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3.3 Soils

NUREG-1748 suggests a single section in the Environmental Report to include information on both soils and geology. However, for ISR operations, the data requirements and environmental concerns for soils and geology differ significantly. In particular, specific soil data are needed to support the proposed topsoil protection practices, surface reclamation, and vegetation reestablishment, while geology data is needed to understand the distribution of the ore reserve. Therefore, the topics of soil and geology are separated in this Environmental Report.

3.3.1 Soil Characteristics

The soils within the Permit Area are typical of the semiarid areas of the western US. Most of the soil has developed from the sedimentary bedrock of the Permit Area. The precipitation of the region is not enough to leach the majority of calcium and divalent cations from the soil profile. As a result, the soil pH tends to be slightly alkaline. Vegetation is also limited by the amount of precipitation in this region. The soils in the Permit Area tend to have low organic matter.

3.3.1.1 Soil Mapping Unit (SMU) Interpretation

The vertical relief of the Permit Area is approximately 260 feet with an average gradient of 1.5 percent. Due to the relative lack of relief and uniform surficial geology, there are only three exposed soil types within the Permit Area. The three units are very similar in color, depth of horizons, and geomorphic surface. The primary difference between the three soils is the texture; and, therefore, the soil texture is the only difference in the three SMU names.

All soil units within the Permit Area support similar vegetation types. The Lowland Big Sagebrush Shrubland is present in and immediately surrounding the ephemeral channels; and the Highland Big Sagebrush Shrubland is present over the remainder of the Permit Area. The uniformity in vegetation across the Permit Area indicates that the three soil units are roughly equally productive, and that plant growth is limited by precipitation and not by soil fertility.

Plate 3.3-1 shows the distribution of the three soil units identified in the Permit Area and their characteristics are described below.

Thirty-four percent of the Permit Area (1,435 acres) is Typic Torriorthent, loamy, mixed, mesic. The soil is brown to yellowish-brown, and is typically five to 15 inches thick. It

generally occurs on the lower foot-slopes, where slopes are less than ten percent but can be as steep as 30 percent. The dominant vegetation is low-growing sagebrush with intermittent patches of grasses. The geomorphic surface ranges from bare loamy soil to pebbles and gravel-sized particles. A typical profile of this soil is brown to yellowish-brown sandy loam; and the subsoil is a brown to pale brown sandy loam that extends to depths greater than 30 inches.

Forty-six percent of the Permit Area (1,941 acres) is Typic Torriorthent, fine loamy, mixed, mesic. This soil is abundant in the down-slope areas of the Permit Area, where slopes are very gradual. The dominant vegetation is sagebrush, with scattered grasses and cactuses. The geomorphic surface consists of bare, fine sandy loam. The upper profile contains a dark grayish-brown silt loam to loam that is about nine inches thick. The subsoil is dark yellowish-brown to light yellowish-brown, and extends to a depth of at least 27 inches.

Twenty percent of the Permit Area (844 acres) is Typic Torriorthent, fine loamy over sandy, mixed, mesic. Slopes are less than five percent; and the dominant vegetation is low-growth sagebrush and scattered grasses. The geomorphic surface is bare loamy soil with approximately 25 percent gravel. The surface layer consists of a brown loam that is ten to 15 inches thick. The subsoil is a brown to a light yellowish-brown sandy loam that extends to a depth greater than 20 inches.

3.3.1.2 Topsoil Suitability

Based on WDEQ-LQD Guideline No. 1, Topsoil Suitability, Table I-2 (1994), all of the Lost Creek samples were within the range for suitable plant growth media for pH, conductivity, sodium adsorption ratio (SAR), texture, selenium, and boron.

Of the 28 Permit Area samples, 11 were classified as marginally suitable for topsoil because of low saturation percentages. The measured saturation percentages of these marginally suitable soils ranged from 16 to 24 percent. These 11 samples were from seven different profiles, and represented all SMUs present in the Permit Area.

One sample from the Permit Area was considered unsuitable for topsoil; because the percentage of coarse fragment was 39 percent compared to a 35-percent threshold for unsuitable soil. This sample represented the B horizon of a soil profile in SMU #3. Therefore, only the top 11 inches of this SMU should be used as reclamation topsoil. One sample is considered marginally suitable due to an over 8.5 pH value. During reclamation, the use of marginal soils as topsoil will be avoided where possible, except in areas where the undisturbed topsoil is marginally suitable.

3.3.2 Geotechnical Investigations

A preliminary geotechnical evaluation of the Permit Area was completed in September 2007. The evaluation found that the subsurface conditions consist of unconsolidated sand with clay lenses from ground surface to depths of up to 20 feet below ground surface (ft bgs), transitioning to weathered to competent sandstone bedrock of the Battle Spring Formation through at least 600 ft bgs. It is unlikely that expansive, soft, or otherwise unsuitable soils will be encountered within the depth of anticipated shallow foundation excavations.

A full geotechnical engineering report will be performed prior to construction. This report will include engineering analyses on the representative site soils to determine the bearing capacity and potential settlement. The report will be used to determine the foundation type, depth, and allowable bearing capacity as well as provide guidance on preparation, earthwork, and cement type.

3.3.3 Historical Surface Disturbances

There was surface disturbance prior to LC ISR, LLC operations within the Permit Area. Most of this disturbance was due to historical exploration activities for oil and gas, as well as for uranium, and to support livestock and wildlife grazing. The primary activities included vehicle traffic, drilling activities, and stock tank usage. Approximately 26 miles of existing roads were delineated from the 2002 aerial photo of the Permit Area (**Figure 3.3-1**). Field measurements in 2007 indicate that the roads range from 6.9 to 9.4 feet wide. A few of these roads may still be used by grazing lessees, hunters, and for on-going exploration activities. Evidence of abandoned drill sites and stock tanks is more difficult to delineate; but numerous small areas are evident on the aerial photograph.

The roads caused compaction to the soil, which limits infiltration rates and decreases the vegetation regrowth (**Figure 3.3-2**). Active road surfaces have little to no organic matter, and most of the topsoil has been eroded from the road surface.