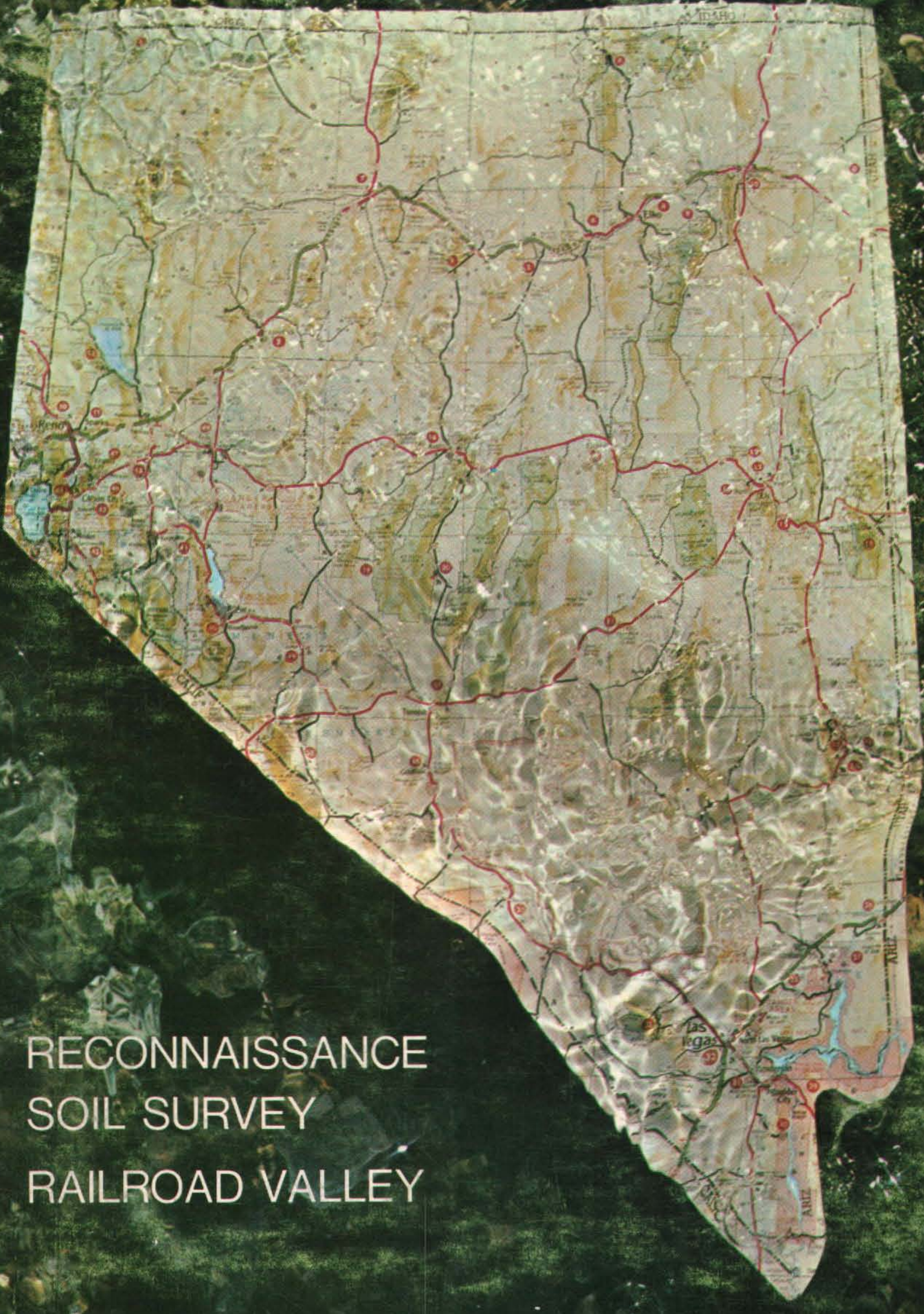
Water for Nevada



RECONNAISSANCE SOIL SURVEY

RAILROAD VALLEY

State of Nevada

WATER PLANNING REPORT

WATER

FOR NEVADA

Prepared by the State Engineer's Office,
the Agricultural Experiment Station —
University of Nevada, Reno
and the Soil Conservation Service, U.S.D.A.

MAY 1971

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Director

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
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In reply refer to
No.

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TO THE CITIZENS OF THE STATE OF NEVADA

This Report constitutes a part of the State Water Planning effort and was prepared cooperatively by the Division of Water Resources, the Agricultural Experiment Station, University of Nevada, Reno, and the Soil Conservation Service, United States Department of Agriculture.

The statewide reconnaissance soil survey is designed to furnish basic soil data needed to evaluate a variety of potential uses. Soil Hydrologic Groups, Soil Materials Sources, Soil Erosion Potential and Soil Irrigability Classes are among the several interpretive evaluations made in Railroad Valley as a result of the survey. The soils of the Railroad Valley area were identified; mapped, and named according to the U. S. Comprehensive System of Soil Classification.

In addition to being used in the development of the State Water Plan, the progressive reconnaissance soil survey will also contribute to an eventual soil map of Nevada which will be a basic resource data source for state, regional and local land evaluation and development planning.

Respectfully,

Roland D. Westergard
State Engineer

RECONNAISSANCE SOIL SURVEY RAILROAD VALLEY

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SUMMARY

The Railroad Valley soil survey area comprises 1,761,300 acres, of which one-third is mountainous and two-thirds is sloping to nearly level alluvial plains. Two barren playas comprise 3 percent of the survey area. A zone of deep, fine textured, saline soils which are poorly drained surround the large northern playa. Smooth, moderately sloping to nearly level alluvial fans, basin-fill plains, and lake plains are extensive and consist of coarse to fine textured, commonly deep soils. Very gravelly substrata are common in these soils; many of them are salt or sodium-affected. On the upper, dissected alluvial fans and low foothills, the soils are undulating to rolling, fine textured, and shallow to hardpan or bedrock. The mountain soils are commonly shallow to bedrock, fine textured, and in many cases, stoney. A third of the mountainous terrain is rubbleland and rock outcrop. The great majority of the soils of this area are Aridisols (arid soils); only on the highest mountain crests do Mollisols occur (dark colored, steppe-type soils). Among the Aridisols, the majority are Argids and have moderately fine or fine textured subsoils; many contain duripans.

The most extensive vegetation is shadscale desert shrub on the alluvial plains. Several large stands of black greasewood occur on low-lying saline or sodium-affected soils. In the mountains are considerable stands of pinyon-juniper woodland, and on the foothills black sagebrush forms extensive stands. Galleta grass occurs with the shadscale and black sage, whereas a variety of bunchgrasses occur with big sagebrush in the pinyon-juniper zone, and on the shrub covered balds of the high mountain crests.

The area is primarily used for ranching with little land presently cultivated. A large area of potentially irrigable soils, totaling 495,500 acres, is present on the smooth alluvial plains, however. Of these irrigable soils, 800 acres are of irrigability class A, 4,100 acres are of class B, 305,700 acres are of class C, and 184,900 acres are of class D. Somewhat low available waterholding capacity is a common limitation among these irrigable soils, but could be adjusted for by proper irrigation system design. The climate is sufficiently warm and the growing season is long enough for successful cultivation of the forages, small grains, and seed crops commonly grown in Nevada.

The extent, location, and major properties of the common soils are reported here at a scale suitable for general planning. Several interpretive evaluations of the soils are made, including irrigability, and basic soil property data is provided which can be used for additional land use management or planning interpretations on demand. Priority areas for detailed site evaluations also can be selected, using this survey, to insure most profitable returns from any additional field investigations needed for operational developments.

INTRODUCTION

The Railroad Valley area is one of the huge desert basins that comprise most of Nevada. The area is so dry that extensive grazing has been its major agricultural activity, but with modern technology, reported ground water resources might be tapped for irrigation. As population grows, additional roads, power lines, pipelines, and perhaps communities can be expected to be built in even such a remote area as this. Wise land use and profitable land development demand that expensive pumped water be used on only the most suitable land, that engineering works take advantage of the best soil materials, and that any communities be located to minimize building and sanitary waste disposal problems. Finally, progressive range improvement programs need to better establish the potentials of soil-landscapes for rejuvenating existing range or seeding new stands.

Each of these management or planning tasks is best done with some knowledge of the physical and chemical properties of the soils which will be used. However, in such a huge and unknown area as this, a detailed study of the soils is prohibitively expensive and slow. This reconnaissance soil survey was designed to discover enough facts about the common soils to allow evaluation of their potential for irrigated agriculture, for engineering works, and application of certain range improvement practices on at least a planning basis. Enough information about basic soil properties also has been determined by the soil survey to allow evaluations for possible uses not now foreseen. The rapid pace of field survey investigations needed to cover such a large area as this means, of course, that only the more extensive soils can be discovered, and that the map units must show areas where two or three soils occur together in a fairly regular pattern, or soil association, rather than the specific location of each individual kind of soil.

This reconnaissance soil survey was made by first traversing the area and determining the major landforms, kinds of rocks, soils, and vegetation which occur. Numerous backhoe pits were opened to allow us to determine such soil properties as degree of cementation of hardpans or the character of underlying silts, sand, or gravel not easily seen in shovel holes. Precise identification of the kind of soil (i.e., its classification), limited sampling, and detailed technical descriptions of soil properties were also made in the backhoe pits. A number of salinity, alkali, and organic matter analyses were made in the laboratory to establish properties which cannot be determined in the field. With this background experience concurrent stereoscopic study of 1 inch per mile scale aerial photographs and numerous selected transects, it is possible to associate the occurrence of particular soil patterns with peculiar landforms, vegetation, geological parent material, and erosional or deposition features, and thus map soil associations.

ENVIRONMENTAL FEATURES

Location and Cultural Features

This survey area is in south-central Nevada. It is largely in Nye County but includes parts of Lincoln and White Pine Counties. Its boundaries are about 140 miles north of Las Vegas, about 60 miles east of Tonopah, and 40 miles southwest of Ely, Nevada. The survey area is coincident with the Railroad Valley hydrographic area (Rush, 1968) which is comprised of two large drainage basins, both of which empty into playas and are separated by only the low Hot Creek alluvial fan. The area includes all of Railroad Valley, proper, and the southern portion of Reveille Valley and northern portion of Kawich Valley which both drain into the small playa at the south end of Railroad Valley. Floodwater from Hot Creek Valley, to the west, occasionally flows along Hot Creek and into the large northern playa which also collects floodwater from the major part of Railroad Valley. The survey area comprises 2,752 square miles, or 1,761,280 acres, extends some 110 miles in a north-south direction, and about 30 miles east-west across its broadest part.

The present small population in the area is well served by improved roads and most of the area is accessible to vehicles, except for steep, rocky mountainous terrain. U.S. Highway 6, from Tonopah to Ely,

PHOTOGRAPHY BY FREDERICK F. PETERSON

FIGURE 1. An example of widely occurring layering of shallow deposits of fine sandy loam or silt loam on top of very gravelly alluvial fan sediments. This borrow pit is in a medium textured Typic Camborthid on the gently sloping Currant Creek alluvial fan in soil map unit 48. The finer surface horizons may be loessial. The White Pine Range is in the background (most of the slopes seen are in soil map unit 80); below it are the long, sloping and dissected alluvial fans of soil map unit 52.

Nevada, crosses Railroad Valley. It connects with Nevada State Highway 20 at Currant (see the General Soil Map for locations of these features). The latter highway is paved from Currant as far as Duckwater, to the northwest, and then is a good gravel road on to U.S. Highway 50, near Eureka. Nevada State Highway 25, from Warm Springs to Alamo and Caliente, Nevada, crosses the southern end of the survey area and is paved; the Diablo Highway Maintenance Station, on State Highway 25, is the only permanent residence in the far southern part of the area. Highways 6 and 25 are connected by a gravelled road from Currant to Hot Creek, along the east side of the valley; several ranches are located at large springs along this road.

The small community of Currant, on Highway 6, consists of a restaurant, motel, bar, and service station. The Duckwater Indian Reservation, neighboring ranches to the northwest of Currant, and a small oil field settlement immediately south of Currant contain most of the rest of the area's population, excepting the few ranches along the east side of the valley and the Diablo Highway Maintenance Station, far to the south. Fewer than 100 people live in the area.

Ranching is the major economic enterprise, but several families are employed at Currant and in the oil field. A few desert land entries have been made for pump-irrigation agricultural development in the vicinity of Currant and near Green Springs Ranch, to the north, and Nyala ranch, to the south but these farms are not yet permanently occupied or fully operative. At Currant, Duckwater, Bull Creek Ranch, Green Springs Ranch, and at several ranches along the east side of Railroad Valley, a moderately large acreage of irrigated alfalfa and natural wet meadow hay is raised for the livestock operations. Currant Creek and Duckwater Creek below its spring sources are the major flowing streams in the area; otherwise irrigation is from ephemeral streams and several large springs, and wells.

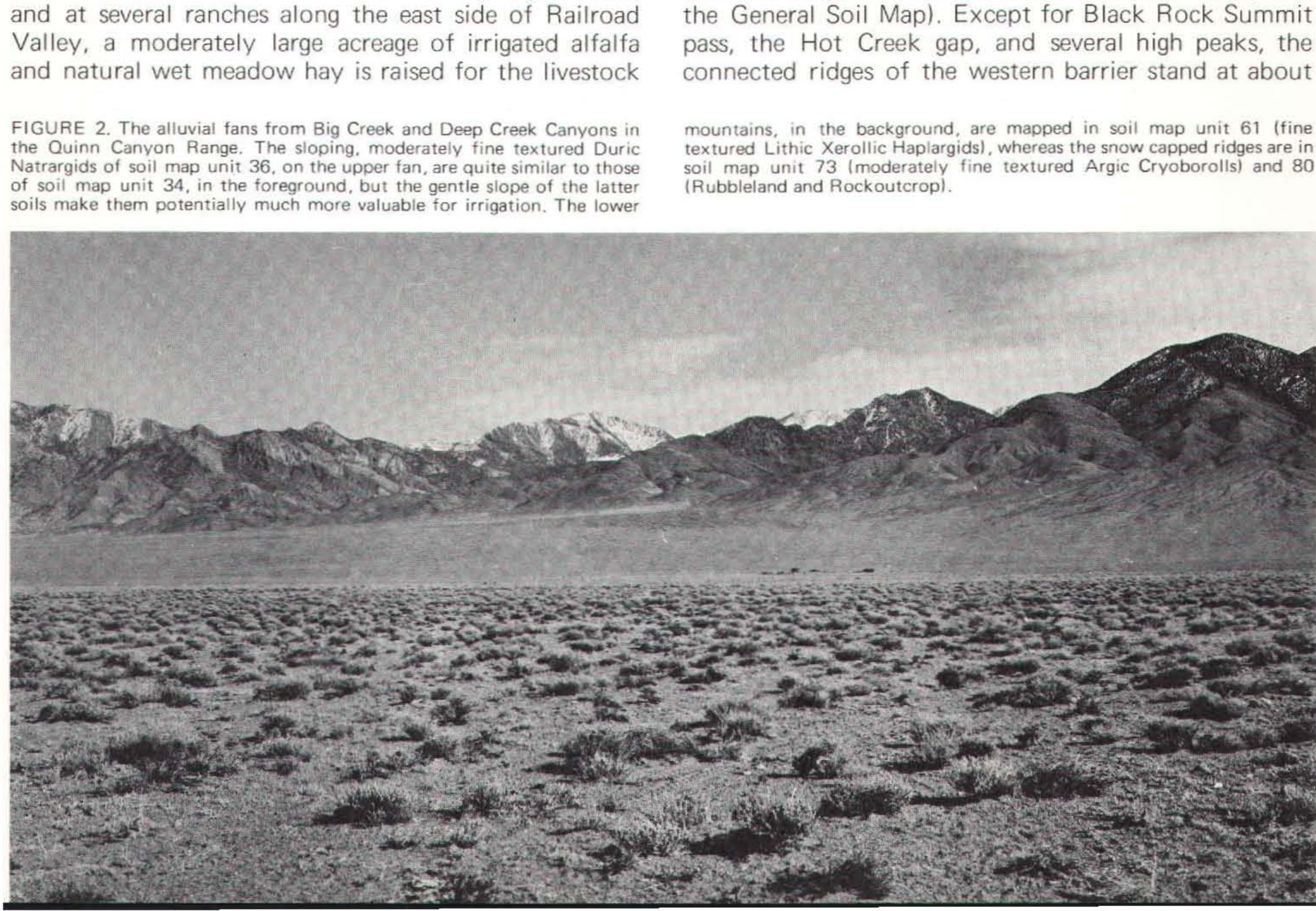
Landforms and Geology

Mountain Ranges

Railroad Valley, and the portions of Reveille and Kawich Valleys included in this survey, are typical north-south oriented, structural valleys of the basin-and-range type which characterize central Nevada. They are structural valleys (as compared with those cut by water erosion) in the sense that the underlying bedrock structure consists of huge upthrown and tilted blocks of bedrock on either side of a basin formed by down dropped blocks, or by the lower side of a tilted block. The upthrown blocks have been eroded into rugged mountain ranges and the sediments washed off these ranges have buried the bedrock floor of the basin deeply. The mountain barriers to the east and west are broken by only a few passes, but ends of the valleys are broadly open with topographic separation from adjacent basins by convergent alluvial fans or gently sloping pediment passes. About one-third of the survey area is mountainous. Two-thirds of the area is sloping or nearly level alluvial plains. The huge main playa and smaller southern playa of Railroad Valley combined comprise 3 percent of the area.

The mountain barrier to the west is formed by the Reveille and Pancake Ranges; it is lower and less rugged than the ranges on the east side of Railroad Valley (see the General Soil Map). Except for Black Rock Summit pass, the Hot Creek gap, and several high peaks, the connected ridges of the western barrier stand at about

FIGURE 2. The alluvial fans from Big Creek and Deep Creek Canyons in the Quinn Canyon Range. The sloping, moderately fine textured Duric Natrargids of soil map unit 36, on the upper fan, are quite similar to those of soil map unit 34, in the foreground, but the gentle slope of the latter soils make them potentially much more valuable for irrigation. The lower mountains, in the background, are mapped in soil map unit 61 (fine textured Lithic Xerollic Haplargids), whereas the snow capped ridges are in soil map unit 73 (moderately fine textured Argic Cryoborolls) and 80 (Rubbleland and Rockoutcrop).



7,000 feet elevation – roughly 2,000 feet above the valley floor. The Reveille and Pancake Ranges are formed of tilted blocks of interbedded volcanic flow-rock and softer, more porous volcanic tuff and volcanic breccia. These rocks range from rhyolitic to andesitic composition. The tuff is readily weatherable, and eroded whereas the flow rocks resist erosion and stand as crags and cliffs. Basalt cinders and some basalt flows occur in a small, Pleistocene cinder cone field at Black Rock Summit on Highway 6.

The eastern mountain barrier is formed of the White Pine, Horse, Grant, and Quinn Canyon Ranges. The rugged White Pine Range (Fig. 1) is composed of largely limestones and some shale and volcanic rocks. Its high ridges stand at 7,000 to 9,000 feet, on the average, and rise to 9,000 and 11,000 foot elevations along the Currant Peak-White Pine Peak massif. Precipitous slopes and cliffs are common in these mountains, but there are also some sloping or rolling areas in interior valleys and across broad ridge crests.

The Horse Range, to the south of the White Pine Range, is notably less rugged and lower than the White Pine Range. Its ridges are 7,000 to 8,000 feet high. The valleys cut into the predominant volcanic flow-rock and tuffs of this range are fairly broad and provide the 7,000 foot-high Currant Summit pass for Highway 6, above the Currant Creek drainage, and a yet lower pass (6,500 feet) at the head of Stone Cabin Valley, south of Currant Summit. The erosional landforms in the Horse Range are similar to those in the likewise volcanic Reveille, Pancake, and Quinn Canyon Ranges.

The high eastern barrier is continued to the south by the Grant Range, with 7,000 to 8,000 foot high ridgelines, and the Quinn Canyon Range, with ridgelines at from 7,000 to 9,000 foot elevations (Fig. 2). In the Grant Range, the Troy peak massif is largely above 10,000 feet elevation. Limestone and some shale is most common in the rugged Grant Range, whereas the Quinn Canyon Range is composed of largely volcanic flow-rock and tuffs. To the far south, the ridges of the Quinn Canyon Range trail off into low peaks and broad pediment passes which provide easy access to Penoyer (Sand Springs) Valley.

The major difference in bedrock composition in this survey area is between the interbedded volcanic rocks and the limestone, quartzite, and shale sedimentary rocks. Surprisingly, the nature of the shallow soils which have weathered from these rocks is not dissimilar, except for features related to altitude-controlled moisture and temperature regimes. The erosional landforms on these rock types are different, however. The limestone-bedrock terrain generally has more relief and more prominent cliffs and rock outcrop than the volcanic-bedrock terrain. In the limestone mountains, valleys are commonly narrow and abruptly steep-sided, whereas accessible, broader, smooth-bottomed valleys are the rule in the volcanic mountains. Buttes and mesas with bounding cliffs occur in the volcanic mountains, as do most smoothly-rounded low peaks and ridges (Fig. 18); in comparison, the large ridges of the limestone mountains are consistently irregular, cliffy, or furrowed by side-gullies.

The soils formed on alluvial fans derived from one or the other rock type show some differences. On middle and upper parts of alluvial fans below limestone mountains the soils are commonly more cobbly, less apt to have clayey subsoils, and more apt to have horizons of calcium carbonate accumulation than those formed on alluvial fans of volcanic rock sediments.

Landforms and Soil Patterns

Since the soil map units of this reconnaissance soil survey are large and include whole landscapes and several kinds of soils, the most probable location of individual kinds of soils within the mapped areas has been indicated by their physiographic position (Table 11). Thereby, a person using this survey in the field has some indication of where to look for the dominant soils, as well as the included, or minor soils. The physiographic positions occupied by the individual soils are described either as whole land forms, (e.g., an alluvial fan), or elements of a landform (e.g., the crest or side-slope of a mountain ridge) if the place of occurrence is more restricted. The common landforms and erosion patterns which are used to map soils and identify their location are described next.

The most prominent physiographic distinction of the entire survey area is that between the erosional landscapes of the mountains (i.e., landforms cut out of rock by erosion) and the constructional landscapes of the alluvial plains (which include some eroded alluvial areas where previously deposited sediments have been gullied). In the mountainous landscapes bedrock commonly occurs at shallow depth. The rocks are commonly jointed or porous enough to allow some water and root penetration, but yet are impediments to both. The soil parent material of the alluvial plains is deep sediment[2] ranging from gravel to clay. One finds stratification of a fairly fine textured, rather thin surface layer of soil or sediment on top of very gravelly sediment a common occurrence on the alluvial plains of this area (Fig. 1). These finer textured surface layers may be due to weathering during soil formation, or to alluvial deposition of fine sediment, or to deposition of wind-blown fines (i.e., loess).

Alluvial Landforms

The alluvial plains referred to here include all those landforms built by deposition of sediments, and in a few cases, built of sediments reworked by water, as are beaches, or wind, as are dunes they also include those alluvial landforms somewhat altered by erosion, as are dissected alluvial fans. If one were to take a vantage point, and look across this valley, he would see these alluvial plains as all those sweeping, broadly sloping to nearly level, apparently smooth land surfaces below and beyond the mountain fronts (Fig. 1, 2, 5).

The Sharp slope break, or juncture between the mountain fronts and the alluvial plains is a distinctive element of basin-and-range physiography. On the alluvial plains side of this demarcation line, the massive, sloping dumps of sediment, or alluvial fans that issue from each mountain canyon are the most characteristic landforms (Fig. 2). Each is characterized by a fan-like distribution of sediment and regularly decreasing slope gradient away from its apex, at the canyon mouth from which it issues. Alluvial fans which are rapidly aggrading in front of steep, isolated canyons have the classic cone-like form shown in textbooks. More commonly, alluvial fans from adjacent canyons abut laterally on each other, i.e., they coalesce to form a continuous slope of alluvium along a mountain front, or coalescent alluvial fan piedmonts. Frequently the term alluvial fan is abbreviated as fan, and one can refer to a "fan piedmont," or "dissected fan."

Consistent changes of slope, texture of materials, degree of dissection,[3] and kinds of soils can be found between the upper, middle, and lower, or toe-slope portions of many alluvial fans. Slopes are steepest at the fan apex and decrease along a stream-gradient curve to a percent or less gradient on the toeslope. The most cobbly or bouldery materials are found near the fan apex, whereas fine sands or loams are characteristic of the toeslope. Textural change with distance from the apex is masked in situations where windblown dust has been deposited over the entire fan, or an old, stable fans where soil weathering has reduced coarse particles to fine textures, or where a uniformly coarse sandy or fine gravelly sediment (such as that from granitic terrain) is carried with equal competence to all parts of a fan.

Both periods of renewed fan building by deposition of fresh sediment, and periods of fan dissection (i.e., gullying) by downcutting of drainageways have been initiated in glacial times by climatic change, and at various past times by vertical displacements due to faulting. Fan building occurs when an erosion cycle in the mountains provides fresh sediment. Fan dissection occurs for a variety of reasons, any or all of which encourage gullying on the fan surface; since erosion is most apt to occur on the most steeply sloping parts of any landscape, dissection commonly occurs on the upper part of an alluvial fan. When a single, large gully forms at the fan apex, and extends on up the source canyon, fan dissection is referred to as "fan head entrenchment," and might or might not be accompanied by lesser gullying across the remainder of the upper fan surface (Fig. 3). Gullying of the upper, or upper and middle portions of a fan is accompanied by deposition of fresh layers of sediment on the lower fan (and thus, burial of the pre-existing soils there) unless the sediment is carried off the fan in a drainageway. Fresh layers of alluvial fan sediment derived by erosion in the mountains or on the upper fan may uniformly cover the whole fan surface, but frequently the deposits are spotty, or occur in a short fan apron which extends only a part of the length of the landform. These small, fresh deposits are called overplaced fans here, to draw attention to the fact that they irregularly bury a pre-existing soil, and therefore increase the complexity and variety of the soil pattern.

Dissection of the lower part of an alluvial fan, or of the entire fan commonly occurs when a drainageway beyond the toeslope entrenches, and gullies work back up the fan from the steep sides of the entrenched drain.[4] The dissected alluvial fan piedmonts of southern Reville Valley (in soil map unit 38) and Duckwater Creek (soil map unit 56) are examples of erosion working headward from an entrenched drainageways (Fig. 4). The dissected fans in soil map unit 52, below the White Pine Range and Grant Range, and soil map unit 51, below the Reveille Range are, conversely, examples of upper fan dissection and fan-head trenching.

These various degrees and patterns of dissection one

FIGURE 3. Fan-head trenching. The broad, steep sided, entrenched drainageway to the right now carries flood waters from the Reveille Range which once spread fresh alluvium across the surface of this dissected alluvial fan. The fine textured Nadurargids on the transversely-level remnants of the old fan surface are much more weathered than the soils of the young sediments in the drainageway and contain distinctive horizons, such as hardpans, not found in the younger Camborthids in the drainageway. This dissected fan is in soil map unit 51. The low mountains are in soil map unit 60, which is comprised of fine textured Typic Durargids, Lithic Haplargids, Rubbleland and Rockoutcrop. Note the moderately sloping pediment toeslopes which flare out from the steep mountain sideslopes (i.e., backslopes, or retreating slopes), and grade to the old fan surface.

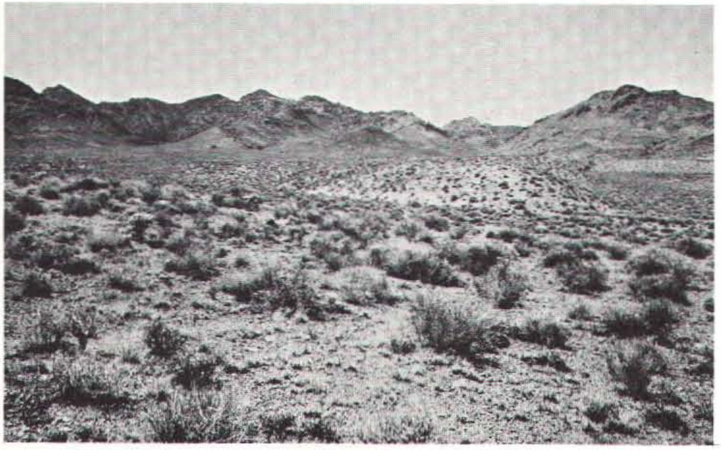


FIGURE 4. The broadly rounded remnants of a dissected alluvial fan, or ballenas, in the middle-background (and immediate foreground) have a moderately fine textured Haplic Durargid on both crest and sideslopes. Coarse textured Camborthids occur in the drainageways between the ballenas (soil map unit 56). The low mountains in the background are mostly Rubbleland and Rockoutcrop (soil map unit 80). The smooth floodplain in the middle ground is a deep, medium textured Typic Torrifluvent (soil map unit 42) which supports a white sage stand; the dark line at the far side of the floodplain is big sagebrush and marks an entrenched channel.

sees in the field are great aids to soil mapping or to reading a soil map in the field since dissection is apparent on aerial photos and obviously indicates soils of different ages. The soils on the higher-standing remnants of the dissected fans are older than the alluvium deposited along drainageways, or spread out as a new fan below the drainageways. The older soils commonly contain distinctive, developed layers such as hardpans or clayey subsoils which are not present in the younger soils.

One should predict considerable differences in the ages, hence properties of the sideslope soil and drainageway soil, as compared with the remnantal, old landsurface soil on the interfluve, for dissected landforms in which the shoulder (i.e., the juncture between the sideslopes of the drainageways and the remnantal surface of the old landform) is sharply angular, rather than rounded. This prediction has to be checked in the field both for verification of soil differences and identification of what sort of morphological differences occur. If the shoulder is well rounded (i.e., the curvature of the shoulder extends well down the drainageway sideslopes and well onto the remnantal interfluve), then one should predict that the sideslope and interfluve soils are of like or similar ages and, hence, similar properties. The soils of the drainageway bottom might or might not be found to be similar to those of the sideslopes.[5] Rolling landscapes consisting of such broadly rounded remnantal ridges of old alluvial fans or old bedrock erosion surfaces are characteristic of several large soil map units in this survey area (e.g., soil map units 56, 60, 61, 62, 63; see Figures 4, 7, 8).

Where floodwaters from adjacent alluvial fans join and flow laterally along nearly level, distributary floodplains, sediment from several mountain valleys is mixed and deposited for form basin-fill plains. Physiographically, these are extensions of the alluvial fan toeslopes. Commonly they connect the alluvial fans with a playa, but in Railroad Valley relict lacustrine landforms are interposed. The most extensive basin-fill plains are in the north (soil map unit 34) and south (soil map units 45, 34) ends of the valley (Fig. 5).

Modern stream floodplains which are notably broader than the stream channel, or which are not part of an alluvial fan form, are inextensive in this area. Narrow floodplains do occur along Duckwater Creek and Bull Creek (soil map unit 42), along Currant Creek (soil map unit 41), in the wet meadow areas at Duckwater, Bull Creek Ranch, and Blue Eagle Springs (soil map unit 23). Except for the wet meadow areas, those floodplains have had their channels entrenched 3 to 20 feet within historical time. As yet, the channel trenches have few side gullies, but these might be expected to develop and destroy the valuable floodplain soils and their remnantal white sagebrush stands (Fig. 4).

Lacustrine Landforms

During glacial times, Railroad Valley was occupied by two permanent lakes. Lake Railroad, in the central part of the valley, had a maximum depth of 315 feet, an area of about 525 square miles maximum, and it received drainage from Hot Creek Valley in addition to most of Railroad Valley. Lake Reveille, centered at

FIGURE 5. The basin-fill plain south of Diablo. Shadscale, Bailey greasewood, and bud sagebrush are common shrubs on the moderately fine textured Duric Natrargids in the foreground (soil map unit 34). This soil landscape is illustrative of a considerable acreages of nearly level Natrargids in southern Railroad Valley which have agricultural potential. To the left background are the low peaks of the farthest south extension of the Quinn Canyon Range.

about the position of the present southern playa, had a maximum area of about 50 square miles and a depth of perhaps 100 feet. Lake Reveille received drainage from southern Railroad Valley and the portions of Reveille and Kawich Valleys included in this survey; it is reported to have overflowed into Lake Railroad (Snyder et al, 1964). Both relict wave-cut terraces and offshore beach bars mark the margins of these lakes and are potential sources of gravel (see soil map unit 32; beaches are also common along the lower edges of soil map units 47 and 36 in the vicinity of the main playa).

The part of the valley which was lake bottom is nearly level (though it does have a real slope toward the playas), and during the later history of the lake received deposits of silty and clayey sediments that are over 5 feet deep at the north end of old Lake Railroad and in the playa (soil map units 20, 21, 31, 90), but which are only about 1 to 2 feet deep over deltaic gravel from the Hot Creek drainage at the south end of the old lake (soil map units 30, 33, 34). These areas are the lake plains of the valley.

Large amounts of sediment have poured into Lake Railroad from Hot Creek Valley through the Hot Creek gap, as indicated by the large alluvial fan which debouches from the Hot Creek gap (Fig. 16). It is composed of clean, stratified and sorted sand and gravel covered with a thin cap of late or post-Pleistocene, fine sandy loam material (soil map unit 35). Presently, Hot Creek drains to the main playa along a braided, distributary floodplain of many channels. Apparently relict distributary floodplains of perhaps latest-Pleistocene, or more recent time lead to both the north and south playas along the margins of the Hot Creek fan (soil map units 31 and 33). These apparent channelways are distinguished by numerous, large, barren and crusted spots of soil separated by narrow, frequently sub-parallel strips of vegetated soil (Fig. 16). To the southeast and north of the Hot Creek fan two areas of deep, sandy soils (soil map units 43 and 44) occur on deltaic deposits made into the lakes by Pleistocene Hot Creek (Fig. 17).

Playas, Dunes, Spring Mounds

The playas are unremarkable except for the size of the northern one, and the unremitting wonder one must have at their smooth barrenness. Both act as sinks for flood waters, and could act as sinks for drainage water from any agricultural development.

If the playas are not unusual, the absence of a sand dune field, or a sand-mantled slope in some leeward direction from the playas is unusual. The majority of relict lake basins in the Nevada and California deserts have sand dune fields to the lee of their playas. The main playa in Railroad Valley does have areas of coppice dunes (dunes built around plants and eventually supporting plants on their tops, in this case, greasewood) to the north and south (soil map unit 20), but these are of clay or clay loam textured material (Fig. 6). These clay dunes are crusted and their sides are rilled. These clay dunes are attributed to detachment of

FIGURE 6. A coppice dune field marginal to the large northern playa of Railroad Valley. The dunes are formed of clay textured material. The shrubs on the dunes are black greasewood and the soils of the dunes are saline Typic Torriorthents, whereas the playa-like barrens between the dunes are saline Aquic Torriorthents. Some dunes are as much as 15 feet high. The Pancake Range is to the southwest on the skyline.

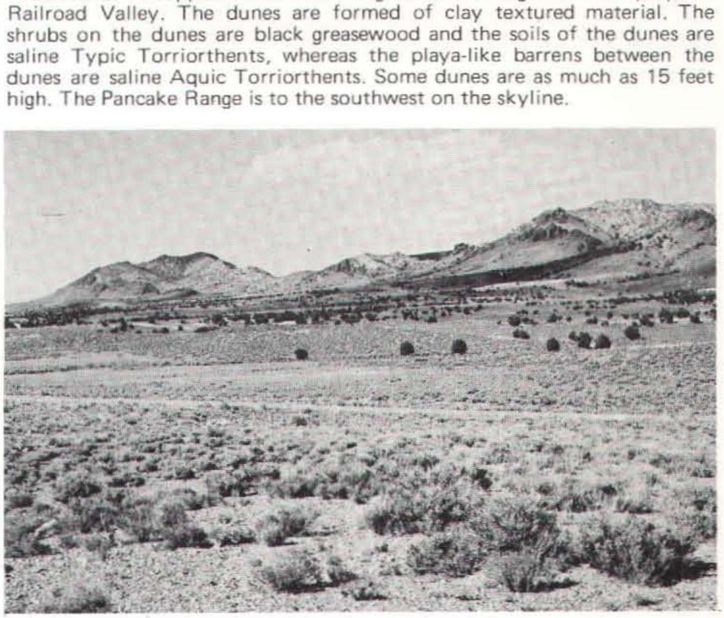


FIGURE 7. Ballenas, or parallel, accordant, and rounded remnautal ridges of a dissected alluvial fan piedmont and associated pediment. In the fore- and middleground are medium textured Duric Haplargids and Haplic Durargids of soil map unit 55; the juniper woodland is on moderately fine textured, shallow Haplic Durargids of soil map unit 56; the low mountains are in soil map unit 80 and form the northeastern boundary of the Duckwater Creek drainage.

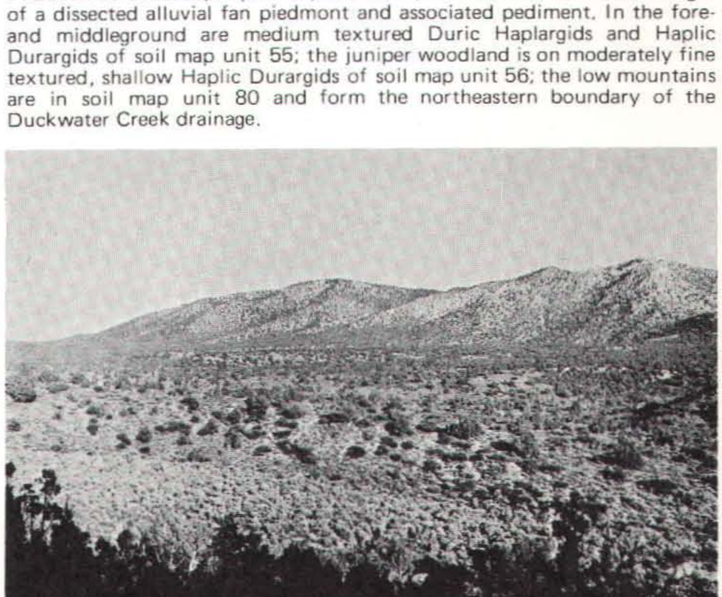


FIGURE 8. Rolling bedrock ballenas of the Quinn Canyon Range. These broadly rounded, remnantal ridges of an ancient, dissected pediment support a pinyon-juniper woodland on fine textured Lithic Xerollic Haplargids of soil map unit 61.

sand-sized aggregates of clayey material from a playa, and its collection in dunes with later consolidation of the clayey aggregates to form a clayey soil.

Large spring mounds of travertine (calcium carbonate and some silica) occur around hot springs in several parts of the survey area. The highly calcareous spring mound material weathers, mixes with dust and sediment, and is eventually transformed into shallow soils with hardpans. Soil map unit 22, southwest of the main playa, contains enough spring mounds and detritus from eroded mounds to be distinctive. Spring mounds also occur at Lockes, along U.S. Highway 6, and at Duckwater.

Foothill and Mountain Landforms

In the next section on soils, the soil-landscapes of the mountainous areas are described according to elevation, climate, soils, and vegetation. The smoother, somewhat less steep slopes and broader, more accessible valleys of the volcanic rock terrain, as compared with the limestone terrain, have been noted previously. Here, we will briefly describe the landform elements, or positions by which the pattern of occurrence of individual kinds of upland soils can be described.

The two most important physiographic facts of mountainous terrains are the steep and long slopes. In the foothills, or that is, the low peaks and ridges at the periferies of the main mountain masses, sideslopes are of somewhat lesser gradient, are shorter, and are less extensive with respect to more gently sloping ridge crests and valley bottoms than in the high mountains. In the foothills and low mountains, a distinct and common landform pattern occurs which is comprised of roughly parallel, moderately low, well rounded ridges with fairly accordant tops (i.e., the tops of the ridges are at the same elevation at like points along their lengths).[6] The geomorphic implication of similar soils on sideslopes and crests which we would make from this shoulder rounding has been confirmed in the field. These accordant ridges are the remnants of a pre-existing, smoothly sloping landform cut by erosion into bedrock and called a pediment (Figures 7, 8, 9).

A pediment is a relatively gentle slope left at the base of a steep slope which is retreating about parallel to itself due to rilling, gullying, and creep. It is in a footslope position. The detritus from the steep retreating slope, or backslope, is washed across the pediment and flushed down a stream or onto an alluvial fill without affecting the pediment slope; the pediment therefore has been called a "surface of transport." In Figure 10, a very large pediment at the base of a steep mountain slope (the retreating slope) is shown; this pediment itself has been dissected.

In young, deeply dissected mountains the valleys are narrow, the steep eroding slopes (i.e., the retreating slopes) are close together and the detritus from them washes or slips directly into a stream channel and is flushed away. There is little or no footslope (i.e., pediment) development in such terrains. Access along such a canyon is difficult unless it has been backfilled with sediment so there is a floodplain. The deep valleys of the White Pine, Grant and Quinn Canyon Ranges are of this nature.

An older mountainous landscape, or one where the rocks are more subject to erosion has wider valley bottoms, and unless they are deeply backfilled with sediment over their bedrock floor, they have a gentle footslope at each side which is shallowly underlain by bedrock. The volcanic terrains in the Pancake, Reveille, Horse, and Quinn Canyon Ranges are of this nature

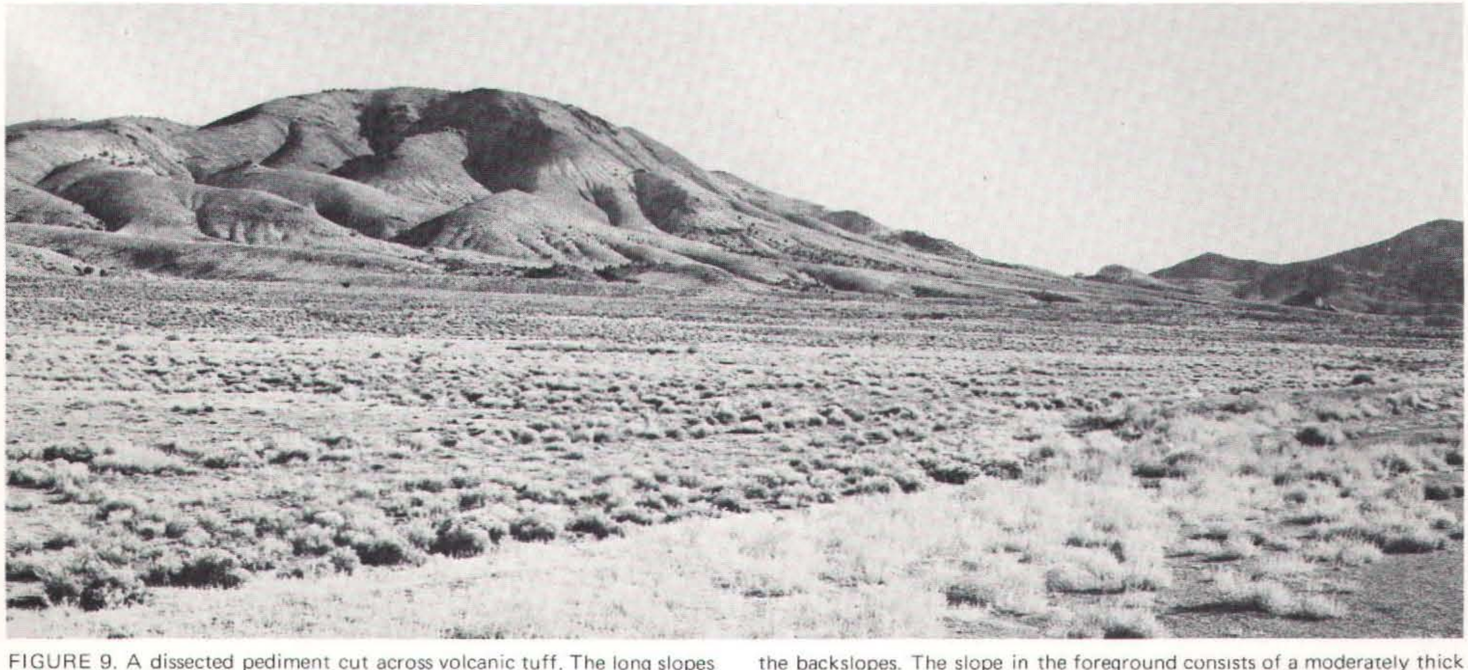


FIGURE 9. A dissected pediment cut across volcanic tuff. The long slopes flaring away from the steep mountain sideslopes (i.e., backslopes, or retreating slopes) are fine examples of pediment slopes seen in profile. This pediment has been deeply dissected, leaving the present system of accordant ridges. The incised drainageways are also cut back into parts of the backslopes. The slope in the foreground consists of a moderately thick veneer of alluvium over a buried pediment surface. This landscape in the Hot Creek Range is characteristic of extensive erosional landscapes on the volcanic rocks of south central Nevada.

(Figures 3, 17).

If the stream channel in a valley with pedimented sideslopes entrenches, lateral gullies will cut back into the pediment slope, and as it is dissected, it is transformed into a series of parallel, accordant ridges connected to a higher, steep slope at their upper end. This is the origin of the landform pattern of accordant ridges in the foothills which was mentioned above. The height of these accordant ridges can vary from 5 to 20 feet (as they occur in soil map unit 56 and 62), up to ridges from 30 to over 100 feet high (as occur in soil map units 61 and 63).

In mountainous terrain, the backslopes of the pediments are obviously the sideslopes of the hills and mountains, and are well-called that. Above the sideslopes are the crests or summits of the ridges and peaks, and the rounded slope between is called the shoulder.

The steepest slopes in a landscape are the most apt to erode, but they need not and indeed usually are not in a state of continual (or "geologic") erosion. Geomorphic research during the past 25 years has demonstrated that erosion, and accompanying sediment deposition, is a periodic phenomenon in most landscapes. (Butler, 1959). For extended periods of time even steep mountain slopes can be quite stable and erode not one significant bit. Most all of the mountain slopes in this survey area have been quite stable for thousands of years; the clayey soils on them, even though shallow, are evidence of this stability. Evidence of historical, man-induced erosion is largely confined to gullies in the alluvial fills of the canyons. However, the fact that the mountains do have a mantle of soil means there is a potential for further accelerated erosion and large scale sediment movement if the land is not properly managed.

Slope and Elevation

Temperature and moisture differences in the Great Basin are largely associated with relief, as are the steep slopes and closely spaced, steepsided drainageways which are serious limitations to land uses involving mechanized equipment. These four factors, besides soils and regional climate, are determinants of natural and cultivated plant adaptability and land use.

In Nevada, the major division between steep, mountainous landforms and the alluvial plains coincides approximately with the break between areas with dominant slopes greater than, or less than 15 percent gradient. About one-third of this survey area has slopes greater than 15 percent. Two-thirds of the survey area is comprised of sloping to level alluvial plains. One-third of the survey area is comprised of alluvial plains with slopes less than 4 percent. The level to gently sloping valley floor is peripheral to and includes the playas, and is mostly below 5,000 feet elevation. The lowest part of the main playa is at 4,635 feet elevation, whereas its margins are at 4,700 to 4,800 feet elevation. The more sloping alluvial fan piedmonts commonly lie between 5,000 and 6,000 feet elevation. The major mountain barriers rise 2,000 to 5,000 feet above the valley floor.

Climate[7]

The Railroad Valley area has a semi-arid, continental climate. Precipitation is low, sunshine is abundant, and evapotranspiration is high. Hot days and cool nights characterize the summer; winters are fairly mild.

The climate of the area, like most of Nevada, is affected by two main sources of air movement into the State. A source from the Pacific brings air across the Sierra Nevada range and persists primarily from the fall through the spring. The mountains are effective barriers, and as the air rises over the Sierra, much moisture is lost. Consequently, air flowing down the eastern slope of the Sierra is warmed by compression. When the air reaches the interior portions of Nevada it is relatively dry, but is still the primary source of precipitation during fall, winter, and spring.

A second major source of moist, warm air, flowing from out of the south during summer and early fall, creates infrequent but heavy thunderstorms. About 13 thunderstorms per year occur in the southern end of the valley, near Diablo, and about 20 per year near Currant Creek Summit on Highway 6 near the northern end of the valley. Hail falls only once or twice a year during one of these thunderstorms. Hail size is commonly small and consequently damage is minimal.

Besides differences of air sources, factors such as topography, orientation of mountains, elevation, and distance from the mountains to locations on the valley floor markedly affect local climate.

Long-term weather records for the area are not available. Two locations with limited records occur within the valley at the Diablo Highway Maintenance Station (1959-1969; 5100 feet elevation; Table 1) and at the Currant Highway Maintenance Station (1963-1969; 6240 feet elevation; Table 2). For comparison, climatic data for the former Rattlesnake Highway Maintenance Station (1942-1960; 5910 feet elevation; Table 3), which is located in the adjacent Hot Creek Valley to the west, is included. Diablo and Currant Highway Maintenance Stations do not include sufficiently long records to provide reliable absolute figures. Therefore, caution should be exercised when using their data. However, some general information can be obtained from these data when they are supplemental with other available regional climatic data, such as an isohyetal map.

Precipitation should average approximately 5 to 8 inches per year on the valley floor below about 5,000 feet elevation with higher amounts at higher elevations. For example, in the Duckwater watershed north of the Duckwater Indian Reservation, where the Bureau of Land Management maintains a network of rain gages, annual precipitation has averaged from 8.6 inches at 5800 feet to approximately 12.9 inches at 6675 feet for seven years of record. At Currant Highway Maintenance Station, seven years of observation show that about 10 inches of precipitation falls annually. Therefore, from 6000 to 7500 feet elevation, annual precipitation is estimated between 8 to 12 inches; above 8000 feet, elevation, annual precipitation is estimated at 16 to 20 inches a year.

Precipitation is highly variable. Extremes range from none for a few months to a thunderstorm-type rainfall which can lead to flood conditions. As much as 1.69 inches of rainfall has fallen in a 24-hour period at Currant Highway Maintenance Station (see Table 2). Snowfall averages from about 3 inches a year on the valley floor at the southern end of the valley to approximately 70 inches in the mountain peaks. On the valley floor, however, warm daytime temperatures melt the fallen snow rapidly and, unless extremely heavy, snow does not persist for more than a few days. Even though snowfall is infrequent, as much as 8 inches of snow has fallen in the southern end of the valley and as much as 65 inches of snow has fallen in the mountains in a given month.

The daily temperature range is very large, averaging slightly over 30 degrees F. Summer daily ranges average 35 degrees with the very warm days in the 90's, dropping to cool 50's at night. On the valley floor, temperature extremes are estimated at 110°F during the summer to a low -20°F in winter. Winter temperature maximums on the valley floor average in the 40's to 50's, whereas the minimums average in the teens and low 20's. Degree of "hotness" is characterized by the number of days with temperatures equal to or greater than 90°F; near Diablo the average is near 65 days, ranging to 70 days in the main playa and to about 35 days in the mountains at the Currant Highway Maintenance Station.

Growing season is defined as the number of continuous days when the minimum temperature is above a selected level, e.g., 24°, 28° or 32°F. Average growing season lengths and probable dates of the last spring low temperatures and first fall temperature for the Diablo, on the valley floor, and Currant Highway Maintenance Station, in the mountains, are given in Tables 4 and 5. The average growing season at Diablo is about 147 days, but lower parts of the valley floor, and particularly the main playa (4635 feet), should have considerably shorter growing seasons because of cold air drainage from the higher to the lower elevations at night. Furthermore, the growing season should be shorter at the northern end of the valley floor than at the southern end of the valley because of elevation and latitude differences. The southern half of the valley should be generally warmer than the northern half.

Average annual pan evaporation is estimated at 75 to 85 inches, with the higher evaporation rates occurring at the southern end of the valley. Humidity is relatively low, ranging from about 30 percent in the summer to 60 percent in the winter. However, daytime humidity is considerably lower than the average, ranging from 15 percent in the summer to 25 percent in the winter.

There is no wind information for Railroad Valley and although topography and weather maps suggest that prevailing wind in the valley should be from the southerly direction and average less than 20 miles per hour, wind velocities which could cause soil erosion do occur. During winter, however, wind shifts should be observed from the south to northerly directions when storm fronts pass. This change in direction is partly influenced by the constraining influence of the surrounding mountains. Gusty winds associated with thunderstorms can occur from any direction. Maximum wind velocity is difficult to estimate. The nearest location with observed maximum wind is at Ely, Nevada with 61 miles per hour.

Water Resources[8]

Duckwater Creek, the largest stream in Railroad Valley, is located in the northwest portion of the valley and is made up primarily of discharges from Big Warm Springs, Little Warm Springs, Collins Springs and numerous smaller springs. The flow is sometimes augmented by snowmelt runoff. Big Warm Springs, the largest spring area, contributes a continuous discharge of about 14 c.f.s. The waters of Duckwater Creek are used for the irrigation of 3,016 acres of land and for stock water and domestic purposes. The total water right allocated from this stream is 14,104 acre-feet per year.

Currant Creek, in the northeast portion of the valley, is also a spring fed stream, but the ranches along its reach receive most of their water from snowmelt. Six hundred acres of alfalfa and natural meadow hay are irrigated by Currant Creek and little water spills on to the desert below the community of Currant, When an unusually high water year occurs and the 4,224 acre-feet of vested water rights have been served, the remainder is used to supplement pump-irrigation on desert land entries below Currant.

The extreme northern portion of Railroad Valley contains the Green Spring Ranch and the Bull Creek Ranch, 60 acres and 560 acres, respectively.

Approximately 1,000 acres of irrigated lands lie on the east side of the valley between Blue Eagle Mountain and Nyala and are served by numerous small empheral streams and springs.

Locke's Springs rise on the west side of the valley and are used for the irrigation of 403 acres of land and for the maintenance of water fowl habitat. Locke's Springs has a continuous flow of 4.5 c.f.s.

The development of ground water for irrigation started in the early 1920's with the drilling of artesian wells near the natural discharge areas of the valley. Only small areas of pasture were developed by this method. Early in the 1950's applications for Desert land entries covered a large area near Currant and development of ground water was promising, however, only a few entries were allowed and fewer yet were successful.

Desert Land entries were again allowed in 1964, but few are permanently occupied or fully operative. At the present time, permits have been granted for 1,600 acres near Green Spring Ranch; 134 acres with perfected rights and 2,560 acres with permitted rights in the vicinity of Currant; 3,285 acres near Nyala. If all of the land with permits, 7,579 acres, is fully developed and used the 4.0 ac. ft. per acre allocation, there would be a withdrawal of 30,316 ac. ft. Pumpage during 1969 is estimated to be 390 ac. ft.

The ground water development near Locke's Springs has been made for recreation and wildlife purposes for maintaining water fowl habitat and amounts to 1,500 ac. ft. per year.

Table 16 gives the results of chemical analyses made on water from six wells in Railroad Valley. The high concentrations of iron in two of the analyses undoubtedly were caused by corrosion on the well casing.

It is estimated that the periennial yield in Railroad Valley is approximately 52,000 acre-feet and the water stored in the first 100 feet of saturated soil is 7 million acre-feet.

Crop Adaptability

Available climatic data suggest a good potential for irrigated agricultural crops on the irrigable soils of the valley bottom and the lower, smooth alluvial fans.[9] Most of these areas should be well suited to alfalfa hay production. The entire irrigable area has an excellent potential for irrigated pasture. Winter barley or winter wheat should be adapted to the whole irrigable area, whereas spring barley or spring wheat is not so well adapted, although it should be still satisfactory. Throughout the irrigable area, there is a good potential for production of grass seed and alfalfa seed. Indeed, climatic conditions appear somewhat more favorable here than in other agriculturally developed valleys of central Nevada. A variety of other climatically adapted crops could be grown, given profitable market conditions.

Development of desert soils for any of these crops, including rejuvenation of natural meadows with higher yielding species, should be planned on as a several year program during which annual crops (e.g., small grains) are grown. Initial infiltration rates on most soils can be expected to be low, soils will settle, and some of the salt or sodium affected soils may require amendments for reclamation. Since low available waterholding capacity is a common limitation for most of the irrigable soils, care must be exercised to plan an irrigation system capable of carrying a crop through peak moisture-stress periods in the hot, windy, summer season. Fertilizers will be needed for all crops, and should be applied according to crop needs and soil fertility tests.[10] Wind erosion control practices will be essential on the more sandy irrigable soils; these erodable soils should be developed carefully in small blocks with protective strips and sprinkling during windy periods until a crop is established as cover.

Vegetation

The vegetative aspect of Nevada is dominated by the shrub covered alluvial plains which comprise the majority of the landscape. The woodland, sparse patches of forest, and shrub "balds" of the mountains are prominent because they stand out in altitudinal bands above the monotonous plains. With respect to the dominant, shrub-covered plains, Nevada is divided in three zones (Billings, 1951). The Railroad Valley area is in the intermediate shadscale zone (Figures 2, 5). The creosote bush zone lies roughly 100 miles south of Railroad Valley in lower, warmer basins below the 3,300 to 3,400 feet elevation. The higher, cooler basins to the north, above roughly 5,500 feet elevation, are in the sagebrush-grass zone of Nevada.

The gross aspect of the shadscale zone vegetation ". . . is typified by low, widely spaced, more or less spiny, grayish, microphyll shrubs . . . Shrubs cover only about 7 percent of the ground area, the other 93 percent being mostly bare. A few scattered perennial and annual herbs appear in spring when winter precipitation has been sufficient." In the Railroad Valley area, the sagebrush-grass zone vegetation occupies some of the foothills above the shadscale; sagebrush-grass type stands are dominant in the higher mountain-interior valleys, are an element of the mountain woodlands, and cover the higher mountain crests and slopes which, from a distance, look smoothly green and "bald" of trees. Billings (1951) also aptly describes the aspect of the sagebrush-grass zone vegetation as consisting ". . . of relatively large (1½ to 6 feet high), non-spiny shrubs, perennial and annual grasses and forbs . . . The relatively abundant herbaceous vegetation, especially grasses, gives the sagebrush-grass zone many of the characteristics of a steppe rather than a desert. This is particularly true toward the north where bunchgrasses must be considered among the dominants . . . Ground coverage by shrubs . . . is markedly greater than in the shadscale zone, approximating 20 percent in many stands. The herbs, particularly the grasses, also show much greater coverage values."

The shadscale zone vegetation in the Railroad Valley consists of several distinct communities, of which some have been described in detail for the watershed area north of Duckwater (Blackburn, et al, 1968). The perhaps most common plant community of the alluvial plains has shadscale (Atriplex confertifolia) and bud sagebrush (Artemesia spinescens) as the dominant shrubs; galleta grass (Hileria jamesii) and Indian Ricegrass (Oryzopsis hymenoides) are characteristic grasses of this and other shadscale communities. Shadscale-bud sagebrush communities occur on a variety of soils of coarse to fine texture and variable salt contents.

Black greasewood (Sarcobatus vermiculatus) forms both relatively pure stands and stands with shadscale and bud sagebrush. It is frequently associated with salty soils and soils with shallow groundwater tables, where it is a phreatophyte. Saltgrass (Distichlis stricta) alkali sakaton (Sporobolus airoides) are common associates of greasewood on poorly drained soils. Bailey greasewood (Sarcobatus baileyi) also forms communities with shadscale and bud sagebrush on well drained upland soils. Spiny hopsage (Grayia spinosa) is a common member of various shadscale communities; on very gravelly, coarse textured soils spiny hopsage frequently is dominant in a community including bud sagebrush and shadscale. Rabbitbrush (Chrysothamnus spp.) is a very common member of these and other plant communities; where grazing and trampling have been particularly intense, rabbitbrush forms almost pure stands (Figure 16).

The shadscale communities are largely confined to the alluvial plains, but do extend onto the shallow soils of the foothills. On these foothills, at the margin of the mountains, a group of similar plant communities occur which are dominated by black sagebrush (Artemesia nova), and commonly include shadscale and bud sagebrush (Figure 17). Black sagebrush also occurs on some of the higher, older alluvial fans. It is regularly associated with shallow, frequently stoney soils which have thin topsoils (A horizons) and clayey subsoils (B horizons); these soils can be underlain by either bedrock or hardpan. The black sagebrush communities might be considered part of the shadscale zone or of the sagebrush zone, since black sagebrush extends to high elevations. In aspect, the low-growing black sagebrush is similar to the vegetation of the shadscale zone. Black sagebrush also occurs with juniper and pinyon pine.

Big sagebrush (Artemesia tridentata) and black sagebrush (Artemesia nova) are the dominant shrubs of the sagebrush-grass zone and the high mountain balds.

They are accompanied by a number of bunchgrasses, and, at higher elevations, by other shrubs such as bitterbrush (Purshia tridentata), apache plume (Fallugia paradoxa), service berry (Amelanchier spp.), and snowberry (Symphoricarpos spp.). In the mountains of intermediate elevation, the big sagebrush commonly occurs on moderately deep or deep soils, whereas black sagebrush and juniper (Juniperous osteosperma) and pinyon (Pinus monophylla) occur on the shallow soils.

The mountainous areas which are not extremely rocky or dry support extensive pinyon-juniper woodland with a variety of shrubby understories (Figure 8). At high elevations on rubbleland and jointed bedrock, open groves and scattered individual conifers and mountain mahogany (Cercocarpus ledifolius) occur.

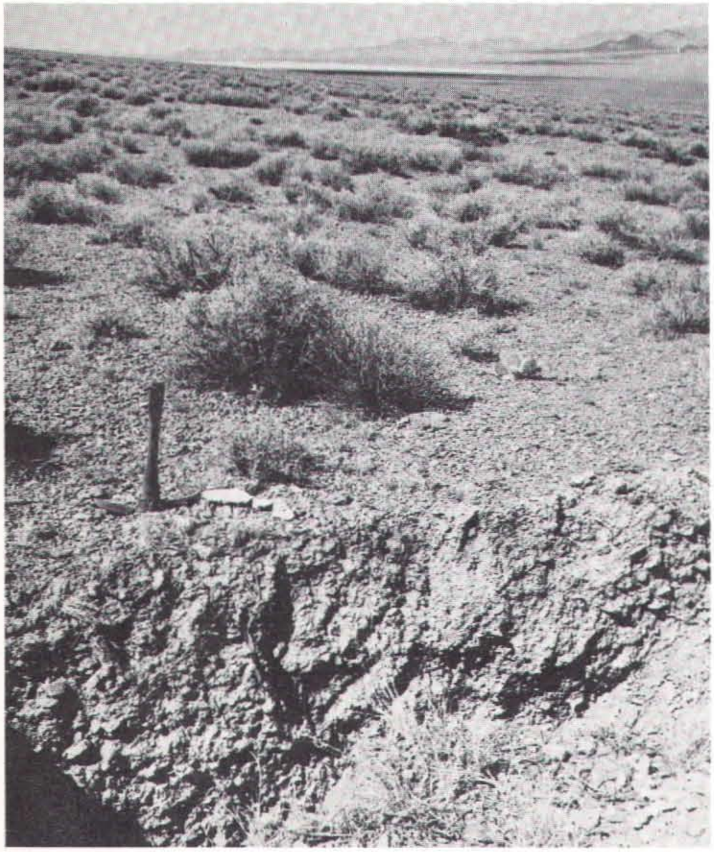


FIGURE 10. A prominent stand of spiny hopsage on a very gravelly fine sandy loam soil of soil map unit 47. It is on a relatively young alluvial fan apron below the volcanic Reveille Range. This soil is a member of a loamy-skeletal, mixed (calcareous), mesic Family of Typic Torriorthents. It does not have as prominent an accumulation of very fine sandy loam material in the surface 8 to 12 inches as do similar soils on the limestone fans below the Grant Range and to the lee of the main Railroad Valley playa. In the background is the whitish, barren surface of the southern playa, the Quinn Canyon Range foothills, and the alluvial fans of soil map unit 36.

SOILS

Soil Taxonomy

Standard reconnaissance or detailed soil surveys attempt to record enough about the basic physical and chemical properties of soils (as well as map their extent), that one can use these facts for evaluations of a variety of potential soil uses. A land-classification type survey, in comparison, checks only a few properties against a preconceived rating system, and records only the evaluations on a map; if the rating criteria change, if new technology suggests possible use of hitherto low-value soils, or if the next demand is for locating a highway alignment instead of a gravity irrigation project, the land-classification must be repeated at the same expense. Obviously, surveys which record basic data about soil properties, not evaluations, are the most efficient environmental inventories for multiple-use planning.

Historically, a major portion of the scientific effort of the National Cooperative Soil Survey has been to discover which soil properties we should measure to provide us basic data for making the best interpretations for a variety of uses. These properties have to be capable of being determined in the field. If laboratory measurements, they must be related to some field determinable features. The properties also have to be mappable on broad or detailed scale, and must be put in a logical arrangement so technical workers can identify and retrieve data. Suffice it to say, the relatively new U.S. Soil Taxonomy system (Soil Survey Staff, 1967) includes the most useful selection of tested criteria to date. The soils of the Railroad Valley area were identified, mapped, and named according to this taxonomic system. Each kind, or class of soil has a defined range of properties, according to this taxonomic system. These properties, depending on the level of classification, can be used to make different interpretations. Although use of this data-organization system, or classification, is a technical job, its soil names are connotative and many of the soil properties, such as presence of a hardpan, are closely indicated by the names.

Table 6 lists all of the kinds of soils identified in this survey area, according to the U.S. Soil Taxonomy.

This classification system has 6 categories from Order to Series, of which only the top 5 are used here (the soil Series, which is the most specific class identification, is used in detailed soil surveys, the more inclusive soil Family classes are used here since they better fit the greater flexibility needed for a reconnaissance soil survey). Note that the first syllable of the Order names[11] appear in each of the names of their respective Suborders. Similarly, the entire Suborder name reappears as part of the longer names in the Great Groups, and then an additional word is added to the Great Group name to make the Subgroup name. The names of the soil Family classes are formed by adding several descriptive words to the Subgroup name (e.g., see column 2, Table 11); in Table 6, only those additional words descriptive of texture, mineralogy, and temperature are listed for the Families, since the Subgroup portion of the Family name is given in the adjacent column.

Since the Family classes do not use all the soil property information wanted for this survey as diagnostic criteria, soils in most Families were split apart into yet more detailed classes called phases, which are based on slope, stoniness, salinity, depth to hardpans, and occurrence of gravelly substratum (if not recognized in the Family criteria). The phase separations are not a part of the U.S. Soil Taxonomy system, and are designed to reflect needs for use and management.

The syllables, or formative elements that make up the soil names, each suggest a major property of the soils which belong to that class of soil. For instance, an Aridisol is an arid, or very dry soil which can support only desert vegetation, whereas an Aquoll is a wet Mollisol affected by high groundwater. A list of formative elements is in Table 7 for readers who wish to key out the meanings of the soil names. For careful,

FIGURE 11. A shovel slice profile of a fine textured, saline, Duric Natrargid of soil map unit 31. Note the inch-thick, light colored, crusted and vesicular A horizon. The B horizon, or natric horizon, shows moderate coarse prismatic structure. A few white salt crystals show at the base of the B horizon.

complete identification of significant soil properties, one must refer to the complete soil taxonomic system (Soil Survey Staff, 1967).

Characteristic Soil Features in the Area

Soils are weathered, and altered rock material or sediments. Unless the soil forming material is very young and effects of soil forming processes are not yet apparent (as in the Entisols), soils can be seen to be composed of distinct layers, or horizons which parallel the land surface and have fairly constant thicknesses and sequence. Commonly, three major developed layers occur in this survey area.

The uppermost layer, or A horizon (surface soil) is either distinctively light gray, or if it has had humus accumulate due to vigorous growth of grasses and shrubs, as in the moister rangelands, it is distinctly dark colored. In soil taxonomy, thick, dark A horizons rich in bases are called mollic epipedons, and all soils with such a surface horizon are Mollisols. Soils with light colored A horizons are either Aridisols or Entisols; the light colored surface is evidence of low rainfall and sparse vegetation.

The second layer, or B horizon (subsoil) is commonly brownish or reddish brown colored. If it is more clayey than the A horizon, as can be noted by greater stickyness, it is called an argillic horizon, which is a horizon of clay accumulation. If, in addition to accumulating clay washed from the A horizon, it has accumulated significant levels of sodium (alkali), it is called a natric horizon (Figure 11). In the soil names, the formative elements arg and natr indicate presence of such horizons. If clay accumulation has not taken place, but there is evidence of mixing and weathering of the B horizon, it is called a cambic horizon; the soils called Orthids commonly have cambic horizons.

Limited rainfall commonly wets the soils of the alluvial plains only a foot or two deep. Soluble weathering products are leached that far and deposited. These lowermost, commonly light colored horizons of deposition form a third major horizon in many, but not all, soils of this area. Where considerable amounts of deposited calcium carbonate whiten the third layer, or form many nodules, it is called a calcic horizon. If the deposits are of opal (silica), and cement the layer into a hardpan, it is called a duripan. The Calciorthids have calcic horizons. The Durorthids (and any soil with dur in the name) have duripans in them (Figures 12, 13).

In the names of the soil Families, the terms loamy, coarse-loamy, sandy-skeletal, etc., refer to the average texture of the subsoil zone, or control section (Figure 10). Exact depths of this zone vary for different soils, but generally speaking, it is the B horizon if an argillic or natric horizon is present, or the 10 to 40 inch depth if one is not, or the entire soil if it is less than 14 inches deep and lacks an argillic horizon. The terms mixed, montmorillonitic, etc., refer to mineralogical composition. The terms mesic and frigid refer to soils with warmer and colder soil temperatures, respectively.

When a reader of this survey report needs to determine properties of a soil which cannot be simply determined from its name, or the listings of properties, he should consult a Soil Scientist familiar with the soil classification system.

FIGURE 12. A shallow duripan in a medium textured Haplic Durargid of soil map unit 56. The duripan is the ledgy, whitish layer projecting from the pit wall at about 12 inches depth.

FIGURE 13. A shallow duripan exposed by erosion along a road ditch. Note the smooth whitish surface coating of opal laminae. This horizon is an obvious barrier to root and water penetration.

General Soil Map

By the geologic chances of mountain-building, erosion, and deposition, large portions of the Railroad Valley area have similar landsurface ages, soil parent materials, local climates, and vegetation. Within these areas, the prominent and more important properties of the soils are similar, their slope and drainage patterns are repetitious, and interpretations for potential uses or limitations can be outlined in broad fashion. There are 8 of these natural kinds of soil-landscapes in this area. They provide a simple way of remembering the features of the landscape, the major soils, and their locations. They are used as the map units of the General Soil Map. The three of these soil-landscapes which occur in mountainous terrain, and share the over-riding limitation of steep slopes, have been grouped together for display in the small-scale General Soil Map. (These soil-landscape areas have been generalized from the Reconnaissance Soil Map. They could not have been efficiently conceived or delineated without construction of the more detailed map, and do not involve soil property information at a level detailed enough for general planning of land-use alternatives, although the General Soil Map could be used for small-scale display of very general planning.)

Soil-Landscapes of the Railroad Valley Area :

Area 1: Playas
(Soil Map Unit 90; 54,200 acres)

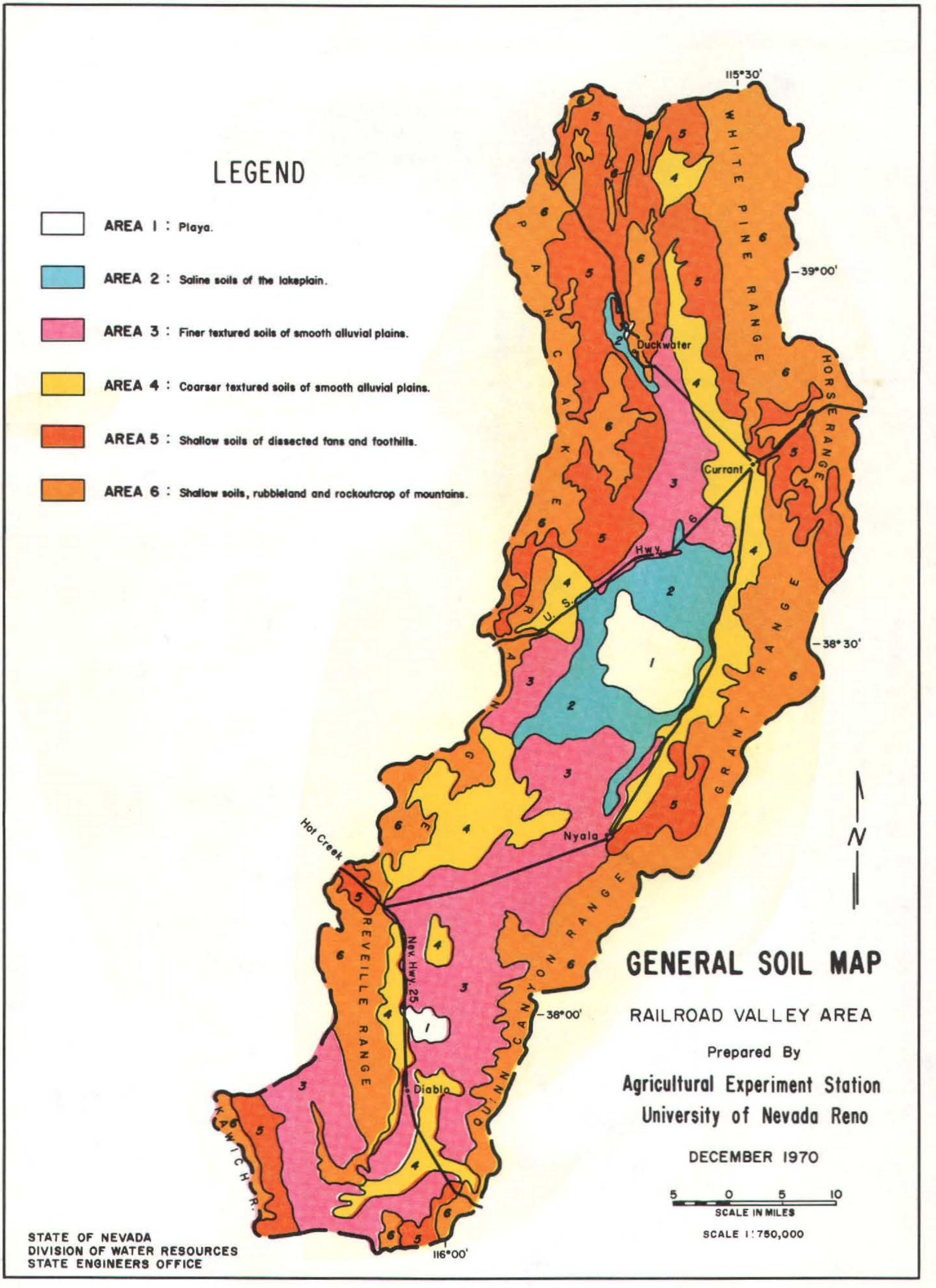
The sediments of the playas are uniformly barren, crusted, deep, and moderately fine or fine textured. Because of periodic flooding, poor physical condition, or salinity and sodium, native plants do not grow and reclamation for agriculture would be prohibitively difficult. The areas are valuable as sinks for floodwater, and are potential sinks for agricultural drainage.

Area 2: Saline Soils of the Lake Plain
(Soil Map Units 20, 21, 22, 23; 106,200 acres)

These soils are nearly level, deep, and moderately fine or fine textured. They have a mesic soil temperature regime and are most commonly somewhat poorly to very poorly drained. Most are saline. They occur on smooth lake plains and on floodplains below large springs.

The wet soils below springs support native meadow and are used for hay and pasture (soil map unit 23). They vary in salinity according to the effectiveness with which they are flushed by the spring water, and in some cases production could be improved.

Black greasewood is the most common shrub of the lake plain portion of Area 2, and occurs both as nearly pure stands and with shadscale, rabbitbrush and budsage. Black greasewood,saltgrass and alkali sacatone


LEGEND
AREA 1 : Playa.
AREA 2 : Saline soils of the lakeplain.
AREA 3 : Finer textured soils of smooth alluvial plains.
AREA 4 : Coarser textured soils of smooth alluvial plains.
AREA 5 : Shallow soils of dissected fans and foothills.
AREA 6 : Shallow soils, rubbleland and rockoutcrop of mountains.
GENERAL SOIL MAP
RAILROAD VALLEY AREA
Prepared By
Agricultural Experiment Station
University of Nevada Reno
DECEMBER 1970
5 0 5 10
SCALE IN MILES
SCALE 1:750,000
STATE OF NEVADA
DIVISION OF WATER RESOURCES
STATE ENGINEERS OFFICE
115°30'
39°00'
38°30'
38°00'
116°00'
WHITE PINE RANGE
HORSE RANGE
PANCAKE RANGE
GRANT RANGE
QUINN CANYON RANGE
REVEILLE RANGE
KAWICH R.
Duckwater
Currant
Nyala
Hot Creek
Diablo
U.S. Hwy. 6
Nev. Hwy. 25
N

indicate subsoil moisture over large parts of the area where groundwater under moderate hydraulic head occurs at shallow depths (Figure 14).

During winter and early spring, when most of the vegetation is dormant, capillary groundwater reaches the surface of many of these soils. One-quarter inch to inch-thick efflorescences of sodium carbonate and other salts accumulate in patches and nearly continuous white mantles over much of the area supporting saltgrass and shrubs. During frontal storms, strong winds blow dense white clouds of salt from these flats high into the mountains in all directions. The notable alkalinity of many of the upland soils in this survey area is thought to be due to windblown salt.

Except for the wet meadow soils, the saline soils of this low-lying lake plain have little or no agricultural value because of salinity and high groundwater tables. They have some value for range where salt-tolerant shrubs, saltgrass and alkali sacaton occur. The soils present serious problems for engineering uses.

Area 3: Finer Textured Soils of Smooth Alluvial Plains (Soil Map Units 30, 31, 32, 33, 34, 35, 36, 37, 38; 368,500 acres)

These soils are nearly level to sloping. They have moderately fine textures in their upper horizons[12], and are most commonly deep, in the sense of not having shallow hardpan or bedrock, but many have very gravelly horizons at shallow depths. These soils are well drained and have aridic soil moisture regimes and mesic soil temperatures. Most have moderate contents of soluble salts and sodium in their subsoil. They occur on the somewhat more elevated portions of the smooth lake plains, on smooth basin-fill plains, and on both smooth and dissected alluvial fans (Figures 2, 5,15).

The most common vegetation is shadscale and bud sagebrush with rabbitbrush. On some soils, black greasewood or Bailey greasewood are prominent members of the stand.

A majority of the soils are irrigable, but most of these will require some reclamation practices to remove salts and sodium. Low available waterholding capacity is a limitation for many of these soils and must be accounted for in planning irrigation systems. Most of these soils are suitable for foundations for roads and structures, with few design problems. They are also good sources of gravel.

Area 4: Coarser Textured Soils of Smooth Alluvial Plains (Soil Map Units 40, 41, 42, 43, 44, 45, 46, 47, 48; 248,900 acres)

These soils are nearly level to sloping, they are deep, and they are coarse to moderately coarse textured. They are well drained, have aridic soil moisture regimes and mesic soil temperatures. They are mostly not significantly salt or sodium affected, except in deeper horizons, and few will require reclamation procedures for agricultural development. They occur on smooth deltaic lake and basin-fill plains, on smooth

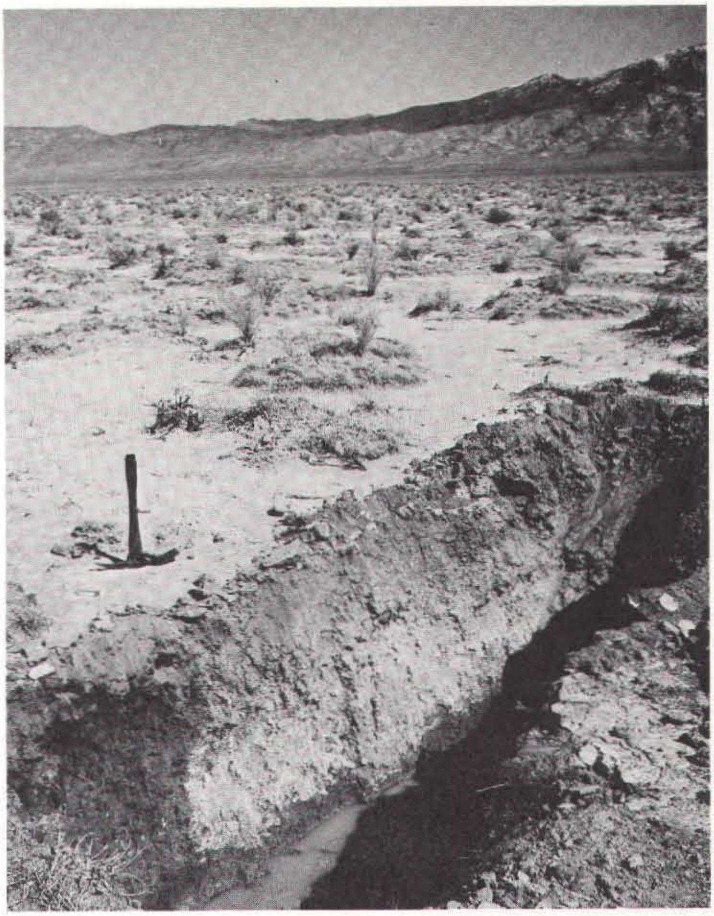


FIGURE 14. Prominent sodium carbonate efflorescences and high groundwater in fine textured Aquic Natrargid of soil map unit 21. Flowing water was encountered at 56 inches depth in a sandy stratum under silts and silty clay loams when this pit was dug in late March, 1970. A few days later, water was standing at 39 inches depth. Saltgrass forms small islands a few inches above the crusted, salt-caked soil surface; even the greasewood is stunted. The Grant Range is in the background.

FIGURE 15. These barren and crusted spots on a moderately fine textured Duric Natrargid of soil map unit 33 occur along what appears to be a relict distributary floodplain of Hot Creek. It is along the south margin of the nearly level Hot Creek fan, which is in the middle ground. Another relict channel occurs along the north margin of the fan, just below the cliffs and short fan piedmont of the Pancake Range, in the background. The polygonal pattern of pebbles on the crusted surface is attributed to dessication and frost action. Deep plowing should hasten reclamation of these spots, should the land be cultivated.

modern floodplains (mostly with entrenched channels), on smooth alluvial fan toeslopes, and on both smooth and dissected middle slopes of alluvial fans (Figure 16).

The landforms in Area 4 are essentially like those of Area 3, and the major difference recognized is the coarser texture of the soils. They range from very gravelly sandy loams, to sandy loams shallow over sand or gravel, to sands, and to deep fine sandy loams or silt loams. Almost all have limited available waterholding capacity due to coarse texture, and some are liable to wind erosion, but they all enjoy the greater permeability, tilth, and freedom from salt and sodium effects also associated with coarser textures. Properly designed sprinkler irrigation systems could ameliorate the problem of low waterholding capacity and also aid in wind erosion control on the more sandy soils.

The more sloping areas on aluvial fans are generally the least desirable soils for development in this soil-landscape because of dissection, cobbles, and extremely gravelly textures (e.g., soil map unit 47 and the upper slopes of unit 48, Figures 3, 10). The smooth, nearly level areas on deltaic lake plains, basin-fill plains, and alluvial fan toeslopes of this soil-landscape are the most desirable areas for development. Actual development site selection should be preceded by detailed soil survey within these high priority areas. Some of the most sandy soils will present serious wind erosion hazards during development or where fallow (e.g., soil map units 43, 44), and control measures should be pre-planned. Problems in engineering uses probably will be most marked on the silty soils, but generally the area should be well suited for roads and structures.

Shadscale, budsage and rabbitbrush are the most common shrubs on most soils. White sage occurs notably on the deep soils of the soil map unit 42, and prominent stands of spiny hopsage occur on the most gravelly, coarse soils of soil map unit 47.

Area 5: Shallow Soils of Dissected Fans and Foothills (Soil Map Units 50, 51, 52, 53, 54, 55, 56, 57, 58; 347,600 acres)

These soils are undulating to rolling and occur on old, smoothly rounded remnants of dissected alluvial fans and bedrock pediments in part (Figure 7), and on broad, old, smooth, gently sloping to sloping alluvial fans in part. They are most commonly moderately fine and fine textured and are underlain by hardpan or bedrock at shallow depths (Figures 12, 13). They are well drained, have aridic soil moisture regimes, have mesic or frigid soil temperatures, and are commonly not salt-effected, though some do contain significant levels of exchangeable sodium.

Shadscale, bud sagebrush, and rabbitbrush are common at lower elevations in this soil-landscape. Black sagebrush is common at intermediate and higher elevations on the finer textured, shallow soils. Juniper and some pinyon occur in the peripheral foothills, and there are a few areas of big sagebursh within the foothills on the deepest soils. White sage occurs on several included narrow floodplains.

Except for small, included areas of deeper soils, these soils are best suited for rangeland rather than agricultural development. The moderate acreages of

FIGURE 16. The nearly level plain in the foreground is interpreted to be a deltaic plain deposited by Pleistocene Hot Creek in Lake Railroad; the Hot Creek gap is visible on the skyline to the west. The soil here has a loamy sand textured surface horizon and a sandy loam subsoil; it is a Typic Torriorthent of soil map unit 43. It should be productive under careful management, but the wind erosion hazard is severe and protection must be planned. The shrubs are largely rabbitbrush.

FIGURE 17. Relict Pleistocene pediment slopes on volcanic tuffs and flow rock of the "Brown Hills," north of Duckwater. The smooth and fully rounded shoulders and crests, and short sideslopes, and the flaring pediment toeslopes of these low mountains attest to the perfect erosional modeling of this landscape. The soils over the slopes and across the broadly concave valley bottoms are shallow fine textured Typic Durargids of soil map unit 60.

included deeper soils might be the best sites for range improvement. With due consideration to hardpans, bedrock, and fine textured subsoils, these soils should be suitable for roads and structures.

Area 6: Shallow Soils, Rubbleland and Rock Outcrop of the Mountains:

Area 6A: Foothill and Lower Mountain Soils (Soil Map Units 60, 61, 62, 63, 64; 342,200 acres)

These soils are rolling, hilly, or very steep and are most commonly shallow to bedrock or hardpan. They are moderately fine and fine textured, and many are stoney. Considerable areas of rubbleland and rock outcrop occur here, but the landscape is dominantly covered with soil. The soils are well drained, have aridic soil moisture regimes and mesic or frigid soil temperatures. They are not salt or sodium-effected. This soil-landscape is comprised of the lower, more rounded, drier foothills and mountain ridges and the broadly rounded remnantal ridges of dissected pediments in several mountain-interior valleys (Figure 8).

Black sagebrush communities are characteristic of the lowest, warmest (mesic) soils (e.g., soil map unit 60, Figure 17). Juniper and pinyon, associated with stands of both black sagebrush and big sagebrush, are characteristic of the higher, cooler and moister (frigid and xerollic) soils (e.g., soil map unit 63).

These soils are best suited for range and wildlife. Shallow depth to bedrock or hardpan and steep slopes will be major limitations for engineering uses.

Area 6B: High Mountain Soils (Soil Map Units 70, 71, 72, 73; 38,400 acres)

These soils are hilly to very steep and range from shallow to deep to bedrock. They are moderately fine textured, well drained, and have xeric soil moisture regimes and frigid or cryic soil temperatures. They are not sodium or salt-affected. These are the soils of the smooth, high mountain slopes and crests. A moderate area of rubbleland and rock outcrop is included, but the area is composed of dominantly soil covered slopes.

Vegetation consists of big sagebrush, snowberry, mountain mahogany, bitterbrush and a variety of grasses and forbs. Steep slopes are the prime limitations to use, and this landscape is best suited to range, wildlife and watershed uses (Figure 8).

Area 6C: Rubbleland and Rock Outcrop (Soil Map Unit 80; 255,400 acres)

This portion of the mountainous soil-landscapes includes areas of extensive rock-surface exposure, whether it consists of talus, scree, roughly horizontal flow rock exposures, or steep rock cliffs and crags. Although these areas include roughly a third soil cover, they are of limited value for any uses except wildlife and watershed and esthetics (Figures 4, 7).

Since these rocky areas occur from the valley floor to the mountain crests, a wide variety of plant communities occur on the small areas of included soils and on the rubble slopes and in jointed bedrock. Shadscale, bud sagebrush and black sagebrush communities are common at lower elevations. Pinyon and juniper occur on the intermediate mountain elevations, along with big sagebrush and various browse plants. At the highest elevations, scattered conifers occur in craggy positions, along with big sagebrush, snowberry, and other browse on small areas of soils.

Description of Map Units of the Reconnaissance Soil Map

The kinds of soils included in each map unit of the Reconnaissance Soil Map, notes on physiographic position helpful for finding individual soils in the field, and soil properties useful for making interpretations are given in Table 11. Entries in this Table are explained next:

Column 1: Soil Map Unit Symbols and Acreage

The map unit symbols are grouped in decades, and are connotative of major soil properties and landforms. For instance, most soils of map units numbered in the 30's have similar properties, occur on similar landforms, and are roughly of the same potential utility. These similar soil properties are the basis of the General Soil Map and are described in the preceeding section on soil-landscapes.

Acreage of each map unit was calculated as a fraction of the acreage of the entire survey area (1,761,280 acres) calculated by planimetrically measuring its constituent delineations, and dividing this value by the total planimetrically measured value for the entire map area.

Column 2: Constituent Soils and Inclusions

Dominant soils of each map unit are named as phases[13] of soil Families and their estimated proportional extent for the map unit is given in parentheses. Names and phases are explained in the section on soil taxonomy.

The proportional extent of each soil is an estimate within about ±20 percentage units of the probable actual value for any one specific map delineation.[14] This range reflects both possible error, because of the necessarily limited frequency of observations during mapping, and the necessary range of values which must be allowed for the variable soil patterns of delineations mapped in different locations and all reported under the same map unit symbol.

Soils of minor extent are described lastly as inclusions, and their aggregate proportional extent indicated in parentheses. Unless otherwise stated, the textures and slopes of these minor soils are like or similar to those of the dominant soils. Average textures for the minor soils are indicated by standard textural names (Soil Survey Staff, 1951), rather than Family-class textural names used for the dominant soils. Slope class names (Table 8) are used for the minor soils, rather than percentage gradients. Some mention of the soils of minor extent should be helpful if this map is used in the field, since these small areas commonly are prominent landform elements or carry a distinctive vegetation.

Column 3: Physiographic Position

Mention of the kind of landform a soil occurs on is intended to both help the reader visualize the soil landscape, and to find particular soils in the field. Terms are explained previously in this text.

Column 4: Typical Vegetation

Only the more prominent and commonly observed plants occurring on a soil are listed here. These are not complete lists of dominants,do not reflect the variability of plant communities on some soils, and should be taken as only very generally descriptive.

Column 5: Soil Drainage

Only two inclusive classes of natural soil drainage are reported here: well drained and poorly drained. The well drained class includes the excessively, somewhat excessively, well drained, and moderately well drained classes, used in detailed soil surveys; the poorly drained class includes the somewhat poorly, poorly, and very poorly drained classes of detailed soil surveys (Soil Survey Staff, 1951).

Column 6: Depth to Bedrock, Hardpan, or Gravelly Substratum

Depths to bedrock, hardpan, or a gravelly substratum occurring under finer textured soil material are given in depth ranges which approximate the variability in the field. Only the upper 5 feet of soil or regolith, or the material down to a hardpan is described in Table 11, but if a soil with a hardpan ocurs in the mountainous uplands, it can be assumed the hardpan is underlain by rock. If a soil with a hardpan occurs on the alluvial plains in association with soils which have gravelly substrata, or if it is on a gently sloping or sloping alluvial fan, it is probable that the hardpan is underlain by a gravelly substratum.

Shallow, finer textured soil material over coarse, gravelly material is common on the alluvial plains of this survey area. If there is a fairly abrupt change from the fine to coarse material (i.e., in less than 5 inches depth), and if the textures of the fine earth fractions (i.e., the < 2 mm soil material) is quite contrasting, this texturally layered condition is noted in the soil Family name (e.g., "fine-loamy over sandy skeletal"). If the change is more gradual, or if the fine earth portion of an underlying gravelly substratum is loamy, criteria for soil Families do not allow recognition of the gravelly material (in a detailed soil survey it would be recognized as a different soil Series). Since recognition of these coarse substratum materials is important for assessing available waterholding capacity and engineering uses, we are using a "gravelly substratum" phase to flag those soils not covered by an appropriate soil Family name. A gravelly substratum phase is a soil which has as its lowermost horizon a layer of very gravelly material (>50 percent by volume gravel) or stratified sand and very gravelly material, the top of which is within 40 inches of the soil surface.

Column 7: Profile Permeability

The estimates of permeability given in this column are based on assumptions that the soil is thoroughly wetted, that the permeability rate is determined by the least permeable, or limiting horizon, and that this horizon is usually a subsoil horizon. (For thunderstorm-type events, the infiltration rate and permeability of the surface horizon might well be the limiting factor in many of these soils, and different evaluations would be needed.) Subsoil texture and occurrence of shallow hardpans or bedrock (i.e., lithic and paralithic contacts) are the primary soil properties used for evaluation (Table 9). These criteria have been used in two previous reconnaissance soil surveys in Nevada (USDA Nevada River Basin Survey Staff, 1969 and 1970). The validity of these criteria and class ranges of permeability is supported by the work of O'Neal (1952) and Persinger and Yahner (1970). Obviously, in many of the fine textured soils of the alluvial plains which have gravelly substrata, the low permeability rates given would not apply to such interpretations as utility for septic tank sewage systems, since the leach lines could be placed in the permeable gravel. Estimates of water losses from ponds and canals, etc., on such soils would also have to consider the textural layering.

Column 8: Available Waterholding Capacity

Available water is that which plants can readily retrieve from storage in a soil for vigorous growth. High available waterholding capacities mean that irrigations can be spaced out longer, and that native plants which grow in the spring or early summer on winter precipitation stored in the soil will grow larger, or that more mesic plants can persist.

The estimates given here are based on soil texture (Anon., 1968), and an assumed 4 foot rooting depth, or depth to a hardpan or bedrock, if shallower than 4 feet. The classes of available waterholding capacity used to characterize this soil property (Table 10) reflect the ranges of capacity found in the field, and are also the classes used for evaluating soil irrigability potential.

Columns 9 and 10: Coarse Fragments

Coarse fragments of rock on top of soils interfere with use of mechanical equipment, such as farm and range implements, and some estimate of frequency of occurrence should help evaluate the potential of a soil for agricultural development or range improvement practices. The surface ocver of "coarse fragments" reported here includes cobbles, stones, and boulders larger than 3 inches diameter; it does not include gravel of 2 mm - 3 inches diameter. Percent surface cover is given in estimated ranges to account for natural variability. Coarse fragments on the soil surface are also recognized by stoney phases of the soil Families (10-25% cover), but these could be mapped only if considerable inclusions of "slightly stoney" (2-10% cover) and "very stoney" (25-90% cover) areas were allowed. "Rubbleland" (>90% cover) in practice includes most of the very stoney soils in this survey area.

Coarse fragments of rock within a soil can interfere with cultivation and act as diluents to reduce waterholding capacity. When soils are being used for construction materials, coarse fragments may be deleterious or advantageous. The subsoil (below surface) volume of coarse fragments estimated in Table 11 includes all gravel, cobbles, stones, and boulders larger than 2 mm diameter; it is difficult to estimate this volume because of great natural variability. In "skeletal" Families, a consistently high volume of coarse fragments can be recognized.

Soil Interpretations for Landuse Planning and Management

In Table 15, the dominant soils of each mapping unit have been evaluated for a variety of possible land uses and physical responses which condition land use and management. These interpretations reflect current requests for land use evaluations which the National Cooperative Soil Survey regularly receives. Enough basic soils information has been collected for this area that other additional interpretations can be made on demand.

Column 11: Soil Irrigability Classification

Determination of the extent and quality of potentially irrigable soils in the Railroad Valley area was one of the many planning and management purposes for which this soil survey was initiated. Evaluation of potential irrigability of the soils was made without respect to availability of water or to climate, even though some supplies of groundwater are known to be available and limited climatic data from Diablo indicates feasibility or irrigated agriculture on the best adapted soils. The soils, per se, were evaluated according to a 5-class system, essentially like the one devised in 1967 by the Coordinated Planning Subcommittee of the Pacific Southwest Inter-Agency Committee for Studies Relating to Criteria for Type I Framework Comprehensive River Basin Studies. This group worked under the auspicies of the U.S. Government's Water Resources Council; its reports were circulated to the participants rather than being formally published. Only slight alterations from the criteria of the committee document were made to fit peculiar soil conditions in Nevada and the phase criteria limits of this soil survey; all such changes of substance are explained in Table 12, which details our criteria.

The soil irrigability class for each dominant soil is given in Table 15, and a summary tabulation of acreages of irrigable soils by class is given in Table 13; the total acreages were calculated for only the identified dominant soils and are probably conservative, since in several cases the included minor soils are fully irrigable.

The approximate geographic distribution of the irrigable soils, by irrigability class and proportion of various areas comprised of irrigable soils, is shown in the Irrigable Soils Map in the rear pocket. This map was generalized from the Reconnaissance Soil Map. It shows some of the same patterns as the General Soil Map, but differs from it in several respects. A detailed legend for the Irrigable Soils Map is given in Table 14.

Column 12: Soil Hydrologic Groups

This grouping is used to estimate runoff from rainfall for hydrologic planning. Soil properties which determine minimum rate of infiltration after prolonged wetting of a bare soil are used for this evaluation. The influence of vegetative cover is treated independently. Criteria used here are given in the Walker River Subbasin Soil Survey (USDA Nevada River Basin Survey Staff, 1969).

Columns 13 and 14: Land Capability Classes

This is an interpretive grouping of soils primarily for their agricultural value for irrigated crops or for rangeland. It is based on the ability of a soil to produce cultivated crops or rangeland pasture for an extended period without soil deterioration (Anon., 1964). In Nevada, there are no significant areas of dryland cultivated crops, therefore all cultivated crops are considered to be irrigated, and the potential value or limitations of a soil for irrigated crops are shown by Land Capability classes I to IV, in decreasing value. If a soil is nonirrigable, no entry is made in column 13. Dryland use (column 14) is restricted to range in Nevada; class VI land shows potentials for range improvement by seeding, spraying, or other fairly intensive treatments; class VII land is useful for range, but has little potential for profitable improvement by other than grazing management; class VIII land is of little value for range and is very difficult to improve.

Columns 15 and 16: Erosion Hazard

Water erosion hazards have been qualitatively estimated for the dominant soils assuming that a protective cover of vegetation is not present; a 5-class scale of erodibility hazard is used: low, moderately low, moderate, moderately high, and high erosion hazard. Erodibility is determined by the detachability and transportability of soil particles and is influenced by slope, soil structure, infiltration, litter, gravel or cobbles, and opportunities for channelization of runoff in rills or streams.

Wind erosion hazard depends on the ease of detachment and transport of particles by wind, and is estimated here for bare soils without protective vegetation. Three hazard classes are used: slight, moderate, severe (USDA Nevada River Basin Survey Staff, 1969).

Column 17: Shrink-Swell Hazard

Soils which shrink and swell as they dry and wet up can break road pavements, dislodge posts and poles, and break foundations of light structures. The degree of the hazard is largely related to the clayeyness of a soil material and the thickness of the potentially swelling layer. Only the former factor – that is, the potential of soil material to swell – is rated here in three hazard classes: low, moderate, and high. Coefficient of Linear Extensibility (COLE) values corresponding to these classes are 0.03, 0.03-0.06, and 0.06 respectively; the COLE value is the decimal fraction of the increase in thickness (i.e., "length") of a dry soil layer when it wets (in./in.). If the total thickness of the swelling soil material is known, then the total potential "heave" is the COLE value times that thickness. Shrink-swell hazard ratings are given for the soil Family textural control section, which for the most of these soils is the horizon. The COLE values are closely related to the "Shrinkage Index" values and PVC, or "Potential Volume Change" values used by engineers (Anon., 1967, 1970).

Columns 18 and 19: Engineering Soil Classes

The "Unified" (column 18) and "AASHO" (column 19) systems of engineering-use classification of soil materials are based on the textural (particle sizes) and plasticity properties of soil materials which affect their behavior when used as foundations for roads, embankments, fills, etc. The ratings given here are for the subsoils, since it is assumed the thin topsoils will be removed or mixed during construction. Where fine soil material is prominently layered over gravelly or sandy material within the 5-foot profile examined, this condition is shown by giving the engineering classes for each layer. For some soils, alternative engineering classes are given which reflect field variability or inability to precisely identify the engineering class. Engineering classes were assigned on the basis of conversion of U.S.D.A. soil textures and wet consistency determinations made in the field (Anon., 1967, pp. 4-16).

Columns 20 and 21: Suitability as Gravel or Sand Sources

The suitability of soil materials in the upper 5 feet observed during field survey is rated here according to percent of gravel and sand, overburden thickness, and thickness of the gravelly or sandy layer (Soil Conservation Service, 1970). Ratings are good, fair, and poor; materials which show no value are rated poor.

Additional Possible Interpretations

This soil survey is the first comprehensive identification of the kinds of soils and their properties in this large desert valley. It includes enough technical information (which can be supplemented by original detailed soil descriptions and original field maps at one inch per mile scale on file with the Cooperative Soil Survey) that soil scientists could make several kinds of single-factor land use planning or land evaluation maps on demand and in addition to those presented here. For those problems or possible land developments which might necessitate additional field investigations, this survey can identify those areas most apt to be profitably worked. Possible additional uses or interpretations which might be based on this survey include:

- Highway, Transmission Line, Pipeline and Canal Alignment Planning
- Urban Facilities Location
- Airfield Location
- Construction Materials Location
- Suburban Development Location
- Landuse Zoning
- Rangeland and Forestland Management Planning
- Soils-Plant Community Relations
- Geographic and Ecological Studies

FOOTNOTES

1 H.B. Summerfield is a Soil Scientist, Soil Conservation Service, U.S. Department of Agriculture; F.F. Peterson is an Associate Soil Scientist, Agricultural Experiment Station, University of Nevada, Reno. This soil survey has been made according to standards of the National Cooperative Soil Survey. Field correlation of kinds of soils and technical reviews were made by Eddie L. Spencer, Soil Correlator, and Edmund A. Naphan, State Soil Scientist, Soil Conservation Service, Reno, Nevada.

2 Alluvium is water-deposit sediment; sediment includes all cobbles, sand, silt, or clay particles which have been moved by water of wind at some time.

3 Dissection of an alluvial fan (or upland landform) is caused by down-cutting of stream channels, leaving gullies or narrow valleys and intervening ridges. The depth and spacing of these drainageways is of great importance to land use. Unfortunately, patterns of dissection and drainage depths are so irregular that they cannot be consistently mapped at a reconnaissance level. As an approximate description, landforms are called dissected in this report when drainageways are deeper than 3 feet and are spaced closely enough to interfere with use of mechanized equipment. Conversely, smooth areas have drainageways either shallower than 3 feet, or quite widely spaced.

4 A drainageway, or drain is any watercourse of any size along which water collects and flows as a stream. A drainageway necessarily is in some sort of depression which may be a rill, a gully or a valley. The portion of land between two drainageways is called an interfluve, and again no necessary size is implied. The interfluve may be merely a couple-foot wide strip between two rills, or it could be a major mountain ridge between two valleys.

5 In the Railroad Valley area this generalization on shoulder-rounding and crest-sideslopes soil similarity in dissected landscapes proved so useful that we coined the terms ballena and ballena-form to identify broadly rounded, remnantal ridges of old, dissected alluvial fans or pediments on which the same soil extends from the crest, over the shoulder and down the sideslope. Ballena is Spanish for "whale," and is the name of a village in southern California near which are several such broadly rounded ridges composed of Eocene-age gravel and covered with thick, clayey, Pleistocene-age soils. The generalization on shoulder rounding seems more generally applicable in Nevada than that on angular shoulders; both require field checking in new areas.

6 Each of these well-rounded remnantal ridges might well be called a bedrock ballena, in conformity with the previously suggested term of ballena for rounded ridge-like remnants of dissected alluvial fans. Figure 8 is an example of the large-scale bedrock ballenas which may be seen in many mountain-interior valleys.

7 This section was prepared by Clarence M. Sakamoto, State Climatologist for Nevada, National Oceanic and Atmospheric Administration (NOAA).

8 This section was prepared by Thomas J. Smales of the Division of Water Resources.

9 These estimates of crop adaptability were prepared by H.R. Guenthner, Agronomist, Cooperative Extension Service, and E.H. Jensen and H.P. Cords, Agronomists, Agricultural Experiment Station, University of Nevada, Reno.

10 Soil tests for salts, sodium, and fertility, as well as irrigation water quality tests are available from the Nevada Soil and Water Testing Laborátory, Agricultural Experiment Station, University of Nevada, Reno. Sample bags and information forms are available at local County Cooperative Extension Service Offices.

11 Soils of only 3 of the 10 possible Orders occur in this area, and not all of Suborders, Great Groups, Subgroups or Families are represented by soils of this area.

12 In this reconnaissance soil survey, the soil textures referred to in Table 11 and in this section are averages for the subsurface horizons. The commonly thin surface horizons are somewhat coarser textured in most cases; they are coarest where subsurface horizons are sandy, and finest where subsurface horizons are clayey.

13 Among the phases recognized, stoney soils have an about 10 to 25 percent cover of coarse fragments larger than 3 inches diameter; saline soils have enough soluble salts in their upper 20 inches to give conductivities of saturated paste extracts of more than 4 mmhos/cm; in this area, saline soils have considerable content of sodium carbonate in addition to other salts and should be sodic; shallow soils are less than 20 inches deep to hardpans; lithic soils are less than 20 inches deep over bedrock, and this fact is noted by the word "lithic" in their names.

14 A delineation is a specific land area shown by a boundary on a map. A map unit is a group of delineations, all of which have similar patterns and proportions of soils. The map unit description must have enough range to cover the variations between delinations mapped in different locations.

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TABLE 1. TEMPERATURE AND PRECIPITATION DATA FOR DIABLO HIGHWAY MAINTENANCE STATION (1959-1969). ELEVATION 5100 FEET.

Month	TEMPERATURE						PRECIPITATION				
	Average Daily Maximum	Extreme Maximum	Average Daily Minimum	Extreme Minimum	Mean	Mean No. of Days 90°F	Average Monthly Total	Maximum Monthly Total	Maximum 24-Hour Total	Average Monthly Snow	Maximum Monthly Snow
JANUARY	44.5	62	11.9	-12	28.2	0	0.44	1.96	0.76	0.4	2.5
FEBRUARY	50.4	70	20.0	- 5	35.2	0	0.70	2.32	1.18	0.6	3.0
MARCH	57.3	78	24.3	3	40.8	0	0.20	0.47	0.45	*	0.2
APRIL	66.7	89	33.0	12	49.8	0	0.51	1.58	0.90	1.0	8.2
MAY	77.0	96	42.4	21	59.7	1	0.26	0.96	0.83	*	0.4
JUNE	85.3	105	51.1	29	68.2	11	0.46	1.22	0.70	T	T
JULY	94.7	110	58.5	38	76.6	25	0.76	2.52	1.50	0.0	0.0
AUGUST	91.8	108	56.8	36	74.3	22	0.51	1.56	1.40	0.0	0.0
SEPTEMBER	83.0	96	45.6	25	64.3	7	0.52	2.04	0.80	0.0	0.0
OCTOBER	74.3	89	36.0	20	51.2	0	0.24	1.51	1.00	T	T
NOVEMBER	58.1	76	23.7	6	40.9	0	0.26	0.91	0.50	*	0.5
DECEMBER	44.7	68	14.1	-20	29.4	0	0.42	1.70	0.80	1.3	7.8
ANNUAL	69.0	110	34.8	-20	51.9	66	5.28	7.97	1.50	3.3	17.1

* Less than 0.1 inch

TABLE 2. TEMPERATURE AND PRECIPITATION DATA FOR CURRANT HIGHWAY MAINTENANCE STATION (1963-1969). ELEVATION 6240 FEET.

	TEMPERATURE						PRECIPITATION				
Month	Average Daily Maximum	Extreme Maximum	Average Daily Minimum	Extreme Minimum	Mean	Mean No. of Days 90°F	Average Monthly Total	Maximum Monthly Total	Maximum 24-Hour Total	Average Monthly Snow	Maximum Monthly Snow
JANUARY	40.1	56	14.0	-20	27.1	0	1.47	3.64	1.07	12.6	21.0
FEBRUARY	44.5	57	17.1	-17	30.8	0	0.97	3.64	1.69	20.0	65.0
MARCH	51.9	75	22.3	-12	37.1	0	0.80	2.78	0.39	7.5	15.0
APRIL	60.2	73	30.1	3	45.2	0	0.86	2.42	0.90	5.8	14.0
MAY	70.9	85	36.9	11	53.9	0	0.69	2.21	0.73	3.8	22.0
JUNE	77.8	92	43.0	26	60.4	2	1.90	3.88	1.45	0.3	2.0
JULY	88.9	95	51.1	31	70.0	17	0.78	1.62	1.17	0.0	0.0
AUGUST	86.2	92	49.3	24	67.8	12	0.68	2.38	1.19	0.0	0.0
SEPTEMBER	79.0	87	41.1	17	60.0	3	0.59	1.49	1.10	0.0	0.0
OCTOBER	68.6	83	33.4	12	51.0	0	0.18	0.41	0.30	0.0	0.0
NOVEMBER	52.4	67	23.3	2	37.8	0	0.61	1.59	0.76	2.0	7.0
DECEMBER	43.4	57	16.4	-22	29.9	0	1.13	2.26	1.30	12.6	23.0
ANNUAL	63.7	95	31.5	-22	47.6	34	10.66	13.55	1.69	64.6	87.0

TABLE 3. TEMPERATURE AND PRECIPITATION DATA FOR RATTLESNAKE HIGHWAY MAINTENANCE STATION (1942-1960). COORDINATE: 38° 26'N, 116° 03'W. ELEVATION 5910 FEET.

	TEMPERATURE						PRECIPITATION				
Month	Average Daily Maximum	Extreme Maximum	Average Daily Minimum	Extreme Minimum	Mean	Mean No. of Days 90°F	Average Monthly Total	Maximum Monthly Total	Maximum 24-Hour Total	Average Monthly Snow	Maximum Monthly Snow
JANUARY	41.3	62	17.6	-11	29.5	0	.31	1.24	0.55	2.1	12.0
FEBRUARY	45.7	69	20.5	-19	33.1	0	.30	1.67	0.54	2.0	8.5
MARCH	52.6	80	25.6	-10	39.0	0	.45	2.06	0.64	1.9	10.2
APRIL	63.5	87	34.5	12	49.0	0	.45	1.98	0.60	*	7.0
MAY	71.0	90	41.9	22	56.4	**	.49	2.42	1.33	T	T
JUNE	81.9	100	51.5	29	66.8	7	.27	1.33	1.10	0.0	0.0
JULY	90.2	103	59.9	45	75.0	17	.34	1.12	0.71	0.0	0.0
AUGUST	87.8	100	57.8	40	72.9	12	.36	1.40	1.20	0.0	0.0
SEPTEMBER	81.5	98	50.9	24	66.3	3	.39	1.00	0.70	T	T
OCTOBER	67.6	85	39.3	17	53.8	0	.44	2.18	1.80	*	2.5
NOVEMBER	52.9	74	26.6	5	39.8	0	.49	2.76	1.07	1.8	8.5
DECEMBER	45.3	66	21.3	- 9	33.5	0	.46	1.33	0.91	1.0	4.7
ANNUAL	65.1	103	37.3	-19	51.3	39	4.75	10.84	1.80	8.8	21.8

* Less than 0.1 inch

** Less than 1 day

TABLE 4. SPRING AND FALL LOW TEMPERATURES AND GROWING SEASON PROBABILITIES AT THE DIABLO HIGHWAY MAINTENANCE STATION (1959-1970)

Dates of Last Spring Occurrence of Low Temperatures					
Temperature	Percent Chance of Occurrence Later Than Indicated Date				
(°F)	90%	75%	50%	25%	10%
24 (or lower)	April 5	April 13	April 23	May 5	May 11
28 (or lower)	April 19	April 26	May 4	May 12	May 20
32 (or lower)	April 22	May 1	May 12	May 23	June 2
Dates of First Fall Occurrence of Low Temperatures					
Temperature	Percent Chance of Occurrence Earlier Than Indicated Date				
(°F)	10%	25%	50%	75%	90%
24 (or lower)	Oct. 16	Oct. 22	Oct. 29	Nov. 5	Nov. 11
28 (or lower)	Sept. 23	Oct. 4	Oct. 16	Oct. 29	Nov. 8
32 (or lower)	Sept. 27	Oct. 7	Oct. 19	Oct. 31	Nov. 11
Growing Season Lengths (Days) For Selected Minimum Temperatures					
Temperature	Percent Chance of Longer Than Indicated Length				
(°F)	10%	25%	50%	75%	90%
24 (or lower)	199	191	183	174	167
28 (or lower)	201	185	167	149	134
32 (or lower)	169	159	147	135	125

TABLE 5. SPRING AND FALL LOW TEMPERATURES AND GROWING SEASON PROBABILITIES AT THE CURRANT HIGHWAY MAINTENANCE STATION (1948, 1963-1968)

Dates of Last Spring Occurrence of Low Temperature					
Temperature	Percent Chance of Occurrence Later Than Indicated Date				
(°F)	90%	75%	50%	25%	10%
24 (or lower)	April 23	May 4	May 14	May 24	June 4
28 (or lower)	May 18	May 25	June 1	June 8	June 15
32 (or lower)	June 11	June 18	June 25	July 2	July 9
Dates of First Fall Occurrence of Low Temperatures					
Temperature	Percent Chance of Occurrence Earlier Than Indicated Date				
(°F)	10%	25%	50%	75%	90%
24 (or lower)	Sept. 1	Sept. 16	Oct. 2	Oct. 18	Nov. 2
28 (or lower)	Aug. 22	Sept. 1	Sept. 12	Sept. 23	Oct. 3
32 (or lower)	Aug. 20	Aug. 30	Sept. 10	Sept. 21	Oct. 1
Growing Season Lengths (Days) For Selected Minimum Temperatures					
Temperature	Percent Chance of Longer Than Indicated Length				
(°F)	10%	25%	50%	75%	90%
24 (or less)	172	154	134	114	97
28 (or less)	128	115	101	87	75
32 (or less)	98	85	71	57	45

TABLE 6. KINDS OF SOILS MAPPED IN THE RAILROAD VALLEY AREA

Order	Suborder	Great Groups	Subgroups	Family and Depth, Salinity, or Substratum Phases
Entisols	Fluvents	Torrifluvents	Typic Torrifluvents	Coarse-loamy, mixed (calcareous), mesic
	Orthents	Torriorthents	Typic Torriorthents	Loamy-skeletal, mixed (calcareous), mesic
				Coarse-loamy, mixed (calcareous), mesic
				Fine, montmorillonitic (calcareous), mesic, saline
			Aquic Torriorthents	Fine, montmorillonitic (calcareous), mesic saline
	Psamments	Torripsamments	Typic Torripsaments	Mixed, mesic
Aridisols	Argids	Durargids	Typic Durargids	Fine, montmorillonitic, mesic, shallow
			Haplic Durargids	Fine-loamy, mixed, frigid, shallow
				Fine-loamy, mixed, mesic, shallow
			Haploxerollic Durargids	Fine-loamy, mixed, frigid, shallow
			Xerollic Durargids	Fine, montmorillonitic, frigid, shallow
		Haplargids	Duric Haplargids	Fine-loamy, mixed, frigid
			Durixerollic Haplargids	Fine-loamy, mixed, frigid
			Lithic Haplargids	(Fine) clayey, montmorillonitic, frigid
				(Fine) clayey, montmorillonitic, mesic
			Lithic Xerollic Haplargids	Clayey, montmorillonitic, frigid
				(Fine) loamy, mixed, frigid
		Nadurargids	Typic Nadurargids	Fine-loamy, mixed, mesic, shallow, saline
				Fine, montmorillonitic, mesic, shallow
			Aquic Haplic Nadurargids	Fine, montmorillonitic, mesic, shallow, saline
			Haplic Nadurargids	Fine-loamy, mixed, mesic, shallow
				Fine, montmorillonitic, mesic, shallow

Order	Suborder	Great Groups	Subgroups	Family and Depth, Salinity, or Substratum Phases
		Natrargids	Aquic Natrargids	Fine, montmorillonitic, mesic, saline
			Duric Natrargids	Fine-loamy, mixed, mesic
				Fine-loamy, mixed, mesic, gravelly substratum
				Fine-loamy over sandy or sandy-skeletal, mixed, mesic
				Fine, montmorillonitic, mesic
				Fine, montmorillonitic, mesic, saline
				Fine, montmorillonitic, mesic, gravelly substratum
		Paleargids	Xerollic Paleargids	Fine, montmorillonitic, frigid
	Orthids	Calciorthids	Aquic Calciorthids	Fine-loamy, mixed, mesic, saline
		Camborthids	Typic Camborthids	Loamy-skeletal, mixed, mesic
			Duric Camborthids	Sandy-skeletal, mixed, mesic
				Loamy-skeletal, mixed, mesic
				Coarse-loamy, mixed, mesic
		Durorthids	Typic Durorthids	Coarse-loamy, mixed, mesic, shallow
			Entic Durorthids	Coarse-loamy, mixed, mesic, shallow
Mollisols	Aquolls	Calciaquolls	Typic Calciaquolls	Fine-loamy, carbonatic, mesic
				Fine-loamy, carbonatic, mesic, saline
	Borolls	Cryoborolls	Argic Cryoborolls	Fine-loamy, mixed
			Argic Lithic Cryoborolls	(Fine) loamy, mixed
	Xerolls	Argixerolls	Aridic Argixerolls	Fine-loamy, mixed, frigid
			Aridic Lithic Argixerolls	Clayey, montmorillonitic, frigid
		Durixerolls	Aridic Durixerolls	Fine, montmorillonitic, frigid, shallow
		Haploxerolls	Torrifluventic Haploxerolls	Fine-loamy, mixed, mesic

TABLE 7. MEANINGS OF THE FORMATIVE ELEMENTS IN NAMES OF SOIL CLASSES

Formative Element	Example of Use	Meanings for Soils of Railroad Valley Area
arg	Durargids	With subsoil horizon of clay accumulation (argillic horizon)
aqu	Aquolls	With properties due to wetness
bor	Borolls	Cold soil
calc	Calciaquolls	With subsoil horizon of calcium carbonate accumulation (calcic horizon)
camb	Camborthid	With altered subsoil horizon
cry	Cryoborolls	Very cold soils
dur	Durargid	With silica-cemented hardpan (duripan)
ent	Torriorthent	Recent, without diagnostic horizons (one of the Entisols)
ent	Entic* Durorthid	With strongly cemented or discontinuous duripan
fluv	Torrifluvent	On an active floodplain
hapl	Haplargid	Simple, without special features
hapl	Haplic* Durargid	With strongly cemented or discontinuous duripan
id	Aridisol	An arid soil (one of the Aridisols)
lith	Lithic Haplargid	Shallow to hard bedrock
nadur	Nadurargids	With sodium-affected subsoil and a hardpan (natric horizon and duripan)
natr	Natrargid	With a sodium-affected subsoil horizon of clay accumulation (natric horizon)
oll	Xeroll	With a dark colored, thick surface horizon (mollic epipedon; one of the Mollisols)
orth	Camborthid	Common example (for Aridisols means without argillic horizon; for Entisols means not a sand texture)
pale	Paleargid	Old soil with very thick, clayey subsoil
psamm	Psamment	Very sandy soil; a sand
torr	Torriorthent	An arid soil (same degree of dryness as for Aridisols), mesic soil temperatures
typic	Typic Durorthid	Common example; without special features
xer	Xeroll	With a winter-moist and summer-dry soil moisture regime
xer	Xerollic* Durargid	A somewhat more moist soil than in the "typic" subgroup

*When this formative element is used in the adjectival portion of this particular Subgroup name, it has the particular meaning given here.

TABLE 8. SLOPE CLASSES AND NAMES

SLOPE NAMES		Slope Classes by Gradient
Simple Slopes	Complex Slopes	%
Level or Nearly Level	Level or Nearly Level	0-2
Gently Sloping	Undulating	2-4
Moderately Sloping	Gently Rolling	4-8
Sloping	Rolling	8-15
Moderately Steep	Hilly	15-30
Steep	Steep	30-50
Very Steep	Very Steep	50-70
Extremely Steep	Extremely Steep	> 70

TABLE 9. SOIL PROFILE PERMEABILITY CLASS CRITERIA

Permeability Class[1]	Range	Criteria
Slow	< 0.2"/hr.	Fine, very fine, clayey, fine-silty textural families; soils with hardpan, lithic or paralithic contacts.
Moderate	0.2-2.0"/hr.	Coarse-silty, fine-loamy, clayey-skeletal textural families.
Moderately Rapid	2.0-6.3"/hr.	Coarse-loamy, loamy-skeletal textural families.
Rapid	> 6.3"/hr.	Sandy, sandy-skeletal, fragmental textural families.

[1] The slow permeability class of this report includes the very slow and slow classes used in more detailed technical classifications (Anon., 1967); similarly, our moderate class includes moderately slow and moderate classes, and our rapid class includes rapid and very rapid classes.

TABLE 10. AVAILABLE WATERHOLDING CLASS RANGES

Class	Range of Available Waterholding Capacity to 4 Feet Depth, or to Hardpan or Bedrock
	(inches of water)
I	6
II	4.5-6
III	3-4.5
IV	2.5-3
V	2.5

Table 11. KINDS OF SOILS IN MAP UNITS AND THEIR PROPERTIES
Railroad Valley Reconnaissance Soil Survey Area, Nevada

Map Unit Symbol & Acreage (1)	Constituent Soils or Land Types in Map Unit and Approximate Proportions (2)	Physiographic Position (3)	Typical Vegetation (4)	Soil Drainage (5)	Depth to Bedrock or Hardpan or Gravelly Substratum (inches) (6)	Profile Permeability (7)	Available Water-holding Capacity Class (8)	Coarse Fragments % Surface Cover (9)	Coarse Fragments % Subsoil Volume (10)
20 22,000 Ac.	Aquic Torriorthents – fine, montmorillonitic, (calcareous) mesic, -02% slopes, (50%) saline.	Lake plains marginal to playas.	Black greasewood	Poorly drained (Subject to overflow)	> 60	Slow	I	None	None
	Typic Torriorthents – fine, montmorillonitic, (calcareous) mesic, 4-30% slopes, (40%) saline.	Large coppice dunes of sand-sized clay aggregates.	do.	Well drained	> 60	Slow	I	None	None
	Inclusions of Playa in small areas between some dunes and along margins of the main playa. (10%)		Barren						
21 55,900 Ac.	Aquic Calciorthids – fine-loamy, mixed, mesic, 0-2% slopes, saline. (35%)	On lake plains in complexes with the Natrargids.	Black greasewood, Rabbitbrush, Salt bush, Salt grass, Alkali sacaton, Shadscale	Poorly drained (Subject to overflow)	> 60	Moderate	I	None	None
	Aquic Natrargids – fine, montmorillonitic, mesic, 0-2% slopes, saline. (35%)	On lake plains in complexes with the Calciorthids.	do.	Poorly drained (Subject to overflow)	> 60	Slow	I	None	None
	Inclusions of Typic Calciaquolls in seepy areas, Aquic Haplic Nadurargids in complexes, Aquic Xerorthents in shallow drainageways, and Typic Torripsamments as dunes. (30%)		do.						
22 16,700 Ac.	Typic Nadurargids – fine-loamy, mixed, mesic, 0-4% slopes, shallow, saline. (60%)	Alluvial fan toeslopes, lake plains, and weathered travertine spring mounds.	Black greasewood, Shadscale	Well drained	10-20 to hardpan	Slow	IV	None	None
	Aquic Haplic Nadurargids – fine, montmorillonitic, mesic, 0-2% slopes, shallow, saline. (15%)	Low-lying lake plains and alluvial fan toeslopes.	do.	Poorly drained (Subject to overflow)	10-20 to hardpan	Slow	V	None	None
	Inclusions of coarse textured Typic Durorthids on weathered travertine spring deposits and of Aquic Natrargids in complexes with the Nadurargids. (25%)		do.						
23 11,720 Ac.	Typic Calciaquolls – fine-loamy, carbonatic, mesic, 0-2% slopes. (70%)	Seep and overflow areas below springs.	Native wet meadow	Poorly drained (Subject to overflow)	> 60	Slow	I	None	None
	Typic Calciaquolls – fine-loamy, carbonatic, mesic, 0-2% slopes, saline. (20%)	In complexes with the less saline Calciaquolls.	do.	Poorly drained (Subject to overflow)	> 60	Slow	I	None	None
	Inclusions of medium textured Aquic Torrifluvents in drainageways from outside areas. (10%)		Black greasewood Rabbitbrush						
30 38,750 Ac.	Haplic Nadurargids – fine-loamy, mixed, mesic, 0-2% slopes, shallow. (60%)	Lake plains.	Black greasewood, Shadscale, Bud sagebrush, Rabbitbrush	Well drained	10-20 to hardpan	Moderate	V	None	None
	Duric Natrargids – fine-loamy, mixed, mesic, 0-2% slopes. (20%)	Lake plains.	do.	Well drained	> 60	Moderate	II-III	None	0-15
	Inclusions of fine textured Aquic Natrargids and Aquic Haplic Nadurargids and medium textured Duric Natrargids shallow over gravel in complexes with the dominant soils. (20%)		do.						

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
31 15,200 Ac.	Duric Natrargids – fine, montmorillonitic, mesic, 0-2% slopes, saline. (60%)	Old distributary flood-plains crossing lake plains.	Black greasewood, Rabbitbrush, Shadscale	Well drained	> 60	Slow	I	None	None
	Duric Natrargids – fine, montmorillonitic, mesic, 0-2% slopes, saline, crusted. (30%)	30-100 foot-wide, slightly depressed, barren spots, in complexes with vegetated and less crusted Natrargids.	do.	Well drained	> 60	Slow	I	None	None
	Inclusions of medium textured Haplic Nadurargids in complexes with the other Argids, and of Typic Torripsamments on stabilized low dunes. (10%)		do.						
32 32,300 Ac.	Duric Natrargid – fine, montmorillonitic, mesic, 0-2% slopes. (75%)	Lake plains and lake flats between offshore bars.	Black greasewood, Shadscale, Rabbitbrush, Alkali Sacaton	Well drained	> 60	Slow	I	None	None
	Typic Torriorthent – loamy-skeletal, mixed, (calcareous) mesic, 0-8% slopes. (15%)	Off-shore bars and beaches	Shadscale Bud sagebrush	Well drained	7-11 to gravel	Moderately rapid	III	None	None
	Inclusions of saline Aquic Natrargids and saline Aquic Calciorthids, and medium textured Duric Natrargids shallow over gravel in complexes with the dominant soils. Many 30-50 foot-wide, crusted, barren spots occur on the fine textured Natrargids. (10%)		Black greasewood Alkali Sacaton Rabbitbrush						
33 15,000 Ac.	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes. (50%)	Old distributary flood-plains crossing relict lake plain and along fan toeslope margins.	Shadscale Bud sagebrush Galleta grass	Well drained	18-26 to gravel	Moderate	III	None	25-60
	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes, crusted. (35%)	30-150 foot-wide, slightly depressed, barren spots in complexes with vegetated Natrargids.	Barren	Well drained	18-26 to gravel	Moderate	III	None	25-60
	Inclusions of moderately coarse textured Typic Torriorthents in drainageways and on alluvial fan toeslopes; of very gravelly, moderately coarse textured Duric Camborthids on fan toeslopes, and of deep, medium textured Duric Natrargids in complexes with the other Natrargids. (15%)		Shadscale Bud sagebrush Galleta grass						
34 82,700 Ac.	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes. (50%)	Smooth alluvial fan toeslopes, lacustrine plains, and basin-fill plains.	Shadscale Bailey greasewood, Bud sagebrush, Rabbitbrush, Galleta grass	Well drained	18-26 to gravel	Moderate	III	None	25-60
	Duric Natrargids – fine-loamy, mixed, mesic, 0-2% slopes, gravelly substratum. (30%)	In complexes with the other Natrargids.	do.	Well drained	30-50 to gravel	Moderate	II-III	None	5-15
	Inclusions of very gravelly and non-gravelly, moderately coarse textured Duric Camborthids and Typic Torriorthents on alluvial fan toeslopes and in drainageways; some fine-textured Duric Natrargids occur in complexes with the moderately fine textured ones. (20%)								

Map Unit Symbol & Acreage (1)	Constituent Soils or Land Types in Map Unit and Approximate Proportions (2)	Physiographic Position (3)	Typical Vegetation (4)	Soil Drainage (5)	Depth to Bedrock or Hardpan or Gravelly Substratum (inches) (6)	Profile Permeability (7)	Available Water-holding Capacity Class (8)	Coarse Fragments % Surface Cover (9)	Coarse Fragments % Subsoil Volume (10)
35 18,600 Ac.	Duric Natrargids – fine loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes. (70%)	Smooth alluvial fans.	Shadscale Bud sagebrush Galleta grass	Well drained	18-26 to	Moderate	III	None	25-60
	Inclusions of very gravelly and gravelly, moderately coarse textured Duric Camborthids and deep, medium textured Duric Natrargids in complexes with the dominant Natrargids. (30%)		do.						
36 56,200 Ac.	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 4-15% slopes. (80%)	Smooth and dissected, middle and upper alluvial fans.	Shadscale Bud sagebrush Galleta grass Rabbitbrush	Well drained	18-26 to gravel	Moderate	III	None	25-60
	Inclusions of gravelly and very gravelly moderately coarse textured Duric Camborthids and Typic Torriorthents in drainageways and on small overplaced alluvial fans, and of medium textured Haplic Nadurargids in complexes with the dominant Natrargids. (20%)		do.						
37 7,300 Ac.	Duric Natrargids – fine-loamy, mixed, mesic, 2-8% slopes. (75%)	Smooth and dissected alluvial fans.	Shadscale Bud sagebrush Galleta grass Rabbitbrush	Well drained	45-60+ to gravel	Moderate	II-III	None	5-15
	Inclusions of very gravelly, moderately coarse textured Typic Torriorthents on small alluvial fans and in drainageways, and nearly level, medium textured Duric Natrargids shallow over gravel on alluvial fan toeslopes. (25%)		Spiny hopsage Shadscale						
38 102,400 Ac.	Duric Natrargids – fine, montmorillonitic, mesic, 0-4% slopes, gravelly substratum. (65%)	Interfluves of dissected and smooth alluvial fans.	Shadscale, Bud sagebrush, Bailey greasewood, Galleta grass, Rabbitbrush	Well drained	18-30 to gravel	Slow	III	<2	20-35
	Duric Natrargids – fine, montmorillonitic, mesic, 4-15% slopes, gravelly substratum. (20%)	Upper, dissected alluvial fans.	do.	Well drained	18-30 to gravel	Slow	III	<2	20-35
	Inclusions of sloping, fine textured, shallow Typic Durargids on upper, dissected alluvial fans, and of nearly level, medium textured Duric Haplargids on smooth and dissected fans, and of moderately coarse textured Duric Camborthids in drainageways and on small overplaced fans. (15%)		do.						
40 3,000 Ac.	Alluvial Land – 0-4% slopes. (40%)	Ephemeral stream channels.	Shadscale Rabbitbrush	Well drained (Subject to overflow)	Variable to gravel	Moderate to rapid	III-V	0-25	0-70
	Typic Torriorthents – loamy-skeletal, mixed (calcareous), mesic, 2-30% slopes. (30%)	Sideslopes of incised drainageways.	do.	Well drained	7-18 to gravel	Moderate	III	<2	50-70
	Included Psamments, Argids, Orthids, Orthents on 2-15% slopes on small dissected stream terraces and sideslopes. (30%)		do.						
41 1,000 Ac.	Torrifluventic Haploxerolls – fine-loamy, mixed, mesic, 2-4% slopes. (85%)	Smooth floodplains drained by stream entrenchment.	Rabbitbrush Shadscale	Well drained (Subject to overflow)	>60	Moderate	I	None	None
	Inclusions of moderately coarse textured Duric Camborthids on alluvial fan toeslopes, and of medium textured Typic Calciaquolls on wet floodplains, and of saline, fine textured Duric Natrargids on fan toeslopes. (15%)		do.						

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
42 15,300 Ac.	Typic Torrifluvents – coarse-loamy, mixed, (calcareous), mesic, 0-4% slopes. (80%)	Smooth, modern stream floodplains with commonly entrenched drainageways.	White sage, Halogeton	Well drained (Subject to overflow)	> 60	Moderate	I	None	None
	Inclusions of gravelly, moderately coarse textured Typic Camborthids on small, marginal alluvial fans, and of medium to moderately fine textured Typic Torrifluvents on the floodplains. (20%)		Shadscale White sage Halogeton Rabbitbrush						
43 14,800 Ac.	Typic Torriorthents – coarse-loamy, mixed, (calcareous), mesic, 0-4% slopes. (90%)	Smooth alluvial fan toeslopes and deltaic plains.	Rabbitbrush Shadscale Indian Ricegrass	Well drained	> 60	Moderately rapid	III	None	None
	Inclusions of very gravelly, moderately coarse textured Duric Camborthids and medium textured Duric Natrargids on smooth alluvial fan toeslopes. (10%)		Shadscale Rabbitbrush						
44 7,100 Ac.	Typic Torripsamments – mixed, mesic, 0-4% slopes. (80%)	Smooth deltaic plain	Horsebrush Rabbitbrush Galleta grass Indian Ricegrass	Well drained	> 60	Rapid	III	None	10-30
	Inclusions of medium textured Haplic Nadurargids and Duric Natrargids on marginal lake plains. (20%)		do., Black greasewood						
45 24,400 Ac.	Duric Camborthids – sandy-skeletal, mixed, mesic, 0-4% slopes. (90%)	Smooth alluvial fan toeslopes and basin-fill plains.	Shadscale Bud sagebrush Galleta grass Indian ricegrass Rabbitbrush	Well drained	10-18 to gravel	Moderately rapid	IV	None	40-65
	Inclusions of medium textured Duric Natrargids on smooth alluvial fan toeslopes, and of moderately coarse textured Typic Torriorthents in drainageways and on small fans. (10%)		do.						
46 57,400 Ac.	Duric Camborthids – coarse-loamy, mixed, mesic, 0-4% slopes. (90%)	Smooth alluvial fans and fan toeslopes.	Shadscale Bud sagebrush Indian ricegrass Galleta grass	Well drained	- - - - -	Moderately rapid	III-IV	< 2	15-30
	Inclusions of medium textured Duric Natrargids on smooth alluvial fan toeslopes and very gravelly, coarse textured Typic Torriorthents in drainageways. (10%)		do.						
47 58,600 Ac.	Typic Torriorthents – loamy-skeletal, mixed, (calcareous), mesic, 0-8% slopes. (80%)	Dissected and smooth alluvial fans.	Spiny hopsage Shadscale Bud sagebrush	Well drained	7-14 to gravel	Moderately rapid	III-IV	0-5	45-70
	Inclusions of sloping Typic Torriorthents on fan apexes and sideslopes of dissected fan remnants, of moderately coarse textured, shallow Typic Durorthids on upper, dissected fans, and of moderately fine textured Duric Natrargids, deep or shallow to gravel on alluvial fan toeslopes and marginal lake plains. Soils from limestone sediments in this map unit are more cobbly; those from volcanic rocks are finer gravelly. (20%)		do.						
48 67,300 Ac.	Typic Camborthids – loamy-skeletal, mixed, mesic, 0-4% slopes. (60%)	Smooth, lower alluvial fans and fan toeslopes.	Shadscale Bud sagebrush Bailey greasewood Spiny hopsage	Well drained	12-14 to gravel	Moderately rapid	III-IV	0-5	50-70

(48 continued on next page)

Map Unit Symbol & Acreage (1)	Constituent Soils or Land Types in Map Unit and Approximate Proportions (2)	Physiographic Position (3)	Typical Vegetation (4)	Soil Drainage (5)	Depth to Bedrock or Gravelly Substratum (inches) (6)	Profile Permeability (7)	Available Water-holding Capacity Class (8)	Coarse Fragments	
								% Surface Cover (9)	% Subsoil Volume (10)
	Typic Camborthids – loamy-skeletal, mixed, mesic, 4-15% slopes. (25%)	Smooth and dissected, middle and upper alluvial fans.	do.	Well drained	12-14 to	Moderately rapid	III-IV	0-5	50-70
	Inclusions of nearly level, medium textured Duric Camborthids on alluvial fan toe-slopes, of very gravelly, moderately coarse textured Typic Torriorthents along drainageways, and of shallow, moderately coarse textured Entic Durorthids on smooth and dissected middle and upper alluvial fans. (15%)		do.						
50 59,000 Ac.	Haplic Durargids – fine-loamy, mixed, mesic, 2-8% slopes, shallow. (70%)	Smooth and dissected alluvial fans.	Shadscale Bud sagebrush Galleta grass Rabbitbrush	Well drained	10-20 to hardpan	Slow	V	> 2	0-5
	Duric Camborthids – loamy-skeletal, mixed, mesic, 2-8% slopes. (15%)	Smooth, small, recent alluvial fans and drainageways.	do.	Well drained	10-20 to gravel	Moderately rapid	IV	> 2	45-70
	Inclusions of medium textured shallow Haplic Nadurargids and Typic Durargids, and of medium textured Duric Haplargids shallow over gravel, all on smooth and dissected alluvial fans; also, inclusions of very gravelly, moderately coarse textured Typic Torriorthents in drainageways and on small overplaced fans. (10%)		do.						
51 61,500 Ac.	Haplic Durargids – fine-loamy, mixed, mesic, 2-8% slopes, shallow. (50%)	Dissected and smooth alluvial fans (in complexes with the other Argids).	Black sagebrush Shadscale Bud sagebrush Galleta grass	Well drained	10-20 to hardpan	Slow	IV-V	> 2	0-5
	Haplic Nadurargids – fine, montmorillonitic, mesic, 2-8% slopes, shallow. (25%)	do.	do.	Well drained	10-20 to hardpan	Slow	IV-V	> 2	0-5
	Typic Nadurargids – fine, montmorillonitic, mesic, 2-8% slopes, shallow. (15%)	do.	do.	Well drained	10-20 to hardpan	Slow	IV-V	> 2	0-5
	Inclusions of very gravelly, moderately coarse textured Duric Camborthids and nearly level, moderately coarse textured Typic Torriorthents on small alluvial fans and along drainageways. (10%)		do.						
52 100,500 Ac.	Entic Durorthids – coarse-loamy, mixed, mesic, 2-15% slopes, shallow. (50%)	Smooth and dissected alluvial fans (in complexes with other Durorthids and Durargids).	Rabbitbrush Shadscale Spiny hopsage Galleta grass Bailey greasewood	Well drained	10-20 to hardpan	Moderate	V	> 2	20-30
	Typic Durorthids – coarse-loamy, mixed, mesic, 2-15% slopes, shallow. (15%)	do.	do.	Well drained	10-20 to hardpan	Slow	V	> 2	10-30
	Haplic Durargids – fine-loamy, mixed, mesic, 2-8% slopes, shallow. (15%)	dp/	do.	Well drained	10-20 to hardpan	Slow	IV-V	> 2	0-5
	Inclusions of very gravelly, moderately coarse textured Typic Torriorthents and moderately coarse textured Duric Camborthids on small overplace alluvial fans and along drainageways; also inclusions of shallow moderately coarse textured Typic Durorthids on weathered travertine spring deposits near Duckwater. (20%)		do.						

Table 11. KINDS OF SOILS IN MAP UNITS AND THEIR PROPERTIES – Railroad Valley (continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
53 9,700 Ac.	Typic Durargids – fine, montmorillonitic, mesic, 2-8% slopes, shallow. (70%)	Dissected alluvial fans.	Shadscale	Well drained	10-20 to hardpan	Slow	V	> 2	20-30
	Inclusions of fine textured Duric Natrargids and moderately fine textured ones, shallow over gravel, on smooth alluvial fan toeslopes; also inclusions of moderately coarse textured Duric Camborthids along drainageways and on small alluvial fans. (30%)		do.						
54 6,000 Ac.	Duric Haplargids – fine-loamy, mixed, frigid, 0-4% slopes. (50%)	Narrow, gently sloping, alluviated valleys between low mountains.	Big sagebrush Rabbitbrush Needle-and-thread grass Squirreltail grass	Well drained	> 60	Moderately rapid	I-II	None	0-5
	Lithic Haplargids – (fine) clayey, montmorillonitic, frigid, 2-8% slopes, shallow. (20%)	Lower pediment slopes at margins of mountain valley alluvial fill.	Juniper Pinyon Black sagebrush	Well drained	7-20 to bedrock	Slow	V	10-25	0-10
	Haplic Durargids – fine-loamy, mixed, frigid, 2-8% slopes, shallow. (20%)	Dissected and broadly rounded old alluvial fan and pediment remnants.	do.	Well drained	10-20 to hardpan	Moderate	V	> 2	5-25
	Inclusions of medium and moderately coarse textured Typic Torrifluvents and Duric Camborthids in drainageways, and of sloping Haplic Durargids on sideslopes of old dissected alluvial fan remnants. (10%)		Big sagebrush or Black sagebrush						
55 5,500 Ac.	Haplic Durargids – fine-loamy, mixed, frigid, 0-4% slopes, shallow. (50%)	Smooth and shallowly dissected alluvial fans.	Black sagebrush Pinyon Juniper	Well drained	10-20 to hardpan	Moderate	V	> 2	5-25
	Duric Haplargids – fine-loamy, mixed, frigid, 0-4% slopes. (20%)	Smooth alluvial fans and old drainageways within dissected fans.	Big sagebrush Rabbitbrush	Well drained	> 60	Moderately rapid	I-II	None	0-5
	Typic Torrifluvent – coarse-loamy, mixed, (calcareous), mesic, 0-4% slopes. (15%)	Modern drainageway floodplains.	White sage Halogeton	Well drained	> 60	Moderate	I	None	None
	Inclusions of sloping to hilly Lithic Haplargids on rounded low bedrock ridges, of sloping, shallow Haplic Durargids on rounded remnants of dissected alluvial fans, and of moderately coarse textured Duric Camborthids in drainageways. (15%)		Black sagebrush Juniper Pinyon or Big sagebrush						
56 83,800 Ac.	Haplic Durargids – fine-loamy, mixed, frigid, 2-8% slopes, shallow. (80%)	Dissected and broadly rounded old alluvial fan and pediment remnants and some smooth alluvial fans.	Juniper Pinyon Black sagebrush Rabbitbrush	Well drained	10-20 to hardpan	Moderate	V	> 2	5-25
	Inclusions of sloping Haplic Durargids on rounded remnants of dissected alluvial fans, of sloping to hilly Lithic Haplargids on rounded low ridges and lower mountain slopes, of Entic Durorthids on dissected alluvial fans, and of moderately coarse textured Duric Camborthids along drainageways and on small alluvial fans. (20%)		do.						
57 12,600 Ac.	Xerollic Durargids – fine, montmorillonitic, frigid, 2-8% slopes, shallow. (70%)	Smooth and dissected alluvial fans.	Black sagebrush Big sagebrush Galleta grass	Well drained	10-20 to hardpan	Slow	V	> 2	0-5
	Inclusions of fine textured Duric Natrargids and moderately fine textured ones, shallow over gravel, on smooth alluvial fans in complexes with the Durargids. (30%)		do.						

Map Unit Symbol & Acreage (1)	Constituent Soils or Land Types in Map Unit and Approximate Proportions (2)	Typical Vegetation (4)	Physiographic Position (3)	Soil Drainage (5)	Depth to Bedrock or Gravelly Substratum (inches) (6)	Profile Perme-ability (7)	Available Water-holding Capacity Class (8)	Coarse Fragments	
								% Surface Cover (9)	% Subsoil Volume (10)
58 9,000 Ac.	Ardic Durixerolls – fine, montmorillonitic, frigid, 0-8% slopes, shallow. (80%)	High, dissected alluvial fans.	Black sagebrush Pinyon Juniper	Well drained	10-20 to hardpan	Slow	IV	< 2	20-30
	Inclusions of fine textured Xerollic Durargids on high, dissected alluvial fans and very gravelly, moderately coarse textured Typic Torriorthents in drainageways. (20%)		do. and Big sagebrush						
60 136,400 Ac.	Typic Durargids – fine, montmorillonitic, mesic, 4-30% slopes, shallow, stoney. (40%)	Smoothly rounded, volcanic mountains and foothills at lower elevations.	Black sagebrush Shadscale Squirreltail grass Rabbitbrush	Well drained	7-18 to hardpan	Slow	V	10-20	0-5
	Lithic Haplargids – (fine) clayey, montmorillonitic, mesic, 4-30% slopes, stoney. (20%)	do.	do.	Well drained	7-20 to bedrock	Slow	V	10-20	0-5
	Rubbleland and Rock outcrop. (20%)	Mountain slopes, cliffs, crags, summits.	do.	----	----	----	----	----	----
	Inclusions of hilly and steep Lithic Haplargids, of sloping to hilly, shallow, moderately fine textured Haplic Durargids, and of gently sloping, very gravelly, moderately coarse textured Typic Torriorthents in drainageways. (20%)								
61 86,000 Ac.	Lithic Xerollic Haplargids – clayey, montmorillonitic, frigid, 15-50% slopes, stoney. (50%)	Sideslopes, shoulders, and summits of foot-hills and mountains of intermediate elevations.	Juniper Pinyon Black sagebrush Big sagebrush	Well drained	7-20 to bedrock	Slow	V	10-25	0-10
	Lithic Xerollic Haplargids – clayey, montmorillonitic, frigid, 4-15% slopes, stoney. (25%)	Broadly rounded lower foothills.	do.	Well drained	7-20 to bedrock	Slow	V	10-25	0-10
	Inclusions of rolling Haploxerollic Durargids on rounded remnants of dissected alluvial fans, and of Rubbleland and Rock outcrop on mountain slopes and summits. (25%)		do.						
62 24,000 Ac.	Haploxerollic Durargids – fine-loamy, mixed, frigid, 4-30% slopes, shallow. (80%)	Broadly rounded, large mountain ridges and rounded remnants of dissected alluvial fans of intermediate elevations.	Pinyon Juniper Black sagebrush Big sagebrush	Well drained	10-20 to hardpan	Slow	V	< 2	5-25
	Inclusions of Durixerollic Haplargids in complexes with the dominant Durargids, of hilly to steep Duric Lithic Haplargids on mountain sideslopes, and of Rubbleland and Rock outcrop. (20%)		do.						
63 92,300 Ac.	Lithic Xerollic Haplargids – (fine-)loamy, mixed, frigid, 30-70% slopes, slightly stoney. (50%)	Sideslopes of broadly rounded, large mountain ridges.	Pinyon Juniper Black sagebrush Big sagebrush	Well drained	7-20 to bedrock	Slow	V	0-10	0-5
	Durixerollic Haplargids – fine-loamy, mixed, frigid, 30-70% slopes. (20%)	Lower sideslopes of broadly rounded large mountain ridges.	do.	Well drained	30-50 to bedrock	Moderate	II-III	< 2	0-5
	Rubbleland and Rock outcrop. (15%)	Mountain slopes and crests.		----	----	----	----	----	----

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Inclusions of only sloping Lithic Haplargids on mountain ridgecrests, of only moderately steep Lithic Xerollic Haplargids on mountain sideslopes, of sloping to moderately steep Haplic Durargids on mountain footslopes, and of Aridic Lithic Argixerolls on sloping to steep, northern mountain slopes. (15%) Note: In areas south of Blue Eagle Peak and astride Willow Creek, Rubbleland and Rock outcrop comprise 45% of this association.								
64 3,300 Ac.	Xerollic Paleargids – fine, montmorillonitic, frigid, 4-15% slopes. (80%)	Alluvial bottoms and lower slopes of mountain valleys.	Black sagebrush Big sagebrush Rabbitbrush	Well drained	> 50	Slow	I	None	None
	Inclusions of moderately fine textured, gently sloping to steep Typic Argixerolls and Lithic Xerollic Haplargids on mountain sideslopes. (20%)		Pinyon Juniper						
70 6,300 Ac.	Aridic Argixerolls – fine-loamy, mixed, frigid, 15-50% slopes. (80%)	Slopes and crests of moderately high mountains	Big sagebrush Rabbitbrush	Well drained	> 50 to bedrock	Moderate	I	< 2	15-30
	Inclusions of hilly and steep Lithic Haplargids on lower-lying mountain slopes, and of steep and very steep Argic Cryoborolls and Argic Lithic Cryoborolls on high mountain slopes and crests. (20%)		Black sagebrush or Big sagebrush						
71 9,300 Ac.	Aridic Lithic Argixerolls – clayey, montmorillonitic, frigid, 8-30% slopes, stoney. (70%)	Sideslopes and crests of moderately high mountains	Pinyon Juniper Black sagebrush	Well drained	10-20 to bedrock	Slow	IV-V	5-25	0-5
	Inclusions of shallow, undulating Xerollic Durargids on dissected alluvial fans, of undulating and rolling Typic Argixerolls on mountain crests and north slopes, and of Rubbleland and Rock outcrop. (30%)		do.						
72 5,500 Ac.	Argic Lithic Cryoborolls – (fine-)loamy, mixed, 30-70% slopes. (80%)	Sideslopes and ridgecrests of high mountains.	Big sagebrush Snow berry Mountain mahogany	Well drained	10-20 to bedrock	Slow	V	< 2	0-10
	Inclusions of hilly and steep, fine textured Typic Cryoborolls of steep, very gravelly, cobbly, medium textured Argic Lithic Cryoborolls, and of Rubbleland and Rock outcrop. (20%)		do.						
73 17,300 Ac.	Argic Cryoborolls – fine-loamy, mixed, 30-70% slopes. (80%)	Sideslopes and crests of high mountains.	Big sagebrush Snow berry Service berry Bitterbrush	Well drained	> 40 to bedrock	Slow	I	< 2	0-10
	Inclusions of Argic Lithic Cryoborolls, Typic Argixerolls, Rubbleland and Rock outcrop on mountain slopes, and of fine textured Argic Cryoborolls on hilly and steep mountain slopes. (20%)		do.						
80 255,400 Ac.	Rubbleland and Rock outcrop. (70%)	Most commonly steep and very steep, elongated screes (or "rock streams") of closely packed, soil-free cobbles, stones and boulders, and cliffs or crags; also some barren rock tablelands.	Shrubs or trees	Well drained	Highly variable	Slow	V	> 90	70-100
	Included shallow and very shallow, stoney and very stoney, moderately fine textured, small bodies of soils in intricate complexes with Rubbleland and Rock outcrop. (30%)		do.						
90 54,200 Ac.	Playa. (100%)	Large, flat, crusted, silty or clayey sinks occupied by ephemeral lakes.	Barren.	Well to poorly drained	> 60	Slow	I	None	None

TABLE 12. CRITERIA FOR EVALUATION OF SOIL IRRIGABILITY POTENTIAL[1]

Soil Property	Irrigable Soil Classes				Nonirrigable Soil Class
	A	B	C	D	E
1. Soil depth to bedrock or hardpan (inches)[2]	> 40	> 30	> 20	> 10	< 10
2. Available waterholding capacity to 48 inches or bedrock or hardpan (inches of water)	> 6	> 4.5	> 3	> 2.5	< 2.5
3. Texture of surface 10 inches after mixing[3]	lvfs, vfsl, fsl, sl, 1, sil, sicl, scl, cl	ls, lvfs, vfsl, fsl, sl, l, sil, sicl, scl, cl, c, peat, muck sic, sc	ms, fs, ls, lvfs, vfsl, fsl, sl, l, sil, sicl, scl, cl, c, peat, muck, sic, sc	ms, fs, ls, lvfs, vfsl, fsl, sl, l, sil, sicl, scl, cl, c, peat, muck, sic, sc	any
4. Profile permeability, (inches/hour)[4]	0.2-6.3	0.06-6.3	0.06-20.0	any	any
5. Coarse fragments in control section (% volume)[5]	< 15	< 35	< 55	< 70	> 70
6. Cobbles or stones at or on the surface (% of area covered)[5]	< 0.1	< 3	< 15	< 15	> 15
7. Rock outcrops (feet separation)	> 300	> 100	> 30	> 30	< 30
8. Estimated equilibrium salinity under irrigation with drainage if needed and feasible ($EC_e x 10^3$, saturated paste extract) [6]	< 4	< 8	< 12	< 16	> 16
9. Estimated equilibrium exchangeable Na content under irrigation with drainage if needed and feasible (% exch. Na)[6]	< 15	< 20	< 20	< 30	> 30
10. Slope (%)[7]	< 4	< 4	< 8	< 15	> 15

Soil Property	Irrigable Soil Classes				Nonirrigable Soil Class
	A	B	C	D	E
11. Estimated depth to water table during growing season and with drainage structures where needed and feasible (inches)[8]	> 60	> 36	> 18	> 10	< 10
Equivalent soil drainage class, with artificial drainage where needed and feasible[8]	Well drained and moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained (some drying later in season)	Very poorly drained (don't dry for harvest most years)
12. Flooding hazard (% of years with overflow)	< 50	< 50	< 50	< 50	> 50

FOOTNOTES:

1 These irrigability classes are based largely on criteria developed by the "Coordinated Planning Subcommittee (CPS), Pacific Southwest Inter-Agency Committee" and given in their Table I, Criteria for Irrigation Soil Classes for Type I River Basin Studies," distributed in 1968. Note that 4 classes of irrigable and 1 class of nonirrigable soils are shown here, as they are in the source classification. Criteria have been altered only to fit peculiar Nevada soil situations or phase criteria of this survey. Variations from this source classification are explained below. In determining the irrigability class for a soil, failure to meet any one soil property requirement drops the class to the appropriate lower class. Soil properties are to be considered in the context of a reclaimed soil if original salt-alkali contents are high, but reclamation is feasible.

2 Soil depth limitations accord closely to the classes of available waterholding capacity (AWC) to 48" for medium textured soils, and could be dropped. They were retained, however, since they give the reader an easily comprehended evaluation of a soil. Note that moderately coarse to very coarse textured soils will fail the AWC requirements for the irrigability classes in which they satisfy minimum soil depth requirements. Depth to cobbles as a depth criteria has been dropped, as cobbles at depth act as a diluent, and are accounted for by the AWC and the coarse fragment content, whereas very shallow cobbles will appear as stoniness.

3 Texture of the surface horizon is the average after mixing to 10" depth. A 10" depth is chosen, rather than the 12" depth of the CPS committee, since it more frequently accords to the thickness of the surficial layer above the textural control section. Note that downgrading is for only loamy sand, clay, peat, muck, medium sand, and fine sand surfaces in appropriate classes. Such surface layer textures are phase-type information in this reconnaissance soil survey and was taken from field notes.

4 Soil permeability class limits (inches/hr.) have been changed from those of the CPS committee to those currently used by the Soil Conservation Service, in its Soil Engineering Interpretive Guide (1967).

5 Coarse fragment criteria are considered in two aspects here: textural control section volume content and surface cover. These criteria are more conservative than the CPS committee criteria.

6 Maximum equilibrium salinity and sodium levels are estimated for the soil after reclamation, installation of drainage structures where needed and feasible, and an extended period of irrigation. Therefore, this criteria in effect is an estimate of effective potential permeability and drainage. The CPS committee criteria of percent area which is sodium-affected has been dropped since it can not be determined; their exchangeable sodium levels for estimating sodium hazard have been retained.

7 Subdivision of slope classes by soil erodibility, as used by the CPS committee, has been dropped. In Nevada, where sprinkler irrigation can frequently be assumed, slopes up to 4% are quite appropriate for "A" Class soils. The break to soils so steep, stoney, or dissected as to be useless for irrigation is at about 15%. In "B" and "C" classes, more restrictive slope limits are used here than were by the CPS committee because costs of using steeper land seem prohibitive in Nevada.

8 Criteria for depth to water table are not subdivided by texture, as in the CPS committee report, because slowly pervious, stratified soils of several textures occur in Nevada. Averaged depths to water tables are given, and equivalent soil drainage classes are listed since these can be determined in this soil survey.

TABLE 13. ACREAGES OF IRRIGABLE AND NONIRRIGABLE SOILS IN THE RAILROAD VALLEY AREA

Irrigability Class	Acreage in the Southern Part (Hydrographic Area 173-A)	Acreage in the Northern Part (Hydrographic Area 173-B)	Total Acreage
A	......	800	800
B	......	4,100	4,100
C	135,900	169,800	305,700
D	30,800	154,100	184,900
Total Irrigable	166,700	328,800	495,500
E (Nonirrigable)	219,200	1,046,600	1,265,800

TABLE 14. DETAILED LEGEND FOR THE IRRIGABLE SOILS MAP

Map Unit	Description
C-1	60 to 90 percent of these areas are class "C" irrigable soils, some small areas of class "A" and "B" irrigable soils are included, and the remaining soils are nonirrigable. Properties of the irrigable soils which will require consideration in management are: (1) common low available waterholding capacity which might necessitate frequent irrigation, (2) sandy topsoils in some soils which will require wind erosion control, (3) commonly occurring, moderate salt and sodium contents which will necessitate some initial reclamation, and (4) wetness in a few soils which might necessitate artificial drainage.
C-2	30 to 60 percent of these areas are class "C" irrigable soils, some small areas of class "D" and "B" irrigable soils are included, and the remaining soils are nonirrigable. Properties of the irrigable soils which will require consideration in management are: (1) common low available waterholding capacity which might necessitate frequent irrigation, (2) commonly occurring, moderate salt and sodium contents which will necessitate some initial reclamation, and (3) closely spaced gullies which markedly reduce possible field size in a few soil areas.
D	75 to 90 percent of these areas are class "D" irrigable soils and the remaining soils are nonirrigable. Properties of the irrigable soils which will require consideration in management are: (1) low available waterholding capacity which might necessitate frequent irrigation in some of the soils, (2) closely spaced gullies which will markedly reduce possible field size in some soil areas, (3) stoniness of some soils, and (4) salt and sodium contents which will require reclamation of some soils.
E	Nonirrigable soils, except for a few small areas of included, irrigable soils. These soils are too steep, or too shallow, or too stoney, or too salty and poorly drained to be potentially irrigable.

Table 15. SOIL INTERPRETATIONS
Railroad Valley Reconnaissance Soil Survey Area, Nevada

Map Unit Symbol & Acreage (1)	Constituent Soils or Land Types in Map Unit and Approximate Proportions (2)	Soil Irrig-ability Class (11)	Soil Hydro-logic Group (12)	Land Capability Class		Erosion Hazard		Shrink-Swell Hazard (17)	Engineering Soil Classes		Suitability for	
				Irrigated (13)	Dry (14)	Water (15)	Wind (16)		Unified (18)	AASHO (19)	Gravel (20)	Sand (21)
20 22,000 Ac.	Aquic Torriorthents – fine, montmorillonitic, (calcareous) mesic, 0-2% slopes, (50%) saline.	E	D	----	VIII	Low	Slight	High	CL or CH	A-6 or A-7	Poor	Poor
	Typic Torriorthents – fine, montmorillonitic, (calcareous) mesic, 4-30% slopes, (40%) saline.	E	D	----	VIII	Moderately high	Slight	High	CL or CH	A-6 or A-7	Poor	Poor
	Inclusions of other soils. (10%)											
21 55,900 Ac.	Aquic Calciorthids – fine-loamy, mixed, mesic, 0-2% slopes, saline. (35%)	E	C	----	VII	Low	Moderate	Moderate	ML or CL	A-4 or A-6	Poor	Poor
	Aquic Natrargids – fine, montmorillonitic, mesic, 0-2% slopes, saline. (35%)	E	D	----	VII	Low	Slight	High	CH	A-7	Poor	Poor
	Inclusions of other soils. (30%)											
22 16,700 Ac.	Typic Nadurargids – fine-loamy, mixed, mesic, 0-4% slopes, shallow, saline. (60%)	E	D	----	VII	Moderately low	Slight	Moderate	ML-CL	A-4 or A-6	Poor	Poor
	Aquic Haplic Nadurargids – fine, montmorillonitic, mesic, 0-2% slopes, shallow, saline. (15%)	E	D	----	VII	Moderately low	Slight	Highq	CL or CH	A-6 or A-7	Poor	Poor
	Inclusions of other soils. (25%)											
23 11,700 Ac.	Typic Calciaquolls – fine-loamy, carbonatic, mesic, 0-2% slopes. (70%)	C	D	III	V	Low	Slight	Moderate	ML or CL	A-6	Poor	Poor
	Typic Calciaquolls – fine-loamy, carbonatic, mesic, 0-2% slopes, saline. (20%)	C	D	III	VII	Low	Slight	Moderate	ML or CL	A-6	Poor	Poor
	Inclusions of other soils. (10%)											
30 38,800 Ac.	Haplic Nadurargids – fine-loamy, mixed, mesic, 0-2% slopes, shallow. (60%)	E	D	----	VII	Low	Moderate	Moderate	CL above hardpan, GP below hardpan	A-4 or A-6 above hardpan, A-1 below hardpan	Poor above hardpan, fair below hardpan	Poor
	Duric Natrargids – fine-loamy, mixed, mesic, o-2% slopes. (20%)	C	C	III	VII	Low	Moderate	Moderate	ML over SP or GP	A-4 over A-1	Poor or Fair	Fair or Poor
	Inclusions of other soils. (20%)											
31 15,200 Ac.	Duric Natrargids – fine, montmorillonitic, mesic, 0-2% slopes, saline. (60%)	D	D	IV	VII	Low	Slight	High	CL or CH	A-6 or A-7	Poor	Poor
	Duric Natrargids – fine, montmorillonitic, mesic, o-2% slopes, saline, crusted (30%)	D	D	IV	VIII	Low	Slight	High	CL or CH	A-6 or A-7	Poor	Poor
	Inclusions of other soils. (10%)											
32 32,300 Ac.	Duric Natrargid – fine, montmorillonitic, mesic, 0-2% slopes. (75%)	D	D	IV	VII	Low	Slight	High	CL or CH	A-6 or A-7	Poor	Poor
	Typic Torriorthent – loamy-skeletal, mixed, (calcareous), mesic. (15%)	D	B	IV	VII	Moderate	Moderate	Low	GM	A-1	Fair or good	Poor
	Inclusions of other soils. (10%)											

Table 15. SOIL INTERPRETATIONS – Railroad Valley

(1)	(2)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
33 15,000 Ac.	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes. (50%)	C	C	III	VII	Low	Moderate	Moderate	ML or CL over SP or GP	A-6 or A-7 over A-1	Poor or fair	Fair or poor
	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes, crusted. (35%)	C	D	IV	VIII	Low	Moderate	Moderate	ML or CL over SP or GP	A-6 or A-7 over A-1	Poor or fair	Fair or poor
	Inclusions of other soils. (15%)											
34 82,700 Ac.	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes. (50%)	C	C	III	VII	Low	Moderate	Moderate	ML or CL over SP or GP	A-6 or A-7 over A-1	Poor or fair	Fair or poor
	Duric Natrargids – fine-loamy mixed, mesic, o-2% slopes, gravelly substratum. (30%)	C	C	III	VII	Low	Moderate	Moderate	ML or CL GM or SM	A-6 or A-7 over A-1	Poor	Poor
	Inclusions of other soils. (20%)											
35 18,600 Ac.	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 0-2% slopes. (70%)	C	C	III	VII	Low	Moderate	Moderate	ML or CL over SP or GP	A-6 or A-7 over A-1	Poor or fair	Fair or poor
	Inclusions of other soils. (30%)											
36 56,200 Ac.	Duric Natrargids – fine-loamy over sandy or sandy-skeletal, mixed, mesic, 4-15% slopes. (80%)	D	C	IV	VII	Moderate	Moderate	Moderate	ML or CL over SP or GP	A-6 or A-7 over A-1	Poor or fair	Fair or poor
	Inclusions of other soils. (20%)											
37 7,300 Ac.	Duric Natrargids – fine-loamy, mixed, mesic, 2-8% slopes. (75%)	C	C	III	VII	Moderate	Moderate	Moderate	ML or CL	A-6	Poor	Pooe
	Inclusions of other soils. (25%)											
38 102,400 Ac.	Duric Natrargids – fine, montmorillonitic, mesic, 0-4% slopes, gravelly (65%) substratum.	C	D	III	VII	Moderately low	Moderate	High	CH or CL over GM	A-6 or A-7 over A-1	Poor or fair	Poor or fair
	Duric Natrargids – fine, montmorillonitic, mesic, 4-15% slopes, gravelly (20%) substratum.	E	D	----	VII	Moderate	Moderate	High	CH or CL over GM	A-6 or A-7 over A-1	Poor or fair	Poor or fair
	Inclusions of other soils. (15%)											
40 3,000 Ac.	Alluvial Land – 0-4% slopes. (40%)	E	A	----	VII	Moderate	Moderate or severe					
	Typic Torriorthents – loamy-skeletal, mixed, (calcareous), mesic, 2-30% slopes. (30%)	E	B	----	VII	Moderate	Moderate	Low	GP	A-1	Poor or fair	Poor or fair
	Inclusions of other soils. (30%)											
41 1,000 Ac.	Torrifluventic Haploxerolls – fine-loamy, mixed, mesic, 2-4% slopes. (85%)	A	C	II	VII	Moderately low	Slight	Moderate or low	ML or CL	A-6	Poor	Poor
	Inclusions of other soils. (15%)											
42 15,300 Ac.	Typic Torrifluvents – coarse-loamy, mixed, (calcareous), mesic, 0-4% slopes. (80%)	C	B	III	VII	Moderately low	Slight	Low	ML or SM	A-4 or A-2	Poor	Poor
	Inclusions of other soils. (20%)											

Map Unit Symbol & Acreage (1)	Constituent Soils or Land Types in Map Unit and Approximate Proportions (2)	Soil Irrig-ability Class (11)	Soil Hydro-logic Group (12)	Land Capability Class: Irrigated (13)	Land Capability Class: Dry (14)	Erosion Hazard: Water (15)	Erosion Hazard: Wind (16)	Shrink-Swell Hazard (17)	Engineering Soil Classes: Unified (18)	Engineering Soil Classes: AASHO (19)	Suitability for: Gravel (20)	Suitability for: Sand (21)
43 14,800 Ac.	Typic Torriorthents – coarse-loamy, mixed (calcareous), mesic, 0-4% slopes. (90%)	C	B	III	VII	Moderately low	Severe	Low	SM	A-4	Poor	Fair
	Inclusions of other soils. (10%)											
44 7,100 Ac.	Typic Torripsamments – mixed, mesic, 0-4% slopes. (90%)	C	A	III	VII	Moderately low	Severe	Low	SM	A-2	Poor	Good
	Inclusions of other soils. (20%)											
45 24,400 Ac.	Duric Camborthids – sandy-skeletal, mixed, mesic, 0-4% slopes. (90%)	D	B	IV	VII	Moderately low	Slight	Low	SM or GP	A-1 or A-2	Fair	Poor
	Inclusions of other soils. (10%)											
46 57,400 Ac.	Duric Camborthids – coarse-loamy, mixed, mesic, 0-4% slopes (90%)	C	B	IV	VII	Moderately low	Moderate	Low	SM	A-2	Poor	Poor
	Inclusions of other soils. (10%)											
47 58,600 Ac.	Typic Torriorthents – loamy-skeletal, mixed, (calcareous), mesic, 0-8% slopes. (80%)	D	B	IV	VII	Moderate	Slight	Low	GM	A-1	Fair or poor	Poor
	Inclusions of other soils. (20%)											
48 67,300 Ac.	Typic Camborthids – loamy-skeletal, mixed, mesic, 0-4% slopes. (60%)	C	B	III	VII	Moderately low	Moderate	Low	GM	A-1	Fair or poor	Poor
	Typic Camborthids – loamy-skeletal, mixed, mesic, 4-14% slopes. (25%)	D	B	IV	VII	Moderate	Moderate	Low	GM	A-1	Fair or poor	Poor
	Inclusions of other soils. (15%)											
50 59,000 Ac.	Haplic Durargids – fine-loamy, mixed, mesic, 2-8% slopes, shallow. (70%)	E	D	----	VII	Moderately low	Slight	Moderate	CH or CL to hardpan	A-6 or A-7 to hardpan	Poor	Poor
	Duric Camborthids – loamy-skeletal, mixed, mesic, 2-8% slopes. (15%)	D	B	IV	VII	Moderately low	Slight	Low	GM	A-1	Fair or poor	Poor
	Inclusions of other soils. (10%)											
51 61,500 Ac.	Haplic Durargids – fine-loamy, mixed, mesic, 2-8% slopes, shallow. (50%)	E	D	----	VII	Moderately low	Slight	Moderate	CH or CL to hardpan	A-6 or A-7 to hardpan	Poor	Poor
	Haplic Nadurargids – fine, montmorillonitic, mesic, 2-8% slopes, shallow. (25%)	E	D	----	VII	Moderate	Slight	High	CH	A-7	Poor	Poor
	Typic Nadurargids – fine, montmorillonitic, mesic, 2-8% slopes, shallow. (15%)	E	D	----	VII	Moderate	Slight	High	CH	A-7	Poor	Poor
	Inclusions of other soils. (10%)											
52 100,500 Ac.	Entic Durorthids – coarse-loamy, mixed, mesic, 2-15% slopes, shallow. (50%)	E	D	----	VII	Moderately low	Slight	Low	SM or ML to hardpan	A-4	Fair below hardpan	Poor
	Typic Durorthids – coarse-loamy, mixed, mesic, 2-15% slopes, shallow. (15%)	E	D	----	VII	Moderate	Slight	Low	SM or ML to hardpan	A-4	Poor	Poor
	Haplic Durargids – fine-loamy, mixed, mesic, 2-8 % slopes, shallow (15%)	E	D	----	VII	Moderately low	Slight	Moderate	CH or CL to hardpan	A-6 or A-7 to to hardpan	Poor	Poor
	Inclusions of other soils. (20%)											

(1)	(2)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
53 9,700 Ac.	Typic Durargids – fine, montmorillonitic, mesic, 2-8% slopes, shallow. (70%)	E	D	----	VII	Moderate	Slight	High	CH or CL	A-6 or A-7	Poor	Poor
	Inclusions of other soils. (30%)											
54 6,000 Ac.	Duric Haplargids – fine-loamy, mixed, frigid, o-4% slopes. (50%)	B	B	III	VI	Moderately low	Slight	Moderate	SC or CL	A-4 or A-6	Poor	Poor
	Lithic Haplargids – (fine) clayey, montmorillonitic, frigid, 2-8% slopes, stoney. (20%)	E	D	----	VII	Moderate	Slight	High	CH	A-7	Poor	Poor
	Haplic Durargids – fine-loamy, mixed, frigid, 2-8% slopes, shallow. (20%)	E	D	----	VII	Moderate	Slight	Moderate	SC or CL	A-4 or A-6 to hardpan	Poor	Poor
	Inclusions of other soils. (10%)											
55 5,500 Ac.	Haplic Durargids – fine-loamy, mixed, frigid, o-4% slopes, shallow. (50%)	E	D	----	VII	Moderately low	Slight	Moderate	SC or CL	A-4 or A-6 to hardpan	Poor	Poor
	Duric Haplargids – fine-loamy, mixed, frigid, o-4% slopes. (20%)	B	B	III	VI	Moderately low	Slight	Moderate	SC or CL	A-4 or A-6	Poor	Poor
	Typic Torrifluvent – coarse-loamy, mixed, (calcareous), mesic, 0-4% slopes. (15%)	C	B	III	VI	Moderately low	Slight	Low	ML or SM	A-4 or A-2	Poor	Poor
	Inclusions of other soils. (15%)											
56 83,800 Ac.	Haplic Durargids – fine-loamy, mixed, frigid, 2-8% slopes, shallow. (80%)	E	D	----	VII	Moderate	Slight	Moderate	SC or CL	A-4 or A-6 to hardpan	Poor	Poor
	Inclusions of other soils. (20%)											
57 12,600 Ac.	Xerollic Durargids – fine, montmorillonitic, frigid, 2-8% slopes, shallow. (70%)	E	D	----	VII	Moderate	Slight	High	CH	A-7	Poor	Poor
	Inclusions of other soils. (30%)											
58 9,000 Ac.	Aridic Durixerolls – fine, montmorillonitic, frigid, 0-8% slopes, shallow. (80%)	E	D	----	VII	Moderately low	Slight	High	CH	A-7	Poor	Poor
	Inclusions of other soils. (20%)											
60 136,400 Ac.	Typic Durargids – fine, montmorillonitic, mesic, 4-30% slopes, shallow, stoney. (40%)	E	D	----	VII	Moderately high	Slight	High	CH	A-7	Poor	Poor
	Lithic Haplargids – (fine) clayey, montmorillonitic, mesic, 4-30% slopes, stoney. (20%)	E	D	----	VII	Moderately high	Slight	High	CH	A-7	Poor	Poor
	Rubbleland and Rock outcrop. (20%)	E	D	----	VIII	Low	Slight	----	----	----	----	----
	Inclusions of other soils. (20%)											
61 86,000 Ac.	Lithic Xerollic Haplargids – clayey, montmorillonitic, frigid, 15-50% slopes, stoney. (25%)	E	D	----	VII	Moderately high	Slight	High	CH	A-7	Poor	Poor
	Lithic Xerollic Haplargids – clayey, montmorillonitic, frigid, 4-15% slopes, stoney. (25%)	E	D	----	VII	Low	Slight	High	CH	A-7	Poor	Poor
	Inclusions of other soils. (25%)											
62 24,000 Ac.	Haploxerollic Durargids – fine-loamy, mixed, frigid, 4-30% slopes, shallow. (80%)	E	D	----	VII	Moderate	Slight	Moderate or high	CL	A-6	Poor	Poor
	Inclusions of other soils. (20%)											

Map Unit Symbol & Acreage (1)	Constituent Soils or Land Types in Map Unit and Approximate Proportions (2)	Soil Irrig-ability Class (11)	Soil Hydro-logic Group (12)	Land Capability Class		Erosion Hazard		Shrink-Swell Hazard (17)	Engineering Soil Classes		Suitability for	
				Irrigated (13)	Dry (14)	Water (15)	Wind (16)		Unified (18)	AASHO (19)	Gravel (20)	Sand (21)
63 92,300	Lithic Xerollic Haplargids – (fine-)loamy, mixed, frigid, 30-70% slopes, slightly stoney. (50%)	E	D	----	VII	Moderate	Slight	Moderate	CL or CH	A-6 or A-7	Poor	Poor
	Durixerollic Haplargids – fine-loamy, mixed, frigid, 30-70% slopes. (20%)	E	C	----	VII	Moderate	Slight	Moderate	CL or CH	A-6 or A-7	Poor	Poor
	Rubbleland and Rock outcrop. (15%)	E	D	----	VIII	Low	Slight	----	----	----	----	----
	Inclusions of other soils. (15%)											
64 3,300 Ac.	Xerollic Paleargids – fine, montmorillonitic, frigid, 4-15% slopes. (80%)	D	D	----	VII	Moderately low	Slight	High	CH	A-7	Poor	Poor
	Inclusions of other soils. (20%)											
70 6,300 Ac.	Aridic Argixerolls – fine-loamy, mixed, frigid, 15-50% slopes. (80%)	E	C	----	VII	Moderate	Slight	High	CL or CH	A-6 or A-7	Poor	Poor
	Inclusions of other soils. (20%)											
71 9,300 Ac.	Aridic Lithic Argixerolls – clayey, montmorillonitic, frigid, 8-30% slopes, stoney. (70%)	E	D	----	VII	Moderate	Slight	High	CH or CL	A-7 or A-6	Poor	Poor
	Inclusions of other soils. (30%)											
72 5,500 Ac.	Argic Lithic Cryoborolls – (fine-)loamy, mixed, 30-70% slopes. (80%)	E	D	----	VII	Moderately	Slight	Moderate	ML or MH	A-4 or A-6	Poor	Poor
	Inclusions of other soils. (20%)											
73 17,300 Ac.	Argic Cryoborolls – fine-loamy, mixed, 30-70% slopes. (80%)	E	C	----	VII	Moderately high	Slight	Moderate	CL	A-6	Poor	Poor
	Inclusions of other soils. (20%)											
80 255,400 Ac.	Rubbleland and Rock outcrop. (70%)	E	D	----	VIII	Low	Slight	----	----	----	----	----
	Inclusions of other soils. (30%)											
90 54,200 Ac.	Playa. (100%)	E	D	----	VIII	Low	Slight	High or moderate	CH or CL	A-7 or A-6	Poor	Poor

TABLE 16. CHEMICAL ANALYSIS OF WATER SAMPLES FROM RAILROAD VALLEY

Concentrations, mg/1 (except pH)

	Constituent	USPHS & Nevada Standards	Well Location					
			5/55-27b	5/55-33b	5/55-34d	6/56-14c	6/56-23a	8/57-14a
RECOMMENDED	Alkyl Benzene Sulfonate (ABS)	0.5						
	Arsenic (As)	0.01						
	Chloride (Cl)	250.	14	6	11	2	2	8
	Copper (Cu)	1.						
	Carbon Chloroform Extract	0.2						
	Cyanide (CN)	0.01						
	Fluoride (F)	(See Table II-4)						
	Iron (Fe)	0.3	56	tr.	3.6	tr.	0	tr.
	Managanese (Mn)	0.05						
	Nitrate (NO_3)	45.	3	2	1	3	4	2
	Phenols	0.001						
	Sulfate (SO_4)	250.	45	21	40	3	8	25
	Total Dissolved Solids	500.	222	233	206	252	223	370
	Zinc (Zn)	5.						
MANDATORY	Arsenic (As)	0.05						
	Barium (Ba)	1.0						
	Cadmium (Cd)	0.01						
	Chromium (Hexavalent)(Cr^{+6})	0.05						
	Cyanide (CN)	0.2						
	Fluoride (F)	(See Table II-4)						
	Lead (Pb)	0.05						
	Selenium (Se)	0.01						
	Silver (Ag)	0.05						
NO LIMITS GIVEN	Alkalinity ($CaCO_3$)		94	154	136	214	190	300
	Bicarbonate (HCO_3)		115	188	165	261	232	366
	Total Hardness ($CaCO_3$)		116	156	140	220	184	276
	Calcium (Ca)		30	37	93	54	46	72
	Magnesium (Mg)		10	16	56	20	17	23
	Sodium and Potasium (Na+K)		17	14	22	1	8	24
	pH		7.9	7.9	8.0	7.7	7.8	7.5
	Carbonate (CO_3)		0	0	0	0	0	0

SOURCE: Samples collected by Montgomery Engineers of Nevada and analyzed by Nevada State Division of Health
NOTE: High iron concentrations most probably caused by lengthy inactivity of well sampled.

State of Nevada

WATER PLANNING REPORT