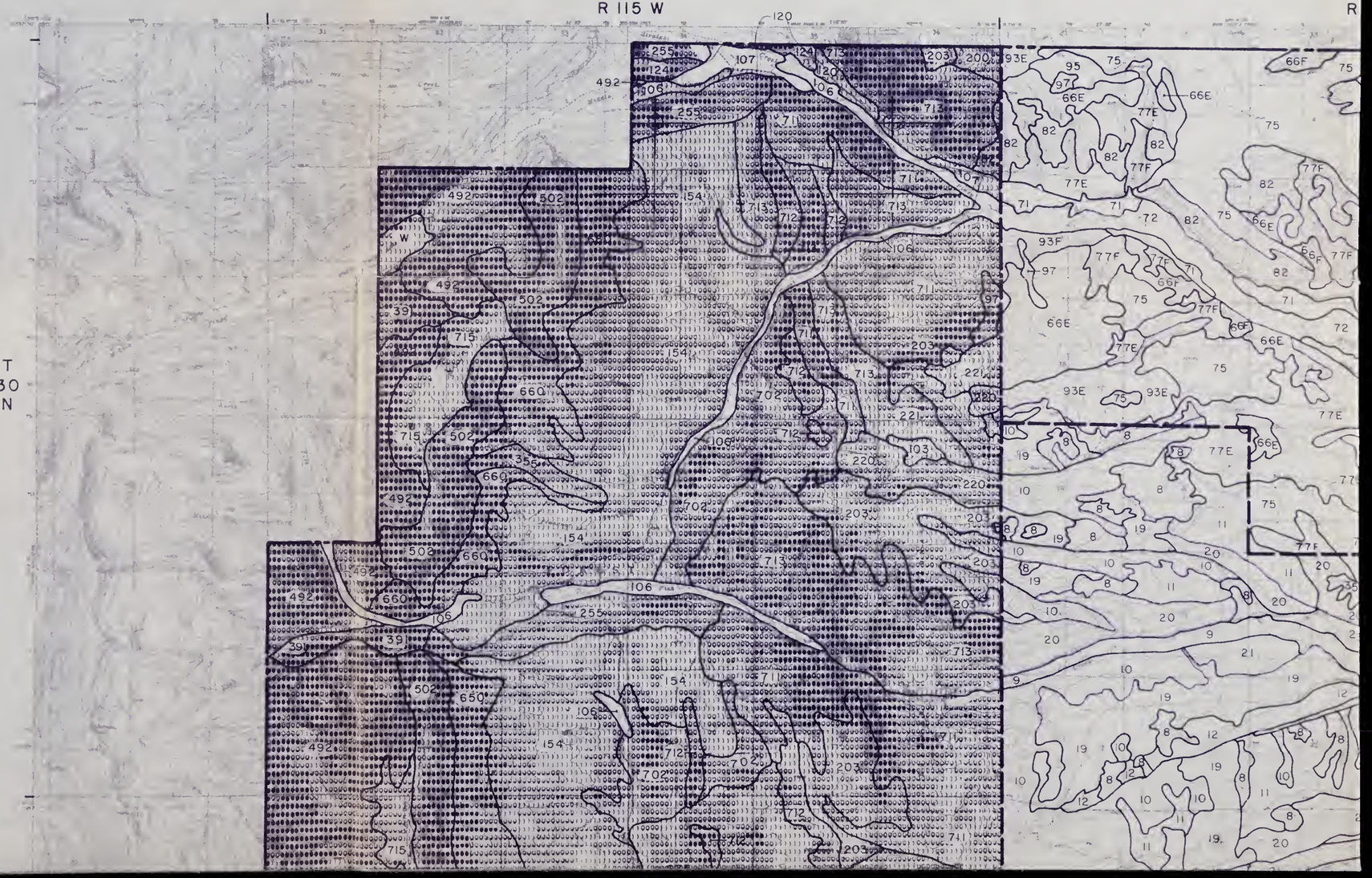
BS	Big Sagebrush	MP	Mixed Pine
SC	Sagebrush Complex	SF	Spruce-Fir
MS	Mountain Shrub	D	Douglas-fir
Gr	Greasewood	A	Aspen
P/H	Pasture / Hayfield	C	Clearcut
W	Willow	B	Barren
M	Meadow	L	Lake
G	Bunchgrass		

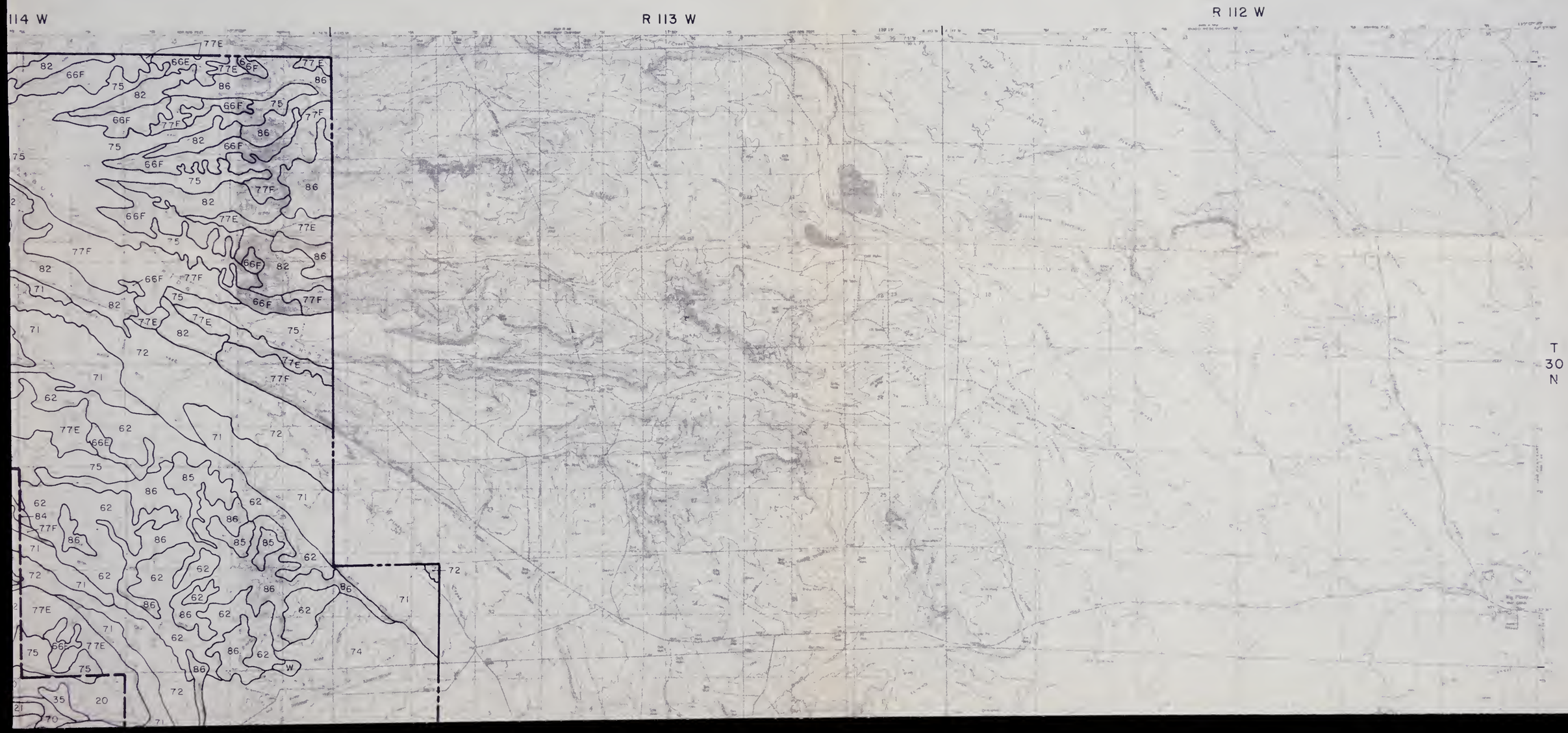
T
27
N

R 114 W

R 113 W

Map 1-4
Riley Ridge Well Field Vegetation Map


R 115 W
R
T
30
N


114 W
R 113 W
R 112 W
T
30
N

T
29
N

T
28
N

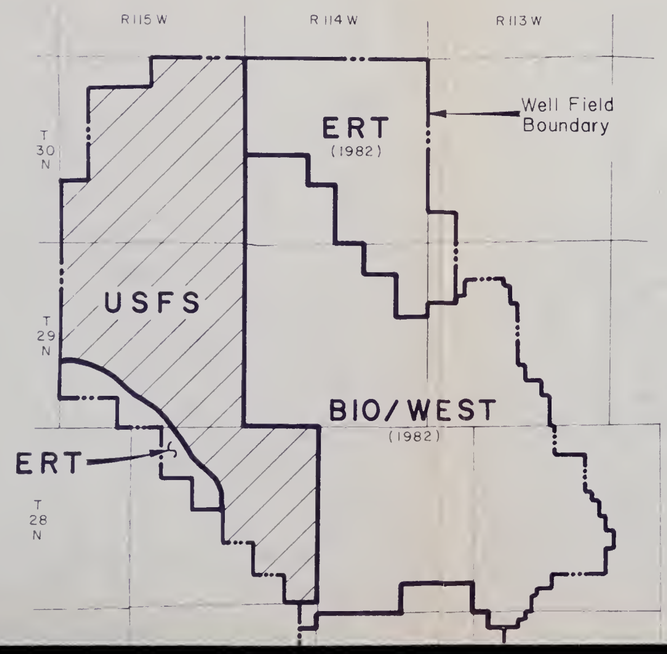
T
29
N

T
28
N

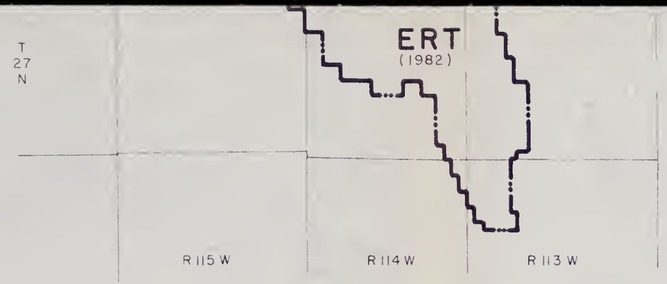
FOREST SERVICE SLOPE SYMBOLS

Forest Service soil resource inventory delineations have been supplemented by USGS VIEWIT slope information. Symbols and slope ranges are as follows:

Slope Range (%)	Symbol
0 to 5 (alluvial bottomlands)	
5 to 15	
15 to 30	
30 to 50+	

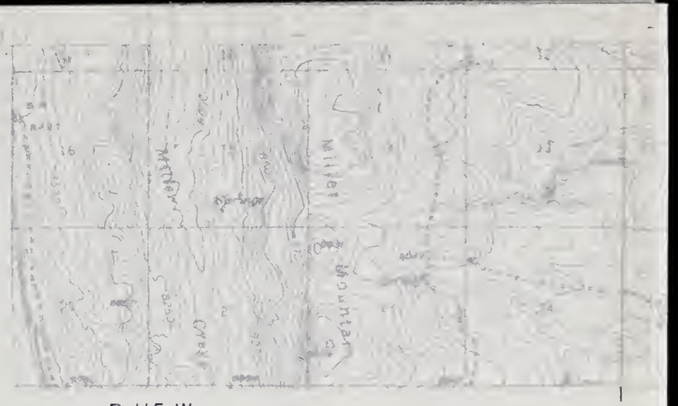


T
27
N



Soil Survey Areas Within The Well Field

For purposes of differentiating the three surveys within the well field, Bio/West mapping symbols are numbered 1-47, ERT symbols are numbered 50-99, and FS symbols are numbered greater than 100. Differing symbols may occur within a soil delineation where the mapping unit crosses a match line between surveys. The location and extent of the three survey areas are shown on the inset.



R 115 W

R 114 W

R 113 W

Map 1-3
Riley Ridge Well Field Soil Survey Map

Guides to map symbols and mapping unit descriptions are presented in the Soils, Vegetation and Reclamation Technical Report.