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TRW Environmental  
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# Environmental Baseline File for Soils

## Civilian Radioactive Waste Management System

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### Management & Operating Contractor

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U.S. Geological Survey

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WBS 1.2.1.5  
QA: N/A

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Management & Operating Contractor**

**Environmental Baseline File for Soils**

**B00000000-01717-5700-00007 REV 00**

**March 1999**

Prepared for:

U.S. Department of Energy  
Yucca Mountain Site Characterization Office  
P.O. Box 30307  
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Under Contract Number  
DE-AC08-91RW00134

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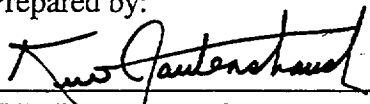
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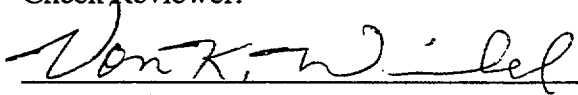
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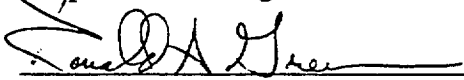
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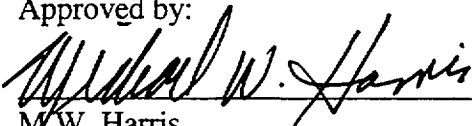
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## CONTENTS

	Page
1. INTRODUCTION.....	1
2. INFORMATION ON SOILS .....	1
2.1 YUCCA MOUNTAIN .....	2
2.1.1 Soil Characteristics .....	2
2.1.2 Soil Contaminants.....	6
2.1.3 Reclamation Program .....	6
2.1.4 Soil Disturbances at Yucca Mountain .....	7
2.2 REGION SURROUNDING YUCCA MOUNTAIN .....	8
2.3 TRANSPORTATION CORRIDORS AND FACILITIES.....	8
3. DESCRIPTION OF SOILS AT YUCCA MOUNTAIN.....	9
4. REFERENCES.....	9
4.1 DOCUMENTS CITED .....	9
4.2 STANDARDS & REGULATIONS CITED .....	11
4.3 PROCEDURES.....	11
 APPENDIX A - DESCRIPTIONS OF SOIL SERIES MAPPED AT YUCCA MOUNTAIN, NEVADA (RESOURCE CONCEPTS, INC. 1989; NRCS 1998).....	A-1
 APPENDIX B - SOIL MAPPING UNIT INTERPRETATIONS AND LIMITATIONS .....	B-1

## TABLES

	Page
1 Soil Mapping Units, Percent (%) of the 18-Km <sup>2</sup> Survey Area, Geographic Settings, and General Characteristics of Soil Associations or Map Units at Yucca Mountain .....	3

## ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
CRWMS M&O	Civilian Radioactive Waste Management System Management and Operating Contractor
DOE	U.S. Department of Energy
EBF	Environmental Baseline File
EIS	Environmental Impact Statement
ESF	Exploratory Studies Facility
NRCS	Natural Resources Conservation Service
NTS	Nevada Test Site
RIP	Reclamation Implementation Plan
RPP	Reclamation Program Plan

## 1. INTRODUCTION

This Environmental Baseline File (EBF) contains information on soil resources that may be useful to the U.S. Department of Energy (DOE) during the development of the Environmental Impact Statement (EIS) for the construction, operation, and eventual closure of a geologic repository (hereafter called the proposed action) at Yucca Mountain, Nye County, Nevada (60 FR 40164-40170, 1995). It summarizes the best available information describing soils in the areas to be affected and evaluates the impacts of the proposed action on soil resources. It also summarizes reports containing information that may be useful during development of the EIS for evaluating the suitability of soils for construction and other activities.

Regions of influence considered in this EBF are Yucca Mountain and the transportation corridors and intermodal transfer facilities where land clearing and grading may occur. Soil resources in these regions may be affected (e.g., erosion, compaction) by construction of the repository, rail and heavy haul routes, and intermodal transfer facilities. Information on soil properties in these regions may be needed during development of the EIS to evaluate design criteria for those facilities.

Section 2 of this report is a review of information on soils in and near the regions of influence. Section 3 is a summary description of soils at Yucca Mountain. Appendix A is a description of the soil series that may occur at Yucca Mountain. Appendix B lists limitations related to construction and engineering projects and physical and chemical properties of these soils series.

The information summarized in this EBF should be sufficient for conducting the analysis of impacts on soil resources needed for the EIS. In addition, there are no opposing views concerning soil resources at Yucca Mountain; thus, sections on data needs and opposing views, which have been included in many other EBFs prepared for this project, are not included in this EBF for soil resources.

## 2. INFORMATION ON SOILS

Subsection 2.1 summarizes information on the characteristics of soils at Yucca Mountain, soil contaminants at that site, the reclamation program conducted for site characterization, and disturbances that have occurred at Yucca Mountain. Information on the soils in the region surrounding Yucca Mountain that may be useful for development of the EIS is described in Subsection 2.2, and information on soils within transportation corridors and facilities is summarized in Subsection 2.3.

Regulatory requirements related to the use, management, and conservation of soil have been summarized by DOE (1996a, Section 2.0) and are not discussed in this report.



## 2.1 YUCCA MOUNTAIN

### 2.1.1 Soil Characteristics

Information on soils at Yucca Mountain is available from several soils, geological, engineering, and environmental studies conducted during site characterization.

A third-order soil survey was conducted during 1989 on an 18-km<sup>2</sup> area that included Midway Valley and the ridges west of Midway Valley. This area included most of the sites at Yucca Mountain where soil-disturbing activities for the proposed action are planned. Seventeen soil series were identified and grouped into seven map units, or associations (Table 1). The report summarizing this survey (Resource Concepts, Inc. 1989) describes the soil series and map units and lists some physical and chemical properties of the common series. Appendix A of this EBF includes detailed descriptions of these series. Appendix B describes limitations related to construction and engineering projects and physical and chemical properties of the series. The information in the appendices was obtained from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), Southern Nevada Resource Area Office, Las Vegas, Nevada. The appendices contain information from an unpublished soil survey of southwestern Nye County, south and west of Yucca Mountain. The descriptions, interpretations, and limitations from this survey should be characteristic of the soil series at Yucca Mountain.

A more general, fourth-order soil survey and map has also been prepared for the entire Yucca Mountain area (Guertal and Davies 1997). The only soil orders found in this survey and in the third-order survey (Resource Concepts, Inc. 1989) were aridisols and entisols. Aridisols, the most extensive soil order at Yucca Mountain, are very dry soils with well-developed horizons that develop under conditions of low moisture. Consequently, some of these soils have lime-cemented hardpans. They occur most often on mesa tops, piedmont remnants, and old alluvial fans. Entisols are generally found on steep slopes and areas of more recent alluvium. They are young soils consisting of unconsolidated mineral materials lacking horizon development.

Soil pits were dug at four locations in Midway Valley in 1985 to evaluate the suitability of soils for supporting foundations for proposed surface facilities (Ho et al. 1986). Soils at the four sites were similar. Index and engineering properties (e.g., permeability, compressibility, and shear strength), recommended bearing capacity, and estimated settlement of footings were presented. The soil was described as:

“The alluvial material at the potential surface facility sites varies from about 35 to 150 feet in thickness. Generally, the soil in the top 1.5 to 2 feet contains a high percentage of fine sand and silt, and is quite loose. Below this layer, to a depth of about 8 feet, is a soil horizon (termed the K horizon) that is partly to wholly cemented with well-developed secondary calcite. The remaining alluvium to the top of bedrock is a gravel-sand mixture with little or no cementation.” (Ho et al. 1986, p. 1)

Table 1. Soil Mapping Units, Percent (%) of the 18-Km<sup>2</sup> Survey Area, Geographic Settings, and General Characteristics of Soil Associations or Map Units at Yucca Mountain (Resource Concepts, Inc. 1989, pp. 3-10).

Map Unit	%	Geographic Setting	General Characteristics
Upspring-Zalda	11	Mountain tops and ridges. Slope 2-15 %. Elevation 1,170-1,505 m. Upspring soil on smooth, gently sloping ridge tops and shoulders; Zalda on nearly flat mesa tops. Formed in residuum from rhyolite and tuffs.	Upspring is shallow (10-36 cm) to bedrock and somewhat excessively drained. Zalda is well drained and shallow (18-51 cm) to a thin duripan over bedrock. Low available water capacity, medium to rapid runoff potential, and slight erosion hazard.
Gabbvally-Downeyville-Talus	8	North-facing mountain sideslopes. Slope 30-50 %. Elevation 1,215-1,430 m. Talus occurs randomly throughout unit in long, narrow, vertically oriented stringers of stone-sized rock. Formed in residuum from rhyolite and tuffs.	Gabbvally is shallow (15-36 cm) to bedrock. Downeyville is very shallow (10-36 cm) over bedrock. Permeability class moderate (Gabbvally) to moderately rapid (Downeyville). Moderate to rapid runoff potential, well drained, low available water content, and moderate erosion hazard.
Upspring-Zalda-Longjim	27	Mountain sideslopes. Slope 2-50 %. Elevation 1,080-1,430 m. Upspring soil on south aspect slopes; Zalda on east and west aspects. Longjim on moderately sloping alluvial deposits below sideslopes. Upspring and Zalda formed in residuum from rhyolite and tuffs; Longjim formed in alluvium from mixed volcanic rocks.	Upspring is shallow (10-36 cm) to bedrock and somewhat excessively drained. Zalda is shallow (18-51 cm) to a thin duripan over bedrock and well drained. Longjim is shallow (36-51 cm) and well drained. Permeability class moderately rapid (Upspring) to rapid (Longjim and Zalda). Runoff potential is moderately rapid (Upspring and Zalda) to rapid (Longjim). Very low available water capacity and slight erosion hazard.
Skelon-Aymate	22	Alluvial fan remnants. Slope 0-15 %. Elevation 1,080-1,215 m. Skelon soil on smooth, gently to strongly sloping summits and upper sideslopes; Aymate on nearly level to gently sloping, east aspect, summits.	Skelon is moderately deep (51-102 cm) to an indurated duripan; very low available water capacity. Aymate is moderately deep (51-102 cm) to an indurated petrocalcic horizon; low available water capacity. Permeability class moderately rapid, slow runoff potential, and slight erosion hazard.
Strozi variant-Yermo-Bullfor	7	Alluvial fan remnants. Slope 0-8 %. Elevation 1,090-1,130 m. Strozi variant soil on gently sloping, east aspect, alluvial fan remnants. Yermo on moderately sloping, north aspect, alluvial fan remnants; Bullfor on fan remnants and stream terraces adjacent to large drainages.	Strozi is a variant because it is <51 cm to an indurated duripan. Yermo is deep (102 cm). Bullfor is moderately deep (51-102 cm). Permeability class rapid, very low available water holding capacity, slow runoff potential, well drained, and slight erosion hazard.
Jonnic variant-Strozi-Arizo	12	Dissected alluvial fan remnants. Slope 0-8 %. Elevation 1,080-1,155 m. Jonnic variant soil on fan summits; Strozi on moderately sloping, fan sideslopes; Arizo on moderately sloping lower fan sideslopes and inset fans. Formed in alluvium from mixed volcanic sources.	Jonnic is a variant because it is <63 cm to a duripan. Strozi is moderately deep (36-43 cm) over a strongly cemented duripan, Arizo is deep (>102 cm). Permeability class slow (Jonnic and Strozi) or rapid (Arizo). Runoff potential slow (Strozi and Arizo) or moderate (Jonnic). Very low available water holding capacity. Slight erosion hazard.

Table 1. Soil Mapping Units, Percent (%) of the 18-Km<sup>2</sup> Survey Area, Geographic Settings, and General Characteristics of Soil Associations or Map Units at Yucca Mountain (Resource Concepts, Inc. 1989, pp. 3-10). (Continued)

Map Unit	%	Geographic Setting	General Characteristics
Yermo-Arizo-Pinez	13	Inset fans and low alluvial sideslopes in mountain canyons and broad alluvial drainages between alluvial fan remnants. Slope 2-15%. Elevation 1,070-1,310 m. Yermo on moderately sloping inset fans near drainages. Arizo on moderately to strongly sloping inset fans adjacent to lower alluvial fans remnants. Pinez on strongly sloping lower fan remnants below foothills. Formed in alluvium from mixed volcanic rocks.	Yermo and Arizo are deep (> 102 cm); very low available water holding capacity. Pinez is deep (102-152 cm) over an indurated duripan; low available water holding capacity. Permeability class moderately slow (Pinez), moderately rapid (Yermo), or rapid (Arizo). Runoff potential slow (Yermo and Arizo) to medium (Pinez). Well drained and slight erosion hazard.

Geotechnical investigations were conducted in 1992 at 73 test pits located at, or near, the then-proposed location of the North Portal Facility in Midway Valley (Bureau of Reclamation 1992). Detailed descriptions of physical properties of soils from 46 of the test pits were presented, and recommendations were made for design bearing capacities and slopes. Soils were described as:

“Topsoil typically ranges from 0 to three feet of silty sand (SM), silty sand with gravel (SM), poorly graded gravel with sand, (GP-GM), and silty gravel with sand...The [underlying] soil at the site is primarily colluvium and alluvium generally composed of silty sand (SM) and silty gravels (GM, GP-GM) with fines ranging from 4 to 30 percent. Some clayey sand (SC) and clayey gravel (SC, GC) with fines ranging from 29 to 40 percent are present but in very limited amounts.” (Bureau of Reclamation 1992, p. 13)

Geotechnical investigations were also conducted near the Exploratory Studies Facility (ESF) in 1995 to assess facility design recommendations for the proposed muck conveyor (SNL 1995). Five test pits were dug in native soil; standard-penetration-test boreholes and plate-load tests were conducted on both native soil and fill material at the ESF pad. Information on the texture, compaction, bearing capacity, and the estimated settlement of native soil and fill material was presented, and recommendations for construction of foundations and footings were made. The native soil was described as:

“2 to 6 feet of moist [samples were conducted soon after rain], dark brown to brown, dense, cobbly to silty gravel soil with occasional boulders. The native soil overlies a slightly moist, light brown to whitish, partially to well calcium carbonate cemented conglomerate of cobbles and gravel with boulders, which essentially extended to the maximum trench depth which ranged from 19 to 20 feet deep.” (SNL 1995, pp. 3–4)

Guertal et al. (1994) characterized and measured horizons in the exposed soil of a cliff face in Fortymile Wash and calculated soil water retention parameters for each horizon. Guertal et al. (1994) also conducted a ponding experiment at the site to evaluate water infiltration. An equivalent of 30 years of precipitation (50,000 liters) was allowed to infiltrate into the soil. The maximum infiltration depth was 7.4 m. Petrocalcic horizons appeared to slow the vertical flow of water and caused water to flow horizontally.

Soil samples were collected during 1989–1997 from 94 soil profiles at sites that were to be disturbed due to site characterization activities. The samples were collected to assist in formulating site-specific reclamation requirements (e.g., depth of salvageable soils and management of stockpiled soil) and to determine if soils had properties that would hinder reclamation (e.g., salinity, limited nutrients, etc.). The following parameters were measured for each sample: percent organic matter; percent sand, silt, and clay; water retention at  $-1/10$ ,  $-1/3$ , and  $-15$  bars; pH; electrical conductivity; extractable calcium, magnesium, sodium, and potassium; bicarbonate; bulk density; cation exchange capacity; and plant available nitrogen, phosphorus, iron, manganese, sulfur, and zinc.

Hansen et al. (1997) conducted a wetlands assessment of the Nevada Test Site (NTS). The area closest to Yucca Mountain that contained hydric soils was at Cottonwood Springs, 6 km northeast

of the ESF near the top of the western ridge of Fortymile Canyon. No springs, seeps, or other sites that may have hydric soils are known to occur on Yucca Mountain or to the west in Crater Flat.

### 2.1.2 Soil Contaminants

The Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) Environmental Protection Division tracks contaminated soils (hydrocarbon and other contaminants) at Yucca Mountain, and the Yucca Mountain Site Characterization Project adheres to the *Spill Prevention, Control and Countermeasure Plan for Site Activities* (CRWMS M&O 1998) which outlines the policies and practices for preventing, cleaning, and reporting soil contamination. PRO-EP-002, *Nonhazardous Waste Management*, describes the current policy for identification, excavation, accumulation, sampling, analysis, and transport to an off-site contractor of soils contaminated by hydrocarbons.

CRWMS M&O (1999a) summarizes information on the levels of natural and man-made radionuclides in the soil at Yucca Mountain. These data were obtained from 98 surface soil samples collected within 16 km of the ESF. The naturally-occurring radionuclides uranium-234 and thorium-232 were found at low levels relative to published data from other areas around the world; however, the levels of potassium-40 and the progeny of uranium-234 (radium-226, lead-210, and polonium-210) and thorium-232 (radium-238 and thorium-228), all of which are naturally occurring, were relatively high. High levels of these radionuclides may be present because soil derived from igneous rocks (i.e., soils at Yucca Mountain) have higher concentrations of these radionuclides than soils derived from parent materials such as limestones and sandstones. The man-made radionuclides strontium-90, cesium-137, cesium-134, europium-155, and plutonium-239 were also detected in the soil samples, but generally at much lower levels than samples from the north and northeast of the ESF on the NTS (CRWMS M&O 1999a). There are no locations at Yucca Mountain known to have high concentrations of radionuclides resulting from atmospheric testing or other activities on the NTS; however, some areas in Area 25 (12–18 km east of the ESF) contain soils contaminated during nuclear rocket testing (DOE 1996b, Section 4.1.4.3).

### 2.1.3 Reclamation Program

The goal of reclamation at Yucca Mountain is to return lands disturbed by site characterization activities to a form and productivity similar to the pre-disturbance state (DOE 1989, p. 1). Re-establishment of native vegetation on disturbances will minimize soil erosion, provide food and cover for native wildlife, and improve aesthetics. Some site characterization activities occur on lands administered by the Bureau of Land Management (BLM) and the BLM has stipulated in Right-of-Way Reservations and Plans of Development (BLM correspondence, E.F. Spang to C.P. Gertz, N-47748, January 6, 1988, MOL.19980529.0167; and E.F. Spang to DOE, N-48602, June 28, 1994, MOL.19971030.0184) that DOE must reclaim BLM lands disturbed by site characterization activities.

The *Reclamation Program Plan* (RPP) (DOE 1989) defines the reclamation policy for the Yucca Mountain Site Characterization Project. The RPP directed the development of two additional plans: the *Reclamation Feasibility Plan* (DOE 1990) and the *Reclamation Implementation Plan* (RIP) (DOE 1995). The *Reclamation Feasibility Plan* (DOE 1990) addresses the technical data needs for

reclamation and describes studies initiated to determine which reclamation techniques would be most successful at Yucca Mountain. The RIP describes reclamation activities planned at Yucca Mountain following disturbances and the steps to be taken to implement policies outlined in the RPP. The RIP further describes methods for topsoil salvage and stockpiling, interim and final reclamation, reclamation success standards, and post-reclamation monitoring.

As part of the reclamation program at Yucca Mountain, topsoil has been salvaged and stockpiled since 1991 at most disturbed sites. Prior to disturbing a site, site-specific information is gathered to determine depth of salvageable topsoil and soil profile characteristics. After topsoil is stockpiled, it is stabilized with a chemical stabilizer (e.g., Hydroshield or Soil Master) to reduce wind and water erosion, and large stockpiles are revegetated. In 1993, a study was initiated to determine the effects of stockpile depth and duration of stockpiling on soil viability (i.e., soil microbial populations and soil physical and chemical properties). Data collected for this study have been analyzed, and a report is being prepared. Preliminary results indicated that there were no significant differences in soil microbial activity (i.e., bacteria and fungi) at different depths, microbial biomass in stockpiled soil was different from undisturbed topsoil, and microbial biomass in the stockpile generally was different from undisturbed soil during the second year. It was concluded that topsoil stockpiling was not detrimental to soil viability and that current management practices for topsoil stockpiling at Yucca Mountain should continue.

Reclamation studies have been conducted at Yucca Mountain to determine the feasibility of using soil amendments (e.g., fertilizers, water absorbing gels, etc.), mulches, water harvesting techniques, transplants, soil stabilization agents, fill materials as topsoil replacement, and irrigation to improve reclamation success. Initial results of these studies have been reported (CRWMS M&O 1999d), and many of the study plots will be monitored to determine long-term effects of the various treatments.

As described in the RIP, interim reclamation was conducted on several disturbed sites and topsoil stockpiles where activities are ongoing. The primary objective of interim reclamation is to stabilize soils and minimize erosion until final reclamation is implemented. As of January 1998, interim reclamation had been conducted on approximately 14 ha at Yucca Mountain. After activities are completed at a site, final reclamation is conducted using techniques developed from the reclamation feasibility studies. The primary objectives of final reclamation are erosion minimization and establishment of a stable vegetative cover similar to the adjacent plant community. As of January 1998, final reclamation had been conducted on an additional 14 ha.

Post-reclamation monitoring is being conducted to determine whether reclamation success standards have been met. Parameters monitored include plant cover, plant density, species richness (number of species present per unit area), animal use, and soil erosion. Reclamation success standards and specific post-reclamation monitoring methods will be addressed in the revised RIP.

#### **2.1.4 Soil Disturbances at Yucca Mountain**

The amount of land disturbed by site characterization activities is measured quarterly by the CRWMS M&O Environmental Sciences Department and reported to DOE. As of March 30, 1998, approximately 1.26 km<sup>2</sup> had been disturbed at or near Yucca Mountain for site characterization activities (CRWMS M&O correspondence, M.W. Harris to W.R. Dixon, May 11, 1998,

MOL.1998.01717.0009). An additional 3.1 km<sup>2</sup> were disturbed prior to the initiation of site characterization activities in 1991. Almost half of the disturbances that occurred during site characterization were at four sites: The Fran Ridge borrow pit (18 ha), ESF (16 ha), mine-spoil storage area (12 ha), and topsoil storage area (9 ha). The remainder of the disturbances were smaller and were scattered throughout the Yucca Mountain area (CRWMS M&O 1999c).

## **2.2 REGION SURROUNDING YUCCA MOUNTAIN**

A brief, general description of soils at the NTS can be found in an EIS by the DOE (1996b, Subsection 4.1.4.3). This EIS also discusses soil contaminants, primarily radionuclides, their location, extent, and movement potential in the soil.

During the 1980s, the NRCS conducted a third-order soil survey in southwestern Nye County, including the region south and west of the NTS. The results of that survey have not been published, but information is available from the NRCS, including information on the suitability of soils in this region for farming, mining of fill material, and other uses. None of the series identified are considered prime farmland.

The CRWMS M&O (1999b) report reviewed data from the NRCS soil survey of southwestern Nye County. This report also summarized data from 8 cultivated and 23 uncultivated sites in the Amargosa Valley (located 5–26 km south of Yucca Mountain) that were sampled to determine if the soils in these sites were suitable for farming. That report includes detailed information on the morphology and chemistry of soils at the sites sampled. It also contains a map of soil types in the region and appendices describing the soil series there. Soils that were suitable and unsuitable for farming were found in the area south of Yucca Mountain.

## **2.3 TRANSPORTATION CORRIDORS AND FACILITIES**

The best available information on soils within transportation corridors and facilities comes from soil surveys conducted by the NRCS. Soil surveys of specific interest due to their proximity to rail corridors are:

- Big Smoky Valley Area, part of Nye Co., 1980
- Las Vegas and Eldorado Valleys Area, 1967
- Las Vegas Valley Area, 1985
- Meadow Valley Area, 1976
- Pahranaagat-Penoyer Area, 1968

Copies of these surveys may be obtained from the NRCS.

The results of these soil surveys are summarized in the State Soil Geographic Database (STATSGO), which is also available from the NRCS. This database was prepared by generalizing detailed soil survey information and is designed for broad planning and management uses covering large areas (map scale of 1:250,000). The maps in the STATSGO database are linked to Soil Interpretation Record information that includes over 25 physical and chemical soil properties, interpretations, and productivity. Examples of information in this database include available water holding capacity, soil

reaction, salinity, erodibility, flooding, and interpretations for engineering uses. STATSGO maps and related information are available in U.S. Geological Survey Digital Line Graph (DLG-3), GRASS 4.13, and ArcInfo 7.0 formats.

### 3. DESCRIPTION OF SOILS AT YUCCA MOUNTAIN

A third-order soil survey was conducted on an approximately 18-km<sup>2</sup> area centered on Midway Valley and the ridges to the west (Resource Concepts, Inc. 1989). A more general soil survey was also conducted of the entire Yucca Mountain area (Guertal and Davies 1997), and the NRCS has conducted, but not published, a third-order soil survey of southwestern Nye County, south and west of the NTS. Seventeen soil series and seven associations, or map units (Table 1), were identified at Yucca Mountain (Resource Concepts, Inc. 1989). None of these series are classified as prime farmlands. Based on a wetlands assessment of the NTS (Hansen et al. 1997), there are no hydric soils at Yucca Mountain. Soils at Yucca Mountain are derived from underlying volcanic rocks and mixed alluvium dominated by volcanic material. They generally have a low water-holding capacity.

The shallow soils on ridge tops at Yucca Mountain often consist of a thin hardpan on top of bedrock and are well to excessively drained. The soils have A horizons typically less than 15 cm thick, and a B horizon from 5 to 30 cm thick may be present. Soil textures are gravelly to cobbly, loamy sands to sandy loams. Soils are calcareous, with lime coatings on the underside of rocks in the B horizon. They are moderately to strongly alkaline with a pH ranging from 8.0 to 8.6. Rock fragments ranging in size from gravel to cobbles dominate approximately 45 to 65 percent of the surface.

Soils on fan piedmonts and within steep, narrow canyons are moderately deep to deep and well drained. These soils developed from volcanic residuum, with a component of calcareous eolian sand. Soils that formed in volcanic residuum range from moderately shallow to moderately deep over a thin duripan on top of bedrock. The A horizons are generally less than 25 cm thick, with a B horizon between 25 and 50 cm thick. Mixed soils containing volcanic residuum and calcareous eolian sand are often deep or moderately deep with a well-cemented duripan or petrocalcic horizon. The A horizons are less than 15 cm thick, with a C horizon up to 150 cm deep. Soil textures are gravelly, sandy loams with 35 to 70 percent rock fragments. Soils are calcareous and moderately to strongly alkaline.

Soils on alluvial fans and within stream channels are very deep and well to excessively drained. The A horizons are generally less than 20 cm thick, with C horizons up to 150 cm deep. Soil textures are very gravelly, with fine sands to sandy loams with abundant rock fragments. The soils are calcareous and moderately alkaline.

### 4. REFERENCES

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#### **4.3 PROCEDURES**

PRO-EP-002, *Nonhazardous Waste Management*

## **APPENDIX A**

### **DESCRIPTIONS OF SOIL SERIES MAPPED AT YUCCA MOUNTAIN, NEVADA (RESOURCE CONCEPTS, INC. 1989; NRCS 1998)**

The NRCS (1998) states that these data have not been through a final correlation in accordance with National Soil Survey Policy and should not be treated as advanced data.

**Established Series**

Rev. LNL/RLB

05/97

**ARIZO SERIES**

The Arizo series consists of very deep, excessively drained soils that formed in mixed alluvium. Arizo soils are on recent alluvial fans, inset fans, fan apron, stream terraces, floodplains of intermittent streams and channels. Slopes are 0 to 15 percent. The mean annual precipitation is about 7 inches and the mean annual temperature is about 62 degrees F.

**TAXONOMIC CLASS: Sandy-skeletal, mixed, thermic Typic Torriorthents****TYPICAL PEDON:** Arizo very gravelly fine sand, desert wildlife habitat. (Colors are for dry soil unless otherwise noted.)

A--0 to 8 inches; light brownish gray (10YR 6/2) very gravelly fine sand, dark grayish brown (10YR 4/2) moist; weak coarse platy structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; few fine vesicular and many very fine and fine interstitial pores; 35 percent pebbles; strongly effervescent; moderately alkaline (pH 8.2); abrupt wavy boundary. (0 to 10 inches thick)

C1--8 to 36 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark grayish brown (10YR 4/2) moist; single grained; loose, nonsticky and nonplastic; few fine and medium roots; many very fine and fine interstitial pores; 60 percent pebbles, 10 percent cobbles; few very thin coats of lime on undersides of pebbles; strongly effervescent; moderately alkaline (pH 8.2); gradual wavy boundary. (12 to 36 inches thick)

C2--36 to 62 inches; light brownish gray (10YR 6/2) extremely gravelly sand, dark grayish brown (10YR 4/2) moist; single grained; loose, nonsticky and nonplastic; few very fine and fine roots; many very fine and fine, and few medium interstitial pores; 60 percent pebbles, 20 percent cobbles, 3 percent stones; strongly effervescent; moderately alkaline (pH 8.2).

**TYPE LOCATION:** Clark County, Nevada; about 1,000 feet east and 600 feet south of center of section 20, R. 13 S., R. 17 E.**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, moist for short periods throughout the moisture control section during December through March. Moist above and periodically in upper part of moisture control section for 10 to 20 days cumulative, during July through October.

**Soil temperature** - 59 to 72 degrees F.

**Reaction:** Mildly alkaline to strongly alkaline.

**Other features:** Effervescent in some or all parts, with thin lime coatings on undersides of rock fragments in some pedons.

**Control section** - Rock fragments: 35 to 85 percent, mainly pebbles.

**A horizon** -

Hue: 10YR or 7.5YR.

Value: 5 through 8 dry, 3 through 6 moist.

Chroma: 2 through 6.

**C horizon** -

Hue: 10YR or 7.5YR.

Value: 5 through 8 dry, 3 through 6 moist.

Chroma: 2 through 6.

Texture of fine earth: Averages coarse sand or loamy sand.

Structure: Single grained or massive.

**COMPETING SERIES:** These are the Jean (NV) and Kokan (NM) series. Jean soils have a shallow Bw horizon and have textures in the upper control section of loamy sand or loamy fine sand with less than 15 percent rock fragments. Kokan soils are moist for short periods in some part mainly in July, August, and early September and are dry the rest of the year.

**GEOGRAPHIC SETTING:** Arizo soils are on recent alluvial fans, stream terraces, floodplains of intermittent streams and channels. These soils formed in alluvium from mixed rock sources. Slopes are 0 to 15 percent. Elevations are 750 to 4,500 feet. The climate is arid or semiarid with mild winters and hot dry summers. The mean annual precipitation is 4 to 10 inches and may range to 13 inches in Arizona where temperatures are 67 to 70 degrees F.; mean annual temperature is 57 to 70 degrees F., and the frost-free season is 200 to 300 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Bard, Bitter Spring, Gila, Nickel, Tonopah, and Vinton soils. Bard soils have a petrocalcic horizon. Bitter Spring soils have a gravelly sandy loam B2t horizon. Gila soils have a loamy control section. Nickel and Tonopah soils have a calcic horizon. Vinton soils have a loamy fine sand or loamy sand control section.

**DRAINAGE AND PERMEABILITY:** Excessively drained; slow or medium runoff; very rapid permeability.

**USE AND VEGETATION:** Source of sand and gravel, rangeland, and wildlife habitat. The present vegetation is mainly creosotebush and white bursage.

**DISTRIBUTION AND EXTENT:** Southern Nevada, Southern California, Arizona, and New Mexico. These soils are extensive. MLRA 30,40,41,42.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** Clark County (Virgin River Area), Nevada. 1971.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Particle-size control section - The zone from 10 to 40 inches.

National Cooperative Soil Survey

U.S.A.

LOCATION AYMATE

NV

**Established Series**

Rev.DJM/RLB

5/97

**AYMATE SERIES**

The Aymate series consists of moderately deep, well drained soils that formed in mixed alluvium from volcanic tuffs and limestone. The Aymate soils are on fan piedmont remnants. Slopes are 0 to 8 percent. The mean annual precipitation is about 8 inches and the mean annual temperature is about 57 degrees F.

**TAXONOMIC CLASS: Fine-loamy, mixed, superactive, thermic Ustalfic Petrocalcids**

TYPICAL PEDON: Aymate gravelly sandy loam, rangeland. (Colors are for dry soil unless otherwise noted.) The soil surface is partially covered with 2 percent cobbles and 22 percent pebbles.

A--0 to 3 inches; reddish brown (7.5YR 5/4) gravelly sandy loam, reddish brown (7.5YR 4/4) moist; moderate thin platy structure; soft, very friable, nonsticky and slightly plastic; many very fine roots; many very fine and fine interstitial pores; 22 percent pebbles; slightly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary. (2 to 4 inches thick)

AB--3 to 13 inches; brown (5YR 5/4) sandy loam, dark brown (5YR 4/4) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine interstitial and few very fine tubular pores; few thin clay films on faces of peds and lining pores; 5 percent pebbles; slightly effervescent; moderately alkaline (pH 8.0); clear smooth boundary. (6 to 12 inches thick)

Btk1--13 to 19 inches; reddish brown (5YR 5/4) gravelly clay loam, yellowish red (5YR 4/6) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, very sticky and very plastic; common very fine and fine roots; common very fine and fine tubular pores; common moderately thick clay films on faces of peds and lining pores; common thin lime coats on undersides of rock fragments; common fine lime filaments and threads; 1 percent cobbles, 15 percent pebbles; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary. (4 to 8 inches thick)

Btk2--19 to 28 inches; reddish brown (5YR 4/4) gravelly sandy clay loam, yellowish red (5YR 4/6) moist; strong fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; many moderately thick clay films on faces of peds and lining pores and bridges between sand grains; many thin lime coats and pendants on vertical and undersides of rock fragments; common fine lime filaments, threads, and seams; 2 percent cobbles, 28 percent pebbles; violently effervescent; moderately alkaline (pH 8.4); gradual smooth boundary. (8 to 11 inches thick)

Bk--28 to 35 inches; pink (5YR 7/3) very gravelly coarse sandy loam, light reddish brown (5YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; many very fine and fine interstitial and common very fine tubular pores; many moderately thick lime coats and pendants on vertical and undersides of rock fragments; many large soft lime masses, filaments, and seams; common discontinuous weakly to strongly lime cemented

masses and lenses; 2 percent cobbles, 45 percent pebbles; violently effervescent; moderately alkaline (pH 8.4); abrupt smooth boundary. (0 to 7 inches thick)

Bkqm--35 inches; white (10YR 8/1) indurated petrocalcic horizon, light gray (10YR 7/2) moist.

**TYPE LOCATION:** Lincoln County, Nevada; approximately 1 mile east of Tule Desert Well; about 1250 feet east and 225 feet north of the southwest corner of section 5, T. 10 S., R. 69 E.; 37 degrees, 5 minutes, and 33 seconds north latitude, 114 degrees, 18 minutes, and 12 seconds west longitude.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, moist in late summer and for short periods in winter and spring. (Ustic-Aridic)

**Soil temperature** - 59 to 64 degrees F.

**Depth to petrocalcic horizon** - 20 to 40 inches.

**Reaction** - Moderately alkaline or strongly alkaline.

**Control section** - Clay content: Averages 18 to 30 percent.

Rock fragments: 15 to 35 percent, predominantly pebbles.

**A horizon** -

Hue: 10YR or 7.5YR.

Value: 5 through 7 dry, 4 or 5 moist.

Chroma: 2 through 4.

**Btk horizons** - Hue: 5YR or 7.5YR.

Value: 4 through 6 dry, 4 or 5 moist.

Chroma: 2 through 6.

Texture: Gravelly clay loam, gravelly sandy clay loam, or gravelly loam.

Structure: Moderate to strong subangular blocky.

Other features: Rock fragments commonly contain thin to thick lime coats and pendants on vertical and undersides.

**Bk horizon (when present)** -

Hue: 5YR or 10YR

Value: 6 or 7 dry, 3 through 6 moist.

Chroma: 3 or 4 .

Texture: Very gravelly coarse sandy loam, gravelly coarse sandy loam, or gravelly sandy loam.



**Bkqm horizon** - Cementation: Very strongly lime cemented or indurated petrocalcic horizon with discontinuous accessory silica cementation.

Thickness: 3 to 6 feet observed.

Other features: Very gravelly or extremely gravelly matrix.

**COMPETING SERIES:** There are no competing series.

**GEOGRAPHIC SETTING:** Aymate soils are on fan piedmont remnants. These soils formed in mixed alluvium from volcanic tuffs and limestone. Slopes are 0 to 8 percent. Elevations are 2600 to 3400 feet. The climate is semiarid with hot, intermittently moist summers and cool, moist winters. The mean annual precipitation is 5 to 8 inches; the mean annual temperature is 58 to 65 degrees F., and the frost-free season is 190 to 240 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Arizo, Geta, and Canutio series. Arizo soils are commonly flooded and have a sandy-skeletal particle-size control section. Geta soils have a coarse-loamy particle-size control section and lack an argillic horizon and a petrocalcic horizon. Canutio soils have a loamy-skeletal particle-size control section and lack an argillic horizon and a petrocalcic horizon.

**DRAINAGE AND PERMEABILITY:** Well drained; medium runoff; moderately slow permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The present vegetation is mainly creosotebush, big galleta, Anderson wolfberry, spiny hopsage, cheeseweed burrobrush, bush muhly, desert needlegrass, Nevada ephedra, and banana yucca.

**DISTRIBUTION AND EXTENT:** Southeastern Nevada. These soils are not extensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** Lincoln County, Nevada, South Part, 1992.

**REMARKS:**

**Diagnostic horizons and features recognized in this pedon are:**

Ochric epipedon - The zone from the soil surface to 13 inches (A and AB horizon).

Argillic horizon - The zone from 13 inches to 28 inches (Btk1 and Btk2 horizons).

Calcic horizon - the zone from 13 to 35 inches (Btk1, Btk2 and Bk horizon).

Petrocalcic horizon - The boundary at 35 inches (Bkqm horizon).

Particle-size control section - The zone 13 inches to 28 inches (Btk1 and part of the Btk2 horizons).

**National Cooperative Soil Survey**

**U.S.A.**

**LOCATION BULLFOR**

**NV**

**Established Series**

**Rev. WRK/RLB/WED**

**05/97**

**BULLFOR SERIES**

The Bullfor series consists of moderately deep to a silica-cemented hardpan well-drained soil, that are on sand sheets. Bullfor soils formed in eolian sands over mixed alluvium. Slopes are 0 to 4 percent. The mean annual precipitation is about 6 inches and the mean annual temperature is about 62 degrees F.

**TAXONOMIC CLASS: Sandy, mixed, thermic Typic Haplodurids**

**TYPICAL PEDON:** Bullfor gravelly loamy sand. (Colors are for dry soil unless otherwise noted.) Approximately 50 percent of the soil surface is covered with pebbles.

A--0 to 1 inch; very pale brown (10YR 7/3) gravelly loamy sand, yellowish brown (10YR 5/4) moist; weak medium platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common fine interstitial pores; 25 percent pebbles; slightly effervescent; moderately alkaline (pH 8.2); abrupt wavy boundary. (1 to 2 inches thick)

Bk--1 to 24 inches; very pale brown (10YR 7/3) loamy sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; common fine, medium and coarse roots; common fine interstitial pores; 3 percent pebbles; slightly effervescent with strongly effervescent spots; moderately alkaline (pH 8.2); abrupt wavy boundary. (19 to 28 inches thick)

Bqkm--24 to 25 inches; white (10YR 8/2) silica and lime cemented duripan; very pale brown (10YR 8/4) moist; laminar cap indurated in upper 2 to 3 millimeters and strongly cemented below; very hard, violently effervescent; clear wavy boundary (1 to 3 inches thick)

2Bqk--25 to 60 inches; white (10YR 8/2) very gravelly sandy loam, very pale brown (10YR 8/4) moist; massive; hard, firm, nonsticky and nonplastic; common very fine and fine interstitial pores; 55 percent pebbles, 10 percent strongly silica and lime-cemented masses; strongly effervescent; strongly alkaline (pH 8.6).

**TYPE LOCATION:** Nye County, Nevada; in Sarcobatus Flat about 20 miles northwest of Beatty, about 3,000 feet and 2,000 feet east of the northwest corner of section 30, T. 9 S., R. 45 E.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry. Moist for short periods of time in the late winter and 10 to 20 day cumulative between July through October due to summer convection storms.

**Soil temperature** - 63 to 67 degrees F.

**Depth to duripan** - 20 to 40 inches.

**Other features** - In some pedons a weakly to strongly cemented layer underlies the indurated portion of the duripan.

**Control section** -

Clay content: 2 to 5 percent.

Rock fragments: 0 to 10 percent pebbles.

**Bk horizon** -

Hue 10YR or 7.5YR.

Value: 6 or 7 dry, 4 or 5 moist.

Chroma: 3 or 4.

Structure: Massive or single grained.

Texture: Loamy sand or fine sand.

**Bqkm horizon** - Rupture resistance: Strongly cemented to indurated.

2Bqk horizon -

Hue 10YR or 7.5YR

Value: 7 or 8 dry or moist.

Chroma: 3 or 4.

Rock fragments: 40 to 60 percent.

**COMPETING SERIES:** This is the Agon(NV) series. Agon soils have bedrock immediately below the duripan.

**GEOGRAPHIC SETTING:** Bullfor soils are on gently sloping sand sheets of basin floors. These soils formed in sand sheets over mixed alluvium with a large component from volcanic rock sources. Slopes are 0 to 4 percent. Elevations are 2,000 to 4,200 feet. The climate is arid with cool winters and hot dry summers. Distribution of precipitation is relatively even with slight peaks in January and August. The mean annual precipitation is about 3 to 9 inches; mean annual temperature is about 58 to 64 degrees F., and the frost-free season is about 210 to 250 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** The Canutio series. The Canutio soils have a loamy-skeletal control section and lack a hardpan.

**DRAINAGE AND PERMEABILITY:** Well drained. Slow runoff; rapid permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The present vegetation is mainly white burrobrush, and wolfberry and shadscale with some spiny mendora.

**DISTRIBUTION OF EXTENT:** Southern Nevada. These soils are not extensive.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES PROPOSED:** Nye County, Nevada, (Southwest Part). 1983. The name is coined from Bullfrog Hills, an area north of Beatty.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Duripan - The zone from about 24 to 25 inches (2Bqkm horizon).

Textural control section - The zone from 10 to about 24 inches (lower portion of Bk horizon).

**National Cooperative Soil Survey**

**U.S.A.**

**LOCATION DOWNEYVILLE**

**NV**

**Established Series**

**Rev. JBF/WED/RLB**

**9/95**

**DOWNEYVILLE SERIES**

The Downeyville series consists of very shallow and shallow well drained soils that formed in residuum and colluvium from andesite, basalt, rhyolite and metavolcanic rock. Downeyville soils are on hills, mountain slopes, pediments, plateaus and mesas. Slopes are 4 to 75 percent. The mean annual precipitation is about 5 inches and mean annual temperature is about 53 degrees F.

**TAXONOMIC CLASS: Loamy-skeletal, mixed, mesic Lithic Haplargids**

**TYPICAL PEDON:** Downeyville very gravelly fine sandy loam, rangeland. (Colors are for dry soil unless otherwise noted.)

A1--0 to 2 inches; light brownish gray (10YR 6/2) very gravelly fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; 45 percent pebbles, 10 percent cobbles; moderately alkaline (pH 8.0); clear smooth boundary. (1 to 3 inches thick)

A2--2 to 4 inches; pale brown (10YR 6/3) gravelly fine sandy loam, brown (10YR 4/3) moist; weak fine platy and weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine and medium roots; common very fine and fine interstitial and tubular pores; 20 percent pebbles; few thin films of lime coating undersides of rock fragments; moderately alkaline (pH 8.0); clear smooth boundary. (0 to 4 inches thick)

Btk1--4 to 6 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; moderate thin platy and moderate fine subangular blocky structure; soft, friable, slightly sticky and nonplastic; common very fine, fine and medium roots; common very fine and fine interstitial and tubular pores; few thin clay films on faces of peds and lining pores; 30 percent pebbles; common moderately thick lime and silica on undersides of rock fragments; moderately alkaline (pH 8.2); abrupt smooth boundary. (1 to 8 inches thick)

Btk2--6 to 9 inches; very pale brown (10YR 7/4) very cobbly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine and fine roots; common very fine and fine interstitial and tubular pores; few thin clay films on faces of ped and lining pores; 30 percent pebbles, 20 percent cobbles; many moderately thick lime coating on undersides of rock fragments; slightly effervescent; moderately alkaline (pH 8.4); abrupt wavy boundary. (2 to 7 inches thick)

R--9 inches; fractured hard volcanic tuff; discontinuous lime and silica cementation in fractures; weathered in upper 2 inches.

**TYPE LOCATION:** Esmeralda County, Nevada, about 2,400 feet west and 2,100 feet south of the northeast corner of Section 13, T. 7 S., R. 41 E.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, moist in some part for short periods during winter and early spring months and for 10 to 20 days cumulative between July and October due to convection storms.

**Soil temperature** - 53 to 57 degrees F.

**Depth to bedrock** - 4 to 14 inches.

**Effervescence** - Noneffervescent to strongly effervescent.

**Control section** -

Clay content: 14 to 25 percent.

Rock fragments: 35 to 60 percent.

Reaction: Moderately alkaline or strongly alkaline. Sandy surface layer may be neutral.

**A horizon** -

Hue: 7.5YR or 10YR.

Value: 6 or 7 dry, 3 through 5 moist.

Chroma: 2 or 3.

**Bt and Btk horizon** -

Value: 5 through 7 dry, 3 through 5 moist.

Chroma: 2 through 4.

Texture (fine-earth fraction): Loam, fine sandy loam and some pedons may have silt loam subhorizons.

Clay content: 18 to 27 percent.

Rock fragments: Average 5 to 20 percent cobbles and stones; 30 to 50 percent pebbles.

Structure: Platy or subangular blocky.

Consistence: Soft to hard dry, very friable or friable moist, slightly sticky or sticky and nonplastic or slightly plastic wet.

Secondary lime and silica: Lime and accessory silica in the form of pendants on the undersides of pebbles ranging from few to many.

Effervescence: Slightly effervescent to violently effervescent in lower part.

**Other features:** The upper part of the Bt horizon may not contain visible lime accumulation or may not be effervescent in some pedons.

**COMPETING SERIES:** These are the Hoot (NV), Mirkwood (NV), Theon (NV), Tognoni (NV), Valleycity (UT), Vium (NV) and Waucoba (CA) series. Hoot soils are noncalcareous throughout the profile and have a neutral Bt horizon. Mirkwood soils have 25 to 35 percent clay in the control section and have noncalcareous sola. Tognoni soils have more than 35 percent clay in the argillic horizon. Valleycity soils contain mainly stone and cobble sized fragments in the control section and formed from calcareous sedimentary rocks. Vium soils are dry between July and October and contain 10 to 18 percent clay in the Bt horizon. Waucoba soils are 14 to 20 inches deep to bedrock.

**GEOGRAPHIC SETTING:** Downeyville soils are on hills, mountains, pediments plateaus and mesas. The soils formed in residuum and colluvium from andesitic, rhyolitic and altered volcanic rock. Slopes are 4 to 75 percent. Elevations are 4,000 to 7,500 feet. The mean annual temperature ranges from 49 to 55 degrees F.; the mean annual precipitation is 4 to 8 inches, and the frost-free season is 110 to 140 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Blacktop, Pintwater and Stewval soils. Blacktop and Pintwater soils lack an argillic horizon; Stewval soils have a Xeric moisture regime.

**DRAINAGE AND PERMEABILITY:** Well drained; medium or rapid runoff; moderate permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The vegetation is bud sagebrush, shadscale, Indian ricegrass and galleta.

**DISTRIBUTION AND EXTENT:** Central Nevada. These soils are moderately extensive. MLRA 29, 27.

**MLRA OFFICE RESPONSIBLE:** Reno, Nevada

**SERIES ESTABLISHED:** Esmeralda County, Nevada, 1984.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - From the surface to about 4 inches.

Argillic horizon - The zone from about 4 to 9 inches (Btk1 and Btk2 horizons).

Particle-size control section - The zone from the soil surface to 9 inches (A1, A2, Btk1 and Btk2 horizons).

Lithic contact - The zone at 9 inches (R horizon).

**ADDITIONAL DATA:** NSSL - S83NV-009-003(832987-832990)

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION GABBVALLY

NV

Established Series

Rev. EWB/WED/RLB

4/97

**GABBVALLY SERIES**

The Gabbvally series consists of shallow and very shallow, well drained soils that formed in residuum and colluvium from volcanic rocks. Gabbvally soils are on hills, plateaus, mesas and mountain sideslopes. Slopes are 2 to 75 percent. The mean annual precipitation is about 10 inches and the mean annual temperature is about 53 degrees F.

**TAXONOMIC CLASS:** Loamy-skeletal, mixed, superactive, mesic Lithic Xeric Haplargids

**TYPICAL PEDON:** Gabbvally extremely stony loamy coarse sand, rangeland. (Colors are for dry soil unless otherwise noted.) The soil surface is covered with 25 percent pebbles, 20 percent cobbles and 15 percent stones.

A--0 to 2 inches; pale brown (10YR 6/3) extremely stony loamy coarse sand, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots; common very fine interstitial and few very fine tubular pores; 25 percent pebbles, 20 percent cobbles, 15 percent stones; neutral (pH 7.2); clear smooth boundary. (1 to 4 inches thick)

Bt1--2 to 4 inches; light yellowish brown (10YR 6/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; soft, very friable, sticky and slightly plastic; common very fine roots; common very fine tubular and few very fine interstitial pores; common moderately thick clay films on faces of peds; 45 percent pebbles, 5 percent cobbles; neutral (pH 7.2); clear smooth boundary. (2 to 9 inches thick)

Bt2--4 to 8 inches; light yellowish brown (10YR 6/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; common very fine roots; common very fine tubular and few very fine interstitial pores; common thin and few moderately thick clay films on faces of peds; 45 percent pebbles, 5 percent cobbles; mildly alkaline (pH 7.4); abrupt irregular boundary. (2 to 7 inches thick)

R--8 inches; hard fractured rhyolitic tuff; few roots and disseminated lime in fractures.

**TYPE LOCATION:** Mineral County, Nevada; in the Gabbs Valley Range; approximately 800 feet north and 400 feet west of the southeast corner of section 23, T. 10 N., R. 33 E.; 38 degrees, 42 minutes, 39 seconds north latitude and 118 degrees, 15 minutes, 27 seconds west longitude.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, moist in winter and spring months, dry in summer and fall except for 10 to 20 days between July and October due to convection storms.



**Soil temperature** - 53 to 59 degrees F.

**Depth to bedrock** - 6 to 14 inches.

**Reaction** - Neutral or mildly alkaline.

**Control section** - Clay content: 15 to 25 percent.

**Rock fragments** - 35 to 50 percent, predominantly pebbles.

**A horizon** -

Value: 5 or 6 dry, 3 or 4 moist.

Chroma: 3 or 4 dry or moist.

**Bt horizon** -

Value: 5 or 6 dry, 3 through 5 moist.

Chroma: 3 or 4 dry or moist.

Texture: Sandy clay loam, loam, sandy loam.

Structure: Subangular blocky or angular blocky

Clay content: 18 to 27 percent.

Rock fragments: 35 to 50 percent.

Consistence: Soft or slightly hard, very friable or friable, slightly sticky or sticky.

**COMPETING SERIES:** These are the Atlow (NV), Boomstick (NV), Checkett (UT), Cottle (ID), Fortyday (T)(WA), Hooplite (NV), Nevo (T)(WA), Olac (NV), Old Camp (NV), Phliss (NV), Rowel (NV), Soughe (NV), Stewval (NV), and Thike (NV) series. Atlow soils have 27 to 35 percent clay in the control section and have bedrock at a depth of 14 to 20 inches. Boomstick soils are 14 to 20 inches to bedrock. Checkett soils have bedrock at a depth of 15 to 20 inches, more than 50 percent rock fragments in the control section, and the Bt horizon is moderately or strongly alkaline. Cottle soils are 10 to 20 inches to bedrock and contain a Bk horizon. Fortyday soils have bedrock at 14 to 20 inches. Hooplite soils have calcareous profiles and are not moist for 10 to 20 days in the summer. Nevo soils contain 25 to 33 percent clay in the control section. Olac soils are not moist for 10 to 20 days in the summer. Old Camp soils contain 27 to 35 percent clay in the Bt horizon. Phliss soils have secondary lime accumulation at depth of 3 to 10 inches, and are dry from July through October. Rowel soils contain 50 to 80 percent coarse fragments with 25 to 35 percent clay in the control section and the Bt horizon is 40 to 55 percent clay. Soughe soils have 25 to 35 percent clay in the control section and are not moist for 10 to 20 days in the summer. Stewval soils have calcium carbonate throughout. Thike soils have more than one-half the pebbles which are 2 to 5 millimeters in size and the sand fraction is dominantly coarse sand.

**GEOGRAPHIC SETTING:** Gabbvally soils are on hills, plateaus and mountain slopes. These soils formed in residuum and colluvium weathered from volcanic rocks. Elevations are 4,350 to 8,500 feet. Slopes are 2 to 75 percent. The climate is cool semiarid with warm dry summers and cool, moist winters. The mean annual

precipitation is 8 to 12 inches; the mean annual temperatures range from 50 to 54 degrees F.; and the frost-free season is 100 to 130 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Tejabe and Calpeak soils. Both soils lack an argillic horizon and Calpeak soils also lack hard bedrock within 20 inches.

**DRAINAGE AND PERMEABILITY:** Well drained; medium to very rapid runoff; moderate permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The native vegetation is Wyoming big sagebrush, desert needlegrass, bottlebrush squirreltail, Nevada ephedra and galleta.

**DISTRIBUTION AND EXTENT:** West-central Nevada. The soils are not extensive. MLRA 27, 29.

**MLRA OFFICE RESPONSIBLE:** Reno, Nevada

**SERIES ESTABLISHED:** Esmeralda County, Nevada, 1984.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - From the surface to 2 inches.

Argillic horizon - The zone from about 2 to 8 inches (Bt horizon).

Lithic contact - The point at 8 inches (R horizon).

Xerollic features - Meets organic carbon and soil moisture regime requirement for "Xerollic".

Particle-size control section - The zone from the surface to 8 inches (A and Bt horizons).

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION GREYEAGLE

CA+AZ NV

Established Series

Rev. JCW/TDC

10/97

**GREYEAGLE SERIES**

The Greyeagle series consists of shallow, somewhat excessively drained soils formed in mixed alluvium. Greyeagle soils are on fan terraces and hillslopes and have slopes of 0 to 40 percent. Average annual precipitation is 6 inches and mean annual temperature is 53 degrees F.

**TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, thermic, shallow Typic Haplodurids**

**TYPICAL PEDON:** Greyeagle very stony loam - on a sloping alluvial fan under creosotebush and white bursage at 2,246 feet elevation. (Colors are for dry soil unless otherwise stated. When described August 1976 the soil was dry throughout).

A1--0 to 3 inches; very pale brown (10YR 7/3) very stony loam, brown (10YR 5/3) moist; strong thick platy structure; hard, friable, slightly sticky and slightly plastic; common very fine vesicular and interstitial pores; 60 percent 2 mm to 7 cm pebbles, 15 percent stones, 2 percent cobbles; violently effervescent, disseminated lime; moderately alkaline (pH 8.0); abrupt smooth boundary. (2 to 4 inches thick)

A2--3 to 6 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots; few fine interstitial pores; 15 percent 2 mm to 7 cm pebbles; violently effervescent, disseminated lime; moderately alkaline (pH 8.1); clear wavy boundary. (3 to 5 inches thick)

Bk--6 to 8 inches; very pale brown (10YR 7/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine interstitial pores; 40 percent 2 to 5 mm fragments; violently effervescent, medium irregular soft masses of lime and coatings less than 1 mm thick on rock fragments; moderately alkaline (pH 8.0); clear wavy boundary. (2 to 5 inches thick)

2Bqkm--8 to 24 inches; white and very pale brown (10YR 8/2, 8/3) continuous duripan with thin opalized laminations between layers of cemented gravel, very pale brown (10YR 7/4) moist; massive; extremely hard, indurated by silica and calcium carbonate; clear smooth boundary. (16 to 18 inches thick)

2Bk--24 to 60 inches; very pale brown (10YR 7/4) stratified extremely stony loamy sand; massive; very hard and extremely hard, firm.

**TYPE LOCATION:** Inyo County, California; Saline Valley; about 1/4 mile south of intersection of Saline Valley Road and Lippincott mine road; about 20 feet east of Saline Valley Range and 20 feet west of an exposed bank in a drainage way, N 1/2 of SE 1/4 sec. 20, T. 15 S., R. 40 E., MDB&M.

**RANGE IN CHARACTERISTICS:** Depth to an indurated, lime-silica cemented duripan ranges from 4 to 20 inches. The mean annual soil temperature is about 65 degrees F. The particle-size control section averages 10 to 18 percent clay. These soils are dry throughout from June until late November for about 180 days. The soil temperature is warmer than 41 degrees F from March to mid-December for about 290 days.

The A horizon has dry color of 10YR 7/3, 6/3, 6/4; or 7.5YR 6/4 and moist color of 10YR 4/3, 4/4, 5/3, 5/4,, 6/3; 7.5YR 4/4, or 5/4. The upper 3 to 4 inches of the A horizon consists of a vesticular layer of very stony loam to very gravelly loam. Rock fragments 2 mm to 7 cm in diameter range from 35 to 60 percent; 7 cm-25 cm 1 to 5 percent, and 25 cm+ up to 15 percent in the upper part of the A horizon. The lower part of the horizon ranges from gravelly sandy loam to very gravelly sand.

The Bk horizon has colors similar to the A horizon. It is very gravelly sandy loam or very gravelly loamy sand.

Underlying the 2Bqkm horizon is mixed, extremely gravelly, stratified alluvium that is massive and extremely hard or very hard when dry. It can be dug with a pick and shovel, but with difficulty.

**COMPETING SERIES:** These are the Alko, Muroc, Nebona, Osobb, Pahroc and Stewart series in other families. Alko, Muroc, Nebona and Stewart soils are loamy. Osobb and Pahroc soils have mesic soil temperature.

**GEOGRAPHIC SETTING:** Greyeagle soils are on old dissected fan terraces and hillslopes. Slopes are 0 to 40 percent. The soils formed in alluvium from mixed sources. Elevations are 1,800 feet to 4,000 feet. The climate is arid with very hot dry summers, with infrequent thunder showers of short duration, and cool slightly moist winters. The average annual precipitation varies from 4 to 12 inches. Mean January temperature is 45 degrees F, mean July temperature is 85 degrees F; mean annual temperature is 63 degrees F. Frost-free season is 235 to 300 days. Those soils formed on hillslopes up to 40 percent slopes and 12 inches of precipitation occur in the Sonoran Desert.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Arizo soils. Arizo soils lack a duripan and have a sandy-skeletal particle-size control section.

**DRAINAGE AND PERMEABILITY:** Somewhat excessively drained; rapid runoff, moderately rapid permeability in the soil above the duripan.

**USE AND VEGETATION:** Used mainly for wildlife land and recreation land. The native vegetation is primarily creosotebush, white bursage, Anderson thornbush, spiny hopsage, and buckwheat.

**DISTRIBUTION AND EXTENT:** These soils are mapped in the northern part of the California Desert and are moderately extensive.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** Inyo County, California, Saline Valley Area, 1980.

**National Cooperative Soil Survey**

**U.S.A.**

**LOCATION JONNIC**

**NV**

**Tentative Series**

**Rev. HJB/RLB/WED**

**05/97**

**JONNIC SERIES**

The Jonnic series consists of moderately deep over a duripan, well drained soils that are on fan piedmont remnants. Jonnic soils formed in alluvium from mixed rock sources. Slopes are 4 to 8 percent. The mean annual precipitation is about 9 inches and the mean annual temperature is about 62 degrees F.

**TAXONOMIC CLASS: Clayey-skeletal, smectitic, thermic Xeric Argidurids**

**TYPICAL PEDON:** Jonnic gravelly loam, rangeland. (Colors are for dry soil unless otherwise noted.)

A--0 to 2 inches; very pale brown (10YR 7/4) gravelly loam, yellowish brown (10YR 5/4) moist; moderate coarse platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine and fine vesicular pores; 25 percent pebbles, 1 percent cobbles, 1 percent stones; violently effervescent; strongly alkaline (pH 8.6); clear wavy boundary. (2 to 4 inches thick)

Bt--2 to 9 inches; reddish yellow (7.5YR 6/6) very gravelly clay loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; soft, very friable, sticky and plastic; common very fine and few fine roots; common very fine and few fine interstitial pores; few thin clay films lining pores and on faces of peds; 40 percent pebbles, 2 percent cobbles; few very thin white lime coating on undersides of rock fragments; violently effervescent; strongly alkaline (pH 8.6); clear wavy boundary. (5 to 8 inches thick)

Btk1--9 to 21 inches; reddish yellow (7.5YR 6/6) very gravelly clay, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and common fine roots; few very fine tubular pores; 15 percent medium soft lime masses; few faint clay films bridges sand grains; 40 percent pebbles, 3 percent cobbles; few thin lime-silica pendants on undersides of rock fragments; violently effervescent; strongly alkaline (pH 8.6). (7 to 12 inches thick)

Btk2--21 to 38 inches; reddish yellow (7.5YR 6/6) extremely cobbly sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure, soft, very friable, sticky and plastic; few very fine roots; common very fine and few fine interstitial pores; few faint clay films bridging sand grains; 40 percent pebbles, 35 percent cobbles; common thin lime-silica coats on undersides of rock fragments; violently effervescent; strongly alkaline (pH 8.6); clear wavy boundary. (10 to 20 inches thick)

Bqkm--38 to 42 inches; continuously strongly cemented and indurated white (10YR 8/1) silica-lime hardpan; massive; very hard and extremely hard, very firm and extremely firm; 45 percent pebbles, 5 percent cobbles.

**TYPE LOCATION:** Nye County, Nevada; approximately 1 mile east of Highway 160 near the old mining town of Johnnie and about 1,400 feet south and 200 feet west of the southeast corner of section 6, T. 18 S., R. 53 E., MDBL.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry. Moist in the late winter and spring and for 10 to 20 days following summer convection storms from July to October.

**Soil temperature** - 63 to 69 degrees F.

**Depth to duripan** - 25 to 40 inches.

**Control section** - Percent clay: 35 to 50 percent, weighted average.

**Rock fragments** - 35 to 45 percent pebbles, 2 to 5 percent cobbles, 0 to 5 percent stones.

**A horizon** -

Value: 6 or 7 dry; 4 or 5 moist.

Reaction: Moderately alkaline or strongly alkaline.

**Bt and Btk1 horizons** -

Chroma: 5 or 6 moist or dry.

Texture of fine earth: Clay loam or clay.

Clay content: 35 to 55 percent.

Rock fragments: 35 to 50 percent.

**Btk2 horizon** -

Texture of fine earth: Sandy clay loam or clay loam.

Clay content: 25 to 35 percent.

Rock fragments: 30 to 40 percent pebbles, 20 to 35 percent cobbles, 0 to 5 percent stones.

**Bqkm horizon** -

Rupture resistance: Strongly cemented to indurated.

**COMPETING SERIES:** There are no other soils in this family at the present time.

**GEOGRAPHIC SETTING:** Jonnic soils are on fan piedmont remnants. The soils formed in alluvium from mostly quartzite sources with some shale and limestone. Slopes are 4 to 8 percent. Elevations are 3,000 to 4,500 feet. The climate is arid with hot dry summers and mild winters. Maximum precipitation comes in August with a secondary peak in January. The mean annual precipitation is between 8 and 10 inches; mean annual temperature is between 58 to 64 degrees F., and the frost-free season is about 200 to 250 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Canutio and Arizo soils. Both these soils lack argillic horizons and duripans.

**DRAINAGE AND PERMEABILITY:** Well drained; medium runoff; permeability is slow above the duripan.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The present vegetation is mainly blackbrush, creosotebush, ephedra and wolfberry.

**DISTRIBUTION AND EXTENT:** Southern Nye County, Nevada. These soils are not extensive.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES PROPOSED:** Nye County, Nevada, 1982.

**REMARKS:** The name is coined from the nearby historical mining town of Johnnie. In 1985 the subgroup was changed from Abruptic to Xerollic based on collected data, in addition, mineralogy was changed from mixed to montmorillonitic.

**Diagnostic horizons and features recognized in this pedon are:**

Argillic horizon - The zone from about 2 to 38 inches (Bt, Btk1 and Btk2 horizons).

Xerollic intergrades - Meets organic carbon requirement for "Xerollic"

Duripan - The zone from about 38 to 45 inches (Bqkm horizon).

Textural control section - The zone from about 2 to 22 inches. (Bt, Btk1 and part of the Btk2 horizons)

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION LEALANDIC

NV

Established Series

Rev. JAR/RLB

05/97

**LEALANDIC SERIES**

The Lealandic series consists of moderately deep over a duripan, well drained soils that formed in mixed alluvium from mainly limestone, quartzite, and siltstone sources. The Lealandic soils are on alluvial fan piedmonts and have gradients of 2 to 15 percent. The mean annual precipitation is about 7 inches and the mean annual temperature is about 63 degrees F.

**TAXONOMIC CLASS: Clayey-skeletal, smectitic, thermic Typic Argidurids**

**TYPICAL PEDON:** Lealandic very gravelly sandy loam, rangeland. (Colors are for dry soils unless otherwise noted.) Typically, 35 percent of the soil surface is covered with pebbles, 5 percent with cobbles and 2 percent with stones.

A--0 to 5 inches; brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; moderate very fine and fine platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine, few fine and medium roots; many very fine vesicular and common very fine tubular pores; 40 percent pebbles; slightly effervescent; moderately alkaline (pH 8.4), gradual smooth boundary (2 to 5 inches thick).

Bt--5 to 12 inches; dark yellowish brown (10YR 4/6) gravelly sandy clay, dark yellowish brown (10YR 3/6) moist; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; many fine and medium, few very fine and coarse roots; many very fine tubular and irregular pores; many pressure faces on peds; 30 percent pebbles; moderately alkaline (pH 8.2), gradual smooth boundary (2 to 9 inches thick).

Btk--12 to 23 inches; yellowish brown (10YR 5/6) very gravelly sandy clay, dark yellowish brown (10YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; many very fine tubular and few very fine irregular pores; common moderately thick pressure faces on peds; 50 percent pebbles; few fine soft lime masses and threads; strongly effervescent; moderately alkaline (pH 8.4), abrupt wavy boundary (10 to 20 inches thick).

Bqkm--23 to 40 inches; white (10YR 8/2) indurated duripan, light gray (10YR 7/2) moist; massive; extremely hard, extremely firm; silica-lime cemented laminar cap 2 to 15 mm thick; violently effervescent.

TYPE LOCATION: Nye County, Nevada; 1 mile south of Highway 58, National Monument border along east gravel road. 2,600 feet east, 1,800 feet north of southwest corner of section 7, T. 13 S., R. 46 E., MDBM.

**RANGE IN CHARACTERISTICS:**

**Soil moisture:** Usually dry, but moist in some part of the moisture control section in January, February and March. Moist in some part for 10 to 20 days following summer convection storms.



**Soil temperature:** 62 to 67 degrees F.

**Depth to duripan:** 20 to 40 inches.

**Control section -**

Rock fragments: 35 to 60 percent, mainly pebble.

Clay content: 35 to 50 percent.

Reaction: Moderately alkaline or strongly alkaline.

**A horizon -**

Value: 5 or 6 dry, 3 through 5 moist.

Chroma: 3 or 4.

**Bt & Btk horizon -**

Hue: 10YR, 7.5YR or 5YR.

Value: 4 or 5 dry, 3 or 4 moist.

Chroma: 4 through 6.

Texture: Gravelly sandy clay or very gravelly sandy clay. with secondary accumulation of lime and silica.

Other features: Some pedons have subhorizon of the argillic with textures that range from very gravelly sandy clay loam or very gravelly loam with accumulation of secondary silica and lime.

**Bqkm horizon -** Rupture resistance: Very strongly cemented to indurated.

**COMPETING SERIES:** There are no competing series. Frye soils are similar but contain less than 35 percent rock fragments in the control section.

**GEOGRAPHIC SETTING:** Lealandic soils are on alluvial fan remnants. The soils formed in mixed alluvium, predominantly from limestone and quartzite sources. Slopes are 2 to 15 percent. Elevation ranges from 2,000 to 4,000 feet. The climate is warm and arid. The mean annual precipitation ranges from 3 to 9 inches. The mean annual temperature is between 60 and 65 degrees F. The frost-free season is 190 to 210 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Canutio, Longjim, and Pinez soils. Canutio soils are formed in recent alluvium, lack argillic horizons, or duripans, and have a loamy-skeletal control section. The Longjim soil lacks an argillic horizon and is generally on convex, steeper sites above the Lealandic series. Pinez soils are on mid-fan remnants and have loamy-skeletal control sections.

**DRAINAGE AND PERMEABILITY:** Well drained; runoff is medium; permeability is slow.

**USE AND VEGETATION:** Rangeland. The present vegetation is mainly ephedra, buckwheat, cheatgrass and rabbitbrush.

**DISTRIBUTION AND EXTENT:** Southwest Nevada. These soils are inextensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES PROPOSED:** Nye County, Nevada, Southwest part, 1981. The name is coined.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Argillic horizon - The zone from about 5 to 23 inches (Bt and Btk horizons).

Duripan - The zone from about 23 to 40 inches (Bqkm).

Textural control section - The zone from about 5 to 23 inches (Bt and Btk horizons).

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION LONGJIM

NV

Established Series

Rev. HJB/WED/RLB

5/97

**LONGJIM SERIES**

The Longjim series consists of shallow over duripan, well drained soils that formed in alluvium from mixed rock sources. The Longjim soils are on fan piedmont remnants. Slopes are 2 to 15 percent. The mean annual precipitation is about 8 inches and the mean annual temperature is about 60 degrees F.

**TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, thermic, shallow Typic Haplodurids**

**TYPICAL PEDON:** Longjim gravelly fine sandy loam, rangeland. (Colors are for dry soil unless otherwise noted.) Typically, 50 percent of the soil surface is covered with pebbles and 5 percent with cobbles.

A--0 to 3 inches; light brownish gray (10YR 6/2) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak thick platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and common medium vesicular pores; 30 percent pebbles; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary. (1 to 6 inches thick)

Bw--3 to 8 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine, few medium roots; many very fine interstitial and few fine tubular pores; 20 percent pebbles; strongly effervescent; strongly alkaline (pH 8.8); clear smooth boundary. (0 to 8 inches thick)

Bk--8 to 16 inches; very pale brown (10YR 7/3) very gravelly sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial and few fine tubular pores; 50 percent pebbles, most pebbles are lime coated; few weakly or strongly silica and lime cemented peds; violently effervescent; strongly alkaline (pH 8.6); abrupt wavy boundary. (6 to 15 inches thick)

Bqkm--16 to 45 inches; white (10YR 8/1) strongly and weakly silica-lime cemented hardpan, light gray (10YR 7/2) moist; white (10YR 8/2) dry and light yellowish brown (10YR 6/4) moist; with indurated cap, the pan is indurated in the upper 2 to 4 inches; strongly and weakly cemented below; A few fine and medium roots are between plates. Rock fragment content range from 40 to 60 percent.

**TYPE LOCATION:** Nye County, Nevada; 1,500 feet south and 400 feet west of the northeast corner of section 33, T. 19 S., R. 54 E.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, Moist for short periods of time in the late winter.

**Soil temperature** - 62 to 67 degrees F.

**Depth to duripan** - 14 to 20 inches.

**Control section** -

Clay content: 5 to 10 percent.

Rock fragments: 35 to 70 percent, mainly pebbles. with a few 0 to 10 percent cobbles

**A horizon** -

Value: 6 or 7 dry, 4 or 5 moist.

Chroma: 2 through 4.

**Bw and Bk horizons** -

Hue: 10YR or 7.5YR.

Value: 6 through 8 dry, 4 through 6 moist.

Chroma: 3 or 4.

Texture of the fine earth: Fine sandy loam, sandy loam or coarse sandy loam.

Consistence: Soft and slightly hard.

**Bqkm horizons** -

Value: 6 through 8 dry.

Rock fragments: 40 to 60 percent mainly pebbles with 0 to 15 percent cobbles.

Rupture resistance: Continuous cap or common continuous silica laminae in upper 6 inches. Commonly layered, with weakly and strongly cemented layers and indurated plates.

**COMPETING SERIES:** This is the Cline(T AZ), Crosgrain(T NV), Greyeagle(CA), and Tumarion(T AZ) series. Cline and Tumarion soils have a lithic contact immediately below the duripan. Crosgrain soils are 7 to 14 inches to the duripan and have 10 to 18 percent clay in the control section. Greyeagle soils have duripans at depths less than 14 inches and average 10 to 18 percent clay in the control section.

**GEOGRAPHIC SETTING:** Longjim soils are on fan piedmont remnants. The soils formed in mixed alluvium. Slopes are 2 to 15 percent. Elevation is 3,300 to 4,500 feet. The climate is warm and arid. The mean annual precipitation is 6 to 10 inches. The mean annual temperature is 60 to 65 degrees F. The frost-free season is about 210 to 250 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Alko, Arizo and Canutio soils. The Alko soil are on similar topography to the Longjim soil but is less than 14 inches deep to the duripan. Arizo and Canutio soils are in the drainageways and are very deep and subject to flooding.

**DRAINAGE AND PERMEABILITY:** Well drained; medium runoff; moderate permeability above the duripan.

**USE AND VEGETATION:** Livestock grazing and wildlife habitat. The vegetation is mainly blackbrush, Nevada ephedra and Anderson wolfberry with small amounts of Indian ricegrass, bush muhly and big galleta.

**DISTRIBUTION AND EXTENT:** Southern Nevada. The soils are of small extent. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** Lincoln County, Nevada, South Part, 1992.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Duripan - The zone from 16 to 45 inches.

Particle-size control section - The zone from 10 to 16 inches.

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION PINEZ

NV

Established Series

Rev. JR/RLB/WED

05/97

**PINEZ SERIES**

The Pinez series consists of deep over an indurated duripan, well drained soils on fan piedmont remnants. Pinez soils formed in mixed alluvium mainly from quartzite and volcanic tuff with minor components of limestone, dolomite and shale. Slopes are 2 to 8 percent. The mean annual precipitation is about 5 inches and the mean annual temperature is about 64 degrees F.

**TAXONOMIC CLASS:** Loamy-skeletal, mixed, thermic Durinodic

Haplargids

**TYPICAL PEDON:** Pinez very gravelly loamy sand - rangeland. (Colors are for dry soil unless otherwise noted). Approximately 65 percent of the soil surface is covered with pebbles, 10 percent with cobbles and 5 percent with stones.

A--0 to 4 inches; pale brown (10YR 6/3) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; moderate very fine and fine platy structure; soft, very friable, nonsticky and slightly plastic; few very fine and fine roots; many very fine vesicular and few very fine tubular pores; 45 percent pebbles; slightly effervescent; moderately alkaline (pH 8.2); gradual wavy boundary (2 to 6 inches thick)

BA--4 to 10 inches; pale brown (10YR 6/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; moderate very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine and medium, common coarse roots; common very fine interstitial and few very fine tubular pores; 50 percent pebbles; violently effervescent; moderately alkaline (pH 8.4); gradual wavy boundary (0 to 6 inches thick)

Btk--10 to 29 inches; yellowish brown (10YR 5/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/6) moist; moderate fine and medium subangular blocky structure; soft, very friable, sticky and plastic; common very fine and fine roots; many very fine interstitial and few very fine tubular pores; common faint clay films on pebbles; 60 percent pebbles; common thin lime coats and pendants on undersides of pebbles, strongly effervescent; moderately alkaline (pH 8.2); abrupt wavy boundary (8 to 25 inches thick).

2Bqk--29 to 41 inches; pale brown (10YR 6/3) extremely gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; single grained; loose, nonsticky and nonplastic; many very fine and fine interstitial pores; 85 percent pebbles; 75 percent strongly silica-lime cemented discontinuous plates and masses; strongly effervescent; moderately alkaline (pH 8.4); abrupt wavy boundary (10 to 20 inches thick).

2Bqkm--41 inches; very pale brown (10YR 7/3) indurated duripan with laminar cap; many medium and coarse distinct very pale brown (10YR 8/2) lime coatings, light brownish gray (10YR 6/2) moist; massive; very hard, very firm, brittle; common very fine and fine interstitial and few fine tubular pores; 85 percent pebbles; violently effervescent; moderately alkaline (pH 8.4).

**TYPE LOCATION:** Nye County, Nevada; 2,300 feet east and 2,100 feet north of the projected southwest corner of section 7, T. 13 S., R. 46 E. north latitude 36 degrees, 48 minutes 48 seconds; west longitude 116 degrees, 52 minutes, 15 seconds.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry. Moist in some part for short periods during winter and early spring months and for 10 to 20 days cumulative between July and October due to convection storms.

**Soil temperature** - 65 to 70 degrees F.

**Depth to duripan** - 40 to 60 inches.

**Reaction** - Moderately alkaline or strongly alkaline.

**Control section** -

Clay content: 18 to 35 percent.

Rock fragments: 35 to 60 percent, mainly pebbles.

**A horizon** -

Value: 6 or 7 dry, 4 through 6 moist.

Chroma: 2 through 4.

**Btk horizon** -

Hue: 10YR or 7.5YR.

Value: 5 or 6 dry, 4 or 5 moist.

Chroma: 3 through 6.

Texture: Very gravelly sandy loam, very gravelly sandy clay loam, very gravelly clay loam.

**Bqk or Bk horizons** -

Hue: 10YR or 7.5YR.

Value: 6 or 7 dry, 4 through 7 moist.

Chroma: 3 or 4.

**2Bqkm horizon** -

Rupture resistance: Very strongly cemented to indurated.

**COMPETING SERIES:** This is the Scottcas (NV) series. Scottcas soils average 7 to 15 percent clay in the control section and have a thin shallow argillic horizon with its base at a depth of 6 to 11 inches and do not have an indurated duripan.

**GEOGRAPHIC SETTING:** The Pinez series are on fan piedmont remnants. Slopes are 2 to 8 percent. Elevations are 1,500 to 3,000 feet. The climate is hot and arid. Mean annual temperature is 63 to 68 degrees F. Distribution of precipitation is relatively even with slight peaks in January and August. Average annual precipitation is between 3 and 9 inches. The frost-free season is 190 to 210 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Arizo, Canutio and Skelon soils. Arizo and Canutio soils lack an argillic horizon and occur on low alluvial fans and in washes. Skelon soils are found on slightly steeper alluvial fans and lack argillic horizons.

**DRAINAGE AND PERMEABILITY:** Well drained; medium runoff; moderately slow permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The present vegetation is shadscale, spiny hopsage, wolfberry, ephedra and creosotebush.

**DISTRIBUTION AND EXTENT:** Southern Nevada. These soils are not extensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES PROPOSED:** Nye County, Nevada (Southwest Part), 1981. The name is coined.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Argillic horizon - The zone from about 10 to 29 inches (Btk horizon)

Duric subgroup features - Silica-cemented lenses and masses in the zone from about 29 to 41 inches.

Particle-size control section - The zone from 10 to 29 inches (Btk horizon)

**National Cooperative Soil Survey**

**U.S.A.**



LOCATION SHORIM

NV

**Established Series**

Rev. JR/RLB/WED

05/97

**SHORIM SERIES**

The Shorim series consists of moderately deep to duripan, well drained soils that formed in residuum from igneous rock flows with a component of calcareous eolian material. Shorim soils are on footslopes of hills. Slopes are 2 to 30 percent. The mean annual precipitation is about 4 inches and the mean annual temperature is about 63 degrees F.

**TAXONOMIC CLASS:** Loamy-skeletal, mixed, thermic Typic Haplodurids

**TYPICAL PEDON:** Shorim very gravelly sandy loam, rangeland. The soil surface is covered with 80 percent rock fragments, mainly pebbles.

A1--0 to 3 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; moderate coarse platy structure; soft, very friable, nonsticky and nonplastic; few very fine roots, many fine and medium vesicular and few very fine tubular pores; 50 percent pebbles; strongly effervescent; moderately alkaline (pH 8.0); clear wavy boundary. (1 to 6 inches thick)

A2--3 to 10 inches; pale brown (10YR 6/3) gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium platy structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine vesicular, and common very fine tubular pores; 30 percent pebbles; violently effervescent; moderately alkaline (pH 8.4); gradual wavy boundary. (4 to 12 inches thick)

Bk--10 to 21 inches; very pale brown (10YR 7/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and slightly plastic, few very fine roots; many very fine and fine interstitial and common very fine tubular pores; 40 percent pebbles; common thick lime coats on rock fragments; violently effervescent; strongly alkaline (pH 9.0); abrupt wavy boundary. (8 to 20 inches thick)

Bqkm--21 to 24 inches; pale brown (10YR 6/3) silica-lime cemented hardpan, yellowish brown (10YR 5/4) moist; indurated laminar cap. (1 to 5 inches thick.)

R--24 inches; extremely hard basalt bedrock.

**TYPE LOCATION:** Nye County, Nevada; 1,600 feet south and 2,600 feet east of the projected northwest corner of Section 11, T. 14 S., R. 48 E.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry. The upper part of the moisture control section is moist for a very short time in late winter.

**Soil temperature** - 64 to 70 degrees F.

**Depth to duripan** - 20 to 38 inches.

**Depth to bedrock** - 21 to 40 inches.

**Control section -**

Rock fragments: 35 to 60 percent, mainly pebbles.

Clay content: 5 to 15 percent.

**A horizon -**

Value: 6 or 7 dry, 4 or 5 moist.

Chroma: 2 through 4.

**Bk horizon -**

Value: 6 or 7 dry, 4 or 5 moist.

Chroma: 3 or 4.

Texture of fine earth: Fine sandy loam, sandy loam and coarse sandy loam.

Reaction: Strongly alkaline or very strongly alkaline.

Duripan: Continuous laminar cap directly on top of hard bedrock.

**COMPETING SERIES:** This is the Skelon (NV) series. Skelon soils have a thick duripan over unconsolidated alluvium.

**GEOGRAPHIC SETTING:** Shorim soils are on footslopes of hills and formed from igneous rock flows. Slopes are 2 to 30 percent. Elevations are 3,000 to 4,500 feet. The climate is warm and arid. Distribution of precipitation is relatively even with slight peaks in January and August. Mean annual precipitation is 3 to 5 inches. The mean annual temperature is 62 to 67 degrees F., and the frost-free season is about 210 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Akela, Arizo and Canutio soils. The Akela soils lack a duripan and are shallow to bedrock. Arizo and Canutio soils are very deep soils in drainageways.

**DRAINAGE AND PERMEABILITY:** Well drained, medium runoff; moderately rapid permeability above the duripan.

**USE AND VEGETATION:** Livestock grazing and wildlife habitat. The vegetation is mainly shadscale, desertholly, creosotebush, ephedra, and white bursage.

**DISTRIBUTION AND EXTENT:** Southern Nevada. The soils are not extensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES PROPOSED:** Nye County, Nevada, Southwest Part, 1985. The name is coined.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Duripan - Indurated zone(Typic) from about 21 to 24 inches (Bqkm horizon).

Particle size control section - The zone from 10 to 21 inches.

National Cooperative Soil Survey

U.S.A.

**LOCATION SKELON**

NV

**Established Series**

Rev. HJB/RLB

05/97

**SKELON SERIES**

The Skelon series consists of moderately deep over an indurated duripan, well drained soils formed in alluvium primarily from limestone, basalt, shale, quartzite and obsidian. Skelon soils are on alluvial fans and fan piedmonts. Slope gradients are 0 to 15 percent. The mean annual precipitation is about 4 inches and the mean annual temperature is about 62 degrees F.

**TAXONOMIC CLASS: Loamy-skeletal, mixed, thermic Typic Haplodurids**

**TYPICAL PEDON:** Skelon gravelly sandy loam, rangeland. (Colors are for dry soil unless otherwise noted.) About 45 percent of the soil surface is covered with pebbles, 2 percent with cobbles overlain by a 1/2 to 1-inch thick mantle of alluvial sand.

A1--0 to 2 inches; very pale brown (10YR 7/3) gravelly sandy loam, yellowish brown (10YR 5/4) moist; moderate coarse platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine vesicular and few very fine and fine interstitial pores; 15 percent pebbles; violently effervescent; moderately alkaline (pH 8.2); abrupt wavy boundary. (1 to 3 inches thick)

A2--2 to 4 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine interstitial pores; 10 percent pebbles; few thin lime coats on ped faces and lining pores; violently effervescent; moderately alkaline (pH 8.4); clear wavy boundary. (2 to 3 inches thick)

Bw--4 to 13 inches; very pale brown (10YR 7/3) very gravelly fine sandy loam, light yellowish brown (10YR 6/4) moist; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; many very fine and few fine interstitial pores; 45 percent pebbles, 5 percent cobbles; few thin lime-silica coats on undersides of rock fragments; violently effervescent; moderately alkaline (pH 8.4); clear wavy boundary. (6 to 10 inches thick)

Bqk1--13 to 20 inches; very pale brown (10YR 7/3) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; about 30 percent of horizon has moderate fine platy structure and the remainder is massive; soft, very friable, nonsticky and nonplastic; many very fine and few medium roots; common very fine interstitial pores; 50 percent pebbles, 5 percent cobbles; lime-silica pendants on undersides of most rock fragments; violently effervescent; moderately alkaline (pH 8.4); gradual wavy boundary. (6 to 12 inches thick)

Bqk2--20 to 28 inches; very pale brown (10YR 8/3) very gravelly fine sandy loam, very pale brown (10YR 7/4) moist; massive; soft and slightly hard, very friable, nonsticky and nonplastic; many very fine and common medium roots; common very fine interstitial pores; 40 percent pebbles, 5 percent cobbles; few thin lime coatings along fractures and pores; lime-silica coatings on undersides of most

rock fragments; violently effervescent; moderately alkaline (pH 8.4); clear irregular boundary. (4 to 12 inches thick)

Bqkm--28 to 44 inches; white (10YR 8/1) indurated duripan with thin continuous laminar cap, very pale brown (10YR 7/3) moist; massive; extremely firm; strongly cemented horizontal lenses in lower part; 30 percent pebbles, 5 percent cobbles; violently effervescent. (6 to 36 inches thick)

2B'qk1--44 to 52 inches; very pale brown (10YR 8/3) very gravelly sandy loam, very pale brown (10YR 7/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine interstitial pores; 40 percent pebbles, 5 percent cobbles; common weakly silica and lime-cemented masses and few discontinuous strongly silica and lime cemented plates; violently effervescent; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 24 inches thick)

2B'qk2--52 to 60 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; 60 percent pebbles, 10 percent cobbles; common weakly and strongly silica and lime-cemented masses and discontinuous plates; violently effervescent; strongly alkaline (pH 8.6).

**TYPE LOCATION:** Nye County, Nevada; about 2.75 miles southeast of Lathrop Wells; 1700 feet south and 1500 feet east of the northwest corner of section 32, T. 15S, R 50E, MDBM.

#### **RANGE IN CHARACTERISTICS**

**Soil moisture** - Usually dry, moist in some part for short periods during winter and early spring months and for 10 to 20 days cumulative between July to October due to convection storms.

**Soil temperature** - 59 to 65 degrees F.

**Depth to duripan** - 20 to 40 inches.

**Effervescence** - Strongly effervescent or violently effervescent.

**Control section** -

Percent clay: 3 to 10 percent.

Rock fragments: 35 to 60 percent, mainly pebbles.

**A horizon** -

Value: 6 or 7 dry, 3 through 6 moist.

Chroma: 2 or 3 dry, 3 or 4 moist.

**Bw, Bqk1 and Bqk2 horizons** -

Value: 6 through 8 dry, 3 through 7 moist.

Chroma: 2 through 4 dry, 3 through 6 moist.

Texture of fine earth: Fine sandy loam or coarse sandy loam.

Rock fragments: 35 to 60 percent weighted average, mainly pebbles.

Reaction: Mildly alkaline or strongly alkaline.

**Bqkm horizon -**

Weakly to strongly cemented duripan with continuous laminar cap.

**COMPETING SERIES:** This is the Shorim (NV) series. Shorim soils have a thin duripan that lies directly over a lithic contact.

**GEOGRAPHIC SETTING:** Skelon soils are on fan piedmonts and alluvial fans. Slopes are 0 to 15 percent. These soils are formed in mixed alluvium primarily from limestone, basalt, shale and quartzite. Elevations are 2,300 to 5,000 feet. The climate is arid with cool winters and hot summers. Precipitation comes mostly as fall and winter rain. Average annual precipitation is between 3 and 8 inches. Average annual temperature is between 58 and 63 degrees F. The frost-free season is about 210 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are Corbilt and Shamock soils which contain less than 35 percent rock fragments in the control section. Corbilt soils also lacks a hardpan within the control section.

**DRAINAGE AND PERMEABILITY:** Well drained; slow or medium runoff; moderately rapid permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The vegetation is principally white bursage with some creosotebush, spiny hopsage and prickly pear cactus.

**DISTRIBUTION AND EXTENT:** Southern Nevada. Skelon soils are not extensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** Esmeralda County, Nevada, 1984.

**REMARKS:**

**Diagnostic horizons and features recognized in this pedon are:**

Ochric epipedon - Zone from the surface to 7 inches.

Duripan feature - Indurated (Typic) zone at about 28 to 44 inches (Bqkm horizon).

Cambic horizon - The zone from 4 to 13 inches.

Particle-size control section - The zone at 10 to 28 inches.

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION STROZI

NV

Established Series

Rev. WRK/RLB/WED

05/97

**STROZI SERIES**

The Strozi series consists of moderately deep over a duripan, well drained soils that formed in mixed alluvium. Strozi soils are on fan piedmont remnants. Slopes are 0 to 8 percent. The mean annual precipitation is about 8 inches and the mean annual temperature is about 62 degrees F.

**TAXONOMIC CLASS:** Fine-loamy, mixed, thermic Argidic Argidurids

**TYPICAL PEDON:** Strozi gravelly fine sandy loam - rangeland. About 75 percent of the soil surface is covered with pebbles.

A1--0 to 2 inches; very pale brown (10YR 7/3) gravelly fine sandy loam, yellowish brown (10YR 5/4) moist; moderate very coarse platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine and fine vesicular pores; 20 percent pebbles; violently effervescent; moderately alkaline (pH 8.4); clear wavy boundary. (2 to 4 inches thick)

A2--2 to 5 inches; very pale brown (10YR 7/3) fine sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine roots; common fine interstitial pores; 10 percent pebbles; moderately alkaline (pH 8.4); clear wavy boundary. (2 to 5 inches thick)

Bt--5 to 13 inches; reddish yellow (7.5YR 7/6) clay loam, strong brown (7.5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine interstitial pores; common distinct clay film bridging sand grains; 5 percent pebbles; moderately alkaline (pH 8.4; ); clear wavy boundary (4 to 8 inches thick)

Bqk--13 to 32 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very firm, nonsticky and nonplastic; common fine roots; common very fine and fine interstitial pores; 45 percent pebbles; 30 percent strongly cemented durinodes, violently effervescent; strongly alkaline (pH 8.6); abrupt wavy boundary. (10 to 24 inches thick)

Bqkm--32 to 33 inches; white (10YR 8/1) silica-and lime-cemented hardpan with a very thin discontinuous laminar cap, very pale brown (10YR 8/3) moist; massive; hard, very firm,; strongly cemented grading to weakly cemented in the lower part; violently effervescent; strongly alkaline (pH 8.6); clear wavy boundary. (1 to 6 inches thick)

Cqk--33 to 60 inches, light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very firm, nonsticky and nonplastic; few fine roots; common very fine and fine interstitial pores; 45 percent pebbles; weak continuous brittle matrix; violently effervescent; strongly alkaline (pH 8.6)

**TYPE LOCATION:** Nye County, Nevada; in Sacorbatus Flat about 12 miles northwest of the town of Beatty, about 2,000 feet east and 3,000 feet south of the projected northwest corner of Section 11, T. 10 S., R. 45 E.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, moist during the winter and early spring and for 10 to 20 days periods following summer convection storms July through October.

**Soil temperature** - 63 to 67 degrees F.

**Depth to lower boundary of Bt horizon** - 10 to 16 inches.

**Depth to duripan** - 20 to 40 inches.

**Control Section -**

Clay Content: 27 to 35 percent.

Sand content: 30 to 45 percent.

Rock fragments: 5 to 15 percent.

Effervescent: Noneffervescent or slightly effervescent.

**A horizon -**

Value: 6 or 7 dry, 4 or 5 moist.

Chroma - 3 or 4

**Bt horizon -**

Value: 5 through 7 dry, 4 or 5 moist.

Chroma: 3 through 6.

Rock fragments: 5 to 15 percent.

**Bqk horizon -**

Value: 5 through 8 dry or moist.

Chroma: 1 or 2 dry, 3 or 4 moist.

Rock fragments: 35 to 50 percent.

Reaction: Moderately alkaline or strongly alkaline.

**COMPETING SERIES:** This is the Joshua (CA) series. Joshua soils have argillic horizons with sandy loam or sandy clay loam fine earth textures (more than 45 percent sand) and 15 to 35 percent fine pebbles.

**GEOGRAPHIC SETTING:** Strozi soils are on fan piedmont remnants. These soils formed in alluvium primarily from igneous rocks. Slopes are 0 to 8 percent. Elevations are 2,300 to 4,500 feet. The climate is arid with cool winters and summers are hot and dry. Distribution of precipitation is relatively even with



slight peaks in January and August. The mean annual precipitation is between 6 and 9 inches; mean annual temperature is between 58 to 62 degrees F., and the frost-free season is about 210 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** This is the Canutio series. The Canutio has a loamy-skeletal control section.

**DRAINAGE AND PERMEABILITY:** Well drained. Slow runoff; moderately slow permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The present vegetation is mainly shadscale.

**DISTRIBUTION AND EXTENT:** Nye County, Nevada. These soils are not extensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES PROPOSED:** Nye County, Nevada (Southwest Part). 1982. The name is coined.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Argillic horizon - The zone from about 5 to 13 inches (Bt horizon)

Duripan - The zone from about 32 to 33 inches (Bqkm horizon)

Haplic feature - duripan is not indurated.

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION UPSPRING

CA+NV

Established Series

Rev. JCW/TDC

05/97

**UPSPRING SERIES**

The Upspring series consists of very shallow and shallow, somewhat excessively drained soils formed in material weathered from extrusive basic igneous rocks. Upspring soils are on hills, mountains, and plateaus and have slopes of 15 to 75 percent. The average annual precipitation is 5 inches and the mean annual temperature is 63 degrees F.

**TAXONOMIC CLASS:** Loamy-skeletal, mixed, calcareous, thermic Lithic Torriorthents

**TYPICAL PEDON:** Upspring very stony loam, on a south southwest slope 15 percent on a plateau under extremely sparse cover of atriplex at 1,700 feet elevation. (colors are for dry soil unless otherwise stated. When described the soil was dry throughout.)

About 45 percent pebbles, 10 percent cobbles, and 15 percent stones on the surface.

A1--0 to 1 inch; light gray (10YR 7/2) very stony loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common very fine tubular and interstitial pores; 45 percent pebbles, 10 percent cobbles, and 15 percent stones (mostly on the surface); strongly effervescent, disseminated lime; moderately alkaline (pH 8.0); abrupt smooth boundary. (1 to 2 inches thick)

A2--1 to 6 inches; light gray (10YR 7/2) very stony sandy loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common fine interstitial pores; 45 percent pebbles, 10 percent cobbles, and 15 percent stones; violently effervescent, disseminated lime and lime coating rock fragments; moderately alkaline (pH 8.0); clear irregular boundary. (2 to 8 inches thick)

Bk--6 to 8 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; few fine interstitial pores; 50 percent pebbles, 10 percent cobbles; violently effervescent, disseminated lime and lime coating on rock fragments; moderately alkaline (pH 8.0); abrupt wavy boundary. (1 to 4 inches thick)

R--8 inches fractured hard basalt.

**TYPE LOCATION:** Inyo County, California, Saline Valley; about 3 miles north of the dune road to lower Warm Springs; at the lower edge of the Saline Range lava flow; NW1/4 NW1/4 section 14, T.13S., R.38E., MDB&M.

**RANGE IN CHARACTERISTICS:** Depth to a lithic contact of hard basalt ranges from 4 to 14 inches thick. The mean annual soil temperature is 68 degrees F. The soil contains small amounts of amorphous material from pyroclastic volcanic rocks. Clay averages 10 to 18 percent from the surface to lithic contact. These soils are dry from June through November for about 180 days. The soil temperature is warmer than 41 degrees F. from about March to January for about

300 days. The soils is intermittently moist from January through May but never moist for 90 consecutive days.

The A horizon has dry color of 10YR 7/2 and 7/3 and moist color of 10YR 4/2, 4/3, 5/2 or 5/3. It is very gravelly to very stony sandy loam and averages 35 to 70 percent rock fragments.

The Bk horizon has 35 to 60 percent rock fragments.

**COMPETING SERIES:** These are the Akela(NM), Beach(T TX), Chatticup(T NV), Haleburu(NV), Hindu(AZ), Hulda(T AZ), Razorback(T AZ) and Tecopa(CA) series. Akela soils are moist during the summer from thunder storms. Beach have hue of 2.5YR and 5YR, and contain mainly sandstone fragments. Chatticup soils have 60 to 80 percent rock fragments, mainly pebbles. Haleburu and Razorback soils are moist 10 to 20 days cumulative between July and October. Hindu and Hulda soils are moist more than 20 days cumulative between July and September. Tecopa soils lack an influence of amorphous materials from pyroclastic sources and have formed in materials weathered from quartzite, schist, and gneiss.

**GEOGRAPHIC SETTING:** Upspring soils are on plateaus, hills, and mountains. Slopes are 15 to 75 percent. The soils formed in material from extrusive basic igneous rocks with some pyroclastic materials. Elevations are 1,600 to 4,200 feet. The climate is arid, with hot, dry summers with infrequent thunder showers of short duration, and mildly slightly moist winters. The average annual precipitation is 4 to 6 inches. The mean annual temperature is 63 degrees F.; the average mean January temperature is 45 degrees F.; and the mean July temperature is 85 degrees F. The frost free season is 235 to 300 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Blacktop soils. Blacktop soils have mesic soil temperature.

**DRAINAGE AND PERMEABILITY:** Somewhat excessively drained; rapid runoff; moderately rapid permeability.

**USE AND VEGETATION:** Used mainly for watershed, wildlife habitat, and recreation land. The native vegetation is primarily shadscale and winterfat.

**DISTRIBUTION AND EXTENT:** These soils are mapped in the lava flows of northern California Desert and are moderately extensive.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** Inyo County, California, Saline Valley Area, 1980.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from 0 to 6 inches (A1 and A2 horizons)

Lithic contact - the boundary with hard rock at about 8 inches.

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION YERMO

CA+NV

**Established Series**

Rev. GAW/JWF/GWH

05/97

**YERMO SERIES**

The Yermo series consists of deep, well drained soils that formed in mixed, moderately coarse textured, calcareous, gravelly or cobbly alluvium. Yermo soils are on long, smooth, alluvial fans or uplands and have slopes of 5 to 50 percent. The mean annual precipitation is about 5 inches and the mean annual temperature is about 62 degrees F.

**TAXONOMIC CLASS:** Loamy-skeletal, mixed, calcareous, thermic Typic Torriorthents

**TYPICAL PEDON:** Yermo cobbly sandy loam, on a 3 percent north facing slope under creosotebush, bursage, hopsage, Mormon tea, yucca, and a few Joshua trees at 3,600 feet elevation. (Colors are for dry soil unless otherwise stated. When described the soil was dry throughout.)

A--0 to 10 inches; pale brown (10YR 6/3) cobbly sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; few fine interstitial pores; about 15 percent pebbles and 10 percent cobbles; strongly effervescent with disseminated lime; moderately alkaline

(pH 8.0); abrupt smooth boundary. (8 to 12 inches thick)

C1--10 to 25 inches; very pale brown (10YR 7/3) gravelly sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common coarse and medium roots; common fine tubular pores; about 15 percent pebbles and 5 percent cobbles; violently effervescent with disseminated lime; moderately alkaline (pH 8.0); gradual smooth boundary. (10 to 15 inches thick).

C2--25 to 60 inches; light gray (10YR 7/2) very gravelly sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; few very fine interstitial and tubular pores; about 55 percent pebbles and 15 percent cobbles; 1/8 to 1/4 inch lime coatings on bottom of coarse fragments; violently effervescent with disseminated lime; moderately alkaline (pH 8.0).

**TYPE LOCATION:** San Bernardino County, California; in Lucerne Valley about 0.6 miles southeast of Meridian Road on the turn to Pfizer Cement plant; in NE1/4 NW1/4 NE1/4 section 6, T.3 N., R.1 E.

**RANGE IN CHARACTERISTICS:** The mean annual soil temperature is 59 to 63 degrees F. and the soil temperature usually is not below 47 degrees F. at any time. The soil between the depths of about 8 and 24 inches is dry all the time from mid-spring to early winter and is not continuously moist for as long as 60 days.

The A horizon is pale brown, light yellowish brown, brown or yellowish brown (10YR 6/3, 6/4, 5/3, 5/4). It is cobbly sandy loam or gravelly sandy loam and has 15 to 25 percent gravel and 5 to 15 percent cobbles. Structure is weak to moderate, very fine and fine subangular blocky. This horizon is strongly calcareous to very strongly calcareous with disseminated lime, and is moderately to strongly alkaline.

The C horizon is light gray or very pale brown (10YR 7/2, 7/3). It is gravelly sandy loam and has 15 to 25 percent gravel and up to 5 percent cobbles in the upper part. It is moderately to strongly alkaline and is strongly effervescent. The lower part of the horizon is similar to the upper part but has 40 to 60 percent gravel and up to 15 percent cobbles.

**COMPETING SERIES:** These are the Canutio, Emot and Ogral series.

All of the competing soils are intermittently moist in the moisture control section in the summer. Emot soils have more than 50 percent silt in the fine earth fraction. Ogral soils have hue of 7.5YR or 5YR throughout.

**GEOGRAPHIC SETTING:** Yermo soils are on broad, alluvial fans and on older, faulted or uplifted uplands or valley floors at elevations of about 3,600 to 4,100 feet. Slopes range from 5 to 50 percent. The soils formed in mixed, moderately coarse textured gravelly or cobbly alluvium. The climate is arid, with hot, dry summers and cool, somewhat moist winters. The mean annual precipitation is 4 or 5 inches, most of which occurs as rain in the winter. Some moisture falls occasionally as snow. The mean annual temperature is about 62 degrees F.; the mean January temperature is 46 degree F.; and the mean July temperature is 84 degrees F. The frost free season is 210 to 255 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Arizo and Soboba soils. Arizo soils are loamy sand or coarser. Soboba soils have a xeric moisture regime and are loamy sand or coarser.

**DRAINAGE AND PERMEABILITY:** Well drained; medium to rapid runoff; moderately rapid permeability.

**USE AND VEGETATION:** Used for wildlife habitat and homesites. Vegetation is creosotebush, white bursage, scattered yucca and Joshua tree and annual grasses and forbs.

**DISTRIBUTION AND EXTENT:** Uplands and alluvial fans of Mojave Desert. The soils are moderately extensive.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** San Bernardino County, California, Mojave River Area, 1978.

**REMARKS:**

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - 0 to 10 inches.

Particle-size control section - 10 to 40 inches.

**National Cooperative Soil Survey**

**U.S.A.**

LOCATION ZALDA

NV

**Established Series**

Rev. JR/RLB/WED

05/97

**ZALDA SERIES**

The Zalda series consists of well drained soils that are shallow to a thin duripan over bedrock. Zalda soils are on low hill summits and crests. Zalda soils formed in residuum from igneous rocks, with a component of eolian material. Slopes are 2 to 30 percent. The mean annual precipitation is about 5 inches and the mean annual temperature is about 63 degrees F.

**TAXONOMIC CLASS:** Loamy, mixed, thermic, shallow Typic Haplodurids

**TYPICAL PEDON:** Zalda gravelly fine sand, rangeland. (Colors are for dry soil unless otherwise noted.) The soil surface is covered with 40 percent pebbles and 2 percent cobbles.

A1--0 to 3 inches; pale brown (10YR 6/3) gravelly fine sand, brown (10YR 5/3) moist; single grained; loose, nonsticky and nonplastic; common very fine and fine interstitial and tubular pores; few very fine roots; 15 percent pebbles; moderately alkaline (pH 8.2); gradual wavy boundary. (2 to 7 inches thick)

A2--3 to 7 inches; very pale brown (10YR 7/3) loam, brown (10YR 4/3) moist; moderate medium and coarse platy structure; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine vesicular, common very fine and fine interstitial pores; violently effervescent; strongly alkaline (pH 8.6); abrupt wavy boundary. (3 to 8 inches thick)

Bqkm--7 to 8 inches; extremely hard lime-silica hardpan with an indurated laminar cap 3 to 5 millimeters thick; abrupt wavy boundary. (1 to 8 inches thick)

R--8 inches; basalt.

**TYPE LOCATION:** Nye County, Nevada; 750 feet west, 200 feet north of the projected southeast corner of section 31, T. 13 S., R. 49 E.

**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, moist for short periods of time in the late winter and spring for 10 to 20 days from July through mid October following summer convection storms.

**Soil temperature** - 62 to 67 degrees F.

**Depth to duripan** - 7 to 14 inches.

**Depth to bedrock** - 8 to 15 inches.

**Other features** - Some pedons contain a thin Bw horizon that slightly effervescent.

**Control section -**

Clay content: 6 to 18 percent.

Rock fragments: 5 to 25 percent.

**A horizons -**

Value: 6 or 7 dry, 4 through 6 moist.

Chroma: 3 or 4.

Texture of fine earth: Fine sandy loam or loam.

**Bqkm horizon -**

Continuous laminar cap on unfractured bedrock.

**COMPETING SERIES:** These are the Alko(NV), Muroc(CA), Nebona(CA), and Stewart(AZ) series. Alko, Nebona, and Stewart soils lack bedrock under the hardpan. Muroc soils have a duripan over soft weathered granitic rock, and have sandy loam or coarse sandy loam textures, and contain fine pebbles from decomposed granite.

**GEOGRAPHIC SETTING:** Zalda soils are on low hill summits and crests. The soils formed in residuum from rhyolitic ash fall tuffs and igneous flow rocks with a component of eolian materials. Slopes are 2 to 30 percent. Elevations are 2,500 to 4,200 feet. The climate is arid with relatively even distribution of moisture with slight peaks in January and August. The average annual precipitation is between 3 and 10 inches; the average annual temperature is about 60 to 65 degrees F., and the frost-free season 210 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Akela, Longjim and Shorim soils. Akela soils lack duripans over the bedrock and are found near rock outcrops. Longjim and Shorim soils have loamy-skeletal control sections are generally found on steeper positions of the landform.

**DRAINAGE AND PERMEABILITY:** Well drained; moderate to rapid runoff; moderately rapid permeability above the duripan.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The vegetation consists of shadscale, desertholly, white bursage, creosotebush, and wolfberry.

**DISTRIBUTION AND EXTENT:** Southern Nevada. The soils are not extensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES PROPOSED:** Nye County, Nevada, Southwest Part, 1985. The name is coined.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Duripan - The indurated zone(Typic) from about 7 to 8 inches (Bqkm horizon).

**National Cooperative Soil Survey**

**U.S.A.**

**LOCATION ZIBATE**

NV

**Established Series**

Rev. JR/RLB

05/97

**ZIBATE SERIES**

The Zibate series consists of shallow, well drained soils that formed in residuum of volcanic flow rock, tuff and quartzite. Zibate soils are on hills and mountain slopes. Slopes are 8 to 90 percent. Mean annual precipitation is about 11 inches and mean annual temperature is about 60 degrees F.

**TAXONOMIC CLASS:** Loamy-skeletal, mixed, thermic Lithic Haplargids

**TYPICAL PEDON:** Zibate very gravelly sandy loam, rangeland. (Colors are for dry soil unless otherwise noted.) The soil surface is partially covered with 45 percent pebbles and 5 percent with cobbles.

A1--0 to 3 inches; pale brown (10YR 6/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; few very fine tubular pores; 40 percent pebbles and 3 percent cobbles; moderately alkaline (pH 8.0); clear smooth boundary. (0 to 7 inches thick)

A2--3 to 6 inches; yellowish brown (10YR 5/4) extremely gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common medium and coarse, and few very coarse roots; common very fine and fine tubular pores; 45 percent pebbles and 20 percent cobbles; mildly alkaline (pH 7.8); clear smooth boundary. (0 to 5 inches thick)

Bt1--6 to 10 inches; brown (10YR 5/3) extremely gravelly loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common medium and coarse, and few very coarse roots; common very fine and fine tubular pores; common distinct clay films on peds faces and coating rock fragments; 55 percent pebbles and 10 percent cobbles; mildly alkaline (pH 7.6); clear smooth boundary. (3 to 13 inches thick)

Bt2--10 to 19 inches; brown (10YR 5/3) extremely gravelly loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard; firm, slightly sticky and slightly plastic; common medium and coarse roots; common fine and medium interstitial pores; common distinct clay films on rock fragments; 65 percent pebbles and 10 percent cobbles; mildly alkaline (pH 7.6); abrupt broken boundary. (0 to 10 inches thick)

R--19 inches; hard fractured rhyolitic bedrock; common faint clay films in fractures.

**TYPE LOCATION:** Nye County, Nevada; approximately 2 miles northeast of Silicon Mine, about 2,375 feet west and 1,955 feet south of the northeast corner of section 21, T. 11 S., R. 48 E.



**RANGE IN CHARACTERISTICS:**

**Soil moisture** - Usually dry, but moist in some part for short periods in the winter and early spring months and for 10 to 20 days cumulative between July and October due to convection storms.

**Soil temperature** - 59 to 64 degrees F.,

**Depth to bedrock** - 14 to 20 inches.

**Effervescence** - Noneffervescent to strongly effervescent.

**A horizon -**

Hue: 10YR or 7.5YR.

Value: 3 through 6 dry, 3 through 5 moist.

Chroma: 3 or 4.

Reaction: Mildly alkaline to strongly alkaline.

**Bt horizon -**

Hue: 10YR or 7.5YR.

Value: 3 through 5 dry or moist.

Chroma: 3 or 4.

Texture of fine earth: Averages loam or clay loam.

Clay content: 18 to 35 percent.

Rock fragments: 60 to 85 percent.

Structure: Subangular blocky or horizon is massive.

Consistence: Soft through hard dry, very friable through firm moist, slightly sticky and slightly plastic wet.

Reaction: Mildly alkaline or moderately alkaline.

**COMPETING SERIES:** These are the Bosa(AZ) and Newera(T NV) series. Bosa soils are moist more than 20 days cumulative during the summer, have soil temperature of 69 to 72 degrees F., and have hue of 5YR and 7.5YR. Newera soils have 35 to 60 percent rock fragments.

**GEOGRAPHIC SETTING:** Zibate soils are on all aspects of summits and side slopes of hills and mountains. These soils formed in residuum of volcanic flow rock, tuff, and quartzitic bedrock. Slopes are 8 to 90 percent. Elevations are 3,400 to 5,300 feet. The climate is mild, arid with warm dry summers and cold winters. The mean annual precipitation is 9 to 13 inches; mean annual temperature is 57 to 63 degrees F., and the frost-free season is 160 to 200 days.

**GEOGRAPHICALLY ASSOCIATED SOILS:** These are the Zoyer soils. Zoyer soils lack an argillic horizon.

**DRAINAGE AND PERMEABILITY:** Well drained; rapid or very rapid runoff; moderately slow permeability.

**USE AND VEGETATION:** Rangeland and wildlife habitat. The present vegetation is mainly blackbrush, Nevada ephedra, wolfberry, spiny menodora, and shadscale.

**DISTRIBUTION AND EXTENT:** Southern Nevada. These soils are moderately extensive. MLRA 30.

**MLRA OFFICE RESPONSIBLE:** Davis, California

**SERIES ESTABLISHED:** Esmeralda County, Nevada. 1984.

**REMARKS:** Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - The zone from the surface to about 6 inches.

Argillic horizon - The zone from about 6 to 19 inches (Bt horizon).

Lithic contact - The contact at 19 inches (R horizon).

Particle-size control section - The zone from 6 to 19 inches (Bt horizon).

**National Cooperative Soil Survey**

**U.S.A.**

## **APPENDIX B**

### **SOIL MAPPING UNIT INTERPRETATIONS AND LIMITATIONS**

The map units presented are based on unpublished soil survey information from southwestern Nye County, Nevada, and not from the Yucca Mountain area; however, interpretations and limitations of series should be characteristic of the same series mapped at Yucca Mountain. This information was obtained from NRCS (1998) and the U.S. Department of Agriculture, NRCS, Southern Nevada Resource Area Office, Las Vegas, Nevada. The NRCS (1998) states that these data have not been through a final correlation in accordance with National Soil Survey Policy and should not be treated as advanced data. Limitations of the information presented here are detailed in the text explaining the tables.

BUILDING SITE DEVELOPMENT

General Use

(The information in this report indicates the dominant soil condition but does not eliminate the need for onsite investigation)

	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2010:						
Longjim-----	Severe: cemented pan	Severe: cemented pan	Severe: cemented pan	Severe: slope, cemented pan	Severe: cemented pan	Severe: cemented pan
2140:						
Jonnice-----	Severe: cemented pan	Moderate: shrink-swell, cemented pan, large stones	Severe: cemented pan	Moderate: shrink-swell, slope, cemented pan	Moderate: cemented pan, shrink-swell, large stones	Moderate: small stones, droughty, cemented pan
2191:						
Pinez-----	Severe: cutbanks cave	Moderate: shrink-swell	Moderate: cemented pan, shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Severe: small stones, droughty
Lealandic-----	Severe: cemented pan	Severe: shrink-swell	Severe: cemented pan, shrink-swell	Severe: shrink-swell	Severe: shrink-swell	Severe: small stones

			shrink-swell			
Arizo-----	Severe:	Severe:	Severe:	Severe:	Moderate:	Severe:
	cutbanks cave	flooding	flooding	flooding	flooding,	small stones,
					large stones	droughty
2212:						
Yermo-----	Slight	Slight	Slight	Slight	Slight	Severe:
						small stones
Bullfor-----	Severe:	Slight	Moderate:	Slight	Slight	Moderate:
	cutbanks cave		cemented pan			small stones,
						droughty,
						cemented pan
2230:						
Skelon-----	Severe:	Moderate	Severe:	Moderate	Moderate	Moderate
	cemented pan	cemented pan	cemented pan	cemented pan	cemented pan	small stones,
						droughty
2269:						
Greyeagle-----	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
	cemented pan,	cemented pan	cemented pan	cemented pan	cemented pan	small stones,
	cutbanks cave					droughty,
						cemented pan
Yermo-----	Slight	Slight	Slight	Slight	Slight	Severe:
						small stones
Strozi-----	Moderate:	Slight	Moderate:	Slight	Slight	Moderate:
	cemented pan		cemented pan			excess salt,
						small stones,
						droughty
2280:						
Shorim-----	Severe:	Moderate:	Severe:	Severe:	Moderate:	Severe:

depth to rock   slope,	depth to rock   slope	depth to rock,   small stones,
	depth to rock	slope   droughty

BUILDING SITE DEVELOPMENT--Continued

General Use

	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2280 (con.):						
Zalda-----	Severe:   depth to rock,   cemented pan,   slope	Severe:   slope,   depth to rock	Severe:   depth to rock,   cemented pan,   slope	Severe:   slope,   depth to rock	Severe:   depth to rock,   slope	Severe:   slope,   depth to rock
Upspring-----	Severe:   depth to rock,   slope	Severe:   slope,   depth to rock	Severe:   depth to rock,   slope	Severe:   slope,   depth to rock	Severe:   depth to rock,   slope	Severe:   small stones,   droughty,   slope
2432:						
Zibate-----	Severe:   depth to rock	Severe:   depth to rock	Severe:   depth to rock	Severe:   slope,   depth to rock	Severe:   depth to rock	Severe:   small stones,   depth to rock
2495:						
Downeyville----	Severe:   depth to rock,   slope	Severe:   slope,   depth to rock	Severe:   depth to rock,   slope	Severe:   slope,   depth to rock	Severe:   depth to rock,   slope	Severe:   small stones,   slope,   depth to rock

Gabbvally-----	Severe:	Severe:	Severe:	Severe:	Severe:	Severe:
	depth to rock,	slope,	depth to rock,	slope,	depth to rock,	small stones,
	slope	depth to rock	slope	depth to rock	slope	slope,
						depth to rock



BUILDING SITE DEVELOPMENT

Endnote -- BUILDING SITE DEVELOPMENT

This report shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are "Slight", "Moderate", or "Severe". The limitations are considered "Slight" if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; "Moderate" if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and "Severe" if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

SHALLOW EXCAVATIONS are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or bands to sloughing or caving is affected by soil texture and the depth to the water table.

DWELLINGS AND SMALL COMMERCIAL BUILDINGS are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

LOCAL ROADS AND STREETS have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of

excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

LAWNS AND LANDSCAPING require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION MATERIALS

General Use

(The information in this report indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
2010: Longjim-----	Poor:   cemented pan	Improbable:   excess fines	Improbable:   excess fines	Poor:   cemented pan,   small stones
2140: Jonnic-----	Poor:   cemented pan	Improbable:   small stones	Improbable:   thin layer	Poor:   too clayey,   small stones
2191: Pinez-----	Fair:   cemented pan,   shrink-swell,   thin layer	Improbable:   excess fines	Improbable:   excess fines	Poor:   small stones,   area reclaim
Lealandic-----	Poor:	Improbable:	Improbable:	Poor:

	cemented pan,	thin layer	thin layer	too clayey,
	shrink-swell			small stones
Arizo-----	Fair:	Probable	Probable	Poor:
	large stones			too sandy,
				small stones,
				area reclaim
2212:				
Yermo-----	Good	Improbable:	Improbable:	Poor:
		excess fines	excess fines	small stones,
				area reclaim
Bullfor-----	Good	Improbable:	Improbable:	Poor:
		excess fines	excess fines	too sandy,
				small stones,
				area reclaim
2230:				
Skelon-----	Poor	Probable	Probable	Poor
	cemented pan			small stones,
				area reclaim
2269:				
Greyeagle-----	Poor:	Improbable:	Improbable:	Poor:
	cemented pan	large stones	large stones	cemented pan,
				small stones,
				area reclaim
Yermo-----	Good	Improbable:	Improbable:	Poor:
		excess fines	excess fines	small stones,
				area reclaim
Strozi-----	Good	Probable	Probable	Poor:
				small stones,
				area reclaim

CONSTRUCTION MATERIALS--Continued

General Use

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
2280:				
Shorim-----	Poor: depth to rock	Improbable: thin layer	Improbable: thin layer	Poor: small stones
Zalda-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: depth to rock, cemented pan, small stones
Upspring-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: depth to rock, small stones, slope
2432:				
Zibate-----	Poor: depth to rock	Improbable: excess fines	Improbable: excess fines	Poor: depth to rock, small stones
2495:				
Downeyville----	Poor: depth to rock, slope	Improbable: excess fines	Improbable: excess fines	Poor: depth to rock, small stones, slope

Gabbvally-----	Poor:	Improbable:	Improbable:	Poor:
	depth to rock,	excess fines	excess fines	depth to rock,
	slope			small stones,
				slope

CONSTRUCTION MATERIALS

Endnote -- CONSTRUCTION MATERIALS

This report gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated "Good", "Fair", or "Poor" as a source of roadfill and topsoil. They are rated as a "Probable" or "Improbable" source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this report, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments. The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The report entitled Engineering Index Properties is also available and it provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated "Good" contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet

Soils rated "Fair" have more than 35 percent silt- and clay-sized particles and have a plasticity of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet.

Soils rated "Poor" have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In this report only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the Engineering Index Properties report.

A soil rated as a "Probable" source has a layer of clean sand and gravel or a layer of sand or gravel that contains up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an "Improbable" source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rate "Good" have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated "Fair" are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.



Soils rate "Poor" are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface. The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

ENGINEERING INDEX PROPERTIES

General Use

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
2010:												
Longjim-----	0-3	Gravelly fine sandy loam	SC-SM, GM-GC, GM, SM	A-4, A-2	0	0-5	55-80	50-75	40-60	25-40	15-25	NP-10
	3-8	Gravelly loam	SC-SM, GM-GC, GM, SM	A-4	0	0	55-80	50-75	45-65	35-50	15-25	NP-10
	8-16	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly coarse sandy loam	GM	A-1	0	0	30-55	25-50	15-35	10-20	0-14	NP
	16-20	Indurated			0	0	0	0	0	0	---	NP
	20-45	Cemented			0	0	0	0	0	0	---	NP
2140:												
Jonnic-----	0-2	Gravelly loam	GM-GC, SC-SM, GM, SM	A-2, A-4	0	0-5	60-80	50-75	30-60	25-45	25-35	5-10
	2-21	Very gravelly clay loam,	GC	A-2, A-7	0	5-15	45-60	35-50	25-45	25-40	40-60	15-30

		very gravelly											
		clay											
	21-38	Extremely	GP-GC, GC,	A-2	0-5	40-55	30-45	20-40	10-25	5-20	35-40	10-15	
		cobbly sandy	GM, GP-GM										
		clay loam											
	38-42	Indurated			0	0	0	0	0	0	---	NP	
2191:													
Pinez-----	0-4	Very gravelly	GP-GM, GM	A-1	0	0	45-60	35-50	20-30	10-20	0-14	NP	
		loamy sand											
	4-10	Very gravelly	GM	A-1	0	0	40-50	30-40	20-30	10-15	20-25	NP-5	
		sandy loam											
	10-29	Very gravelly	GM	A-2	0	0	40-50	25-50	20-30	10-25	30-40	5-15	
		sandy clay											
		loam, very											
		gravelly clay											
		loam, very											
		gravelly sandy											
		loam											
	29-41	Extremely	GP	A-1	0	0	20-30	10-20	5-10	0-5	0-14	NP	
		gravelly loamy											
		sand											
	41-51	Indurated			0	0	0	0	0	0	---	NP	

ENGINEERING INDEX PROPERTIES--Continued

General Use

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct						Pct
2191 (con.):												
Lealandic-----	0-5	Very gravelly sandy loam	GM-GC, GM	A-1, A-2	0	0-10	35-55	25-50	20-35	10-20	15-25	NP-10
	5-12	Gravelly sandy clay, gravelly clay, gravelly clay loam	GC, SC, GM, SM	A-7	0	0-10	60-70	50-60	35-45	35-40	40-55	15-25
	12-23	Very gravelly sandy clay, very gravelly clay, extremely gravelly clay loam	GC, GP-GC, GM, GP-GM	A-2	0	0-10	35-50	15-45	10-35	5-30	40-55	15-25
	23-40	Indurated			0	0	0	0	0	0	---	NP
Arizo-----	0-8	Very gravelly sandy loam	GM	A-1	0	0-5	30-55	25-50	20-40	10-20	15-20	NP-5
	8-60	Stratified cobble coarse sand to	GP-GM, GP	A-1	0	10-35	35-55	20-50	10-30	0-10	---	NP

		extremely																
		gravelly sand																
2212:																		
Yermo-----	0-6	Very gravelly	GM, GM-GC	A-1, A-2	0	5-20	35-55	30-50	15-45	10-30	15-25	NP-10						
		sandy loam																
	6-60	Stratified	GM, GM-GC	A-1, A-2	0	10-25	35-55	30-55	15-50	10-35	15-25	NP-10						
		gravelly loam																
		to extremely																
		gravelly sandy																
		loam																
Bullfor-----	0-1	Gravelly loamy	SM	A-1, A-2	0	0	70-85	60-75	40-55	20-30	---	NP						
		sand																
	1-24	Loamy sand,	SM	A-2	0	0	90-100	85-100	55-80	20-30	---	NP						
		fine sand																
	24-25	Indurated			0	0	0	0	0	0	---	NP						
	25-60	Very gravelly	GM	A-1	0	0	35-45	25-35	20-30	10-15	---	NP						
		sandy loam																
2230:																		
Skelon-----	0-4	Gravelly sandy	SM	A-1, A-2	0	0-5	60-80	50-75	40-60	15-35	0-14	NP						
		loam																
	4-28	Stratified	GM, GP-GM	A-1	0-5	0-10	35-55	30-50	15-35	10-20	0-14	NP						
		gravelly fine																
		sandy loam,																
		Gravelly																
		coarse sandy																
		loam																
	28-44	Indurated									---	NP						
	44-52	Gravelly sandy	GM	A-1	0-5	0-10	35-55	30-50	15-40	10-25	0-14	NP						
		loam																
	52-60	Extremely	GP	A-1	0-5	10-25	20-35	15-30	5-15	0-5	0-14	NP						
		gravelly coarse																
		sand																

ENGINEERING INDEX PROPERTIES--Continued

General Use

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
2269:												
Greyeagle-----	0-3	Very gravelly sandy loam	GP-GM, GM	A-1	0	0-10	30-55	25-50	15-30	5-20	20-25	NP-5
	3-6	Gravelly sandy loam	SM	A-1, A-2	0	0	60-75	50-65	30-45	15-30	20-25	NP-5
	6-8	Very gravelly sandy loam, very gravelly loamy sand	GP-GM, GM	A-1	0	0	30-55	25-50	15-35	5-20	20-25	NP-5
	8-24	Indurated			0	0	0	0	0	0	---	NP
	24-60	Stratified extremely cobble loamy sand to very gravelly loamy sand	GP-GM, GM, SP-SM, SM	A-1	0	25-65	30-65	25-60	15-30	5-15	0-14	NP
Yermo-----	0-6	Very gravelly sandy loam	GM, GM-GC	A-1, A-2	0	5-20	35-55	30-50	15-45	10-30	15-25	NP-10
	6-60	Stratified gravelly loam to extremely	GM, GM-GC	A-1, A-2	0	10-25	35-55	30-55	15-50	10-35	15-25	NP-10

		gravelly sandy												
		loam												
Strozi-----	0-5	Gravelly fine	SM, GM	A-2, A-1	0	0	60-85	50-75	40-65	20-35	15-25	NP-5		
		sandy loam												
	5-13	Clay loam	CL	A-6	0	0	85-100	75-95	65-75	50-60	35-40	15-20		
	13-32	Very gravelly	GM, GP-GM	A-1	0	0	35-60	25-50	15-35	5-20	0-14	NP		
		sandy loam												
	32-33	Cemented			0	0	0	0	0	0	---	NP		
	33-60	Very gravelly	GM, GP-GM	A-1	0	0	35-55	25-50	15-35	5-20	0-14	NP		
		sandy loam												
2280:														
Shorim-----	0-3	Very gravelly	GM	A-2, A-1	0	0-10	35-60	25-55	20-45	10-30	15-25	NP-5		
		sandy loam												
	3-10	Gravelly sandy	SM	A-1	0	0-5	65-75	55-65	35-45	20-25	15-25	NP-5		
		loam												
	10-35	Very gravelly	GM, GP-GM,	A-1	0	0-10	30-65	25-55	15-40	5-20	15-25	NP-5		
		fine sandy	SM, SP-SM											
		loam, very												
		gravelly sandy												
		loam												
	35-40	Indurated			0	0	0	0	0	0	---	NP		
	40-50	Unweathered			0	0	0	0	0	0	---	NP		
		bedrock												
Zalda-----	0-3	Gravelly sandy	SM, GM	A-1, A-2	0	0-10	60-80	50-75	40-55	15-30	15-25	NP-5		
		loam												
	3-7	Sandy loam,	SM	A-2, A-4	0	0-10	75-95	70-90	55-70	25-50	15-25	NP-5		
		loam, gravelly												
		sandy loam												
	7-8	Indurated			0	0	0	0	0	0	---	NP		
	8-18	Unweathered			0	0	0	0	0	0	---	NP		
		bedrock												
Upspring-----	0-2	Very gravelly	GM	A-1	0	0-10	35-50	25-40	15-30	10-20	15-25	NP-5		

	sandy loam											
2-12	Very gravelly	GM	A-1	0	0-25	40-55	35-50	25-40	10-20	15-25	NP-5	
	fine sandy											
	loam, very											
	gravelly sandy											
	loam											
12-22	Unweathered			0	0	0	0	0	0	---	NP	
	bedrock											



U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

ENGINEERING INDEX PROPERTIES--Continued

General Use

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
2432:												
Zibate-----	0-6	Very gravelly sandy loam	GM	A-1	0	0-15	35-55	30-50	20-35	10-20	20-25	NP-5
	6-19	Extremely gravelly loam, extremely gravelly clay loam	GP-GC, GM-GC, GC	A-2	0-5	0-25	15-30	10-25	5-20	5-20	25-35	5-15
	19-23	Unweathered bedrock			0	0	0	0	0	0	---	NP
2495:												
Dowmerville----	0-4	Very gravelly fine sandy loam	SC-SM, SM	A-1, A-2	0	5-20	60-70	30-55	25-45	15-30	15-25	NP-10
	4-9	Very gravelly loam, very gravelly fine sandy loam	GC	A-2, A-6	0-5	10-25	40-60	30-50	25-50	20-40	25-35	10-15
	9-13	Unweathered			0	0	0	0	0	0	---	NP

		bedrock											
Gabbwally-----	0-2	Very gravelly	GM	A-1	0	0-10	50-60	35-45	25-40	15-25	20-25	NP-5	
		sandy loam											
	2-8	Very gravelly	GC, GM-GC	A-2	0-5	0-15	50-60	35-50	25-35	15-25	25-35	5-15	
		sandy clay											
		loam, very											
		gravelly sandy											
		loam, very											
		gravelly loam											
	8-12	Unweathered			0	0	0	0	0	0	---	NP	
		bedrock											

ENGINEERING INDEX PROPERTIES

Endnote -- ENGINEERING INDEX PROPERTIES

This report gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

DEPTH to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the published Soil Survey for each soil series under "Soil Series and Their Morphology."

TEXTURE is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Soil Survey Glossary.

Classification of the soils is determined according to the Unified soil classification system and the system adopted by the American Association of State Highway and Transportation Officials.

The UNIFIED system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7

are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock FRAGMENTS larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage of soil particles passing designated sieves (PERCENTAGE PASSING SIEVE NUMBER--) is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

LIQUID LIMIT and PLASTICITY INDEX (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in this report.

PHYSICAL PROPERTIES OF SOILS

General Use

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodability index" apply only to the surface layer)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind	Wind
								K	Kf	T	erodi- bility group	erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
2010:												
Longjim-----	0-3	10-20	1.35-1.50	2.00-6.00	0.11-0.13	Low	0.0-0.5	0.17	0.32	1	4	86
	3-8	10-20	1.35-1.50	0.60-2.00	0.13-0.14	Low	0.0-0.5	0.28	0.49			
	8-16	5-10	1.40-1.60	2.00-6.00	0.04-0.05	Low	0.0-0.5	0.15	0.32			
	16-20	---	---	0.00-0.01	---		---	---	---			
	20-45	---	---	0.00-0.01	---		---	---	---			
2140:												
Jonnice-----	0-2	20-25	1.30-1.50	0.60-2.00	0.06-0.07	Low	1.0-2.0	0.05	0.43	2	5	56
	2-21	35-55	1.25-1.40	0.06-0.20	0.10-0.12	Moderate	0.5-2.0	0.10	0.32			
	21-38	25-35	1.30-1.50	0.20-0.60	0.04-0.05	Moderate	0.0-0.5	0.05	0.49			
	38-42	---	---	0.00-0.01	---		---	---	---			
2191:												
Pinez-----	0-4	5-10	1.50-1.65	6.00-20.00	0.03-0.04	Low	0.0-0.5	0.05	0.17	3	4	86
	4-10	10-15	1.45-1.60	2.00-6.00	0.04-0.06	Low	0.0-0.5	0.10	0.37			

	10-29	18-35	1.35-1.50	0.20-0.60	0.04-0.13	Moderate	0.0-0.5	0.10	0.32		
	29-41	3-8	1.70-1.85	6.00-20.00	0.01-0.03	Low	0.0-0.5	0.02	0.24		
	41-51	---	---	0.00-0.01	---		---	---	---		
Lealandic-----	0-5	8-20	1.40-1.55	2.00-6.00	0.04-0.06	Low	0.0-0.5	0.10	0.37	2	5   56
	5-12	35-50	1.25-1.45	0.06-0.20	0.10-0.12	High	0.0-0.5	0.15	0.32		
	12-23	35-50	1.25-1.40	0.06-0.20	0.07-0.10	High	0.0-0.5	0.10	0.43		
	23-40	---	---	0.00-0.01	---		---	---	---		
Arizo-----	0-8	5-12	1.40-1.55	2.00-6.00	0.05-0.07	Low	0.0-0.5	0.10	0.32	5	5   56
	8-60	0-5	1.45-1.65	>20.00	0.04-0.06	Low	0.0-0.5	0.10	0.32		
2212:											
Yermo-----	0-6	8-18	1.40-1.60	2.00-6.00	0.06-0.08	Low	0.0-0.5	0.05	0.24	5	5   56
	6-60	8-18	1.40-1.60	2.00-6.00	0.06-0.08	Low	0.0-0.5	0.05	0.24		
Bullfor-----	0-1	2-5	1.50-1.70	6.00-20.00	0.05-0.07	Low	0.0-0.5	0.10	0.17	2	3   86
	1-24	2-5	1.50-1.70	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.17	0.20		
	24-25	---	---	0.00-0.20	---		---	---	---		
	25-60	5-10	1.55-1.75	2.00-6.00	0.04-0.06	Low	0.0-0.5	0.10	0.43		
2230											
Skelon-----	0-4	5-10	1.40-1.55	2.00-6.00	0.08-0.10	Low	0.0-0.5	0.15	0.28	2	4   86
	4-28	3-10	1.45-1.65	2.00-6.00	0.05-0.07	Low	0.0-0.5	0.10	0.32		
	28-44	---	---	0.00-0.01	---		---	---	---		
	44-52	5-10	1.45-1.65	2.00-6.00	0.05-0.07	Low	0.0-0.5	0.05	0.32		
	52-60	0-5	1.55-1.75	6.00-20.00	0.03-0.05	Low	0.0-0.5	0.02	0.10		

PHYSICAL PROPERTIES OF SOILS -- Continued

General Use

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility	Wind erodi- bility
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
2269:												
Greyeagle-----	0-3	10-18	1.45-1.65	2.00-6.00	0.04-0.07	Low	0.0-0.5	0.15	0.24	1	5	56
	3-6	10-18	1.50-1.70	2.00-6.00	0.07-0.10	Low	0.0-0.5	0.20	0.24			
	6-8	10-18	1.50-1.70	2.00-6.00	0.04-0.07	Low	0.0-0.5	0.15	0.24			
	8-24	---	---	0.00-0.02	---		---	---	---			
	24-60	5-10	1.65-1.80	6.00-20.00	0.03-0.05	Low	0.0-0.5	0.17	0.20			
Yermo-----	0-6	8-18	1.40-1.60	2.00-6.00	0.06-0.08	Low	0.0-0.5	0.05	0.24	5	5	56
	6-60	8-18	1.40-1.60	2.00-6.00	0.06-0.08	Low	0.0-0.5	0.05	0.24			
Strozi-----	0-5	5-15	1.35-1.55	2.00-6.00	0.08-0.10	Low	0.0-0.5	0.15	0.28	3	4	86
	5-13	27-35	1.35-1.50	0.20-0.60	0.17-0.19	Moderate	0.0-0.5	0.32	0.37			
	13-32	5-10	1.55-1.75	2.00-6.00	0.06-0.08	Low	0.0-0.5	0.15	0.32			
	32-33	---	---	0.00-0.20	---		---	---	---			
	33-60	5-10	1.55-1.75	2.00-6.00	0.07-0.09	Low	0.0-0.5	0.10	0.37			
2280:												
Shorim-----	0-3	5-15	1.45-1.60	2.00-6.00	0.04-0.07	Low	0.0-0.5	0.10	0.32	2	5	56
	3-10	5-15	1.40-1.60	2.00-6.00	0.07-0.08	Low	0.0-0.5	0.15	0.32			
	10-35	5-15	1.35-1.55	2.00-6.00	0.03-0.06	Low	0.0-0.5	0.10	0.32			
	35-40	---	---	0.00-0.01	---		---	---	---			
	40-50	---	---	0.00-0.01	---		---	---	---			

Zalda-----	0-3	6-18	1.35-1.50	2.00-6.00	0.08-0.10	Low	0.0-0.5	0.15	0.32	1	4	86
	3-7	6-18	1.35-1.55	2.00-6.00	0.11-0.13	Low	0.0-0.5	0.28	0.43			
	7-8	---	---	0.00-0.01	---		---	---	---			
	8-18	---	---	0.00-0.01	---		---	---	---			
Upspring-----	0-2	10-18	1.25-1.45	2.00-6.00	0.03-0.06	Low	0.0-0.5	0.15	0.24	1	5	56
	2-12	10-18	1.30-1.50	2.00-6.00	0.04-0.09	Low	0.0-0.5	0.17	0.24			
	12-22	---	---	0.00-0.01	---		---	---	---			
2432:												
Zibate-----	0-6	10-18	1.40-1.55	0.60-2.00	0.06-0.08	Low	0.0-0.5	0.05	0.32	1	5	56
	6-19	18-35	1.40-1.60	0.20-0.60	0.13-0.17	Moderate	0.0-0.5	0.10	0.43			
	19-23	---	---	0.00-0.01	---		---	---	---			
2495:												
Downeyville-----	0-4	8-18	1.35-1.55	2.00-6.00	0.06-0.08	Low	0.0-0.5	0.05	0.32	1	5	56
	4-9	18-27	1.25-1.45	0.60-2.00	0.07-0.09	Low	0.0-0.5	0.10	0.43			
	9-13	---	---	0.00-0.01	---		---	---	---			
Gabbvally-----	0-2	10-18	1.30-1.50	2.00-6.00	0.06-0.08	Low	0.8-2.0	0.10	0.32	1	5	56
	2-8	18-27	1.30-1.50	0.60-2.00	0.11-0.13	Low	0.5-2.0	0.15	0.32			
	8-12	---	---	0.00-0.01	---		---	---	---			



PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS

This report shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

CLAY as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this report, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

MOIST BULK DENSITY is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this report, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

PERMEABILITY refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

AVAILABLE WATER CAPACITY refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

SHRINK-SWELL POTENTIAL is the potential for volume change in a soil with a loss or gain of moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed. Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are "Low," a change of less than 3 percent; "Moderate," 3 to 6 percent; and "High," more than 6 percent. "Very high," greater than 9 percent, is sometimes used.

PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS--Continued

ORGANIC MATTER is the plant and animal residue in the soil at various stages of decomposition. In report U, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

EROSION FACTOR K indicates the susceptibility of the whole soil (including rocks and rock fragments) to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

EROSION FACTOR K<sub>f</sub> is like EROSION FACTOR K but it is for the fine-earth fraction of the soil. Rocks and rock fragments are not considered.

EROSION FACTOR T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

WIND ERODIBILITY GROUPS are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
- 4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.
4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

The WIND ERODIBILITY INDEX is used in the wind erosion equation (WEQ). The index number indicates the amount of soil lost in tons per acre per year. The range of wind erodibility index numbers is 0 to 300.

CHEMICAL PROPERTIES OF THE SOILS

General Use

Map symbol and soil name	Depth	Clay	Cation-	Soil	Calcium	Gypsum	Salinity	Sodium
			exchange		carbonate			
			capacity					ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
2010:								
Longjim-----	0-3	10-20	7.0-15.0	7.9-8.4	5-15	---	0-2	0-5
	3-8	10-20	7.0-15.0	8.5-9.0	5-15	---	0-2	0-5
	8-16	5-10	1.0-7.0	8.5-9.0	5-15	---	0-2	0-5
	16-20	---	---	---	---	---	---	---
	20-45	---	---	---	---	---	---	---
2140:								
Jonnice-----	0-2	20-25	12.0-17.0	7.9-9.0	5-10	---	0-4	0-2
	2-21	35-55	19.0-32.0	8.5-9.0	5-10	---	0-4	0-2
	21-38	25-35	13.0-19.0	8.5-9.0	10-15	---	0-4	0-2
	38-42	---	---	---	---	---	---	---
2191:								
Pinez-----	0-4	5-10	3.0-6.0	7.9-9.0	1-5	---	0-2	0-5
	4-10	10-15	5.0-9.0	7.9-9.0	1-10	---	0-2	0-5
	10-29	18-35	9.0-19.0	7.9-9.0	5-10	---	0-2	0-5
	29-41	3-8	2.0-5.0	7.9-9.0	5-15	---	0-2	0-5
	41-51	---	---	---	---	---	---	---

Lealandic-----	0-5	8-20	4.0-11.0	7.9-9.0	1-5	---	0-2	0-5
	5-12	35-50	18.0-26.0	7.9-9.0	0-5	---	0-4	0-12
	12-23	35-50	18.0-26.0	7.9-9.0	1-10	---	0-4	0-12
	23-40	---	---	---	---	---	---	---
Arizo-----	0-8	5-12	2.0-5.0	7.4-9.0	1-5	---	0-2	0-5
	8-60	0-5	1.0-5.0	7.4-9.0	1-5	---	0-2	1-12
2212:								
Yermo-----	0-6	8-18	5.0-15.0	7.9-9.0	1-10	---	0-4	0-2
	6-60	8-18	5.0-15.0	7.9-9.0	5-15	---	0-4	1-12
Bullfor-----	0-1	2-5	1.0-4.0	7.9-8.4	0-2	---	0-4	0-5
	1-24	2-5	1.0-4.0	7.9-8.4	0-5	---	0-4	0-5
	24-25	---	---	---	---	---	---	---
	25-60	5-10	2.0-5.0	8.5-9.0	1-10	---	0-4	0-5
2230:								
Skelon-----	0-4	5-10	3.0-6.0	7.9-9.0	5-10	---	0-4	0-4
	4-28	3-10	2.0-6.0	7.4-9.0	10-25	---	0-4	0-4
	28-44	---	---	---	---	---	---	---
	44-52	5-10	3.0-6.0	8.5-9.0	15-30	---	0-4	0-4
	52-60	0-5	0.0-4.0	8.5-9.0	10-20	---	0-4	0-4
2269:								
Greyeagle-----	0-3	10-18	5.0-10.0	7.9-8.4	---	---	0-2	0-2
	3-6	10-18	5.0-10.0	7.9-8.4	---	---	0-2	0-2
	6-8	10-18	5.0-10.0	7.9-8.4	---	---	0-2	0-2
	8-24	---	---	---	---	---	---	---
	24-60	5-10	3.0-6.0	7.9-8.4	---	---	0-2	0-2
Yermo-----	0-6	8-18	5.0-15.0	7.9-9.0	1-10	---	0-4	0-2
	6-60	8-18	5.0-15.0	7.9-9.0	5-15	---	0-4	1-12
Strozi-----	0-5	5-15	3.0-9.0	7.9-8.4	0-1	---	4-8	5-12
	5-13	27-35	14.0-19.0	7.9-8.4	0-1	---	4-8	5-12

13-32	5-10	3.0-6.0	7.9-9.0	5-10	---	4-8	5-12
32-33	---	---	---	---	---	---	---
33-60	5-10	3.0-6.0	7.9-9.0	5-15	---	4-8	5-12

CHEMICAL PROPERTIES OF THE SOILS--Continued

General Use

Map symbol and soil name	Depth	Clay	Cation- exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
2280:								
Shorim-----	0-3	5-15	3.0-9.0	7.9-8.4	5-10	---	0-2	0-2
	3-10	5-15	3.0-9.0	7.9-8.4	5-10	---	0-2	0-2
	10-35	5-15	3.0-9.0	8.5-9.0	10-20	---	0-2	0-2
	35-40	---	---	---	---	---	---	---
	40-50	---	---	---	---	---	---	---
Zalda-----	0-3	6-18	3.0-10.0	7.9-8.4	0-5	---	0-4	0-5
	3-7	6-18	3.0-10.0	8.5-9.0	1-5	---	0-4	0-5
	7-8	---	---	---	---	---	---	---
	8-18	---	---	---	---	---	---	---
Upspring-----	0-2	10-18	5.0-10.0	7.9-8.4	---	---	0-2	---
	2-12	10-18	4.0-10.0	7.9-8.4	---	---	0-2	---
	12-22	---	---	---	---	---	---	---
2432:								
Zibate-----	0-6	10-18	6.0-12.0	7.4-9.0	0-5	---	0-2	0-5
	6-19	18-35	11.0-22.0	7.4-8.4	0-5	---	0-2	0-5
	19-23	---	---	---	---	---	---	---



2495:																
Downeyville-----		0-4		8-18		5.0-15.0		7.9-8.4		0-5		---		0-2		0-5
		4-9		18-27		10.0-25.0		7.9-9.0		0-10		---		0-2		0-5
		9-13		---		---		---		---		---		---		---
Gabbvally-----		0-2		10-18		5.0-20.0		6.6-7.8		---		---		0-2		0-5
		2-8		18-27		10.0-20.0		6.6-7.8		---		---		0-2		0-5
		8-12		---		---		---		---		---		---		---
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CHEMICAL PROPERTIES OF THE SOILS

Endnote -- CHEMICAL PROPERTIES OF THE SOILS

This report shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

CLAY as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this report, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

CATION EXCHANGE CAPACITY (CEC) is the total amount of cations held in a soil in such a way that they can be removed only by exchanging with another cation in the natural soil solution. CEC is a measure of the ability of a soil to retain cations, some of which are plant nutrients. Soils with low CEC hold few cations and may require more frequent applications of fertilizers than soils with high CEC. Soils with high CEC have the potential to retain cations, thus reducing the possibility of pollution of ground water.

SOIL REACTION is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

CALCIUM CARBONATE is the percentage by weight of calcium carbonate in the fine-earth material, less than 2 millimeters in size.

GYPSUM is the percentage by weight of hydrated calcium sulfates 20 millimeters or smaller in size, in the soil.

SALINITY is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils.

The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the report. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

SODIUM ADSORPTION RATIO (SAR) expresses the relative activity of sodium ions in exchange reactions in the soil. SAR is a measure of the amount of sodium relative to calcium and magnesium in the water extract from saturated soil paste.

SOIL FEATURES  
 General Use

Map symbol and soil name	Bedrock	Cemented pan	Subsidence				Potential	Risk of corrosion	
	Depth	Hardness	Depth	Kind	Initial	Total	frost action	Uncoated steel	Concrete
	In		In		In	In			
2010:									
Longjim-----	>60	---	14-20	Thick	---	---	Low	High	Low
2140:									
Jonnic-----	>60	---	25-40	Thick	---	---	Low	High	Low
2191:									
Pinez-----	>60	---	40-60	Thick	---	---	None	High	Low
Lealandic-----	>60	---	20-40	Thick	---	---	---	High	Low
Arizo-----	>60	---	---	---	---	---	Low	High	Low
2212:									
Yermo-----	>60	---	---	---	---	---	Low	High	Low
Bullfor-----	>60	---	20-40	Thin	---	---	None	High	Low
2230:									
Skelon-----	>60	---	20-40	Thick	---	---	Low	High	Low

2269:										
Greyeagle-----	>60	---	8-14	Thick	---	---	Low	High	Low	
Yermo-----	>60	---	---	---	---	---	Low	High	Low	
Strozi-----	>60	---	20-40	Thin	---	---	None	High	Low	
2280:										
Shorim-----	21-40	Hard	20-38	Thin	---	---	None	High	Low	
Zalda-----	8-20	Hard	7-14	Thin	---	---	None	High	Low	
Upspring-----	4-14	Hard	---	---	---	---	None	High	Low	
2432:										
Zibate-----	4-20	Hard	---	---	---	---	---	High	Low	
2495:										
Downeyville----	4-14	Hard	---	---	---	---	Low	High	Low	
Gabbvally-----	6-14	Hard	---	---	---	---	Moderate	Moderate	Low	

SOIL FEATURES

Endnote -- SOIL FEATURES

This report gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either "Soft" or "Hard". If the rock is "Soft" or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is "Hard" or massive, blasting or special equipment generally is needed for excavation.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as "Thin" or "Thick". A "Thin" pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A "Thick" pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. This report shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which usually is a result of oxidation. Not shown in the report is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially

drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer. For uncoated steel, the risk of corrosion, expressed as "Low", "Moderate", or "High", is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as "Low", "Moderate", or "High". It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

WATER FEATURES

General Use

	Flooding				High water table and ponding				
	Map symbol and soil name	[Hydro- logic group]	Frequency	Duration Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Pt				Pt
2010:									
Longjim-----	D	None	---	---	>6.0	---	---	---	---
2140:									
Jonnic-----	C	None	---	---	>6.0	---	---	---	---
2191:									
Pinez-----	B	None	---	---	>6.0	---	---	---	---
Lealandic-----	D	None	---	---	>6.0	---	---	---	---
Arizo-----	A	Rare	---	---	>6.0	---	---	---	---
2212:									
Yermo-----	B	None	---	---	>6.0	---	---	---	---
Bullfor-----	C	None	---	---	>6.0	---	---	---	---
2230:									



Skelon-----	C	None		---		---		>6.0		---		---		---		---
2269:																
Greyeagle-----	D	None		---		---		>6.0		---		---		---		---
Yermo-----	B	None		---		---		>6.0		---		---		---		---
Strozi-----	C	None		---		---		>6.0		---		---		---		---
2280:																
Shorim-----	C	None		---		---		>6.0		---		---		---		---
Zalda-----	D	None		---		---		>6.0		---		---		---		---
Upspring-----	D	None		---		---		>6.0		---		---		---		---
2432:																
Zibate-----	D	None		---		---		>6.0		---		---		---		---
2495:																
Downeyville-----	D	None		---		---		>6.0		---		---		---		---
Gabbvally-----	D	None		---		---		>6.0		---		---		---		---

WATER FEATURES

Endnote -- WATER FEATURES

This report gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms. The four hydrologic soil groups are:

Group "A". Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group "B". Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group "C". Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group "D". Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in this report, the first letter is for drained areas and the second is for undrained areas. Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered

flooding, nor is water in swamps and marshes. This report gives the frequency and duration of flooding and the time of year when flooding is most likely. Frequency, duration, and probable dates of occurrence are estimated.

Frequency is expressed as "None", "Rare", "Occasional", and "Frequent". "None" means that flooding is not probable; "Rare" that it is unlikely but possible under unusual weather conditions; "Occasional" that it occurs, on the average, once or less in 2 years; and "Frequent" that it occurs, on the average, more than once in 2 years.

Duration is expressed as "Very brief" if less than 2 days, "Brief" if 2 to 7 days, "Long" if 7 to 30 days, and "Very long" if more than 30 days. The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding. Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods.

Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency level.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in this report are the depth to the seasonal high water table; the kind of water table, that is, "Apparent", "Artesian", or "Perched"; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in this report.

An "Apparent" water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

An "Artesian" water table exists under a hydrostatic beneath an impermeable layer. When the impermeable layer has been penetrated by a cased borehole, the water rises. The final level of the water in the cased borehole is characterized as an artesian water table.

A "Perched" water table is water standing above an unsaturated zone. In places an upper, or "Perched", water table is separated from a lower one by a dry zone. Only saturated zones within a depth of about 6 feet are indicated.

Ponding is standing water in a closed depression. The water is removed only by deep percolation, transpiration, evaporation, or a combination of these processes.

This report gives the depth and duration of ponding and the time of year when ponding is most likely. Depth, duration, and probable dates of occurrence are estimated.

Depth is expressed as the depth of ponded water in feet above the soil surface. Duration is expressed as "Very brief" if less than 2 days, "Brief" if 2 to 7 days, "Long" if 7 to 30 days, and "Very long" if more than 30 days. The information is based on the relation of each soil on the landscape to historic ponding and on local information about the extent and levels of ponding.